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Scripting 'Normality'

Habit tracking applications and the moralities of technologically mediated practices

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Timo Bühler, B.Sc.

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This thesis project has come a long way. When I first started to craft a topic for my master's thesis I intended to investigate the technological infrastructures that keep our digital worlds up and running, but remain invisible for most of us: Atomic clocks and the satellites that are used to determine our position on the surface of the Earth. After some conversations with my going to be supervisor I realized that this was too big of a project to do in the context of a master's thesis and thus I started to look around for another suitable topic. Over the past twelve months I have now written about one-hundred pages about habit tracking applications, which might seem less spectacular than writing about atomic clocks and satellites, but nevertheless this has been an interesting and instructive endeavor for me. All of this would not have been possible without the support of the following people.

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With this thesis project coming to an end now I'm honestly glad that I can pay more attention to other forms of thinking and writing about the world we live again. Although in the past I have only written my texts and poems in German, this project sparked the idea for my first English poem. It is called *Roaring Numbers* and tries to catch in just a few lines what this thesis is about and what I will present to you on the upcoming pages. Those who know me will know that there is no better way for me to introduce my thesis with.

Life is messy, full of stress
too many tasks
for this short game of chess.

Must perform at any time
while the tutor watches
until he routinely chimes.

He offers a journal
always at hand
a shadow eternal
does more than demand.

With ordinary sins
long time gone
a chapter begins
while the metering goes on:
The numbers role
the numbers tell
whether heaven gets a soul
or just bittersweet hell.

We've been good
we've been bad
there's no space for could
but we still don't get mad.

Flesh decayed to numbers
minds are lost in space
our future gets lumbered
for today's epic chase.

Have you ever wondered, who is behind?
These are humans
that just defined.

They welded together
an object of hope
created a tether
made of digital dope.

Their power is hidden
inscribed deep inside
questions forbidden
unless it is tried.

Putting their morals
in a spotlight so bright
reveals crusted corals
inside their tutor's bytes.

Only through looking
closely at them
we overturn the hooking
and become free wo/men.

In the end, we're the master
steering the wheel
making our ride faster
or searching for the real.

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Table of Abbreviations

Abbreviation	Written-out
ANT	Actor Network Theory
ICT	Information and Communication Technology
OTA	Office of Technology Assessment
RRI	Responsible Research and Innovation
UX	User Experience
UI	User Interface
WWW	World Wide Web

1. Introduction

> "Build the *perfect daily routine*"[1] – "Focus on what *truly matters* with Habitify. Build the *best version of yourself* by mastering your habits."[2] – "The Way of Life app helps you *building good habits* or *breaking bad ones*."[3] – "Reset Your Habits. *Transform Your Life*. Rewire Your Brain."[4] – "Goalify helps you to *stay on top of your goals and habits* - easy and effective."[5] – "*Smash Through Your Goals*!"[6]

This is just a short listing of statements and promises made by the developers of so-called *habit tracking applications* on their websites, blogs, in videos or the apps themselves. These statements are addressed to potential users, who are at the same time always potential customers, as well as their current users. All of them transport a similar message: A better life is possible; you can achieve all your goals; you just need to establish better routines and habits. Besides being mere promotional figures that are directed outwards, these statements also tell something about the way, the developers of such mobile applications view and understand the world. Even though the design and features of habit tracking applications differ to some degree from each other, all of these apps share *at least* one common idea: That humans on the one side need routines and habits to live a 'good', healthy, successful, etc. life, but that on the other side they fail to uphold these habits which in consequence makes it necessary to provide external motivation. This way of thinking is part of a (self-)optimization discourse that attributes self-reliance to individual freedom *and* collective prosperity. As pioneers of the neoliberal nation-state like Margaret Thatcher have declared, first and foremost, individuals are responsible for themselves, not the collective institutions like the state. Within such a social climate of self-reliance, habit tracking applications allow their users to track tasks, practices, habits, and even moods through quantifying them. The tracked data is then transformed and displayed in the form of extended (graphical) analysis which is subsequently advertised as the basis for changing habits. This type of mobile application is intentionally used by millions of people[7] from all over the world to track, analyze and organize their private and work life.

Measuring and tracking the time, the number of repetitions, or other quantitative indicators related to the performance of specific habits or the own body can be understood as one form of self-auditing with the goal of comparing oneself to generalized standards and other people. While Michael Power (1999) has focused in his analysis of the 'audit society' on the collective institutions that were more and more created to establish accountability, the case of habit tracking applications displays another

[1] Strides. (n.d.). *Strides: Goal & Habit Tracker*. Retrieved from https://www.stridesapp.com/
[2] Habitify. (n.d.). *Habitify - The Minimal, Data-Driven Habit Tracker*. Retrieved from https://www.habitify.me/
[3] Way of Life. (n.d.). *Way of Life - Habit on. Habit off*. Retrieved from https://wayoflifeapp.com/
[4] Fabuolous. (n.d.). *The Fabulous*. Retrieved from https://www.thefabulous.co/
[5] Goalify. (n.d.). *Goalify - Reach your Goals. Change your Habits*. Retrieved from https://goalifyapp.com/en
[6] HabitBull. (n.d.). *HabitBull*. Retrieved from http://www.habitbull.com/
[7] This is based on the number of downloads of a sample of six habit tracking applications in the Apple AppStore.

dimension of this phenomenon. These apps reveal what is often thought of to be *black-boxed*: The incorporated values that the developers hold. By using apps, the users are exposed to these values that are constitutive for specific design elements and functionalities. Habit tracking applications can thus be understood as *moralizing technologies* (Verbeek, 2006), as they act as mediators and pass on the values of the developers to the users. In general, technical objects are created based on imaginations of specific usages and users, that carry specific characteristics, in mind (Akrich, 1997). These imaginations of the developers – which also reflect more general thought styles (Fleck, 1979) – are therefore *inscribed* into the technical objects and thereby enable, foster or disable certain habits of the users (Akrich, 1997). Following the argumentation of Bruno Latour (1992) and Madeleine Akrich (1997) one can also say that by inscribing and hence materializing specific moralities in the form of habit tracking applications, specific tasks are *delegated* from the human users to the nonhuman apps.

The consistent increase in the use of mobile applications within the last ten years is thereby *an* indicator for what sociologists of technology have diagnosed to be the *digital society* (Lupton, 2015a). Not only the way we live, feel, decide and work has changed in this digital society, but also the way we experience and engage with our environments and our bodies. Today, mobile devices like the smartphone have become one of the most distributed and used technology of everyday life (Pew Research Center, 2019). Most people carry their smartphone with them all day and even during sleeping hours it rests more or less silently on the nearby bed table (Hsu, 2014). The success of the smartphone cannot be explained through its ability to call someone else or send and receive short messages – these functionalities were already available through classic mobile phones and even before that in 'analogue times' –, but because of the possibility to enhance the smartphone through the download of so-called 'third-party' applications that allow extended and ever-changing functionalities. These new interactions and dependencies make clear that in a digital society humans and nonhumans are more than ever part of the same network that ties together everyday life and its organization (Jasanoff, 2004a; Latour, 1992). If we as social scientists want to analyze and understand specific social structures within the digital society, we must overcome the arbitrary distinction between 'the social' and 'the technical'. The study of mobile applications is one space where both are closely entangled and can thus be studied.

When habit tracking applications are advertised with promises like getting into 'perfect daily routines' or when they connect the creation of 'the best version of yourself' to the performance of specific habits, then these assessments are based on the perception of distinct problems as such, on particular values and standards. The work of the developers hence also comprises the establishment of specific problem-solution packages where the habit tracking applications are presented as solutions. In this thesis I am thus going to investigate which aspects of life can and should be tracked according to the developers of habit tracking applications and how this influences the very ability to track those things in the actual apps. I want to learn how the imagined users influence the process of developing habit

tracking applications and ultimately the process of inscription. Altogether, I examine in this thesis how developers design their habit tracking applications and in consequence aim to shape the habits of their users. To address this, I pose the following main research question: *How are the developers of habit tracking applications envisioning and framing users and usage of their apps?*

Studying habit tracking applications and questioning the way their developers imagine users is inextricably linked to specific understandings of what habits are. For this thesis I understand *behavior* to be human actions. This includes the observable actions themselves but also the affects and intentions that drive them. *Practices* are also actions, but they include a social component of behavior. This means that a practice is an action that is defined in its form of execution by social norms and standards. Building on this, *habits are socially and culturally loaded actions that unfold over time*. Behavior in my understanding for this thesis thus becomes a habit, when actions are repeated in a specific rhythm.

This thesis is based on three types of empirical materials that inform each other. The *first* type comprises the habit tracking applications themselves. They form the case for this thesis and that's why I am going to describe in detail a set of four habit tracking applications that are part of my analysis. These apps were sampled out of a list of the most recommended habit tracking applications on websites, blogs, and YouTube videos. The *second* type of empirical materials is derived from my own engagement with these habit tracking applications. To do so I took an autoethnographic approach towards them to form a better understanding for what it is like to use a habit tracking application and how it affects me as a user. These autoethnographic accounts are going to be presented in the form of vignettes wherever they fit. The *third* and last type is a set of interviews that I have conducted with the developers of the four habit tracking applications that are part of my case. The transcriptions of these interviews were coded in vivo first and then revisited in a circular process. All three types of empirical materials inform my analysis and thus contribute their part to answer my research questions.

This thesis is divided into eight chapters. In the following second chapter I provide an overview of the existing literature that is relevant for my thesis. This includes the relations of humans and nonhumans, as well as the study of mobile applications; discussions around standardization, classification and (self-)quantification; as well as practices, habits, and time. In the third chapter I present my empirical case – habit tracking applications and their developers –, and my research questions. Subsequently, in chapter four, I lay out my theoretical framework and describe how I'm going to use it in the analysis of my empirical materials. Then, in the fifth chapter, I describe my methodological approach, including my strategy for gathering and analyzing data. In chapter six I present my results. This includes statements from the interviews as well as vignettes. Building on the existing literature, my theoretical framework, and my methodological approach I then discuss my findings in the seventh chapter. Finally, I will conclude this thesis in chapter eight with some concluding remarks, as well as a personal reflection on doing research in times of a global pandemic.

2. State-of-the-Art

Before engaging with the empirical case for my thesis I take a closer look at the existing literature and research that is connected to my research interests, habit tracking applications and their developers. This basically includes three major areas of literature:

The *first* one is concerned with the *relations of humans and nonhumans*, in specific the *study of mobile applications* as well as the *entrepreneurs, developers, and appsmiths* creating them. As my thesis is concerned with a specific type of mobile applications it is especially interesting to review other studies that have investigated these artefacts that evolved rather recently in the digital society. The focus for this body of literature will primarily be on social science research, including literature from Science and Technology Studies (STS), but also incorporate some works from other fields of study, such as computer science.

The *second* body of literature that is relevant for my research is that of *standardization, classification,* and *(self-)quantification*. Even though each of these topics could make up a full state-of-the-art in itself, from my point of view it is important to get a basic understanding for their characteristics and interrelations. Only by questioning the seemingly objective character of standards and numeric values I hope to show that they are ultimately executing 'politics by other means' (Latour, 1993a).

The *third* and last body of literature is concerned with existing research on *concepts and understandings of time*, how *time is related to practices and habits*, and how *artefacts and material infrastructures impact our practices of keeping track*. While practices and habits have received a lot of attention in the social sciences and beyond, its connection to the dimension of time and thus the structuring and ordering of everyday life is not as prevalent. Here I draw mainly on literature from STS research.

2.1. The study of mobile applications and their developers

To talk about any technology means to talk about the associations we as humans form with these technologies, these nonhumans (Latour, 2007). In the context of social science research – and even beyond – it might seem odd for some readers to engage with technologies on the same level as with humans. From early social science vanguards like Max Weber onwards, the ability to act was belayed to specific social categories and in consequence only humans were perceived to be actors. But as Bruno Latour and other STS scholars have pointed to in the past (Latour, 1992, 1994a, 2007; Latour & Callon, 1981), this a priori distinction actively renders nonhuman actors and their power invisible. Taking nonhuman actors into account and researching them symmetrically to human actors is thus an important

step towards a more comprehensive understanding for the question how agency and power are distributed in a network of actors.

As stated in the introduction mobile applications are globally widespread today across different categories of the social. As such they are powerful actors that are deployed for a variety of usages by different types of users. Mobile applications do not only have the potential to shape their user's behavior or self-perception, but they are also created based on specific values and imaginations. To give a more detailed overview I hence explore in the following sub-chapters, *first* how the relations of humans and nonhumans have been conceptualized and researched in the past. *Second*, building on this general discussion, I provide a short overview of social science research that has engaged with mobile applications. Here I specifically focus on those mobile applications that are used for the organization of individual as well as collective live. Moving on from this, *third*, I give a short introduction to the study of entrepreneurs, developers, and 'appsmiths', hence the creators of technologies.

2.1.1. Nonhumans, the other humans

When talking about habit tracking applications from a social science perspective it is difficult to do so with classical concepts like 'interactionism' or 'functionalism', as they are not able to include objects, or nonhumans, as equally important actors in their analysis. In classic social science 'the social' is merely constituted by humans and their (inter)actions (Latour, 1992, 1993b). Objects, if at all, only play a symbolic role in these contexts. This way of making an arbitrary distinction between humans and nonhumans *before* the analysis is one of the major shortcomings of classic social science approaches when it comes to the analysis of digital societies or phenomena within it. Nevertheless, it fits in with the general notion of modernity that nature and culture are two essentially different spheres that have to be separated, just as humans and nonhumans (Latour, 1993b).

While creating evermore technical objects that accompany us in the light of digital societies, the established boundaries between subjects and objects start to fall apart. According to Bruno Latour (1993b) the *work of purification*, that is the effort to distinguish subjects from objects – or humans from nonhumans – as being basically different, doesn't work anymore in a world that is actively engaged in mashing-up those entities by constantly introducing new technologies. As everyday practices like traveling, shopping or eating are evermore accompanied by and in need of a vast set of technical objects, the necessity for the *work of translation* between those entities increases (Latour, 1993b).

The process of translation, one can also speak of negotiations between human and nonhuman actors, in consequence forms the sociotechnical networks that are surrounding us at any time. The technical objects are active participants in constituting those heterogenous networks (Akrich, 1997). This

theoretical and methodological approach is referred to as *sociology of translation*, *actor network approach* or *Actor-Network-Theory (ANT)* (Latour, 1992). By conceptualizing all participants of a sociotechnical network as having an agency towards other actors in the same network this approach avoids technical as well as social determinism by dissolving the artificially created dichotomy between 'the technical' and 'the social'.

But which 'roles' do technical objects play in such networks? According to Latour (1992, p. 154) they are a mean of turning "a major effort into a minor one." The bottom line of Latour's argument here is that practices that may include several single tasks and that had to be performed by humans before are now evermore *delegated* to nonhumans. To make a more comprehensible point Latour, using a pseudonym, proposed that

> every time you want to know what a nonhuman does, simply imagine what other humans or other non-humans would have to do where this character is not present. This imaginary substitution exactly sizes up the role, or function, of this little character. (Johnson, 1988, p. 299)

Technical objects in use can therefore be perceived as mediators, or quasi-objects, that bind the social contexts in which they are present together (Latour, 1994a). But nonhumans are not just created on purpose to take over tasks from humans, in their role as mediators they in turn shape the actions and maybe more important the *possibilities to act* for humans (Latour, 1992). Thereby it doesn't make a difference whether we investigate a door-closer or a mobile application. Obviously, both entities are different, but their efforts to act are not.

To delegate a task to a nonhuman actor also means to *redistribute power* in the existing sociotechnical network. As delegation describes the "use for which [the technical objects] have been conceived" (Akrich, 1997, p. 205), these technical objects also have incorporated certain *prescriptions* of usage and users. These prescriptions come into being because the "designers [..] define actors with specific tastes, competences, motives, aspirations, political prejudices" (Akrich, 1997, p. 208) and based on that develop so-called *scripts*. These scripts can vary between different imagined groups of users and for different use cases. The concept of the script hence challenges a general view on technology that only focuses on its intended functionalities. It is much more about the moralities that get *inscribed into* the materialized technical objects (Verbeek, 2006) and how they affect the behavior of active or passive users.

Nonhumans are not just technical objects but ultimately everything that is not classified as 'human' in the modern sense. If it's animals, plants, or the environment as a whole, all of them are actors when taking an ANT perspective. As Michel Callon (1986) points to in his famous study on the scallops and fisherman of St Brieuc Bay the animals play a central role when trying to understand the decline of their population and how this affects the local communities of humans. Even though taking nonhuman actors

into account when conducting social science research adds a layer of complexity, it still is worthwhile to do so if we as social scientists want to form a better understanding for past, present, or future events and developments.

More recent approaches to the relation of humans and nonhumans within STS research have focused on the effects that are created through the disruptions to the environment and how the Anthropocene is constituted by dense networks of actors of different kind (Tsing et al., 2017). Here the view has shifted from focusing solely on technologies to other nonhuman actors that could be turned into allies in the quest for a more sustainable living in this world. For these authors it is ultimately about showing that we are living and have been living in a 'more-than-human' world. In this context the relations of nonhuman actors to a capitalist economic system have also received attention from researchers like for example Anna Tsing (2015).

2.1.2. The (new) world of mobile applications

One instance of a nonhuman actor that takes on a central role in contemporary life and economic systems is the mobile application, or mobile app, or simply app. In general, mobile applications are pieces of software that are deployed on mobile devices such as smartphones, tablets or on wearable devices like smartwatches. Following this understanding every piece of software that is not used on classic computers can be considered a mobile application. They are still technical objects[8] and as such nonhuman actors as described in the previous chapter. In addition, they are the ideal type of what Latour (1994a) calls a quasi-object. Mobile applications bind together specific social contexts and as the variety of social contexts is diverse, the variety of mobile applications is as well. The history of mobile applications is thereby inextricably connected to the 'rise of the smartphone' and the emergence of an economic market for mobile applications. In this sense, mobile applications have become a worthwhile area for social science research, as they have not only changed existing social structures and institutions, but also helped to create and stabilize new ones.

Even though the technical origins of mobile applications are like those of classic software, mobile applications still differ from other software that has emerged in recent decades. As Jeremy Morris and Evan Elkins (2015, p. 80) put it, "It is through their specialised functions, their iterative transactions, their novel materialities that apps have been able to so pervasively extend the reach of mundane software." Their ability to be changed and adapted at any time has enabled them to "spread beyond

[8] For the sake of simplicity I will refer to mobile applications as nonhumans or technical objects for the moment. In chapter 4.3 I will expand on the idea of understanding them as 'digital objects' further.

computers and mobile devices to a whole host of technologies, practices and aesthetics." (Morris & Elkins, 2015, p. 81) Thereby it should not be forgotten that mobile applications have co-emerged in a situation of ever-increasing individualization (Beck, 1992) that is based on the constant creation of new needs and desires. Not only since Steve Job's alleged statement that, 'people don't know what they want until you show it to them', the idea of creating needs has been deeply entangled with the field of commercial advertisement and marketing. Today, mobile applications are more and more used as universal instruments to address varying needs that potential users and customers might have (Miller & Matviyenko, 2014).

Creating or using a mobile application is not only about current needs, but also about imagined needs in the future. Paul Miller and Svitlana Matviyenko (2014) correspondingly have called their book 'The Imaginary App' as according to them every mobile application is based on particular imaginaries. On the one side this comprises the imaginaries of the developers: What the app should do, how it should look like, for which users it should be. On the other side it includes the imaginaries of the users which express different desires by using mobile applications – the desire to communicate with people that are in a different place; the desire to stay informed; the desire to consume, etc.

Beyond the imaginary character of mobile applications, they are also artefacts as Deborah Lupton (2014) points to. By investigating the case of health applications for mobile devices she illustrates how these artefacts create new digital bio-objects, that are the result of the tracking and quantification of the own body and behavior. In her case the mobile applications that track and display information about the own body act as proxies for the personal health and well-being of the individual. At the same time new relations between the technology and the "fleshy affordances of human bodies." (Lupton, 2019, p. 139) have emerged.

Especially the smartphone created a 'boom' for practices of self-tracking the personal health status as today basically anyone could engage in such practices with the support of the appropriate devices (Lupton, 2015b). In this context Lupton has also engaged with a group of mobile applications that she labels as 'self-diagnosis apps'. According to her these mobile applications are targeted at lay people that want (or have) to "monitor their bodies and health status" (Lupton, 2015b, p. 132). One central finding of her research is that especially health applications are presented as a mean to create certainty and objectivity about the health condition and the body of its users. By doing so such applications change the practices and daily routines of their users as they have to incorporate the regular self-tracking practices into their daily rhythms. Thereby new interrelations between the human and the nonhuman are formed.

The topic of food and food consumption is closely linked to the topic of personal health and as such has gained attention from researchers in the context of mobile applications in recent years. This is the

case as the consumption of ‘the right’ food in ‘the right’ amount gets directly associated with the topic of health and well-being. As citizens are evermore put in the responsibility to act and be healthy, mobile applications supporting this have seen a rise in downloads and usage. In Germany for example the federal government paved the way in 2020 for the prescription of mobile applications as part of medical treatment (Gesley & Library of Congress, 2020). Building on earlier arguments Lupton (2018a) states in the context of food tracking applications that they exert ‘thing-power’ over the self- and body-perception of their users. The mobile applications thereby do not just display information about food or the own consumption of food, but they attribute specific values to either of them. By using such mobile applications, the users are not only confronted with seemingly objective insights about their food consumption, but also with standards and classifications (see more in chapter 2.2) that are applied to their own body and eating behavior.

Beyond the area of personal health and well-being the topic of organization has created a diverse landscape of mobile applications in the last years. Organization and organizing are central themes in the history of humankind. Especially the development of shared calendar formats and standardized time has increased the ability to coordinate, schedule and organize social (inter)actions (Zerubavel, 1980, 1985) (see also more in chapter 2.3.3). With the emergence of the digital society organization and time scheduling got digitalized and ‘mobilized’. Several studies on the use of mobile applications in the context of time-management have been conducted by Judy Wajcman. Therein she explores how ‘digital assistants’ are increasingly used to not only track time practices but also offer analysis about the spending of this time. According to her those digital assistants are especially interesting to investigate as they “modulate and configure our consciousness of temporality.” (Wajcman, 2019b, p. 333) Mobile applications that target the need for organization are therefore not just supportive tools but also pursue their own agenda.

In another line of research, Wajcman (2019b) engages with electronic calendar systems that are common in work and private usage. Such digital calendars even belong to the set of pre-installed mobile applications that manufacturers normally ship with their smartphones. In her research Wajcman interviewed the developers of such apps and found that these digital materializations of time management do not just supplement existing forms of organizing time, but that they create new social architectures for it. This includes, for example, the ability to easily coordinate large meetings with participants from different time zones. Furthermore, she highlights in her research how the visions of the ‘Silicon Valley’ about a digitalized world are ‘shipped’ across borders and to other cultural contexts through the distribution and usage of these mobile applications.

While the last years have seen a push towards responsible research and innovation (RRI) practices (von Schomberg, 2011), there have also been discussions about the accountability of publicly funded research towards society and ideas have been tested to include citizens in scientific enquiries (Vohland

et al., 2021). In this context researchers have explored how mobile applications can be used on the one side to benefit scientific research and on the other side to allow citizens to take part in research. Rob Lemmens and co-authors (2021) argue for example that through the use of mobile applications citizens can provide relevant data for science in 'real-time' which "not only increases the quality of the provided data (in terms of timeliness) but also improves the connection of the observer with the subject and its environment" (Lemmens et al., 2021, p. 462). Further on the authors highlight that even though younger generations might be more accustomed to the interaction with mobile applications, the uptake of them in society as a whole is broad and in consequence such forms of citizen science should not be limited to younger age groups.

Finally, as Janet Vertesi and David Ribes (2019) argue the investigation of mobile applications from an STS perspective is not a breach with disciplinary traditions, but rather it is a new point of departure for engaging with emerging, stabilizing, and vanishing practices. At the same time STS research can rely on established theoretical frameworks to do so, as this new form of technology ultimately acts as a distributor of agency in a ramified sociotechnical network just like other types of technology.

2.1.3. Entrepreneurs, developers and 'appsmiths'

As I have shown in the previous chapters, nonhuman actors in the form of mobile applications take on a central role in the constitution of contemporary societies and life. They "are becoming the conditions of possibility for human living, crucially forming a computational ecology, made up of disparate software ecologies, that we inhabit." (Berry, 2012, p. 1) For David Berry the world we live in is fundamentally constituted by 'computational concepts and ideas'. With this assessment he points to the fact that computational infrastructures and devices are not confined to specific places or spaces, but that they are interwoven with all social, cultural, and natural processes that surround us and that we are a part of. Speaking with Ludwik Fleck (1979) a thought style that includes computational concepts and ideas by default has reached a predominate position in a global and digital thought collective.

What Berry is not investigating in his 'living book' is the role of those people that develop or transpose these computational concepts and ideas. It seems obvious that the modern information and communication technology (ICT) infrastructures that surround us do not come into existence out of nowhere, but they are designed, produced, and implemented by entrepreneurs and developers. They in turn are members of specific thought styles which influence their way of thinking and problematizing as well as the solutions they come up with for these problems. Richard Barbrook and Andy Cameron (1996) early on called this the 'Californian ideology'. Today we can still witness discussions resolving around the role of the 'Silicon Valley' in the development of globally used technologies (e.g. Wajcman, 2019a as discussed before).

In general, the study of the creators of technologies has a longstanding tradition within STS research, but the focus has often been more on either the study of engineers, their practices and how these are affected by and affect their way of thinking (e.g. Kunda, 2006; Latour, 1994b; Vinck & Blanco, 2003) or on the study of 'makers' and their practices of generating knowledge and artefacts (e.g. Davies, 2017; Meyer, 2015). The last group received more and more attention when they started to establish places where interested lay people could come together and engage with electronics or biohacking (Meyer & Vergnaud, 2020). These so-called makerspaces or hackerspaces are an interesting place for social science research as they create the possibility for access to tools and technologies that people would otherwise not be able to possess or even use individually. Thus, these places play a central role in the formation of new identities and ideas.

This way of engaging with ICTs is partly rooted in the legacy of how these technologies came into being. Stories about the early entrepreneurs of personal computing, including Bill Gates, Steve Jobs, and Steve Wozniak, who started their businesses allegedly in garages are widely circulated and shared. While computers for the personal use have been difficult to access for the general public for a long time, the home computer created the possibility for everyone (with enough money) to create his/her own computer programs. A formal education, for example in computer science or programming, was not necessary to take part in this emerging field.

Nevertheless, programming and coding can be seen as social practices that require specific skills and tools. Even though these skills can be acquired comparatively easily online today and do not require a formal education, they still adhere to a specific way of thinking. To draw on Berry (2012) again, the language that is used to code influences how we can think about a problem and possible solutions for it. Becoming a developer today does not require a particular course of education, but many ways are leading there. Still, programming in the narrow sense, that is the writing of code, has nothing anarchic. It requires to stick to very clear specifications and standards. One can only use specific commands to solve a given problem. What can be considered anarchic in this context is the way one solves the problem, which is normally not limited to one specific way.

Ultimately the developers of mobile applications are programmers or coders. Peter Seibel (2009) opens up this distinction when he writes that " 'coding' could be taken to refer to only one rather narrow part of the larger activity of programming." (Seibel, 2009, p. xiii) As we will see in the following chapters, programming and coding are practices. Both are performed by humans. Nevertheless, coding only describes the process of creating the actual code, it is thus the practice of writing down 'well-formed' lines of computer code. The practice of programming in contrast includes the coding and several other activities, such as the design and development of a software application.

Hanson Hsu (2015) introduced the term of the ‘appsmith’ for the developers of mobile applications. Therewith he expresses at least two important characteristics of these developers: *First*, it is obviously a reference to the term and occupation of the blacksmith which implies that just like this rather manual occupation, the work of an app developer is a form of craftsmanship that requires specific skills and knowledge in order to create an aesthetic and functional artefact. *Second*, it delimitates the developers of mobile applications, apps, from developers who work with other platforms. This is an interesting take as it highlights how different platforms affect the way of thinking and the practices of the respective developers.

To develop a piece of software not only requires specific technical skills, but also an understanding for existing problems. Thereby developers often work in a self-referential way as they are basing their work on their own experiences and values. Adrian Mackenzie (2013, p. 403) explains that “software developers [act] as agents of anticipation.” (p. 403) by applying “a process of self-abduction” to themselves. This is something that is in line with the idea of the I-Methodology (Akrich, 1995). Here, more general the creators of technologies are described to base the assumptions necessary for their everyday work on themselves.

2.2. The power of standardization, classification, and quantification

Being part of any collective means to be subjected to the power that is exerted by different forms of standards, classifications, and quantifications. The term *standard* thereby refers to a set of rules that define how a specific process or action should be conducted or to the way an artefact has to be designed and must work. Some standards have become part of common knowledge, for example the different measurement units for length, but others are not publicly accessible and thus unknown, for example the way Google’s search algorithms work. A form of extension to standards are classifications or categorizations. Based on standards societies have developed different *classifications* and *categories* for natural and social phenomena. These range from the assessment of other people’s clothing style, for example hippie, new romantic, vintage, etc., to the way we classify the taste of food and beverages, for example salty, sweet, bitter, etc. Building on this, *quantification* is an instrument, a way of assessing whether a specific standard is met or the basis for deciding if a certain entity should belong into category A or category B. Quantification ultimately is the abstraction of reality into numeric values to make it apparently more comparable.

Besides the theoretical distinction, all three entities interrelate with each other. The major aspect that binds them together is that all of them exert power in one way or the other over humans and nonhumans. As I have illustrated in the previous chapters, we cannot investigate the social without looking at the technical as they form networks of distributed power together. One problem with a sociological

approach towards power is that it uses a priori categories such as micro/macro actors and based on these categories explains the existing or developing structures of power. According to Bruno Latour and Michel Callon (1981) this is problematic as it black-boxes some relations. According to them it is rather important to observe the effects an actor has in order to determine what kind of category he/she/it fits in. Their idea is oriented towards a symmetrical approach to power: It doesn't matter if an actor is 'small' or 'big', quiet or loud, micro or macro to have power or not. Every actor of a sociotechnical network has the ability to exert power over other actors in the same network.

Using this perspective for the following sub-chapters means that we will encounter entities as actors that might not seem like it, but the effects they have reveal that they exert power and in consequence, following Latour and Callon, they have to be actors. At the same time the idea that objects have power is not specific to STS but can also be found in a lot of popular fictional writing. The exercise of power through standardized technologies or social categories is quite common in writings like 'Brave New World' by Aldous Huxley (1932/2007) or 'Animal Farm' by George Orwell (1945/2008) and as such also reflects existing thought styles.

In the following sub-chapters I discuss the most relevant works that engage with the conglomerate of power, standardization, classification, and (self-)quantification.

2.2.1. Standardization

To engage with standards and the process of standardization is a difficult endeavor as standards are not always visible but rather black-boxed and thus not noticeable if everything goes as it should. According to Lawrence Busch (2011) standards are a central element in our efforts to become modern, even though he agrees with the assessment of Latour (1993b) that 'we have never been modern'. The catchy title of Busch's book, 'Standards. Recipes for reality', already transports a central point: Standards are not only surrounding us all the time, sometimes more, sometimes less visible, but they play a central role in constituting the realities we find ourselves in. By this Busch does not mean that standards dictate how reality *is*, but that standards give certain parameters that limit our way of thinking and our perception of the world. In consequence these limitations affect our ability to shape the world. Applying the idea of co-production here means to acknowledge that technocratically created standards form our social structures, while these social structures form the creation of new standards (or change old ones) at the same time (Jasanoff, 2004a).

As the influential Office of Technology Assessment (OTA) of the U.S. Congress assessed in 1992, standards are the "building blocks for the future." (U.S. Congress, Office of Technology Assessment, 1992) Through this bold headline of one of their reports they underscored that standards not only impact

the existing realities, but that they shape futures. In contemporary societies the need for standards is increasing, especially triggered by an ever-accelerating economic system that seeks to produce and sell more units in less time. Turning the rather positive assessment of the OTA around also means that standards can hamper certain developments that would need to take place outside of currently existing standards. Similar to *though styles* (Fleck, 1979) standards define how we perceive reality but at the same time make us blind for contingent alternative approaches.

Standards are more than a mean to govern the world, they are also an effect of a governed world, of trying to govern nature and culture. Behind the generalizing efforts of standards, individual accounts get easily lost, which can for example be seen in the various education systems that work with standardized curricula, standardized learning materials, and standardized imagined pupils. As Ulrich Beck (1992, p. 134) put it: "Institutions act in legally determined *categories of standardized biographies, to which reality conforms more or less*." When institutions like schools or universities are setup based on 'standardized biographies', maybe it is better to speak of averaged biographies, then actual pupils will have trouble to adhere to these standards. In political discussions we can thus not only witness disputes about the existing standards for education systems and what they should look like, but also about how we can design the process of standardization in this context as sensible as possible.

One area of social life that relies more than others on standards is that of healthcare and medicine. Whether it concerns medical procedures, the way medical diagnoses are stored or the question who can participate in clinical trials and who not, standards impact the way medical practitioners can (or at least should) act. As Steven Epstein (1996) has illustrated these dividing borders can be questioned by actors from outside the field, like the AIDS activists in his case, *but* this only means that the 'border' of this group is shifted not that it is overturned completely.

The standardization in healthcare has on the one side allowed for the creation of better exchange of knowledge across the world and between medical professions. On the other side, as Kay Felder and co-authors (2016) have noted in the context of 'research and care in an obesity outpatient clinic', the strict standardization also leads to the development of 'one-size-fits-all' approaches for medical procedures and treatments that do not account for the individual patient. While standards are a mean to reduce complexity, this can turn into a problem itself. If a complex reality is abstracted to a standard and thereby rendered uncomplex, reality can only fail in its light.

This is especially challenging for areas that are charged with highly sensible and ethical topics as it is the case for organ procurement. Developing and implementing standards here means to decide who gets to live and who not. It is an existential intrusion to individual life. As Linda Hogle (1995) argues the standardization in this area is on the one side a necessary step to allow a globalized research and

medical community to collaborate and advance their practices, while on the other side posing challenges for the local practitioners of organ procurement and transplantation.

Some of the classic laboratory studies, that have been conducted in the field of STS, are ultimately concerned with standards and standardization. In the laboratory studies of Karin Knorr-Cetina (2009) or Bruno Latour (1994b) we learn that scientists in different contexts have established specific forms of social order which influence their way of doing research. Only by standardizing specific practices and processes these social orders can 'travel' from one place to the other. This can also be seen when looking at the history of the experiment, as shown by Steven Shapin and Simon Schaffer (2011) on the case of Robert Boyle and Thomas Hobbes. While the first one was certain that (standardized) experiments can be the basis for political action and decision, the latter rejected this idea. Overall, the controversy over standards and standardized practices was central to the development of modern scientific disciplines and still is a major driver for its differentiation.

Today we live in societies that are not only connected through standardized ways of knowing, but also through standardized products. George Ritzer (2013) illustrates in his book how companies that act on a global scale more and more take over local markets and thereby homogenize the globally available food products. He labels this process 'McDonaldization'. Adding to this, objects play an important role in the context of standardization. On the one side objects can be used to check if standards are adhered to, like scales for example, but they can also be the subject for standards. One central object for the functionality of the globalized world, that is normally not visible in everyday life, is the shipping container. As Marc Levinson (2016) shows, the standardized shipping container is central for the modern and globally active economic system. The size and shape of these containers impacted the way other products and packing had to be designed so that they could fit into these standardized containers without a 'loss of space'.

Finally, there has been research that shows that standards are not universal, even though this might seem contradictory. John Carson (2004) demonstrates in a comparative article about intelligence tests in the United States and France, that the standards that form the basis for these tests differ based on national, social, and cultural values as well as based on the political systems they are embedded in and which they ultimately also constitute. Beyond this Carson illustrates how standardization in modern political systems is always linked to some form of quantification. I will come back to this point in the next but one chapter.

2.2.2. Classification and categorization

Classification and categorization are central modes of operation for humans in their everyday life. As Geoffrey Bowker and Susan Star (2000, pp. 1–2) note: "We all spend large parts of our days doing classification work, often tacitly, and we make up and use a range of ad hoc classifications to do so." While there are some ad hoc classifications, most of them are still based on existing standards, norms, and values. For example, when taking the last apple out of the shelf that is sprinkled with some small brown spots, I might classify it as still eatable as long as I remove the respective parts before. But if the whole apple is brown and has a strong smell to it, I will probably classify it as rotten and not eat it anymore. Both classifications for the same object are based on knowledge that I already hold. It is based on the facts that I have learned through the course of my life about fruits, the process of decomposition, and what kind of food is palatable.

In abstract terms, following Bowker and Star (2000, pp. 10–11), classification is the "spatial, temporal, or spatio-temporal segmentation of the world." According to them, an ideal system for classification requires *first*, "consistent, unique classificatory principles in operation"; s*econd,* "categories [that] are mutually exclusive"; and *third* "the system [to be] complete." In reality classification systems might not always work as these ideal types suggest.

In principle, classification is a practice that has to be learned and thus also taught. In schools, children learn among other things how to classify humans, animals, plants, historic and geological eras. Therefore, they first have to learn about the criteria that, for example, make a bird a bird – it has wings with feathers on it – and a plant a plant – it grows out of the earth and has green leaves. Once they have learned about these specific pre-given characteristics, they will apply this knowledge to new objects or situations they encounter. With time this knowledge can turn into a tacit form and is then still used when classifying as Bowker and Star have also pointed to in the quote above. Interestingly enough as soon as it becomes tacit knowledge it gets difficult to explain to someone else how you apply and use this knowledge (Polanyi, 1969). This can foster social forms of prejudice like racism or sexism, which are both based on arbitrary forms of classification.

Even though classification might seem like a rather recent topic to discuss and question, the predecessors of STS research have already engaged with it. Ludwik Fleck (1986) for example has argued that 'in order to see you first have to know.' For him there is a direct link between being able to see something with your eyes and to know what it is. In addition, he argues that looking at something with our eyes, for example a line of characters, doesn't mean that we can see them. Seeing for him is a collective process as it requires knowledge about the social standards to apply. In this understanding the human ability to classify the external world depends on social and cultural categories.

As such classification can also be seen as a form of getting in touch with the world external to us. The classification of objects or behavior that is external to the individual has the power to change this external world. In a case study by Adrian Mackenzie and co-authors (2013) about the transformation of 'the biological' through biomedicalization they demonstrate how the creation of standards for classifying species based on their DNA has altered the species themselves. Classification is thus not only a form of representing the world, but also always a way of forming it.

There is one area of classification that receives recurring attention not only in research, but especially in public debates. The grading of pupils and students is a matching example for the impact that the classification of humans can have. As a recent study by Björn Högberg and colleagues (2021) demonstrates the introduction of gradings and regular testing of pupils in the 6th and 7th year of school does increase their level of stress while at the same time impacting their academic self-esteem negatively. Particularly in times of home schooling and distance learning national and international media outlets have picked up the question which effects grading has on pupils and students (e.g. Schneider, 2020). Interestingly enough these discussions often drift away rapidly from the initial question of how effective grades as a system of classification are to a discussion about the advantages of having a clear indicator for delimitating pupils' performance.

This is in particular an interesting discussion to follow when talking about classification, as research has already pointed to the fact that even though grading might be standardized it does not mean that it is universal or equal across countries and even within (Carson, 2004). Studies conducted in different countries and thus differing school systems have shown that there is (at least unconscious) discrimination happening in the assessment and grading of pupil's essays by teachers (Hinnerich et al., 2015; Sprietsma, 2013). Now this is something that does probably apply to quantitative and qualitative assessments, but in an education system that is solely focused on grades as the central indicator for being admitted to specific schools and universities or to receive grants and scholarships, this form of classification has long-lasting impacts on the life of the individual pupils and students. To put it differently, grading as a form of classification exerts power over the individual life.

Classification is not only conducted by humans, but evermore delegated to nonhumans. Especially the use of algorithms to process, analyze, and classify big data is a prominent and ubiquitous example for the delegation of classification work to technologies. In Austria, for instance, the Public Employment Service (AMS) has started to use an algorithm in 2020 to classify job seekers into one of three categories. Depending on the category one is attributed to, job seekers receive for example additional training or not. The implementation of such a system has been discussed controversially in the public, but also in scientific literature. Doris Allhutter and co-authors (2020) have illustrated which indicators are used by the algorithm to classify job seekers and what this specific approach renders invisible. In their study

they find that for example soft skills or personal motivation are not considered in this algorithmic model, which ultimately can lead to a discriminatory classification system.

2.2.3. (Self-)Quantification

Although not every standard is tethered to numbers and not every classification is based on quantification, still both regularly rely on exact numbers. As we have seen in the previous chapters standards are a mean to govern our everyday practices (Carson, 2004), while classification is a process to order them. Quantification in turn is a specific epistemology that draws on the assumption that natural and social phenomena can be transformed into and be represented by numeric values.

Thereby quantification can act as a 'technology of distance' as Theodore Porter asserted in 1995. By basing decisions on numbers context specific information are not considered. This has not only lead to the assumption that numbers are more objective and fairer than qualitative assessments, but also to the conclusion that decision-making that is based on numbers is more reliable and hence justifiable. In this understanding quantification black-boxes the complexity of reality by attributing seemingly clear and universal symbols to it.

In general, the history of quantification is very much connected to the formation and stabilization of nation-states (Anderson, 2006). Political leaders of different systems and epochs have relied on quantified information about their areal of influence. The predecessors of modern social science surveys for example have been a tool for the British monarchy after the invasion of Ireland in the 17th century. In a comprehensive report Sir William Petty (1691) collected information about the Irish population and country in form of extensive statistics. This example illustrates how statistics where directly connected to the representation of the world as basis for political decisions and the execution of power (Desrosières, 1998).

As Clark Miller (2005) shows in his study of indicators for local and global sustainability, quantification can also act as a 'technology of visibility'. While global phenomena like climate change might not be visible to everyone, numbers representing changes in the local and global ecosystems can shed light on these fundamental changes. Only by expressing them in numbers they can become an object of political discourse and action.

Conclusively quantification can be done by measuring or counting. As Petter Grytten Almklov pointed to in his presentation at the 4S conference in 2020, measuring and counting are two different forms of quantification. While measuring involves an interaction between the technology that is used to measure and the object that is measured, counting in contrast requires already delimited entities that can be quantified. To give two examples: When measuring the body height of someone a technology like

the measuring tape is necessary. The process of measuring then requires specific knowledge, where to start and where to end the measuring for example, and is vulnerable to inexactness. The data generated based on such a measurement is thus just an incomplete representation of reality. In contrast, when counting the number of people that are entering a building an exact number can be taken. This is probably also true because there are no 'half humans', but also because the entities to be counted have been defined as singular entities to count beforehand.

As I have illustrated until this point the quantification of others stands in a long political tradition. Since the digitalization has started to expand and accelerate the idea of *self-quantification* has reached more popularity and as such also attention from STS researchers. Compared to quantification in general it is concerned with the voluntary tracking of the own body or behavior. The practice of self-tracking is today especially supported or enabled in the first place by various digital technologies like the smartphone and different types of sensors (Lupton, 2016).

As Deborah Lupton (2016) has pointed to, the quantification of the self, or self-tracking, is not a mean in itself, but rather a starting point for feeding the generated information back to oneself. A central finding of Lupton in this context is that self-quantification creates new 'data bodies' or 'new hybrid beings'. Both come into existence through the extensive tracking, aggregation, and analysis of the own body and behavior. The collected data not only serves as source of information about oneself, but the more data is collected the more it is seen as the body or behavior itself. Astrid Mager and Katja Mayer (2019) have pointed to the fact that besides the creation of data bodies through self-tracking also new 'bodies of data' come into existence that require other forms of engagement and analysis.

Beyond this Lupton (2013) describes the social and cultural structures that surround the idea of tracking oneself. In the last years different online and offline communities have formed that believe that self-tracking can make them 'better' people. One of the most active communities on a global scale is probably the 'Quantified Self' movement which operates under the slogan "self knowledge through numbers."[9] When looking closer into their motivations and goals they seem to look for a form of liberation. But this liberation can only be achieved individually by tracking oneself and change based on the gathered data. Here Lupton points to the fact that this movement builds on a neoliberal understanding of responsibility, namely that of self-reliance.

[9] Quantified Self. (n.d.). *Self knowledge through numbers*. Retrieved from https://quantifiedself.com/

2.3. Practices, habits, and their relation to time

In terms of observation, individual and collective life is structured and mediated by communication and practice. Communication can take place verbally or non-verbally and is often also represented in written formats. Through communication humans try to establish orders of meaning and create shared bodies of knowledge. To communicate with others requires a shared set of practices to which this communication can relate (Shankar et al., 2017). Put simply, a practice is something that humans do. It is a basic element of individual action just as it is a corner stone for the social interrelations that constitute the various collectives we live in (Schatzki, 1996).

Practices can require the meeting or collaboration of humans or even the use of technologies. As such they are no actors themselves, but they influence the way actors in the same network engage with each other. Commonly, practices are performed in different tempos, repeated with different frequencies, and are embedded in varying social rhythms. The timing and synchronization of practices is an important ability when navigating through the social world. This ultimately means that practices and time are not two separate entities, but rather complement each other. Practices form different timescapes, while time is experienced through practices.

Building upon the concept of practices there is a tradition in the social sciences that engages with the cultural forces that influence them. Habits, as they are called, are not only acts that are loaded with cultural meaning but acts that are embodied by the individuals that perform them (Wilk, 2009). A habit is thus nothing individual, even though individually performed. It is rather a social phenomenon. As such it lends itself as a category of analysis for the relation of individual actions and collective norms and values.

In the following sub-chapters I will expand on existing literature and research concerning time, practices, habits, and the history of time keeping and managing technologies.

2.3.1. Concepts of time in the social sciences

When it comes to the investigation of time, it is often described to be a ‘natural constant’ that does not change and is equal for all phenomena and experiences. In contrast to such a view, from an STS perspective, it is rather important to distinguish different *experiences of time* and consider their specific configurations. In modernity the question of ‘what time is’, got primarily attributed to a specific way of measuring it: Time is what clocks count and display. Through the face of clocks, time is presented as an entity consisting of hours, minutes, and seconds, thus as a completely quantifiable entity. The uniform intervals of this clock time structure our everyday practices and establish social orders, as research has

shown (e.g. Bruyninckx, 2017; Wajcman & Rose, 2011). On closer inspection it gets clear that this standardized and universal clock time was constructed at specific moments in time for definitive purposes ("Standard Railway Time," 1883; Zerubavel, 1980). Clock time is thus not an ontological constant, but rather a human-made representation of – maybe even an inscription device (Latour & Woolgar, 2013) for – the physical time (Cipriani, 2013). This physical time cannot only be represented by clocks but is the basis for various classifications like that of the changing terms or the position of the Earth in the solar system. In contrast to physical time, social time describes the collective rhythms and temporal orders that societies have established over time. It is tangible for individuals through intersecting and overlapping timescapes and temporalities.

The timescapes that constitute social time can be understood in different ways. On the one side they represent the intertwined relations between the physical time as well as culturally loaded and individually experienced time (Rosa, 2010). That's why, for an STS take on time, the concept of timescapes, originally proposed by Barbara Adam (1998), is a matching fit. On the other side it is an analytical term that can be used to investigate different temporal settings. Roberto Cipriani (2013) for example differentiates four modalities, or timescapes, that can be useful for analysis: Micro-time, meso-time, macro-time, and mega-time. When micro-time represents specific events or practices, meso-time is the aggregation of these single occurrences in broader, but still socially constructed, categories like a workday or school day. Macro-time is a timescape that spans over the course of an average human life, while mega-time is concerned with the unity of time from its start to its end.

These timescapes turn into temporalities as soon as they come together with specific social orders. Even though the units that are measured through clock time might quantitatively be the same they need to be made socially equal or unequal (Cipriani, 2013). For example, this can be seen when it comes to the value that is assigned to specific professions. In contemporary societies the work, and thus every time unit this work consumes, of an IT manager is valued higher than that of an educator when we take the income as a proxy for the value. Besides the different social valuations of time, there exist also different subjective perceptions of time: One can enjoy a week of holiday at the Bahamas and might feel that it 'passed by too quickly', while at the same time a team building event at work over the weekend might feel like 'it is never going to end'.

If time is not equal from one situation to another and is not experienced equally by one individual and another, how can research then be conducted on it? As Eviatar Zerubavel (1985, p. 10) highlighted in his empirical studies on time, a social science approach towards it should precisely focus on the "subjective meanings people attach to it". These different meanings are regularly attributed in the context of distinct events, acts, or practices.

We can also witness time when taking a closer look at the various representations we have developed for it in our everyday life. The tempo or pace of a practice is eventually connected to the subjective experience of the person doing it. In contrast the frequency or periodicity with which the same practice is repeated can be expressed in numeric values and as such be made comparable. A rhythm can also describe that a practice is repeated, but it is much more loaded with cultural meaning. For example, when one goes into the forest 'once a year' to chop down a fir for Christmas, this not only tells us something about the way our temporal order is structured, but also about a specific festivity that only takes place once a year.

As time is difficult to grasp analytically, different scholars have tried to assemble analytical categories for it. Gary Fine (1996) for example has proposed to use the five dimensions of periodicity, tempo, timing, length, and sequence. As Dale Southerton (2006, p. 436) expands: "Periodicity refers to the rhythm of the activity; tempo, to its rate or speed; timing to the synchronization or mutual adaptation of activities; duration, to the length of an activity; and sequence to the ordering of events."

2.3.2. Practices and time

Even though the investigation of practices has a long-standing tradition in social science research, it received more attention in the mid-twentieth century from social theorists that engaged with individual practices to explain greater social structures (e.g. Bourdieu, 1977). With the so-called 'practice turn' in social theory new analytical categories emerged that were neither based on individual actions, nor collective structures (Schatzki et al., 2001). Especially the fact, that these new sets of theories "refuse to promote either the individual or the social whole as the fundamental ontological phenomenon of social analysis." (Blue, 2019, p. 923) makes it promising for STS research.

In general, a practice is among other things, according to Theodore Schatzki (1996, p. 89), a "temporally unfolding and spatially dispersed nexus of doings and sayings." Following Stanley Blue (2019) this definition points to the fact that practices have to be sustained by regular performance. Without the actual *doing* of these practices and their *repetition* by humans – eventually supported by nonhumans – practices are not practices, but merely acts. As practices rely on a temporal dispersal, they are by default linked to the dimension of time. The rhythms created by such temporal dispersed practices are not fixed, they move and "are characterised by repetition and difference; by birth, growth, peak, and decline; and by their affect across a polyrhythmic ensemble." (Blue, 2019, p. 937) This means that not every repeated practice is the same as its predecessor, thus also giving space to explanations for change in human behavior and in consequence social change.

Hence, to study practices also means to study experiences and structures of time, as within theories of practice "time is no longer an external phenomena against which organisations of practices should be read." (Blue, 2019, p. 944) This is also explained by Henri Lefebvre (2013) when he illustrates how any social science study of rhythms outside the own body will always rely on the own bodily rhythms as a reference point. In this understanding practices are not viewed as singular events, but rather as a concatenation of events that reoccur with a specific frequency and happen in different temporal locations.

As the presented research on practices shows, investigating practices always means to investigate time. This is the case because practices can only be conducted in specific sequences, so in a specific order over time. While obviously some practices can be performed in parallel (like preparing food and watching television) others cannot be done in parallel because either each of them requires a specific surrounding and accessories which are not compatible (like preparing food and skiing), or because one practice requires other practices to be performed *before* or *after* it (like having to shop for groceries first, before one can prepare food). Timing these practices is thus necessary and requires individual as well as collective organization to work. Several practices that are set into relation to each other form a series. The unit of measurement for these practices is the clock time or physical time. This does not mean that the thing that is measured by clocks is time, it rather is the specific cultural, social and maybe even anthropological centered institution that represents time (Cipriani, 2013).

The examples in the paragraph above also illustrate that speaking of practices and time is always relational. For example, when I tell somebody that I have finished my thesis before going on vacation, this automatically tells my counterpart that I went on vacation after I have finished my thesis. Even though this seems simple it is a basic way of temporally orienting ourselves in the world. This can be extended to other expressions of time in our language. To give another example, when I tell somebody that I go to the gym regularly this requires different cultural knowledge for my counterpart to understand. Is going to the gym something that is good or bad? What is a common rhythm for going to the gym that would fit the description of regular? These questions can only be answered with knowledge about the specific context the statement has been made in.

2.3.3. A brief history of time keeping and managing

To investigate time also means to investigate the material infrastructures and objects that produce and reinforce our understanding of time and temporalities (Wajcman, 2019a). Watches tell us the time; atomic clocks are the basis for the by now globalized ICT infrastructures; analogue or digital calendars are used to coordinate our time individually and collectively. All these technical devices, these nonhuman actors, facilitate our relationship with time. In consequence time and its measurement "[…]

cannot be understood on the basis of a conception of the world as split into ‘subject’ and ‘object’.” (Elias, 2007, p. 8) To talk about time always means to talk about humans and nonhumans that work together in one way or the other.

Zerubavel (1980) points towards the historic evolution of contemporary time- and rhythm-keeping instruments such as calendars. He locates their origins in the medieval Benedictine monasteries that were highly dependent on daily rhythms to keep-up their social order. The use of candle clocks there can be understood as a way of keeping track of the time and keeping a specific rhythm between different practices as it was required by their socio-religious codes. For the medieval monasteries this was especially important as their religious rules prescribed regular prayers and liturgies also during the night when the time could not be deducted from the position of the sun.

Instruments of time keeping are thus also agents that influence the way social time is formed and experienced. As Helga Nowotny (2018, p. 12) asserts, „Clocks as time-givers also embody the values of a society. The first clocks had little in common with the functional time-givers which show values today that have long since been made international.” While the way time keeping is done has changed over time, so the values that are attached to it have as well. While early forms of time keeping were divided into broader intervals of time – days or hours –, modern time keeping technologies are able to break down time in intervals that are too short for human experience – femto-seconds for example. This fine-grained tracking of time can even contribute to the feeling that ‘time is running’ and that ‘it should not be wasted’.

As Wajcman (2019a, p. 1284) points to: "The notion that time is a resource that is owned by an individual, that it is a territory that can be conquered, is an integral part of the injunction to manage one's own time efficiently." Thus, the emergence of ‘digital assistants’ such as habit tracking applications, that seek to better organize time and the rhythms that constitute it, is aligned to more general values that have prevailed in the digital society (Lupton, 2015a). Especially the idea that ‘multi-tasking’ is an important skill, not only at the workplace, and the fact that there are so many things that we could do (e.g. travel to various places; consume all kinds of goods) but that we do not have enough time to actually do so (Rosa, 2019), creates a discomfort that is countered with ever-increasing planning and organizing, also with the help of technologies.

3. The case for and of habit tracking applications

Before addressing my research questions for this thesis, I provide a short overview of my case, the habit tracking applications, which I have referenced until this point without further explanation. I do this by, *first*, expanding on the 'history' of mobile applications in general, their role in contemporary digital societies as well as on habit tracking applications in specific in chapter 3.1. *Second*, based on this general overview I describe those habit tracking applications more closely in chapter 3.2 that I have specifically looked at for my analysis. In the methods chapter I do describe in detail how I sampled this group of habit tracking applications. *Third* and finally, in chapter 3.3 I describe and explain my research questions, how they work together and inform my research.

3.1. Mobile applications and habit tracking applications

With the announcement of the first iPhone by Steve Jobs in *2007*[10] and its release some months later a new and powerful actor made its way to the stage of the world. This was only *fourteen years* ago and within this short period of time the smartphone became *the* central status symbol and even more a basic need in societies all around the world. The smartphone, a technical artefact, not only allows to connect with other people – through voice communication or short messaging – but its strength lies in the possibility to enable a range of additional use cases through the deployment of mobile applications. This development was favored above all by the rapid growth of computing power; smartphones are able to process more data and information today then regular personal computers were fourteen years ago. No matter if it's playing video games, participating in video conversations, making pictures or videos, editing them, reading books or the newspaper, gathering information about the environment, or tracking the own body; all of this can be done with a technical artefact that fits easily in our hands and pockets.

In the same period, probably in some form of co-development with the smartphone, standards for the World Wide Web (WWW) – like the TCP/IP communication protocol – and its material infrastructures – the web servers, network hubs and cables – advanced in a rapid development. This has not just been a technical development, but also a social. A variety of new occupational areas as well as markets have emerged that made use of and advanced these technologies. Due to these developments not only new actual networks between people have formed, but existing ones also changed. With the evolving

[10] Jonathan Turetta. (2013, May 14). *Steve Jobs iPhone 2007 Presentation (HD)*. Retrieved from https://www.youtube.com/watch?v=vN4U5FqrOdQ

technical possibilities, new forms of social behavior got possible. This also included the idea and practice of self-tracking.

To be precise, the idea of self-tracking and self-quantification is not a new phenomenon of the digital society, but its technological capabilities and propositions offered a new approach to it. With the smartphone it is possible today to automatically track the own body; the internet allows to share this information across different devices and with other people. This has led to the formation of online communities that exchange about the best approaches and techniques for self-tracking. For example, on Reddit, a forum-like discussion website, a growing number of users engages with the topic of the 'quantified self'[11]. There they also exchange recommendations for mobile applications that can help with this self-quantification. When conducting an ad-hoc online search for the term 'quantified self' it is easy to find a big number of websites, videos and trainings that praise the idea of tracking one's own behavior. The globally active movement 'Quantified Self' even promotes a progressive view on data ownership as it is according to them "every person's right and ability to learn from their own data."[12] Even though practices of self-tracking can be viewed as a way to form self-expertise (Heyen, 2020), that was not possible to obtain before the digital society, it also creates new challenges. More than ever it is important to know what this quantified data 'tells' about the reality it represents.

Until this point of the thesis I have been using the terms 'habit tracking applications', 'self-tracking applications', and 'mobile applications' without any further explanation. In general, a *mobile application* is a digital object, a collection of code, that can be executed on mobile devices such as smartphones, tablets, or smartwatches. Technically these applications do not differ much from applications that one would find on a personal computer. The difference is more situated in the fact that the user interface works different: The 'input device' for mobile applications is not a technical object itself, for example a computer mouse, but rather it is the own body, a finger or hand of the user. Also, the fact that the screen sizes are way smaller on mobile devices affects the way these mobile applications can be used and in consequence impacts their design and development.

When it comes to *self-tracking applications* this term can be understood as an umbrella term for different forms of self-tracking. There exist applications that target specific areas of life, like tracking one's own menstrual cycle; the number of calories, fat, sugar, etc. that one consumes; or the time that one spends on performing specific activities or the number of times a specific activity is performed throughout the day. The latter apps can be subsumed under the term *habit tracking applications* and they allow the tracking of everything from having breakfast, over doing sports to working. But even in this group of applications a diversity in target groups, alignment and goals does exists. Some of these

[11] Quantified Self. (n.d.). *Quantified Self* [Reddit board]. Retrieved from https://www.reddit.com/r/QuantifiedSelf/
[12] Quantified Self. (n.d.). *What is Quantified Self?* Retrieved from https://quantifiedself.com/about/what-is-quantified-self/

applications will highlight the importance of habits, so the routinized performance (or non-performance) of specific practices. Habit tracking applications are often used to pre-schedule the day, but not so much based on time slots like with a calendar but rather based on a specific set of habits that should be (or should not be) performed throughout the day.

While every habit tracking application comes with its specific design and set of functionalities (see more in chapter 3.2) there are some common features that recur and as such can be seen as defining characteristics for a mobile self-tracking application to be called a habit tracking application. The *first* one is the possibility to create different types of trackers for habits. This can include trackers that count the number of times a habit has been done over a specified period of time, or trackers that count the time it took to perform a habit. The *second* common feature is the entering of data for each of these trackers. While some trackers may require the manual input of the respective data by the user – for example the information how many glasses of water one has drunk today – others are entered automatically by other technical artefacts – for example the number of steps one has taken per day that were recorded by a fitness bracelet. The *third* and last common feature of habit tracking applications is the graphic display of the tracked data. This can be in the form of arrays of numbers, tables, or different types of charts. These graphic representations of the own habits can thereby show daily data or aggregate it over a longer period of time.

As it is difficult to describe these features in abstract terms, the following chapter will engage with specific habit tracking applications and also include screenshots from each of them (see Figure 1 to Figure 4).

3.2. Habit tracking applications in the focus

While there are numerous habit tracking applications available in both or either of the two biggest digital app stores, Google's Play Store and Apple's AppStore, they share similar features at the core as described in the previous chapter. For this thesis I had to decide which of these habit tracking applications are in particular interesting for my research inquiry. The specific apps I choose evidently had an impact on the group of developers I interviewed. I will describe my sampling strategy in detail in chapter 5.1, but this much can be said I limited the habit tracking applications that were matching my research interest to twelve. In the end I had the opportunity to interview the developers of four of these apps: *Strides*, *Habitify*, *Way of Life*, and *Done*. In the following I am going to give a brief introduction to each of these habit tracking applications, their background story, and also some of their specificities.

Strides

Strides is a habit tracking application that was released the first time in 2013. Therewith it belongs to the group of the oldest habit tracking applications that are still available today. According to its founder Kyle Richey the idea for this app originated already in 2011. The company that develops this app is located in the United States and has two employees. Kyle Richey, who does everything from product management, design, to customer support, and one programmer who solely focuses on the development of the mobile application that is only available for iOS mobile devices.

The plan to expand to other mobile platforms – such as Android or even a web service – was abandoned after realizing that the efforts and costs of such an endeavor were not in balance with the possible output. That's why this habit tracking application is available exclusively on iOS, which is an important fact as it means that the developers can use some of the Apple specific security measurements. This includes the move of all user data from data storages operated by *Strides* itself to the Apple iCloud. Not only is all stored data there encrypted, but the developers do not have access to it anymore. Kyle Richey has therefore no deeper insights into the usage behavior beyond what he learns through personal conversations with the users of his app.

The app is free to download and use but this free version includes limitations to its functionalities. For example, the number of trackers is limited, there is only a limited graphical progress report and no possibility of syncing the gathered data to other iOS devices. The *Strides* Plus version that unlocks all functionalities can either be purchased as a subscription on a monthly basis for 5,49€, as a yearly subscription for 30,99€, or as a 'one-time purchase for life' for 89,99€.

On their website[13] they promote their app with slogans like: "Get organized and track anything you want to build the perfect routine. Stay motivated with charts and reminders to achieve your goals." This is accompanied by numerous screenshots of the different charts that are part of the apps progress reports.

In terms of its functionalities *Strides* is a classic habit tracking application which means that it provides different types of trackers including a habit tracker, a target or average tracker and a project tracker. Every type comes with its own way of entering data to the app. For the habit tracker it is possible to define if the habit is a good or bad habit and how often it should be performed per unit of time (e.g. day, week, month). When tracking a habit, you can only track that you did a habit or that you did not do it. The target and average tracker are oriented towards tracking numbers. For the first one you can define a specific numeric value as a goal and a date until when this goal should be reached. Here the goal is to reach the defined value until the specified date. For the average tracker you do not define a final date,

[13] Strides. (n.d.). *Strides: Goal & Habit Tracker + SMART Goal Setting App*. Retrieved from https://www.stridesapp.com/

but also a numeric value. In contrast to the tracker before the goal here is to reach a specified average over a certain amount of time. The last tracker, the project tracker can again be assigned a due date and the value that is entered is a percentage. The idea is that users are working on a larger project that requires different sub-steps and through this tracker can keep track of how much they have already done for this project.

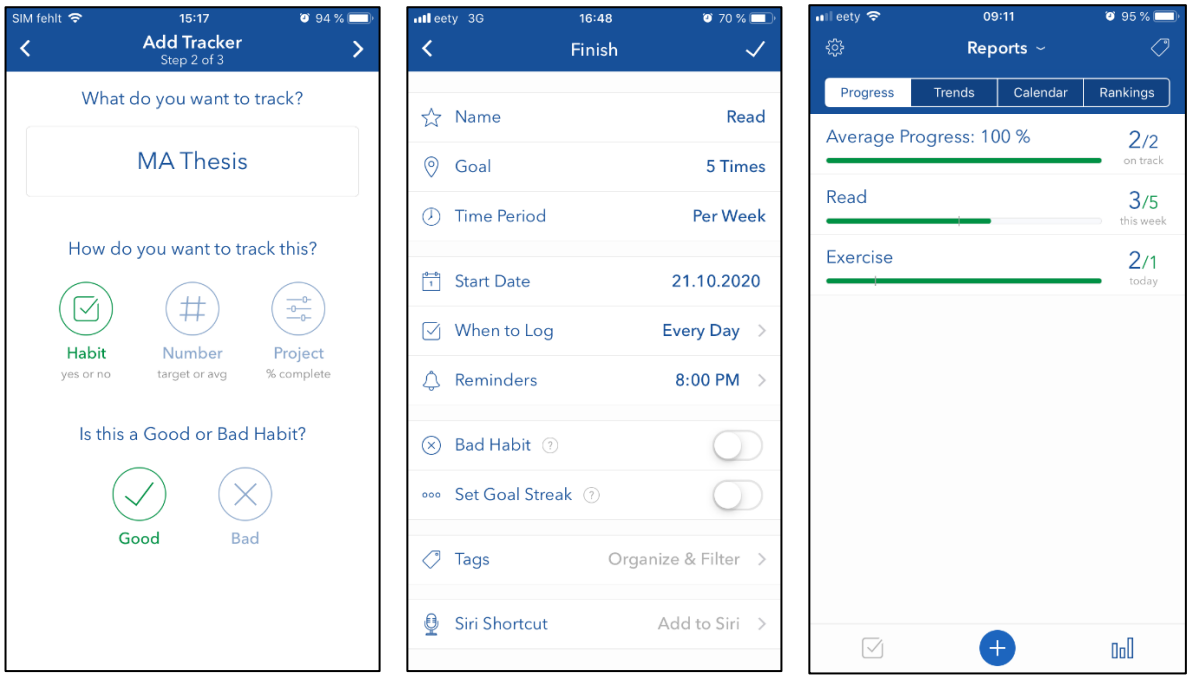

Figure 1: Screenshots from the habit tracking application Strides

Habitify

Habitify is a habit tracking application that is developed and marketed by the Vietnamese company Unstatic. According to my interview partner from *Habitify*, Jack Cao, ten people work at this company divided into two even teams of five people: Marketing and development. It is the only habit tracking application that I have engaged with that has more than two employees. The company was founded in 2016 and does belong to the more widely used habit tracking applications on the market.

Their habit tracking application is available for iOS devices, Android devices and they also offer a web service for their users. They follow a 'multi-platform' strategy which ultimately means that they must provide some form of central storage that is used to store and synchronize the tracked data from one platform to the others. It is not clear in how far the developers themselves have access to the data of their users.

The app can be downloaded and used for free with certain limitations to its functionalities. For example, to unlock an infinite number of trackers or the ability to skip a day without breaking the streak

it is necessary to buy a premium upgrade that can either be purchased as a subscription on a monthly basis for 4,99€, or as a yearly subscription for 34,99€ or as 'one-time purchase for life' for 39,99€.

On their website[14] they position their habit tracking application as a support tool that helps the user 'building the best version of yourself by mastering your habits.' Their way of achieving this is presented in three easy steps: '1) Set up your Habits, 2) Get the Cue, 3) See your Progress', it's presented as simple as that. In a recent promotional video, they compare the use of bulletin journals – painful for editing; lack of overview; manual processing necessary –, online spreadsheets – limited flexibility; unclear priorities – and their habit tracking application in terms of usefulness for tracking habits[15]. It seems not surprising that their own approach to tracking habits through their app is seen as the better and more efficient way.

When searching for *Habitify* on YouTube one can find hundreds of videos that either display the mobile application as part of a 'best of apps for self-tracking' videos or they specifically engage with *Habitify* and tell us that "YOU NEED THIS TO BE SUCCESSFUL! – Habitify App Review!"[16]

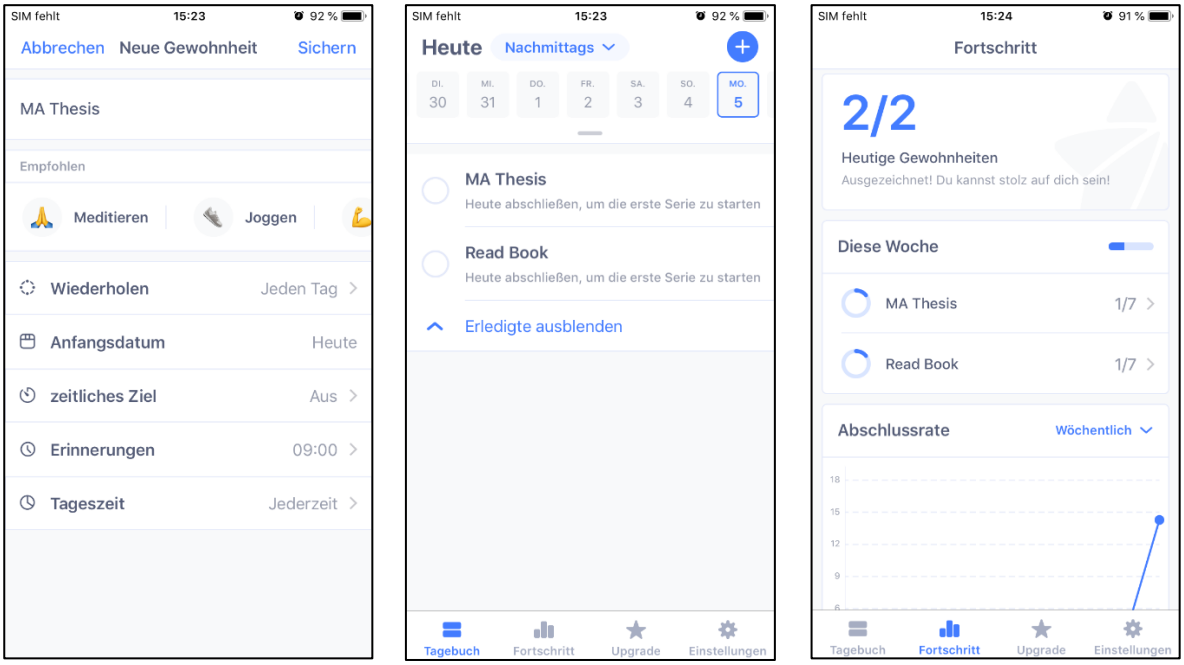

Figure 2: Screenshots from the habit tracking application Habitify

[14] Habitify. (n.d.). *Habitify - The Minimal, Data-Driven Habit Tracker*. Retrieved from https://www.habitify.me/
[15] Habitify. (n.d.). *Landing Page Video Edited* [Video file]. Retrieved from https://firebasestorage.googleapis.com/v0/b/habitify-assets/o/Landing%20Page%20Video%20Edited.mp4?alt=media
[16] YouTube. (n.d.). *Habitify* [Search term]. Retrieved from https://www.youtube.com/results?search_query=habitify

Way of Life

The habit tracking application *Way of Life* was first released in 2009 for iOS and is therefore one of the earliest habit tracking applications that was available. Its founder Lars Arendt is also the only technical employee and responsible for everything from the design and development of the app up to the user support. In 2020 he hired a part-time employee for the management of the social media channels of his company. The company is located in Denmark and *Way of Life* is therefore the only habit tracking application in my research sample that is based in and operated from a European country.

The app is also free to download and use for up to three habit trackers. If you want to use more than three trackers you can buy the premium version that costs 7,99€ one-time. This is actually quite special as the business model of most other habit tracking applications is based on a monthly-based subscription model.

In its design and functionalities *Way of Life* is oriented very much on a classic pen and paper journal. There are not many options when creating a new tracker besides entering a name, telling the app whether this is good or bad behavior for you, attaching a topical label as well as a description to it, and you can choose whether you want to activate the 'streaks' function that is aimed at creating as many successful days in a row as possible. When the trackers are created you have actually only three options to choose from per day: You can say that you have done this habit, that you haven't done it, or that you want to skip this day. Depending on if you have chosen this habit to be a good or bad one, having done it or not will be marked in green or red on the app's dashboard.

The statistics that *Way of Life* offers are rather basic in comparison to other habit tracking applications. As a user you can see on different time scales how often you have performed or not performed a specific habit or how it looks in total. The statistics in *Way of Life* are thus only focusing on the number of times something has been done and doesn't include the time it took to perform a specific habit. You can choose between the depiction as a bar chart or a pie chart.

On the website[17] the app is advertised as "that tool - a beautiful, intuitive habit tracker that motivates you to build a better, stronger and healthier you!" Furthermore, it is stated that "Changing habits is hard work. Having the right tool is half the battle."

[17] Way of Life. (n.d.). *Way of Life - Habit on. Habit off.* Retrieved from https://wayoflifeapp.com/

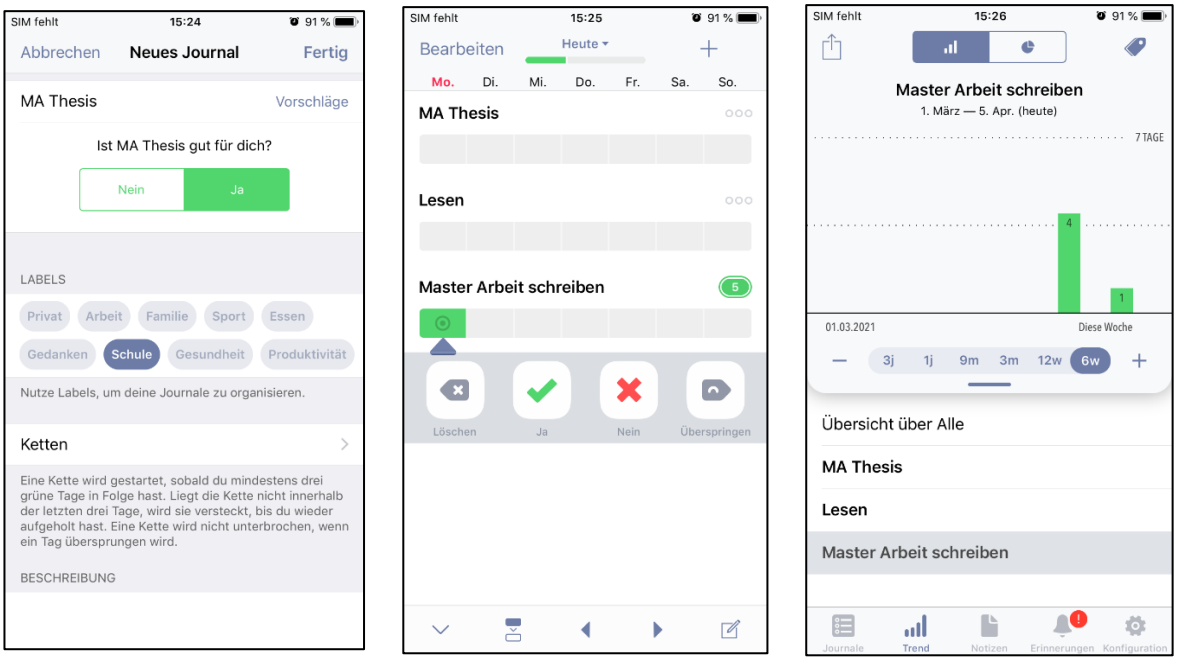

Figure 3: Screenshots from the habit tracking application Way of Life

Done

From all the habit tracking applications I have been looking at *Done* is probably best described as simple. Its design and functionalities are limited to some basic functions compared to other habit tracking applications. Interestingly enough this is also a key element of the advertisement strategy, as the app is for example labeled in the Apple AppStore as “Done: A Simple Habit Tracker”. The app was created in 2016 by Jenny Talavera who has been the only employee of the company for four years, until she sold the app just two months before our interview took place to a company located in Denmark. Jenny Talavera is located in the United States.

As the background of the founder is in graphic design, she put a specific focus on this area, which is also something that differentiates this app from other habit tracking applications that are more focused on adding various functionalities. In comparison *Done* is rather colorful and more rounded in terms of its design. The app allows a simple tracking of habits. In this context it is possible to define whether this is a habit that should be build or quit. In addition, users can choose if the habit should be done daily, weekly, monthly, or yearly and how many times it should be done. Beyond this there are various possibilities to set up reminders for each tracker.

The app can also be downloaded and used for free with limitations to its functionalities. If users want to unlock the ability to track infinite number of habits, they have to purchase a premium version that can only be purchased as a yearly subscription for 43,99€.

On their website[18] they market *Done* as to help you "Build good habits. Break bad ones." while being able to "see the big picture" in form of graphical representations of the tracked data.

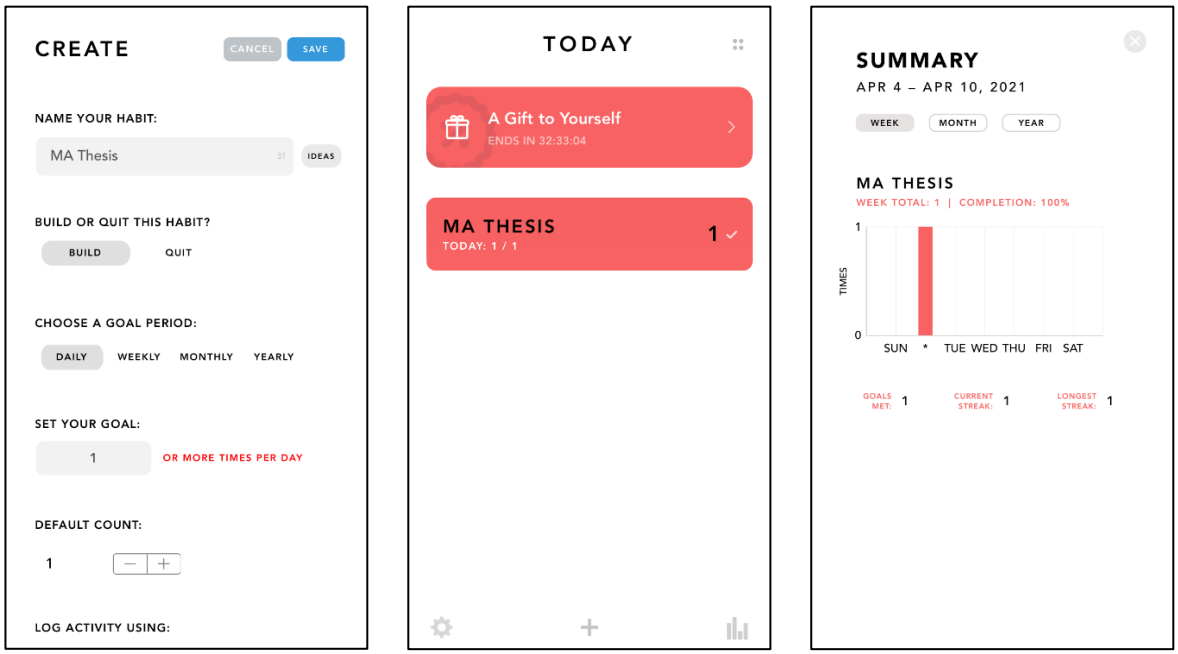

Figure 4: Screenshots from the habit tracking application Done

3.3. Research interest and questions

In the previous two sub-chapters, I have illustrated what mobile applications and habit tracking applications are. My initial interest for these applications developed through my engagement with the social aspects of time. When doing research on this topic I stumbled upon different online discussion forums where people were exchanging about how they track the time that they spent on different activities and which mobile applications they use to do so. I started to do more research on these applications and discovered that they have a high number of downloads and that there is also an active community of 'productivity YouTuber's' that are praising these applications as tools (sometimes even solutions) for a better, more healthy, more active, and happier life. Reading about and listening to these bold claims I decided to focus on habit tracking applications and their developers for my thesis.

As I have explained in the second chapter it is necessary to bring together different bodies of literature to grasp the relations between the developers of habit tracking applications, the applications itself, the envisioned users and broader societal structures. To gain a better understanding for this relation the main research question for my thesis is:

[18] Done. (n.d.). *DONE :: IMPROVE YOURSELF ONE COLOR AT A TIME*. Retrieved from https://thedoneapp.com/

MQ: How are the developers of habit tracking applications envisioning and framing users and usage of their apps?

To develop any form of technology means to think about the usages this technology can offer to what kind of potential users (Akrich, 1997). This conceptual process is also central in the context of programming mobile applications and thus habit tracking applications. Even though programming is often, wrongly, associated with a neutral process of transforming a given problem into a technical solution it actually is a subjective process that is limited by the specifications of the programming language, but ultimately also requires an extensive amount of creativity. In my view, and thus for this thesis, the work of developers is understood as a creative process that draws on the subjective knowledge, experiences, and values of the developers and is fundamentally based on the envisioned usages and users. The term *developers* should thereby be understood in a broader sense and does not only include people who are writing code, but also those people that spent time on the design of the user interface (UI), the user experience (UX), as well as the idea behind the app itself. In the reality of developing habit tracking applications these areas and responsibilities often overlap.

First, to get a better understanding for the reasons the developers have to build habit tracking applications, I'm interested in the following question:

SQ 1: What do developers conceptualize as a problem/as problems to which the habit tracking application is the solution?

This sub-question aims at the fundamental question of what the purpose of a specific mobile application is in the eyes of their developers. By posing this as my first sub-question I want to learn what problem(s) the developers see that could then be 'solved' with the help of their habit tracking applications. Ultimately, I want to know how they create specific problem-solution packages.

This interest leads seemingly to the next sub-question:

SQ 2: Which tasks/routines/habits are perceived as trackable and worth tracking according to the developers? How does this process define the tasks/routines/habits they are tracking?

In order to address the problems that the developers of habit tracking applications see, they must focus on specific habits that should be and can be tracked with their apps. With this second sub-question I thus want to shift the focus towards the process of deciding which aspects of life are worth tracking according to the developers and how these decisions in turn influence the development of the apps.

Besides the envisioned usage of habit tracking applications, it is important in my view to get a better understanding how the developers think about their users:

> *SQ 3: How are the users of habit tracking applications envisioned by the developers of these applications?*

This third sub-question is dealing with the imaginations that the developers hold about their (possible) users. This seems especially important to me as the developers are all running businesses and as such have the goal to make money with their habit tracking applications. Thinking about the users, what they might want and need is thus not only important for idealistic reasons for the developers, but also for existential ones.

Finally, and building on all the previous sub-questions, I am going to address the following question:

> *SQ 4: Which values are inscribed into and which standards get performed through habit tracking applications by the developers? How do the developers reason their choices/moments of choice?*

To build a habit tracking application, and to write code in general, is not a neutral process. It is much more a process of inscribing specific values that might be held individually or collectively into the app. This means that not only by intention functionalities are put into the app by the developers, but also that values and moralities find their way into them. All of this can be subsumed under the term inscription, which I will expand on more in the following theory chapter.

4. Making the theory work

At the core of this thesis lies the interest to learn more about the interrelations between developers and their habit tracking applications. Both are connected to each other in a complex way that cannot be broken down into the shallow descriptions that are regularly used to describe them. Developers are not confronted with a problem, sit down to think about it and then come up with a solution that is straightforward coded into a mobile application. In return the mobile application itself is not an enclosed machinery that processes one command after the other. Rather, both entities affect each other's way of operating while creating a loop of shared experiences and knowledge between them. Even though the wish to solve a specific problem with a mobile application might be at the surface of the intentions of developers, they do much more in their programming. At the same time habit tracking applications are places that users adapt to their own needs and beliefs and thereby affect their advancement.

To grasp such a sociotechnical entanglement is difficult as there are no clear boundaries between the entities: The developers, the apps, the users. All of them work together to create and stabilize a sociotechnical network that acts as a whole. This ontological understanding of 'how it is' must translate in some way to the epistemological question of 'how to research it'. This can cause some fundamental problems as any research project is constrained in terms of time and resources. Thus, the reality of doing research on the topic of developers and their habit tracking applications requires to take decisions about what to look at and what to ignore. It requires the crafting of a delimitated 'case' that can be investigated in the available period of time and that still leaves enough explanatory power for the research to be valid.

As reality hardly aligns to such delimitations that are necessary for practical research, this poses a specific challenge for the theoretical framework of any research endeavor. Should it only account for the aspects at the core of the research questions? Or should it also be able to bridge, at least to some degree, the specific case to broader lines of argumentation? The advantages of the latter outweigh the additional work in my view. Research that only works based on a case runs into danger to overlook the totality of society (Adorno, 1969). This is also true for the engagement with developers and their habit tracking applications. While a well composed case study can bring to light important insights, the results of such a case study must be put into a broader perspective, otherwise any research is in risk of producing evermore puzzle pieces without knowing what the whole puzzle looks like. To stay within this picture another challenge is that case-based research has often difficulties to branch out of what is already there and develop new theoretical approaches, thus to imagine that there are parts of the puzzle that have not even been printed yet.

In consequence, the theoretical framework that I develop in the following is divided into three parts: *First*, those theories that are inherently important to address my research questions that I have described in chapter 3.3. *Second*, the set of theories that allows to take a step back from the specific case and

embed the findings from it into a bigger picture – the structures, processes, norms, and values that connect with the case at hand. And *third*, a theoretical argument that has not been made in this form before within STS research concerning digital objects and their characteristics.

In this understanding a theoretical framework must do (at least) one specific thing for a research project: It must *work for it*. Thereby I mean that the theoretical framework must enable the researcher to focus on his or her research interests while also staying aware of the bigger picture. But there are also things such a framework should not do: Theories should not be understood as canonical in the sense that they are mutually exclusive to each other or that they can only be applied in a specific way but not others.

To be clear, when I speak of a theoretical *framework*, I mean the combination of different theoretical approaches that allow me to address my research questions and make sense of the gathered materials. Such a framework is always a situated construct for the research at hand. In my case, I need to be enabled by my theoretical framework to analyze the process of designing and programming habit tracking applications. Furthermore, I need to understand how the societal structures we live in shape the development of these technologies, just as vice versa.

In short this means that I will bring together and use *thought styles* (Fleck, 1979), *scripting* (Akrich, 1997), the idea of the *I-Methodology* (Akrich, 1995) and *moralizing technologies* (Verbeek, 2006) as central concepts for my theoretical framework. I will expand on them in chapter 4.1. Then, in chapter 4.2, I will take a step back and continue with those concepts that allow to understand the bigger picture in which my case is embedded. This comprises *co-production* (Jasanoff, 2004b), *inscription devices* (Latour & Woolgar, 2013), and *digital bodies* (Lupton, 2017). Finally, in chapter 4.3 I will develop the notion of the *digital object* and argue why it is important for the broader understanding of habit tracking applications.

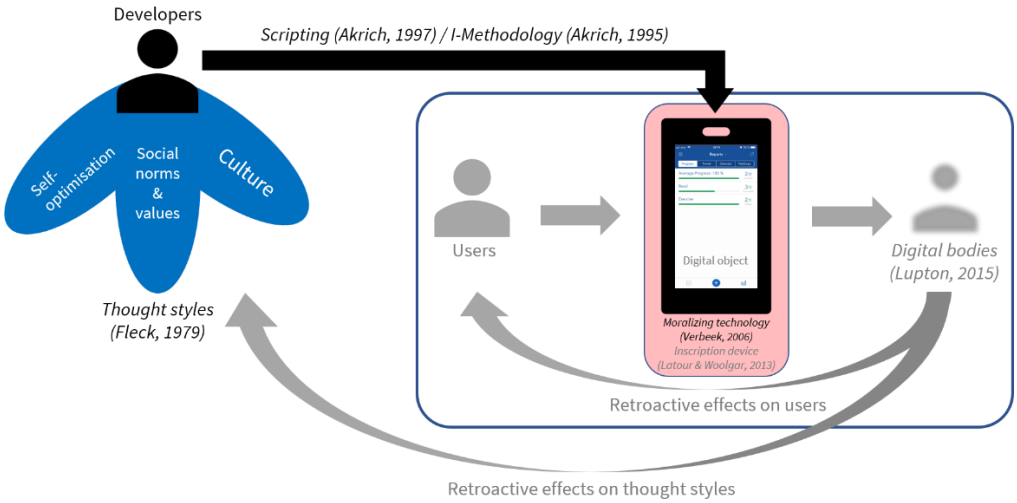

Figure 5: Theoretical framework for engaging with developers and habit tracking applications

Figure 5 represents a graphical overview of what I will develop and expand on in the following. The symbols and the text in grey represents those concepts that are part of the bigger picture of this research, while the elements that are black or colored are those central for addressing my research questions.

4.1. Scripting moralities for mobile applications

Technologies are not created by chance – even though there probably always is also an element of chaos in their emergence –, but with intention. The design and development of any technology requires their creators to think about the possible users and use cases that it should speak to and ultimately satisfy. A rather classical understanding of this process would point to the idea that it's a linear process, where use cases are designed based on specific user groups to then be implemented by impartial creators. In such a process, actual humans are not involved – with their individuality, their emotions, and their desires. The creators are regarded as people with technical skills that are confronted with a problem for which they produce an obvious technical solution. The users on the other side are seen as an abstract group of people, as 'generalized everybody's' as Nelly Oudshoorn and colleagues (2004) call it.

In fact, the process of creating technologies is much more complex than a linear endeavor and it is also not an impartial process as suggested above. It rather is a social process that involves conflicts over standards and moralities. In contrast to societal conflicts the conflicts referenced here are not publicly discussed and decided, but they are rather conflicting in the sense that the developers put forward specific functionalities that ought to influence the users and their behavior.

As Madeleine Akrich (1997) and Bruno Latour (1992) have pointed to, the process of designing and crafting technologies is always connected to intentions. By designing *scripts* for the use of a technology and by *delegating* specific tasks to it, technologies are created as *mediators* of the social world. Such mediators bind together different social contexts, propose rules and ways of interacting with the technologies involved, and have the power to change established networks of action and communication.

For Akrich (1997) the idea of technological scripts involves two broader elements, that of inscription and that of description. The first one concerns the process of designing and implementing the scripts into technologies, while the latter one concerns the process of using and adopting these technologies. By focusing on the description side as well, Akrich makes clear that users are not simply exposed to external forces that push them to behave in a certain way, but that they have some form of autonomy, based on the context they are in. To make an established comparison here: Just as in a theater play, where a given script defines who should say what and when and how, technologies offer specific intended ways of using them. A washing machine for example includes the script of 'separate the dirty clothes based on their color and put them together with detergents into the washing machine to get clean

clothes'. At the same time the users, in our comparison the actors on stage, can stick to this script one-to-one, or they adapt the pregiven scripts to their own interpretation of the role they are depicting at the moment. For the example of the washing machine this can mean that the script suddenly turns into 'there is no time for separating the clothes based on color, so put them altogether with detergents into the washing machine to get clean clothes.'

Looking at the side of developing scripts and inscribing them into a technology the question remains based on which knowledge and assumptions this takes place. In the conception of Akrich the first step that creators take here is to imagine specific users or groups of users that will or should engage with the technology. In this context she points to the fact that this process of imagining does not take place in an abstract manner, but that the creators of any technology base their imagination of specific users and use cases on their own aspirations. She calls this the *I-Methodology* and thereby highlights the situatedness in which specific technologies are created (Akrich, 1995). The idea of the I-Methodology proposes that the creators of technologies do not imagine anyone as users, but rather "consider themselves as representative of the user" (Oudshoorn et al., 2004, p. 41). Hence, the process of designing a technology and creating scripts for it is not a process where the future users are the basis, but where the creators imagine themselves, with their experience, their wishes and states of knowledge to be the future users. Through this process the actual users and their possibilities of interacting with the technology are not simply imagined but they are actually created.

Beyond this individual perspective of the creators of technology it seems important from an STS perspective to also take into account how these allegedly subjective standpoints are part of more general *thought collectives* and their *thought styles* (Fleck, 1979). For Ludwik Fleck a thought style is constituted by a group of people that engage with a specific topic and therefore utilize specific methods and tools and talk to each other in a specific 'language'. This way of working and acting is what he calls a thought style that ultimately binds together a thought collective. These thought styles exert a specific form of power over the members of the respective thought collective. As it guides the perception of the individual members it restricts the questions that are asked and the answers that can be given. Thought styles in this understanding can be witnessed at different levels: For smaller or larger groups of people they form a way of viewing and interpreting the world. Fleck does furthermore argue that 'what we can see' and thus know is influenced by social and cultural thought (Fleck, 1986). By transferring his approach to modern technologies and their creators it can be argued that the creators are part of specific social and cultural thought styles that govern their own actions and the process of designing a technology. In this sense the scripting of technologies is not only based on a subjective I-Methodology, but on a socially and culturally reinformed I-Methodology.

For my case, the habit tracking applications, the points that I just described have several implications. *First*, we can understand that the developers work in a specific way by imagining users and use cases.

Second, it gets clear that the developers base these imaginations on their own situatedness, on their own experiences, aspirations, hopes and fears. *Third*, we learn that this process of imagining users and use cases is not detached from greater societal structures but embedded in them. In short: Developers create scripts based on their own experiences and moralities, which are rooted in general thought styles. These scripts are then 'materialized' through programming the habit tracking applications.

Just as Akrich, Latour is interested in the relations between technologies, their creators, and users. As he illustrates, creating a technology is always connected to the desire to take away tasks from the users. The development and use of technologies is thus a mean to *delegate* specific tasks from humans to nonhumans (Latour, 1992, 2007). In his work he shows, how the most mundane technological artefacts – like a door-closer or a speed bumper – take over responsibilities that otherwise humans would have to take on. The delegation of tasks is thus also always a redistribution of power, that is then executed through other 'modes of action' (Latour, 2007).

Designing a technology and creating scripts for it is thus also always an attempt to rearrange existing tasks. It requires the creators of this technology to identify specific tasks as problematic, tedious, or repetitive and think about ways of delegating these tasks to a technology. This process is obviously limited by certain social and technological parameters. There might be tasks that could be delegated to technologies but this would mean to resign from certain social standards. In the area of healthcare for example we can witness a broad discussion what caring actually means and if it is something that should be taken over by technologies – like robots for example – or something that should only be supported by technologies (e.g. Turkle, 2011). There can also be technical limitations that don't allow for the delegation of a task to a technology. Take the example of playing chess. For centuries it was not possible to train a computer to play chess, as the capacities of early computer systems were not able to process the millions and millions of possible moves that a player could take.

Even though the delegation of tasks is not unlimited, where it is done it is often not a simple delegation of tasks but also a creation of new ones. If for example a specific task within the production line of cars has no longer to be conducted by a human because it can now be done by a robot, there is now the need for someone to make sure that this robot is doing its work as expected. New tasks of monitoring the robot while working have to be conducted just as maintenance or repair tasks. The delegation of tasks is thus not only a process of redistribution but also one of creation. Through delegation new geographies of responsibility emerge and require new forms of social organization around them (Akrich, 1997; Felt & Öchsner, 2019).

In the case of habit tracking applications several tasks are delegated to it by their users, but also by their developers. Most important is the aspect of 'keeping track'. Habit tracking applications store data (or information) that otherwise would have to be remembered by the users. As 'storage capacities' in

the human brain are then free for other information, this delegation can be understood as a form of 'computational offloading'. In computer science this term is normally used to describe the outplacement of calculation processes from one device to another (Akherfi et al., 2018). A second task that is delegated to the habit tracking applications is that of 'making sense' of the stored data. As I have described earlier in chapter 3.1, providing extensive analysis about the gathered data is a key element for almost every habit tracking application. Through the aggregation of data over time and by making it accessible in visualized forms, the habit tracking applications take on the role of interpreters of the data and thus create new information about the own body and habits.

As technologies include scripts and are designed to take over specific task from their users, they do not act neutral. With the words of Paul-Peter Verbeek (2006, p. 364): "Technological artifacts are not neutral intermediaries but actively coshape people's being in the world: their perceptions and actions, experience, and existence." As described earlier technologies are mediators, but this view can be misunderstood in the sense of being a neutral role in a larger network. Actually, the design and usage of a technology is a moralizing process in itself. That's why Verbeek states that "the work of designers [is] an inherently moral activity." (Verbeek, 2006, p. 377) and in consequence, "the ambition to design technologies with the explicit aim to influence human actions raises moral questions itself." (Verbeek, 2006, p. 363)

The idea of a *moralizing technology* (Verbeek, 2006) considers the fact that technologies do not just act but that they actively shape the life of their users. When using a technology that has been designed with a purpose in mind and ways of using it, then the users will be affected by these pre-conditions. This also means that in the moment a technology displays or implies what ethical or unethical behavior is, it turns into an actor that exerts power over the users.

Arguing with the concept of Verbeek technologies like habit tracking applications are thus means to govern the world, as also described by Jasanoff (2004a). As habit tracking applications are spaces where the tracked habits of the users come together with an explicit and implicit assertation whether this habit is good or bad, they are moralizing technologies. ('I have finished too little tasks last week, so I have to do more this week.' – 'I gained too much weight, so I have to stop eating chocolate.') The numbers and graphs displayed in habit tracking applications have a self-regulatory effect on the user's habits.

This is where we have come full circle. By developing their mobile applications, the developers make ethical choices that are passed on to the users. What is especially interesting here is that an STS perspective allows us to shift away from the idea that only the ethics of the pre-defined functions or the goals of a technology can be investigated and questioned. According to Verbeek, and with the idea of scripts in mind, habit tracking applications are in their essence designed to change habits. In this

understanding technologies are the answers to questions of how to live and behave, which is a highly moral question in itself.

4.2. The co-production of mobile applications and habits

As I have already illustrated in the previous chapter the developers of habit tracking applications are influenced in their design work by collective thought styles. Thus, a connection between general social structures and the creation of habit tracking applications and their usage exists. It is important to make clear that this is not a unidirectional process but rather one that reinforces itself in both directions. As my research is not focusing on the users of such mobile applications – not counting the auto-ethnographic approach that I'm following to generate additional materials – the focus in the previous chapter, where I described my core theoretical framework, has not been on the retroactive effects that take place when users engage with habit tracking applications. Although this is not part of my core interest for this thesis, I am certain that it is necessary to think about these aspects to gain a better understanding for the habit tracking applications as a whole.

Engaging with technologies in general, more precisely with technological artefacts, has a consistent tradition within STS's involvement in the study of sociotechnical assemblages. No matter if it's tomato harvesting machines and their political implications (Winner, 1980); bush pumps in Zimbabwe (de Laet & Mol, 2016); coding as a technology and practice (Coleman, 2012); the air-pump – to name a historical example – (Shapin & Schaffer, 2011); or the speed bumpers on the streets (Latour, 1992), all of these examples are part of the theoretical idea that 'the social', our daily practices and the larger social structures surrounding them, cannot sufficiently be explained based on the arbitrary categories that have been established by theorists of society in the past and that are still uphold by social sciences today (Jasanoff, 2004a; Latour, 1993b; Latour & Callon, 1981).

The idea that social structures and technologies (or bodies of knowledge) co-produce each other aims at overcoming technical and social determinism that has prevailed in different scientific disciplines until this day (Jasanoff, 2004a). As Sheila Jasanoff points us to, neither of these spheres has been there before the other, but both develop in dependency to and with each other. Only by considering the interrelations between these two spheres we can form a comprehensive theoretical and practical understanding of the world we live in (and that we have formed to a certain degree without really understanding what we have done there). Using the words of Jasanoff (2004a, p. 17), technologies "and society […] are *co-produced*, each underwriting the other's existence."

Taking this perspective into account means to generalize the ideas of Fleck about the thought styles and broaden the view. The idiom of co-production is still aligned with the idea that a technology is

created based on the existing values, norms, and practices of a society. But in addition, it points us to the fact that any technology impacts exactly these values, norms, and practices. A technology is thus not only moralizing towards a specific individual, but towards the society as such. This is also highlighted by Jasanoff (2004b, p. 2) when she writes that "the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it." This also means that the way we imagine current and future life impacts the way we represent ourselves and the world surrounding us through technology today. Vice versa the existing symbols and representations that surround us in the form of technologies – ultimately a form of social order – impact the way we *can* imagine future(s) in the first place (Jasanoff, 2004a).

How can such an ontological view of the world be useful to understand developers and their habit tracking applications? At first it might seem that co-production is mainly drawing on the world of discourses, symbols and implicit orders for its analysis, but as Jasanoff (2004b, p. 6) clearly states, "co-production is not about ideas alone; it is equally about concrete, physical things." Mobile applications in general and habit tracking applications in specific are hence a good site to investigate the reciprocal relations between the existing social order of 'what to do and what not' and the way collective and individual lives are imagined and lived. As these mobile applications include specific representations of a good and bad life, through displaying habits that should be done more often or less frequent, they also push for a specific social order.

Another reason for taking a co-productionist stance towards habit tracking applications is their role as 'distributors of politics'. As mentioned earlier, the investigation of power structures is a central element within a co-productionist account of the world. This is especially interesting as power dynamics arise out of the relation between the two basic entities – nature and culture; science/technology and society. According to Jasanoff (2004a, p. 14) "science and technology operate, in short, as *political agents*." Thus, looking at technologies can render underlying assumptions about the world – or the 'ways in which we choose to live in it' – visible. Even though she also states that in the 'computer age' it got more and more difficult to determine those locations where politics are at play, I'm convinced that habit tracking applications are such a place. They not only redistribute tasks or create new ones, but they are formed based on a specific political ideology and by their usage reinforce and spread this ideology to their users.

A wide-spread assumption about technologies that engage with data in one way or the other is that they create a one to one depiction of reality. Thereby it is not important if it is about data in the natural sciences – the number of electrons that surround a specific atom; the amount of force one moving object transfers when hitting another stationary object; the weight of an object or a human body – or the social sciences and humanities – the number of people a specific person is interacting with on a daily basis; the organigram of an organization showing the organizational structure and hierarchy; the number of

times a journal article was referenced by others. All of these examples of data sets can be turned (and are turned) into graphical depictions that are presented or perceived as reality.

As research in STS has shown data and depictions based on it can only be seen as an abstracted form of the actual material or social phenomena. Bruno Latour and Steve Woolgar (2013) have famously introduced the concept of the *inscription device* based on one of their laboratory studies. According to them such an inscription device is "transform[ing] a material substance into a figure or diagram." (Latour & Woolgar, 2013, p. 51) The way this transformation takes place is thereby not determined by chance, but rather by the scripts that were written and inscribed by the creators of the respective technology. The logic of how the transformation of reality into data works is much more defined by the creators and thus ultimately by the existing thought styles.

While the collection of data and its graphical representation is an important part in the creation of knowledge and it being passed on, it is necessary to not mistake it for reality. Data and graphical representations of it can only be viewed as an abstracted and generalized instance of the actual phenomena.

Among countless other examples this is also true for the human body and behavior. Deborah Lupton (2017) calls this abstracted version of a human body a *data body*. While such data was previously mainly created by governmental and research organizations, the digitization and the development of mobile applications allows basically everyone today to generate extensive data about the own body. While this can also be seen as a form of emancipation for the individual, a form of creating self-expertise (Heyen, 2020) it is necessary to highlight that such data doesn't speak for itself. It can only be considered when being aware that it is not a one to one representation of the own body and when taking into account "the context in which people decide to collect their data and the social relationships and expectations, places and spaces in which they do so." (Lupton, 2018b, p. 7) Data is thus not contextless, it does not stand for itself and without looking at the conditions of its production it does not support a stable process of sense-making.

In the context of habit tracking applications both concepts, that of the inscription device and that of data bodies, can be applied. Habit tracking applications are inscription devices by design. Based on the specific scripts that the developers have written the users are presented with tabular or graphical representations of their habits (see chapter 3.2 for examples). By asking the users to enter information about the habits they perform, including information about the number of times a habit is performed and/or the duration it is performed, the developers prescribe a certain form of engagement with the own habits. This includes the fact that often habit tracking applications provide pre-defined trackers that come with default settings (e.g. drink eight glasses of water per day) while others are not presented to the users. This ties also back to the aspect of habit tracking applications as moralizing technologies.

Beyond this the habit tracking applications and the gathered data can be seen as a data body. By monitoring their own habits through such a mobile application, the users take the abstracted version of themselves as being themselves. The lines between processed data and reality start to blur and ultimately create retroactive effects for the users. Based on their data body they will adapt their actual habits. As this is at the core the purpose of habit tracking applications it is important to critically reflect on the implicit assumptions that have led the developers to write specific scripts and not others.

4.3. Matter-*ing*: An outline for conceptualizing digital objects

Engaging with mobile applications raises different theoretical questions. One of them is whether such apps can be conceptualized as objects for an analysis, just as any other physical object, and if so, what properties they have. Within STS research nonhuman actors play a central role when studying and analyzing sociotechnical phenomena (see also chapter 2.1.1). Often specific objects or artefacts – like a speed bumper on the street (Latour, 1992) or a bush-pump in Zimbabwe (de Laet & Mol, 2016) – are put at the center of investigation and reasoning. Objects like these are important because in the tradition of Actor-Network-Theory they act as mediators for our social world, often constituting it and as such cannot be missed in a symmetrical research approach. Since habit tracking applications are important in the creation and stabilization of habits for those using them, I consider these apps to have 'object-like' characteristics. Nevertheless, taking a closer look at the way objects have been used within STS research and the way mobile applications work reveals that there still is a difference between what I label *physical* objects, like speed bumpers, and *digital* objects, like habit tracking applications.

The existing literature is rich in terms that express or mean something similar to a physical object, for example the terms material or technical object. Even though there are different ways of determining what a physical object is – which often depends on the disciplinary view one takes – I draw on the understanding of Philipp Faulkner and Jochen Runde (2019, p. 1284) who consider an object to be physical if it has "spatial attributes such as shape, volume, mass, and location, and where this physicality is manifested in the structure of that object, namely its component parts and how these are combined or arranged." This definition highlights the ontological dimension of physical objects and as such attributes a substantial matter to them. Following from this, the epistemological perspective on physical objects tells us that we as humans can immediately access a physical object through our senses: We can see the color of a driller; we can hear the sounds that a combustion engine makes; we can smell the plastic odor of a newly bought television; we can taste the flavor a spoon has; we can feel the surface of a traffic light button when pressing it. Although these sensory impressions can differ in their exact form or intensity from person to person – based on cultural or bodily differences – this doesn't change the fact

that *physical objects are entities that we as humans can experience through the immediate relation between their substantial matter and our senses*.

In contrast a digital object doesn't have a physicality, determined by spatial attributes, on its own. It is much more that a digital object depends on physical objects and their characteristics to become accessible for human perception in the first place. For example, a mobile application requires a smartphone to be deployed and executed on before coming into existence for our human senses. The smartphone does provide specific characteristics such as a touch screen interface and speakers for the interaction between the human and the digital object. In this arrangement the mobile application, more specifically its source code, can be seen as a construction manual that lays out piece by piece how a smartphone should make it look and sound like and how the user should be able to interact with it. Ultimately physical objects have to act as brokers *at any time* between digital objects and the sphere of human experience.

While a physical object is defined by spatial attributes, *digital objects are always just* represented by *this substantial matter*. To be more precise, a digital object, for instance a mobile application, is based on bitstrings (Faulkner & Runde, 2019) which constitute a bipolar system of ones and zeros that are assembled and then interpreted based on specific standards, the respective programming languages. Such standards define how the physical object should read, interpret, and execute these bitstrings and in consequence bring digital objects into the realm of human senses. As Faulkner and Runde (2019, p. 1285) express it, digital objects – or nonmaterial objects as they label it – "must in some way be inscribed onto, contained within, or borne by a material object of some kind." On the electronic level these bitstrings are 'contained' in the form of different energy levels within components like a hard disk or memory chip. When these material components get broken or destroyed, the particular digital object that has been contained by them is lost.

The relation between the substantial matter of the physical objects and the bipolar character of digital objects thus creates a situation where copying a digital object like a mobile application is possible in the twinkling of an eye. Besides a negligible amount of electricity digital objects can be reproduced without high efforts. Every new download of a mobile application from an app store creates an exact copy of this specific app, ultimately of the bitstrings that form its source code. There is not the slightest deviation between the newly created entity and the one it was copied from. As such digital objects are always 'copies without an original'. In the field of design and aesthetics this aspect has been discussed widely, for instance the idea that copies are becoming real in their own way (Baudrillard & Poster, 1988) and the fact that physical objects are "points of interaction with the possibilities of digital technology." (Folkmann, 2020, p. 234) Furthermore, to be an original would require a specific form of uniqueness and peculiarity that digital objects do not have. Every copy of an app, once executed on a smartphone, acts in the same way by offering the same prompts and cues to its users.

The way digital objects use substantial matter – by changing its state temporarily – also creates the possibility for them to be in *constant flux*. While a physical object like a chair or a car is more or less a closed-off entity once it has been produced, acquired, and put into use, digital objects are changed constantly in the way they look and often silently in the way they act. In the case of mobile applications this happens through changes to its source code that are made by their developers and distributed through digital app stores. While it is theoretically possible to circumvent these changes in the apps one 'owns' by detaching the smartphone from its internet connection, the general *mode of persistent adaption* is prevailing for digital objects.

While physical objects can obviously also be changed, for example when reupholstering a chair, this requires an active intervention by their owners. They either have to bring this chair to someone who can perform this task, or they have to do it on their own. Digital objects like habit tracking applications are not only cut-off from the possibility of being changed by their users in ways that were not intended by their developers, but they stay always loyal to these developers. When they decide to stop offering support for new platforms to be executed on, these apps cannot be used anymore and are hence no longer available to their users. This can for example regularly be seen when either Apple or Google ship new versions of their mobile operating systems which older apps might not (yet) support. *Digital objects thus do not work based on the established forms of ownership* that can be applied to physical objects. While the roles of owner and user can fall together for physical objects, this is most of the time not the case for digital objects, especially those that are consumed through digital app stores.

Finally, I want to highlight that digital objects are not material in the classic understanding of this word, but they are in a different sense. The fact that digital objects are never finished, that they are subject to constant change and therefore never closed nor stabilized, also when already in use, and the way they change substantial matter to do so gives them a form of *living materiality*. Digital objects like mobile applications are never finished and fixed, they create a specific form of materiality by temporarily manipulating substantial matter and by utilizing physical objects to do so. I label this process to be one of matter-*ing*, as digital objects only become materialized and in consequence agents of social change, by being deployed and used.

Overall, it is important in my view to keep these three aspects in mind – digital objects are in constant flux; they do not operate based on entrenched forms of ownership; and they possess a living materiality – when investigating digital objects from an STS perspective. Only by doing so we can ensure that we can grasp all relations that these digital objects form once they are put into use.

5. Material and methods

To study the interrelations of human and nonhuman actors – in my case the developers and the habit tracking applications they develop – bears specific methodological challenges that must be addressed to mitigate problems in the research process. First of all, this includes the question *why* we as social scientists should study nonhuman actors in the first place. I have already laid out the answer to this question in chapter 2.1.1 and chapter 4, but I will briefly summarize my central argument concerning this question here: Technologies are not passive objects that produce an unaltered account of reality. Much more technical artefacts act as moralizing technologies, as they have been crafted based on particular moralities and with specific intentions in mind. They are thus always the product of a particular social context and as such reproduce the logic of this context. In addition, technologies of any kind mediate our social interactions and thereby take part in the ongoing construction of reality. Only by including them symmetrically in an analysis, we can learn about and understand social phenomena.

The second challenge concerns the question of *how* a social scientist can study mobile applications. It is not possible to 'talk' to a habit tracking application, to pose questions to it, or to observe its 'behavior' (at least not when no user is interacting with it). If this is the case and the empirical field is not accessible with established methods, should it then not be left for investigation to computer scientist? As I have argued above, I think not. Social scientists should investigate mobile applications to form a complete picture of the social realities that we are interested in.

While some classic methods do not lend themselves to this research project I turned towards others. To gain a better understanding for the habit tracking applications themselves I decided to use my own senses to experience habit tracking applications firsthand by using them for some time. Based on this I generated autoethnographic accounts of my engagement with different habit tracking applications (Adams et al., 2015) and included some of them in my analysis in the form of vignettes (Kandemir & Budd, 2018). This material has also been useful to inform my questions for the interviews with the developers of habit tracking applications.

For my thesis I'm interested in the way the developers have created their habit tracking applications. Therefore, I conducted interviews with them to learn more about their way of reasoning and making sense of their design decisions. As the interviews did take place consecutively, they have also been a source for refining my interview questions for later interviews. Figure 6 illustrates my overall methodological approach and its interdependencies.

In terms of the application of methods, as John Law (2017) points to, the tools used for scientific endeavors are not detached from social reality and its structures, but rather are shaped by it while also shaping it at the same time. This also means that no such thing as a non-reactive scientific method,

meaning that it has no influence on the 'object of interest', exists, even though time and again claimed. In addition, our ability as scientists to produce knowledge is shaped by pre-existing terms and ideas (Fleck, 1986) and is based on specific situated knowledge that we hold (Haraway, 1988). Just as our research interests are formed through this situated knowledge the research process itself is as well. In my case this means that my professional background as a programmer, just as my private interest in ICTs, has shaped my interest in habit tracking applications and their developers.

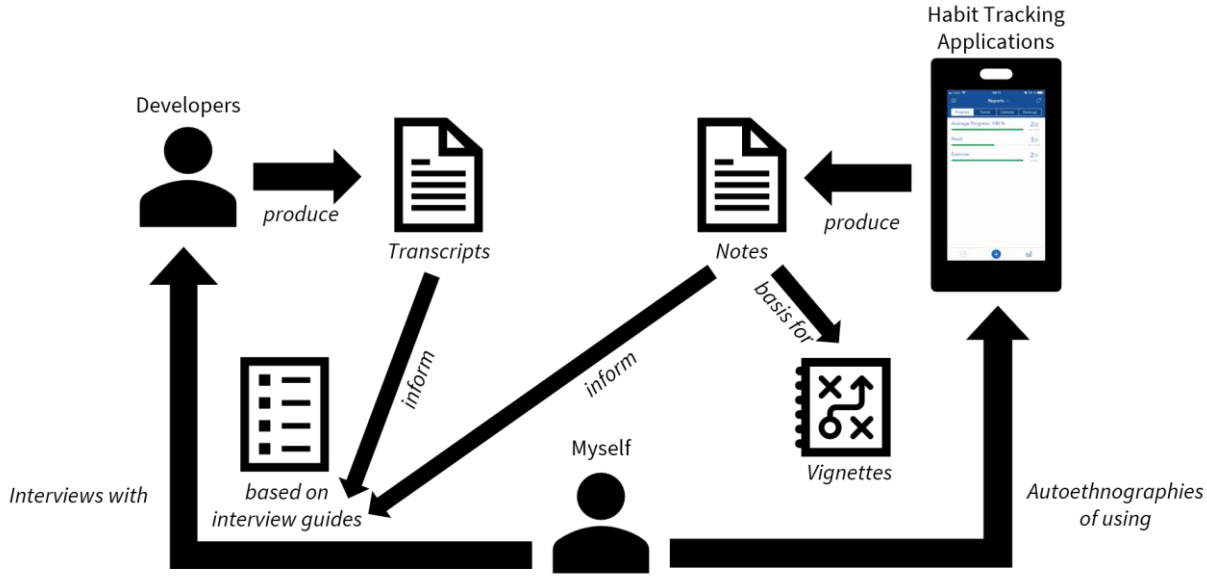

Figure 6: Overview of the methodological approach

In the following chapter 5.1 I describe my sampling strategy for the habit tracking applications and their developers. Then in chapter 5.2 I outline the method of autoethnography with mobile applications and how I derived the vignettes from it. In chapter 5.3 I subsequently illustrate how online interviews can be conducted, what their advantages and disadvantages are. Lastly, in chapter 5.4 I describe how I analyze the gathered materials.

5.1. Sampling habit tracking applications and their developers

As my first encounter with habit tracking applications took place in the form of one specific application that I stumbled upon by chance, I had to take a step back once I actually started to work on this thesis to do a general recherche on this type of mobile applications. While the sampling within any empirical field requires a specific procedure or strategy, mine was not structured in the sense that I had a clear understanding of what to include and what not right from the beginning. As discussed earlier it is often difficult to delaminate the boundaries between habit tracking applications and other types of (self-)tracking apps. The problem of delamination is common when investigating 'the digital' (Markham & Baym, 2008) and I decided to drift with the term habit tracking application for recherche and leave

the definition of it to those people using them instead of crafting my own rigid definition for this research.

I started my recherche with a basic search on Google for the term "habit tracking applications"[19] which at least for me resulted in more than four million results. Among the first five search results were websites and articles that provided lists for the "22 Best Habit Tracking Apps You Need in 2021"[20] (or similar). On these websites I found short descriptions and screenshots about the listed habit tracking applications, which provided me with an initial overview of the most common used habit tracking applications. While some of these apps were mentioned regularly in these listings (e.g. *Strides*) others were not. After having looked through several of these lists I decided to note down those habit tracking applications that where mentioned at least three times. This was an ad-hoc decision that was not informed by a specific reasoning.

When taking a closer look at the websites where these lists were posted I noticed that they were either technology blogs and news sites, or websites engaging specifically with the topic of routine and habit building. As I learned during this phase of my recherche, habit tracking applications were regularly praised as tools to enhance the own performance in the context of work, as helpers to get rid of unwanted habits like smoking, or to build new habits, oftentimes connected to personal fitness and diet.

The second group of websites lead me to the video platform YouTube where a vast number of videos are dedicated to habit tracking and the matching mobile applications. Even though I was not able to determine the number of search results for the term "habit tracking application"[21] there, the scrolling through the results did not find an end. The posted videos where ranging from tips on how to best track your own habits to, again, lists of "The 8 Best Habit Tracking Apps 2019" (or similar). The most successful video I found with my search term had around 900.000 views. This search did actually not change the list of habit tracking applications that I had already crafted before.

At last I turned towards the messaging board Reddit[22] that as of January 2021 is used by around 52 million active users daily and features millions of communities that are centered around different topics

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[19] Google Search. (n.d.). *habit tracking applications* [search term]. Retrieved from https://www.google.com/search?q=habit+tracking+applications&safe=off&source=hp&ei=SWxtYNOGGpCnUsHht_gJ&iflsig=AINFCbYAAAAAYG16WaoMhVDqEhLnYvipgifmkXXc2hnh&oq=habit+tracking+applications&gs_lcp=Cgdnd3Mtd2l6EAMyBggAEBYQHjIGCAAQFhAeMgYIABAWEB4yBggAEBYQHjIGCAAQFhAeMgYIABAWEB4yBggAEBYQHjIGCAAQFhAeMgYIABAWEB4yBggAEBYQHjoICAAQsQMQgwE6CwgAELEDEMcBEKMCOgUILhCTAjoICC4QsQMQgwE6CAgAEMcBEK8BOgIIADoFCAAQsQM6BQguELEDOggILhCxAxCTAjoICAAQxwEQowI6AgguOgQIABANOgYIABANEB5Q5xRYgC1gxC1oAXAAeACAAZsBiAHgFpIBBDcuMTmYAQCgAQGqAQdnd3Mtd2l6sAEA&sclient=gws-wiz&ved=0ahUKEwiTz83M2uvvAhWQkxQKHcHwDZ8Q4dUDCAY&uact=5

[20] Ho, L./Lifehack.org. (2021, January 26). *22 Best Habit Tracking Apps You Need in 2021*. Retrieved from https://www.lifehack.org/668261/best-habit-tracking-apps

[21] YouTube. (n.d.) *Habit tracking applications* [search term]. Retrieved from https://www.youtube.com/results?search_query=habit+tracking+applications

[22] Reddit. (n.d.). *reddit: the front page of the internet*. Retrieved from https://www.reddit.com/

(Reddit, 2021). Even though social science researchers on platforms like Reddit have to be aware of the data biases these platforms come with (Amaya et al., 2019), I only intended to use it as a last source to complement my list of habit tracking applications that I wanted to investigate closer. As the previously used search term was not successful here, I changed it simply to "habit tracking"[23] and took a look at the biggest communities related to this term which were "Get Disciplined!"[24] and "Productivity"[25]. There users do not specifically exchange about habit tracking applications, but they were still mentioned frequently in postings and comments as solutions for the problem of staying focused or productive.

At this point my sample consisted of twelve habit tracking applications. As I knew that I want to use these apps myself I already excluded those habit tracking applications from this list that were only available for Android devices. In the following weeks I downloaded every remaining habit tracking application from my list and took a short tour to get a first feeling for its design and functionalities without actually using it. Based on this I entered the phase of contacting the developers of these apps. To do so I crafted a standard message that introduced myself, in very broad terms what I was interested in and included an explicit invitation for an interview. Most of the time I was able to send this message to a mail address directly, sometimes I could only find a contact form, and in a few instances I had to send the messages on Twitter as there was no other way of contact available. For the twelve messages I sent I received four positive answers for my interview requests. One developer actively declined, another wanted to do an interview via mail which I initially agreed to but had to cancel after a few exchanges, and most developers didn't reply at all.

It is difficult to say with certainty why some developers didn't respond. But I have two assumption that have more to do with business than with a general unwillingness or disinterestedness towards my research project. The *first* concerns the fact that these mobile applications are often created by solo self-employed people that must manage their time in order to be able to stay in business. Spending time on an interview with someone they don't know and about a topic where they might not immediately see a business advantage, is not economical for them. The *second* assumption is a concern about business internals getting public. It should not be underestimated how much of a competition is going on in the area of mobile applications today. Talking to someone external about one's own ideas, strategies and plans for the future – no matter if this person assures anonymity and control over the information that are processed further – is perceived as a personal or business risk and hence simply avoided.

[23] Reddit. (n.d.). *habit tracking* [search term]. Retrieved from https://www.reddit.com/search/?q=habit%20tracking
[24] Reddit. (n.d.) *Get Disciplined!* [sub-reddit]. Retrieved from https://www.reddit.com/r/getdisciplined/
[25] Reddit. (n.d.). *Productivity* [sub-reddit]. Retrieved from https://www.reddit.com/r/productivity/

Left with these four developers and habit tracking applications (*Strides*, *Habitify*, *Way of Life*, and *Done*) I moved on to conduct an autoethnography for each and I scheduled definite interview dates with the developers.

5.2. Creating vignettes with autoethnography

Ethnography has a long-standing tradition in social science research across different disciplines and fields of research. The idea of becoming part of the field of study in order to learn more about it has been applied by different scholars in the past. Over time the method got refined and was also applied to new spaces. For example, Sharon Traweek (1992) studied the work of high energy physicists at the SLAC National Accelerator Laboratory in the United States and the KEK High Energy Accelerator Research Organization in Japan. Through her immediate involvement in the daily work structures of both places she was able to present an immersive study of the values that the high energy physicists hold and the effects this has on their way of working. By positioning herself as part of the field of study she was able to observe those routines that are invisible from the outside and thereby could observe 'science in action' while it was not yet stripped of its modalities (Latour, 1994b).

After all I do not situate myself in an understanding of science that discards the position of the researcher. How could I talk about a topic that I personally am not involved in? How could I talk about habit tracking applications without having used them myself? How could I ask the developers about their values and imaginations when I do not know how they are 'materialized' in the actual habit tracking applications? I cannot, which is why I decided to include autoethnographic accounts of my engagement with habit tracking applications in the analysis.

To do autoethnography means to witness a process of sense-making as close as possible (Adams et al., 2015). It is a tool for me as a researcher to better understand specific phenomena, but it is also a possibility of transporting the experiences of specific practices – in my case the use of habit tracking applications – to those readers that might never have heard of these specific mobile applications or the practices attached to them. As Christopher Poulos (2017, p. 38) puts it: "I write to bring it alive for you. I write for you. Not for me." This is also what I hope to achieve by including some autoethnographic accounts in my analysis.

To be clear: I understand autoethnography as a research method, not as a form of just sharing personal stories and packaging it as science. To conduct an autoethnography means to reflect the own position, the representation and presentation of what I have experienced and my own performance in this context (Wall, 2008). Beyond that, my expectations for an autoethnography lie in the ability of tying the material conditions that surround us to my personal experiences as well as social structures (Thompson, 2017).

Especially when engaging with elements of the digital society, an autoethnographic approach seems useful. As digital medias can be diverse and pervasive at the same time, this makes them an "compelling [object] of ethnographic inquiry." as Gabriella Coleman (2010, p. 488), a pioneer of digital ethnographies, states. While an autoethnography offers many possibilities, it is also important to be aware of its limitations. Especially the fact that the boundaries of these digital entities are not always clear, researchers must make methodological decisions of what to show and what not (Coleman, 2010). To engage with mobile applications in general and habit tracking applications in specific means to immerse oneself in specific relations between the human and the nonhuman, between identity and community, between the self and the social, between the public and private (Thompson, 2017). Some of these aspects will seem more important than others to me as researcher.

While a classic autoethnography requires note taking, I decided to use the advantages of studying a digital object. Hence, I used screen recordings to record different situations where I was engaging with habit tracking applications on my smartphone. Especially the first interaction with every app and the process of creating new trackers was something that I recorded for each of the four apps that had remained in my sample.

The autoethnographic accounts that I produced this way were then the basis for creating vignettes (Kandemir & Budd, 2018). These short bites of text center around specific interactions between me, in the role of a user, and the habit tracking application. They allow the readers to form an initial understanding for what it takes and feels like to use a habit tracking application. In line with the argument of Coleman, that digital ethnographies need decisions what to show and what not, the vignettes are a mean to "selectively stimulate elements of the research topic under study" (Hughes & Huby, 2002, p. 383) and hence "provide entry points to what can be complex research questions" (Kandemir & Budd, 2018, Chapter 1).

The creation of vignettes has for example been used by Kay Felder and co-authors (2016) as entry points for their discussion of research and care practices in obesity outpatient clinics. This allowed them to transport a situation, encounter, or routine that is common in the empirical field to the readers. The method has also been proposed as an approach towards values in social work (Wilks, 2004) or as a material to be used within interviews with teachers to learn about their perspective on specific situations in the classroom (Skilling & Stylianides, 2020).

Ultimately the autoethnographies fulfill two functions. *First*, they allow me as a researcher to form a better understanding for the field I'm studying, the habit tracking applications. These insights can then inform the interviews with the developers, which I describe in detail in the following chapter. *Second*, the autoethnographies provide the basis for the vignettes that are used in the analysis. These vignettes

are thereby on the one side anchor points for the writing process itself and on the other side a way of showing the readers what habit tracking applications *do* when using them.

5.3. Conducting interviews online

As my intention with this research is to learn more about the developers of habit tracking applications, their background, motivations, and perspectives I conducted interviews with them (Silverman, 2006). Compared to, for example, the advertisement videos about specific habit tracking applications, which are highly polished products, interviews open the possibility of the moment. By entering a conversation with the developers, I intended to generate insights about their reasoning of specific design and functionality decisions for their apps. I am convinced, that by talking to them, it was possible to understand how the scripts of habit tracking applications come into being and how these mobile applications are turned into moralizing technologies.

An interview can be setup and structured in different ways. For my purpose and research interest I conducted them as open as possible and as close to a regular conversation as it can be. Thereby it is important to be aware that "Interviews are limited both in terms of time and of function" (Skinner, 2012, p. 55) and as such cannot take place without any pre-given structure or procedure. As my interviews were informed by my research questions and my own experiences with using the habit tracking applications, I prepared a list of guiding questions for every interview. Thus, taking the approach of a semi-structured interview that leaves space for immediate responses and reactions during the interview. The interviews took place online using the video conferencing software Skype and Zoom.

The Covid-19 pandemic was not the original reason for conducting my interviews online. In a first recherche about the field of habit tracking applications during the development of this research project I noticed right away that the companies and developers behind these apps are not located in Vienna, not even in Austria or adjacent countries. As I realized in this phase, they are much more likely to be located in the U.S. (*Strides*, *Done*) or south east Asia (*Habitify*). Only one app from my original sample (*Way of Life*) is developed in Denmark. Based on these insights I planned my research to take place online before the Covid-19 pandemic hit. Nevertheless, it is important for me to put on record that I am convinced that the experiences with this situation actually pushed the willingness of people to do online interviews with me, as they were suddenly omnipresent and thus much more common in 2020 than before. An advantage of doing interviews online is that the dimension of space, that has been central for classic qualitative social science approaches, became less important (Bampton & Cowton, 2002). Suddenly it was possible to talk to people from different countries and cultural backgrounds (thus also from different value systems) which lead to an integrated diversification of the research project itself.

Even though the dimension of space was not as important, that of time still was as the interviews had to take place synchronously across different time zones (e.g. Vienna ↔ San Francisco).

Even though the tools that are necessary to conduct interviews online have been diversified within the last years (and especially in 2020) the earliest versions of Skype already raised interest from social science researchers. Discussions have been going on about the authenticity of such interviews (Sullivan, 2013). The question of what gets lost in this interview format has been posed, as well as how much the interview partners change the performance of their roles in this specific setting. Both are valid methodological questions, but in my experience all of them can be posed for offline face-to-face interviews as well. That's why I did not consider them as being specific for my methodological approach and research.

Another point that has been made in the context of online interviews is that of easier access to more vulnerable social groups (Janghorban et al., 2014). Even though this argument might not specifically apply to my case, it definitely can be conveyed in the sense that developers of habit tracking applications are also always engaged in making business and as such can be hard to access when there is doubt about the legitimacy of a research project.

The decision for using Skype and Zoom as the video and audio software for the interviews was primarily based on my assessment of their security features (e.g. end-to-end encryption) and the reliable integrated recording system they offer. This assessment is purely based on personal experience of teaching and studying with a variety of these tools. As I did not want to force my interview partners to use any specific tool, I always asked them in the process of setting up an interview date which tool they would prefer to use. Ultimately, I conducted two of the interviews via Skype and the other two via Zoom.

Besides the question of authenticity this format of conducting interviews brings its own challenges. One of them has been the fact that the surrounding of the interview partners cannot be controlled. This got especially obvious in one interview where my interview partner, Jack Cao, was located in a shared office space and the interview was scheduled to take place during lunchtime at his location. This led to a very loud and noisy surrounding during our interview. Combined with a rather bad microphone this posed a challenge for me understanding everything that he was saying during the interview and then subsequently when transcribing the recording.

5.4. Working with the materials

My research has ultimately produced different types of materials, *first*, recordings of and notes about the use of and engagement with habit tracking applications that are based on the autoethnographies I conducted and *second*, the transcripts of the interviews with developers of habit tracking applications. As I have documented my engagements with the habit tracking applications also in the form of screen recordings engaging with my materials for the analysis has meant to revisit and consult them over and over again.

As the interviews could only be conducted consecutively, the analysis of these materials did not just start after all interviews were conducted but took place throughout the process of research. Partly, earlier interviews influenced later interviews and the questions I posed, just as the autoethnographies fine grained the questions that I wanted to ask the developers. Also, the fact that at a certain point I had already engaged with habit tracking applications changed the interactions I had with those apps that I used at a later point in time.

For the analysis of the interview transcripts I have used the coding software 'f4analyse'. As my interest was to learn from the field, I did not predefine specific codes but developed them out of the transcripts themselves. After I had finished a first round of coding for all my interview transcripts, I started to revisit the earlier ones to adapt, merge, or group existing codes. With my coding I therefore followed a 'zigzag' approach, travelling back and forth between my materials (Rivas, 2018). This also included my experiences that I made through the autoethnographies and that I subsequently used to create new codes while going through the interview transcripts again.

Overall, my coding has been based on an inductive approach. As it has been my goal to get a better understanding for the subjective imaginations that the developers hold with this research, I tried to derive as many codes as possible 'in vivo' from particular words, phrases, or actual statements that my interview partners used themselves (Rivas, 2018). At the point that all interviews were conducted, transcribed, and coded, I started to group them into broader categories of topics. These categories were based on the one side on my research questions (e.g. 'usage behavior of users') and on the other side on my theoretical framework (e.g. 'helper for breaking bad habits of husband'). Finally, I summarized all these categories in overarching themes that turned into the basis for the four central findings points that I present in chapter 7.

At the beginning of this chapter, in Figure 6, I have illustrated how the autoethnographies and the interviews influenced each other in a reciprocal way for the analysis. By combining these two types of materials I was able to create more context for my interviews, just as for the experiences I made when using the habit tracking applications.

6. Presentation of the results

I'm sitting at home on my couch with my smartphone in front of me. The colorful icons of different kind are resting there, waiting to be pressed and started, waiting to get some attention (those that are too important for me even have the permission to actively ask for my attention by sending me notifications). Right now, I'm waiting for the download and installation of my latest app to finish: *Habitify*[26]. I have already created a folder named 'MA thesis' on one of my home screens where I slid the app in. When I started this research project, I did not want it to cross over too much with my private life, that's why I decided to put all the applications I'm investigating in one place. What an obscure assumption I think, especially by someone who should know better. There is no such thing as an impartial observer, an observer that separates his private and academic selves from each other, no matter how hard he tries. After three months of engaging with habit tracking applications and their developers I already noticed that my initial resistance and even disapproval of this type of mobile applications has begun to crumble.

After a few more seconds the installation of the app has finished and I *tap* on the white icon with a big blue 'H' on it. The app takes some seconds to start – my smartphone is rather old and probably loses software support within the next two years – but eventually I'm greeted with a 'Welcome to Habitify' message and I'm also told right away that 'We believe that the world is more beautiful when every person becomes better'. Well, that's a statement and goal to strive for, I think. If I would have come here, because I feel bad about my body or my habits, I might feel reassured. Yes, I want to become better, I want to make the world more beautiful (who wouldn't want to do that?) I *swipe* to the left and on the following tabs I learn that 'creating sticky habits' will motivate me, *swipe*; that I can 'free my mind' with daily routines and in time reminders, *swipe*; that I can 'get better every day' by looking at my past failures and successes. So far so good, in fact I feel a little bit levitated. In this moment these messages push me and give me the feeling that everything, especially change, is possible.

Now, one big blue button is left for me prominently on the screen. 'Create your first habit' it says and I'm in to try it. *Tap*. Everything in the app is still kept very simple and clean in terms of the design. Not many elements are displayed on the screen and white as a color is predominant. The few lines of text are only placed with big spaces in between. A short list of five items has appeared on my screen by now and I'm asked to 'choose a habit'.

[26] The following vignette is based on my autoethnographic account of the habit tracking application *Habitify* (https://www.habitify.me/) which I used on my iPhone 6 for about two weeks.

The app also reveals right below that '4 out of 10 people have 'Read Book' in their list of habits'. An interesting fact to share, I think. I do also like to read, but in the last weeks I did not manage to read as much as I wanted to, so I probably should add it as well, right? Before doing so I look at the four other suggested habits: 'Meditate', 'Run', 'Core Training', and 'Yoga'. All of these habits are accompanied by numbers – '293,9K', '172,8K', etc. – and a heart icon that I interpret to represent the number of times this habit is tracked by other users. So many people, these must be important habits to engage with! I start to wonder if I should add them too.

For the moment I decide to just stay with the 'Read Book' habit tracker. *Tap*. Another decision is now presented to me on the screen. 'Choose a frequency' I'm asked, and I get several options to choose from like 'daily' or 'three times per week' or 'custom'. I also get the information that my success chances – success for what I wonder? – will increase 'significantly' when I start with a frequency of 'two times' or 'three times per week'. I thus choose the first of the two options. That was an easy decision I reassure myself. *Tap*. The app still wants more input from me. 'Choose a time' where I will be reminded to do the newly created habit. I randomly select 4pm – for this setting I do not get suggestions what works best for other users. *Tap*. It seems like it's coming to an end. The app presents me with a short overview of all the input I provided before – probably just in case I forgot something or made up my mind and want to change it now. 'Read Book, two times per week, 4pm'. Yes, I want to save this habit tracker. *Tap*.

I'm still not finished as I'm now presented with the opportunity to create an account where all my habit trackers and the tracked data can be stored and thus also be restored at any point in time. I just would need to type in my mail address and a password. I'm glad that I can skip this section and *tap* on to the very small 'Do this later' lettering that is placed right below the big blue button that reads 'Create new user account'. With this tap I finally made it; I'm being forwarded to the dashboard of the actual app that will accompany me within the upcoming weeks.

What I have presented in this vignette is my first in-depth encounter with a habit tracking application. It is an experience that millions of users make when first downloading and starting to use a habit tracking application. Such 'onboarding sequences' are common for all habit tracking applications, even though the specific procedure can differ. With the initial messages displayed by the habit tracking application the process of aligning the users to the values of the developers already started. By framing (or maybe adhering to) specific problems, the users ultimately have two choices only. The *first* one is being irritated by the suggestions that are made by the app because they don't include their problems; or the *second*

one is feeling supported and reassured through the pre-given structure in the onboarding sequence. When moving on from the initial message another moment of alignment takes place, when the setup of specific habit trackers is suggested to the users. As I know by now from my interview with Jack Cao, an employee working at *Habitify*, the list of pre-defined trackers that I have just described is manually crafted based on the most popular habit trackers of all users of this app (J. Cao, personal communication, May 8, 2020). The fact that the compilation of these suggested trackers does not take place automated (which would mean that the list of suggested trackers changes dynamically with the changing usage behavior of the app) can be seen as a mean to avoid random trackers appearing in this list, but it can also be understood as a mean of the developers to stay in control over what is the first impression users get from their habit tracking application.

The onboarding sequence that I just described already revealed valuable insights about what the developers see as problems and how they think their habit tracking applications can help the users. In chapter 6.1 I expand more on the background of the developers and the reasoning they used in the interviews to position habit tracking applications as a solution to specific problems. Beyond this my autoethnographic account also tells us something about how the developers envision their users, as the way they choose to communicate with them through the guided process in the mobile application illustrates some of their imaginations. I use chapter 6.2 to expand on this. Finally, this onboarding sequence gave a first impression of what habits the developers perceive as worth tracking and based on this, which values get performed through the habit tracking applications themselves. In chapter 6.3 I thus discuss how these two areas overlap as it got visible from my interviews with the developers of habit tracking applications.

6.1. Problems of the developers, problems of the world

Based on my research interest and questions it was important for me to learn through the interviews what the background of the developers of habit tracking applications is. This comprises general information, for example about their life course, but also how they came to develop habit tracking applications. For the latter I was especially curious as one of my assumptions for this thesis was that the motivation to build a habit tracking application is rooted in a specific understanding of human behavior, the wish to change it and ways how this can be done. The way the developers frame specific problems in my view influences the way they design and develop their habit tracking applications. Ultimately their views are then ‘shipped’ to the users of their apps and as such the problems of the developers are turned into the problems of the world.

In the following chapter 6.1.1 I hence describe and recite the personal and professional background of the four developers I have talked to from the apps *Strides*, *Habitify*, *Done*, and *Way of Life*. In chapter

6.1.2 I then expand on their reasoning concerning the question why people that want to change their habits fail to do so and how their habit tracking applications are designed to help people to succeed in this endeavor.

6.1.1. The background of the developers

Before I conducted my first interview, I was not sure how I could design my questions in such a way that I would learn something about the moralities of the developers. To get insights into someone else's way of thinking, his/her specific modes of making sense of the world, is key for understanding what they view as problems in this world and how they intend to solve them. While roaming through the transcripts of my interviews I noticed that their background and biography was mentioned and used as reference point for specific decisions in the development of their habit tracking applications.

My first interview partner, Kyle Richey from the U.S. based habit tracking application *Strides*, told me that he studied 'systems engineering' and that the key idea of this field of study is to 'zoom out' of a specific context or component to get an overview of the entire system instead. The purpose of this approach is to "see everything from that ten thousand feet up, looking down and you can kinda get a feel for how the whole system is working together and cohesively." (K. Richey, personal communication, May 6, 2020, l. 43) For him every human is ultimately a system in itself that has certain ways of acting incorporated. Thus, trying to understand the own habits for him requires zooming out from the daily practices and instead observing them over a longer period of time.

This aspect, his professional background and interest in systems, is referenced several times during our interview. At one point he chuckled and said "I love systems" (K. Richey, personal communication, May 6, 2020, l. 420) which is a thought that seems to define his way of thinking and designing the habit tracking application fundamentally. For example, he told me that

> I love to-do list apps, like from the day the iPhone was released I was really into that and suddenly it changed the way I did things but they,… a lot of times people don't zoom out and get more of a macro perspective. (K. Richey, personal communication, May 6, 2020, l. 39)

In extension to this statement I not only learned that he was using to-do lists as a form of self-organization before the smartphone as a technology was available to him, but that he was an early adopter of this new technology and immediately used it to digitalize his practices of self-organization. Unfortunately, I did not ask him why he thinks that using digitalized to-do lists is better than using paper-based ones, but nevertheless this is an interesting assumption that he made there.

Another thing that I learned about Kyle Richey more towards the end of our interview, is that he describes himself to be a "numbers guy" (K. Richey, personal communication, May 6, 2020, l. 830).

While this fits in with the general descriptions he gave me about himself, it also tells more about the way he approaches problems and crafts solutions for them. A problem can be identified when there are numbers, or more generally data, available about it. Without having data about specific problems concerning the own habits, it is difficult in his thinking to find possible solutions for them.

As Kyle Richey told me he started to think about creating his own habit tracking application for the iPhone in 2011 and released the first version of it in 2013. Today the app is basically run by two people as he explained to me: “So it's a very small team is my point, it's just... it's essentially just me doing all the product management and design and support, marketing and so, and then the developer Tim is just focused exclusively on development” (K. Richey, personal communication, May 6, 2020, l. 819).

While Kyle Richey described himself to be a ‘numbers guy’, Jenny Talavera from *Done*, which also used to be a U.S. based habit tracking application until she sold it just shortly before our interview, described herself to me in very opposite terms: “I’m just not a numbers person. […] I’m just like, when I look at graphs and numbers […] it doesn’t do anything to me.” (J. Talavera, personal communication, October 21, 2020, l. 447) This is an interesting statement, especially because it seems contradictory to the strong focus on quantitative data that habit tracking applications in general rely on. Normally the quantification of habits is the central feature of these apps that is constantly developed further. In the case of *Done* the quantification is very much limited to a basic counter and also the analysis capabilities are rather limited compared to other habit tracking applications.

The reason for this is, as Jenny Talavera explains to me, that she is a “graphic designer by trade” (J. Talavera, personal communication, October 21, 2020, l. 17) and has always focused on the aesthetic side in her work and she continued to do so when she started to work on her habit tracking application. For her most habit tracking applications that were established at the time when she started to work on her own “had like this Microsoft Outlook feeling, they were just kind of institutional and not very fun” (J. Talavera, personal communication, October 21, 2020, p. 74). When she went on to describe what she didn’t like about these other habit tracking applications she also spent some time to talk about the importance of feelings within the process of changing habits. Overall, she values a different approach towards habit tracking that feels more personal and individual to me compared to most of the existing habit tracking applications. Ultimately, Jenny Talavera tells me that “It's about adding color to your life.” (J. Talavera, personal communication, October 21, 2020, l. 83)

Jenny Talavera did actually not have the idea for developing a habit tracking application on her own. Originally, she was developing mobile applications for children when her husband introduced her to the idea of developing a habit tracking application for him specifically:

> I've never really been interested in tracking habits myself but my husband has a lot of bad habits he's been trying to break. So, I started out doing apps for kids and I was kind of looking for a change

> and he's like, can you make me an app that's going to help me quit smoking. And he's like, you know, can you make an app that could count how many cigars I have and you know blah blah blah, so he kind of gave me this idea. So, I basically made the app for him. And Done is like the third version. I did one version for him. And then I would see, then I could see how this could be applicable for a wider audiences who are not trying to do.. it was originally just to quit smoking app and then I broadened it […]. So the first app is Last, my last app and then I broadened it to Tally to keep track of things and then from Tally I broadened it to Done. (J. Talavera, personal communication, October 21, 2020, l. 48)

As it can be seen in this statement, an app that was specifically targeted at supporting her husband's efforts to quit smoking turned into a more generalized habit tracking application through different stages over time. While developing her app she also looked at other habit tracking applications but came to the conclusion that those "wouldn't help me and so they're not going to help him" (J. Talavera, personal communication, October 21, 2020, l. 96). Her reason to develop a habit tracking application was thus two-folded, *first* she wanted to create something more colorful that would help her husband and *second* she didn't find any existing habit tracking applications that were oriented towards people 'like her'. Her finding that existing apps wouldn't help her and thus also not her husband, is also an interesting aspect I learned from my interview with her.

Actually, at the time of the interview Jenny Talavera had just recently sold her app to a company from Denmark. Until this point it was a 'one-person company' as she told me and when I asked her what she is (or was) doing there she replied that "it's more like a question of what am I not doing […] I do everything basically." (J. Talavera, personal communication, October 21, 2020, ll. 7, 16) For her this included the development of the idea for the app, the design of the user interface and also the actual programming of it.

Similar to Kyle Richey another of my interview partners, Lars Arendt who is living in Denmark and develops the habit tracking application *Way of Life*, was an early adopter of the first iPhone. As Lars Arendt told me he started to engage with tracking his own habits around 2006 with a pen and paper-based system:

> I made these pieces of paper with just four columns on them and then the dates and then I could easily just at the end of the day I had two like huge markers red and green. Color it. Actually, I still think I have those somewhere but that would give me like a nice view at the end of the month, had I too much red, too much green and it worked quite well (L. Arendt, personal communication, September 24, 2020, l. 35).

The reason for doing this was connected to his personal well-being and over time he developed an analogue system that helped him keep track of his habits. With the release of the iPhone he then saw the unique opportunity to digitalize his system and make it available to other people as well.

Lars Arendt also told me that he studied computer science for a couple of years but that he didn't graduate in it. Instead he made movies for ten years before he came up with the initial idea for his habit tracking application. He told me that before he could turn his plans into reality, he had to gain a lot of technical skills, especially connected to the Apple framework for developing mobile applications on their iOS platforms.

What is remarkable in my view is that Lars Arendt told me something similar as Kyle Richey did: "I like numbers. I like graphs. I like spreadsheets." and then he added: "And I like changing myself… for the better, you know, and this is the tool I came up with to do that" (L. Arendt, personal communication, September 24, 2020, l. 100). In his case the motivation to develop a habit tracking application thus originated in the fact that he was already engaging in practices of self-tracking and saw the possibility to enhance this for himself, but also to spread his approach to other people.

During the interview he told me that he released the first version of his app in 2010 and since then has continued to work on it. When I asked him to introduce himself at the beginning of our interview and tell me what he is doing his answer was: "I'm the, the lead developer, the only developer [laughs] and also the janitor." He continued by telling me that he just recently hired someone to take over the social media activities for his company and app, but besides that "it's primarily me." (L. Arendt, personal communication, September 24, 2020, ll. 6, 9)

The last person I interviewed was Jack Cao who works for the company Unstatic that develops the habit tracking application *Habitify*. The company is located in Hanoi, the capital of Vietnam. This is the only interview that I conducted where there is actually a bigger company involved in the development of the habit tracking application. In this case the company employs ten people, with five of them working in the area of marketing and five in the area of development. Thereby it is important to mention that the company, according to their website, develops not only this habit tracking application but also another mobile application in the area of productivity.

Jack Cao told me that he is responsible for increasing "the metrics of engagement for the habit tracker app" (J. Cao, personal communication, May 8, 2020, l. 16). In this role he engages with customers to learn what they need from the app and he also writes blog posts about practices of habit tracking in general and how *Habitify* can be used in the best way. He is thus also the only of my interview partners who is not a developer in the narrow sense of the word itself. He is not directly engaged in programming the habit tracking application, but more with the product development.

When it comes to the development of the habit tracking application in general, he told me that:

> because we are a startup, so there are, there is always a push for innovation, fast moving, our CEO Peter, who designed the app, he started the app like basically by himself. So, he has a very intuitive feel of what works for the app, so, a lot of times a feature, an implementation comes from his

> intuition of what is right. So, he comes to that conclusion by constantly observing the industry, like, what is working well or is not working well in terms of feature. So that's one side, Peter's inspiration of how this app will play out. (J. Cao, personal communication, May 8, 2020, l. 401)

6.1.2. Reasons to use habit tracking applications

While the background of the developers often shaped their general interest in self-tracking and the initial development of their habit tracking applications, they called more reasons in the interviews for why habit tracking applications are useful for their users. Most of these reasons where nevertheless connected to their own background and affiliation towards self-tracking and changing the own habits.

My first interview partner Kyle Richey has been interested in systems and is convinced of their importance as I have already described in the previous chapter. For him one reason to use habit tracking applications is that they can help the user to put a system in place for changing their habits. As there are many distractions in everyday life that require a lot of will power to keep engaging in those activities that you really want to do, a habit tracking application can be the tool that supports the users to 'automate the process' according to Kyle Richey. With 'the process' he refers to the building or quitting of a habit. Actually, the terms Kyle Richey used here and throughout the interview are very much technical terms that he applies to humans and their behavior.

Jack Cao also tells me that their habit tracking application is meant to be a system that helps the users to "focus on what truly matters in their life more easily" (J. Cao, personal communication, May 8, 2020, l. 26). The system in this case is a place, the mobile application, where the users can come back to regularly enter data and view their current progress. According to him this should then in turn lead to "master[ing] their daily activities" (J. Cao, personal communication, May 8, 2020, l. 29).

In my interview with Lars Arendt I had already learned that he engaged in practices of self-tracking before he developed his habit tracking application. To do so he developed a pen and paper-based system that was 'simple' to use and engage with and offered an overview over his own habits at a glance. The 'systems' that all of these developers have talked about consist of some form of storing information about the own habits. This is complemented by graphical representations of this behavior.

'Seeing the progress' is the central argument for using a habit tracking application by all of my interview partners. As Jack Cao told me "Habitify helps people to like really see the progress over the long term." (J. Cao, personal communication, May 8, 2020, l. 53) This is important according to him as changing the own habits takes a long time which can make it difficult for the users to stay motivated and keep on going. Having a place where you enter your daily (or weekly, or monthly) achievements that are then aggregated and displayed back to the user, is a form of 'reward' in his view. To see the

own progress in the form of statistics or charts is central for their users according to him. Turned around he told me that “people drop out because they don’t see the progress” (J. Cao, personal communication, May 8, 2020, l. 162).

Jenny Talavera was also talking about the importance of her habit tracking application as a place where users can see what they have already achieved or where they have to do better. Using a habit tracking application to her “it's kind of like, it's like saying it out loud. I'm going to, I'm going to do this” (J. Talavera, personal communication, October 21, 2020, l. 215). Ultimately seeing the own progress is seen as a form of commitment to oneself, as a commitment to the goals that the users have defined before. At the same time using a habit tracking application is also perceived to be a source of motivation and satisfaction:

> But the fact that, you know, that you [..] exercised every day or that you've met your goal and you can see that I think that kind of confidence and feeling, I'm trying struggling for the right word but it's, it's this feeling of satisfaction for yourself. (J. Talavera, personal communication, October 21, 2020, l. 192)

A similar point is mirrored by Kyle Richey who told me that checking the habit tracking application throughout the day enables the users

> to see what else they have left or what they have already done, and then at the end of the day they would take a quick look and kind of see, okay how did I do for the day, we send like a congrats pop-up that kind of says like 'hey you had a perfect day today' and has confetti and stuff (K. Richey, personal communication, May 6, 2020, l. 134)

For him and the other developers using habit tracking applications is a solution to the problem of staying motivated, it is seen as “a great form of motivation” (J. Cao, personal communication, May 8, 2020, l. 58) and as a tool that enables the users to stay “motivated when things get difficult” (K. Richey, personal communication, May 6, 2020, l. 47).

During the interviews I was already wondering, if people want to change, if changing themselves is something that important for them, why do they lack the motivation to do so? For me this seemed contradictory and I got more and more the feeling that the reasons for the users to change are not intrinsically rooted in themselves, but more in the fact that they feel the need to comply to some general standards concerning their habits.

In the interviews the developers were going into another direction when asked about this. Lars Arendt for example explained to me what the challenge is when trying to change habits. According to him it’s “the willingness to change, to track, to confront” (L. Arendt, personal communication, September 24, 2020, ll. 32–62) that influences the motivation. He goes on to explain that habit tracking applications

are no ‘magical tools’ that can create willingness in their users, but that they can support the individual efforts by pushing them a little bit and thus reinforce their own willingness.

The aspect of lacking will power is actually something that is mentioned regularly across the interviews. In the context of explaining to me how the automation of changing habits can be beneficial, Kyle Richey also mentioned that it is important to “set systems in place so that your environment is working for you so you don't have to rely on your will power.” (K. Richey, personal communication, May 6, 2020, l. 425) For him it is in general difficult to rely “on will power in the moment.” (K. Richey, personal communication, May 6, 2020, l. 407) when being confronted with something that is not in line with your goals. Then, he gave an interesting example for what he means by this and why habits are thus something important to establish:

> for example, if you want to lose weight don’t buy cookies and ice cream from the grocery store, right, don't have it in your house. That's a really simple thing and it's funny that, that's.. if you get in the habit of not buying those things than it leads directly to a goal that is really the things that you value and things that you are looking to do, so, I think that's the reason and their importance, that they, they make it a heck of lot easier to actually accomplish something then brute force and will power. (K. Richey, personal communication, May 6, 2020, l. 427)

In his argumentation human will power is basically not able to withstand ever changing temptations even though they might contradict the own goals. Apart from not exposing oneself to situations where the will power is challenged, he argued for creating systems (as discussed before), in this case the habit tracking applications, that don’t require the users to rely on their will power at every point in time.

While the developers were arguing strongly for the importance of creating a system that would support users in not relying on their will power by tracking the own habits and representing them in the form of statistics and charts, I noticed during my autoethnography with some of the habit tracking applications that this can also create a lot of pressure for the users.

> It is Sunday evening and I’m sitting on my couch watching some TV series. The week was packed with work and studying and also on Saturday I was not really able to switch off. Now I feel a little bit of relaxation spreading through me. A sudden notification sound from my smartphone makes me take a look at it. I *press* the home button and see a notification from *Strides* that says: “How are your goals and habits going? Here’s your Strides progress report.” I’m harried because I know that I haven’t sticked to some of my plans. I know how this “progress” report will look like and I don’t want to see it. But not taking a look won’t make it better as my mind is now already curling itself around this report which represents my failure.
>
> So, I *tap* on the notification and I’m redirected to my progress report of the week. It is a list of the trackers I have defined two weeks ago including ‘Study’, ‘Drink Water’, and ‘No

> Phone in Bed'. The first one I setup to be done once a day during weekdays. I feel happy because I managed to actually do this with just one exception last week and in consequence the bar that shows my progress for the week is green. I click on this tracker and am now presented with a calendar overview of the last weeks and a circular graph that tells me that I met my goal 89% since I started to track it and that I managed to do it on eight out of nine days.

During the time I used the habit tracking applications I often felt guilty for not being able to stick to all of my goals. The fact that a lot of people who are trying to change their habits have similar difficulties is something that the developers are aware of. According to Jenny Talavera a central purpose of habit tracking applications is actually to "help them [the users] get on track" (J. Talavera, personal communication, October 21, 2020, l. 452). For her this is not so much about having a lot of detailed statistics and graphs, but more about creating a rhythm for engaging with the own habits. Typing in data about them is thus also seen to be a habit that the users have to build in the first place.

Lars Arendt told me that the ability to 'get back on track' is crucial for changing the own habits. As there are many distractions and as the will power is a weak spot, he thinks that habit tracking applications offer a solution to these challenges:

> So, I actually honestly believe that it's pretty hard to change habits. But it helps me, and this is the important part, because every day I confront myself with what I think is important in terms of my behavior and my habits. So, it's the daily confrontation with these goals that helps me put me on the right track. (L. Arendt, personal communication, September 24, 2020, l. 115)

While the developers I have talked to acknowledge that the track that one can get off from is an individual one, thus nothing that their habit tracking applications would prescribe, this notion is still used for the public advertisement of their apps as the example of *Way of Life* shows: "Stay on track. Powerful reminders will keep you on track until good habits are formed or bad habits are broken."[27] The notion of a track that one can get off and also come back to is obviously one that is charged with a lot of moralities. Even though picturing this metaphor can probably be helpful for some people who want to change their habits, it still implies that there is a pre-defined track or route in front of them and if they just follow it everything will turn out as planned for them.

[27] Way of Life. (n.d.). *Way of Life - Habit on, Habit off.* Retrieved from https://wayoflifeapp.com/

6.2. The power of habits

The success of habit tracking applications, determined based on the number of users, can possibly be attributed to the increased importance of practices of self-auditing in contemporary societies. As I have shown in chapter 2.2.3 and chapter 3.1 the Quantified Self movement and self-tracking communities in general are convinced that engaging with habits is an important component for changing the own life to a better. This assumption is among other things based on a variety of books that are frequently referenced in these communities and that I also encountered within my interviews with the developers of habit tracking applications. The understanding of what habits are and why they are important is central for investigating habit tracking applications and the moralities of their developers. This is especially true when habits are categorized into good and bad ones, or into habits that should be build or quit.

To provide better insights into these topics I present in the following chapter 6.2.1 how the developers made the case for habits in the interviews. Subsequently I describe in chapter 6.2.2 how the general understanding of habits was transformed and used by them in the process of developing their habit tracking applications.

6.2.1. The case for habits

Central to a habit tracking application are, to no surprise, the habits that ought to be tracked. Just by looking at the term habit tracking application it gets obvious that habits have to be something that one can track and to go even one step back, something that is important to track. In my initial online recherche I noticed that even though a lot of people in the context of self-quantification and self-tracking are talking about habits, there doesn't seem to be a more general understanding about what a habit actually is. That's why I asked my interview partners about this to learn what they think about it.

For Jenny Talavera a habit is an activity that is done on a regular basis. Thereby actions are excluded that you only do erratic and outside of a fixed rhythm. A habit is thus something that people do on a daily, weekly, monthly, or yearly basis. Beyond this scope it gets difficult to label something as a habit, because even though it might take place every ten years, the routine of actually performing a task or participating in an activity is missing. She also told me that a habit is something that you do 'automatically' and that you don't have to think about. She uses the example of surfing here because she personally likes to do this. According to her there is a specific sequence of things that she has to do when preparing for her surfing trips, "you have to like put on your wetsuit and then you have to wax your board. Then you have to like put your appliances in" (J. Talavera, personal communication, October 21, 2020, l. 387). All of this is something that she does without thinking about it,

> but if I have a friend come to me when they start talking to me, I got all screwed up and I like forget my earplugs. I lose my key and I tell them stop talking. Cause I can't... or else I'm gonna like forget, you know do something. (J. Talavera, personal communication, October 21, 2020, l. 389)

A habit in this understanding is thus something that has been repeated so many times before that it doesn't require conscious thinking about it in order to actually do it. Driving a car is another example that is mentioned for this by Kyle Richey as an activity that once people have done it over and over again, they don't think consciously about every step it takes to do it – start the motor, release the handbrake, look around, set the blinker, etc.

The developers of *Habitify* also think that a habit is something that is done regularly, as Jack Cao told me. Thereby he differentiates between tasks and habits. Tasks in his view are activities that are done on an irregular basis. Then, he explained to me that a habit not only requires a reoccurring point in time when it is done, but it also relies on a specific environment and specific tools. As an example, he mentions brushing the teeth which is done on a daily regular basis. It also requires a toothbrush to be done, and it is normally done in a room, the bathroom, which is the specific environment for personal body hygiene. In his view though a habit is an action that is formed through a specific frequency and it is drawing on specific material requirements (J. Cao, personal communication, May 8, 2020).

The character of habits as entities that should be tracked is on the one side determined as something that is repeated on a regular basis and as such can "free your mind up to think about other things" (J. Talavera, personal communication, October 21, 2020, l. 227). On the other side it is seen as an opportunity to confront oneself regularly with the own habits. Lars Arendt for example told me that "it helps me, and this is the important part, because every day I confront myself with what I think is important in terms of my behavior and my habits." (L. Arendt, personal communication, September 24, 2020, l. 116)

When it came to questions about habits during my interview with Kyle Richey, he told me about the book 'The Power of Habits'[28] which describes a habit as the sequence of a cue, the routine, and the reward. He continued by applying this principle to an example that we had stressed several times before in other contexts of our interview:

> if you want to drink eight glasses of water a day, […] so there is a cue, 'I'm thirsty', the routine is, 'I go fill up my water glass and start drinking it', and the reward is 'I'm not thirsty anymore', right. So you build a habit out of going through that little loop, and the routine part is the little thing that you

[28] The book with the full title „The Power of Habit: Why We Do What We Do in Life and Business" was published in 2012 by the New York Times reporter Charles Duhigg. It is one of the books that is commonly referenced by members of the Quantified Self movement, the self-tracking, and productivity communities (see for example here: https://www.reddit.com/r/productivity/comments/dw6n5h/i_made_this_animated_summary_of_the_power_of/). The author itself presents his insights and recommendations as based on scientific research, mainly from the field of neuroscience.

> do, and then you can zoom out a little bit, it gets a little kind of messy, because some people will say that my morning routine is to do these five or six things in a row, but it's still true in the end like they are trying to build the habit of 'I'm going through this process of doing these things', like one cue, routine, reward, trigger loop after another. (K. Richey, personal communication, May 6, 2020, l. 566)

This concept of a habit does not only include the action itself, but also a cue, which ultimately is an indicator for doing something, and a reward for having done the action. This is interesting as it is the basis for how Kyle Richey, but also other developers, adjust their habit tracking applications. Beyond the example of drinking water, the cue is represented in the habit tracking applications in the form of notifications. Users can create them and receive notifications that remind them to perform a specific habit and/or enter the corresponding data into the app. Jack Cao does also reference this concept, even though he doesn't mention a specific book. According to him

> A habit is formed through three things, the queue, an action, and the reward. With the queue, people can set a queue for the habit with Habitify notification. It's very difficult to set a queue with other method of habit tracking, for example, an Excel sheet or a journal. Like a journal can tell you what to do or when to do it, the same thing with Excel, but a habit tracker app, one of the must haves is a notification system. (J. Cao, personal communication, May 8, 2020, l. 79)

Both Kyle Richey and Jack Cao thus connect the way habits work in general with their habit tracking applications and specific functionalities that support the users in their efforts to build or quit a habit. The idea that a habit is comprised out of a cue, routine, and reward is hence inscribed into the apps.

Overall, the developers view habits as actions or practices that people perform in a specific rhythm and that require a specific environment to be performed in. Such an environment can include specific tools or infrastructures like we have seen in the example of tooth brushing. Furthermore, habits are seen as a form of automation that creates the capacities to think about other things and free time to spent on other activities. In this context, their habit tracking applications are presented as tools that can support the efforts of the users to change their habits. This is primarily done through the display of tracked data (as already shown in chapter 6.1.2) and the provision of features like reminders and notifications. The latter are specifically seen as cues for the habits that should be done.

6.2.2. Representing habits

As described in the vignette at the beginning of the sixth chapter habit tracking applications do represent habits in the context of pre-defined trackers (e.g. 'Read Book', 'Meditate', 'Run', etc.). Additionally the tracked data about the user's habits is presented to them in different forms of progress reports as described in the vignette in chapter 6.1.2. While I was eager to learn more about the developers

views on habits in general within the interviews, I also wanted to know how they transformed and inscribed these views into the actual apps.

In the chapter about the reasons to use habit tracking applications we have already seen that the developers view the ability to visualize the own habits as a central feature of their apps. The following statement from Lars Arendt summarizes this idea quite well in my opinion: "it's important to track things if you want to change things" (L. Arendt, personal communication, September 24, 2020, l. 103). This is why every attempt of tracking habits in these apps is started with the setup of a tracker. In the case of *Strides*, the users can choose from four different types of trackers[29]: Project, Average, Target, and Habit. Actually, these are the most common types of trackers across all habit tracking applications I have investigated, even though *Strides* has the most diverse set of them implemented.

When starting the setup of a habit tracker the user is confronted with a set of pre-defined trackers to choose from in all four habit tracking applications. This list is shorter in some apps – *Habitify* for example only recommends seven trackers – while others display extensive and nested lists to choose from – *Strides* for example has over 150 pre-defined trackers in various categories. Jack Cao told me that their selection of pre-defined trackers is based on the user statistics they collect. Those trackers that are used by most of their users are put into the list according to him:

> So, yes, those are actually the ones that has the highest count in terms of people setting up their habits. So, we think that this is a good thing to put up there, because it is the most common, it is the most common ones, so, it's a good start for people. (J. Cao, personal communication, May 8, 2020, l. 201)

Thereby this list is not changing automatically but is manually adapted by the developers. In the case of *Strides* Kyle Richey told me that his list of pre-defined trackers has grown constantly since the app was originally released. One source for new templates for trackers are the users themselves. As he does provide all the support for his habit tracking application himself, he is in regular contact with his users and as a result receives a lot of suggestions for extending the list of templates for trackers: "I have had over fifteen thousand email conversations with users over the years, […] it's mostly just anecdotal conversations" (K. Richey, personal communication, May 6, 2020, l. 238). Besides these conversations he told me that he also does research for himself to determine which templates for trackers could be useful to add to his app:

[29] I have already described in detail what each of them can track in the section about *Strides* in chapter 3.2.

> I remember one of the first things I did was I just started googeling like 'health goals', 'finance goals', things like that and.. or 'most popular, most common something goals', that kind of thing and that helped a lot just to kind of get like a good feel for, you know, there were whatever listicle blog posts or there where forum threads or.. that kind of thing (K. Richey, personal communication, May 6, 2020, l. 242).

This approach is also used by Lars Arendt from *Way of Life* as he described to me during our interview:

> Yeah, it's, it's just been growing over the years. I sometimes, I read an article, sometimes I get inspired by my competitors, they have some stuff in there as a suggestion that I don't have and I think it's a good idea. It's like okay, I'm gonna have that too, so it's, it [the pre-defined trackers] come from different sources. (L. Arendt, personal communication, September 24, 2020, l. 454)

Way of Life is specifically interesting in terms of the pre-defined trackers because it does not only comprise tasks and habits that one would classically attribute to self-optimization, but it also includes trackers like 'Being thankful' and 'Had a nice day'. When I asked him about these he replied that for him the question of "who you are in the world" is something very important and that's why habits are "Not only towards yourself […], but also into the world." (L. Arendt, personal communication, September 24, 2020, l. 469)

When I asked Jenny Talavera about how the pre-defined trackers in her habit tracking application came into being her answer was surprising to me as it differed from the other answers I had received: "I think I just like sat down and came up with it one-day and never looked at them again." (J. Talavera, personal communication, October 21, 2020, l. 516) She continued by telling me that the process of coming up with them included to think about how the users would engage with the app in different ways. This was especially oriented at the question which trackers would be the most helpful for potential users as she explained. Overall, for her the creation of pre-defined trackers did not include an online recherche or conversations with users, but, as she concludes, was based on her thoughts in the moment: "I guess that's my worldview." (J. Talavera, personal communication, October 21, 2020, l. 523)

When the users start to add one of these pre-defined trackers, they are confronted with a number of settings they can adjust. Some of these come with default values. For some settings, this is as straightforward as setting the start date for tracking to today's date. In other cases, it includes default values where I was wondering how they came into being: When adding the tracker 'Drink Water' in *Strides* the goal is set to eight times per day. In addition, four reminders that are distributed over the day are set by default. During my interview with Kyle Richey I thus asked him about these default values and how he determined them. He replied by explaining first that most other habit tracking applications don't do that and that he thus thought it could be an interesting feature for the users to include default values for the setup of the pre-defined trackers. He stressed several times that he 'tried to make them as logical as he can'. I then asked him specifically on which information he based the default values and he replied the following:

> I'll be honest, a lot of it is anecdotal, it's definitely like a personal opinion thing, but, because I know someone can change it I just try to make it as logical as I can, but you're right, like, there are some people that would say 9am doesn't make any sense, I work third shift and I'm sleeping then, so I need completely switch it up, but, but as, as far as.. I like to pick a just really logically default and, that is at least as encompassing as I can, maybe eighty percent of the people are gonna go 'yeah it makes sense' and they just click the button and it's done and they don't have to deal with it. (K. Richey, personal communication, May 6, 2020, l. 282)

While he acknowledges that a majority of the users of his app – eighty percent to be precise – probably just take the default value for granted, he also repeatedly stressed that the users have always the possibility to change all settings and default values. For him this is a matter of 'adjusting the settings according to your own values.' The concept of *Way of Life* for example is different here. Even though there are also suggestions for trackers, their settings just encompass the name or label – for example 'Go jogging' – and the option to tell whether this is a habit that is good for you or not – 'Is going jogging good for you? - No / Yes'. Each suggested tracker has already a default value for this question. Lars Arendt explains to me in our interview:

> But I've tried in the app to make it as open as possible for the user to define what a good or bad habit is. Again, it's a tool, it's not a judge, like, I think, I think some of my competitors they had very specific ideas about what's good or bad, you know, in the, but, but I just tried to be versatile, you know, like track whatever you want. (L. Arendt, personal communication, September 24, 2020, l. 161)

On the one side it seems true based on my autoethnography that the *Way of Life* app prescribes less default settings to the users than other habit tracking applications do. Nevertheless, Lars Arendt mentioned a very important aspect in this statement and that is the differentiation between good and bad habits.

Most habit tracking applications that I have investigated draw on the differentiation between good and bad habits, even though some of them label and frame them differently. I have already shown how Lars Arendt frames it, as a personal question towards the users, 'is this habit good for you?' In the case of *Strides* users can switch a button for any new tracker that says, 'Bad Habit'. If they do so, the logic of the tracker turns around as Kyle Richey explained to me. The goal is then not to perform a habit more than X times, but less than this in the defined timeframe. He also told me in this context that this is a feature that he didn't want to include at the beginning because he doesn't like the idea of looking at bad habits this way. But when a lot of users requested this feature, he finally decided to add it. *Habitify* is the only app from my sample that doesn't include any codified form of good or bad habits.

The last interview I conducted was with Jenny Talavera and at this point in time I already had a lot of insights into habit tracking applications in general through my autoethnographies and also due to the previous interviews. Hence, I was specifically interested in why she labeled the option that tells whether this is a habit that the users want to 'build' or 'quit' and not good or bad ones:

> Why build and quit versus good or bad? I hate those two, I mean… but I think I use them in conversation, bad habits, but it's, I don't know, I didn't want, I don't want this there to be like any kind of sense of judgment. I don't know for the user to be like, okay that I mean if they were working on, on a quit habit, you know, they most often they're bad, but you know, you don't want to think you're failing it. […] I just didn't like, I didn't like to see those words associated with.. and, and yeah, just trying to keep everything positive. (J. Talavera, personal communication, October 21, 2020, l. 238)

For her it is thus about framing the way users view their own habits in a different way. Thereby she circumvents using terms that are attributed with very strong moral assessments about the users and their habits without ultimately questioning the simple classification of habits into good and bad ones.

One last theme that surfaced within the interviews was the way the users can engage with the habit trackers that they have set up and how they are represented in the habit tracking applications. One feature and also way of understanding habits are the 'streaks'. Depending on the habit tracking application this is an option or mandatory for the trackers. It is seen as an indicator for the successful performance of good habits (or non-performance in the case of bad habits). It shows to the users how many days in a row they were able to stick to their goal of doing specific habits or not doing them. Again, this was connected by the developers to the importance of the visualization of the tracked data for the users.

6.3. The users in the mind of the developers

While the developers of habit tracking applications define the way the app works based on themselves (as displayed throughout the previous chapters), they also think about their possible users in this process. This is among other reasons important for them as they want to turn their users into customers. As every habit tracking application that I investigated offers a free version to use with limited functionalities, the developers need to think about ways of turning the users of these free versions into paying customers for their premium versions. This ultimately requires to either imagine users and tailor the app towards them or to know the existing users and what their needs and wishes for the habit tracking applications are.

In the following chapter 6.3.1 I show the imaginations that the developers craft and hold about their users and the way these users are imagined to engage with their habit tracking applications. Then, starting from my autoethnographies, I engage with the social aspects of self-tracking and habit tracking in chapter 6.3.2.

6.3.1. Imagining the users

The developers not only have use cases in mind for their habit tracking applications that are targeted at solving the specific problems they see (see chapter 6.1.2 for details), but they also imagine specific users or groups of users that engage in different ways with their apps. As I have already echoed earlier Jenny Talavera considered herself not to be a ‘numbers person’ but rather a ‘color person’ because of her background as a designer. As she knew that other habit tracking applications focus a lot on the quantification and the display of the tracked data, she wanted to create a habit tracking application that is more targeted towards people who just like her ‘are not into numbers’:

> So, I just, I wanted to, I wanted the app to not be geared towards… I wanted it to be geared towards people like me, who just wanted an app to help them get on track, but didn't want to feel like they had to understand these stats or had to see them all the time or take […] a benefit from looking at percentages or graphs. (J. Talavera, personal communication, October 21, 2020, l. 451)

At another point of the interview she then also told me that in her view the users could “just be anybody. I thought it was it was very general.” (J. Talavera, personal communication, October 21, 2020, l. 178) But then a few sentences later she reduced this general ‘anybody’ to “anybody who wants to improve something about himself” (J. Talavera, personal communication, October 21, 2020, l. 181). Here the users are imagined to be people that have already taken a specific step and decided that they want (or have) to change something about their habits. The users in this view have already engaged with their own habits before starting to use a habit tracking application, even though she hasn’t specified how the users conclude that they ‘want to improve something about themselves’.

This ‘anybody with conditions’ is a figure that I have also encountered in my interview with Kyle Richey. He began explaining to me how anybody could use his habit tracking application, when in the following sentences he also shifted towards a more specific version of this general anybody:

> in general it can be, it can be just about anybody that is at least, I think the pre-qualifier for sure is [...], for just anybody is being driven because you'd have to at least have something in your mind where 'I want to set goals, I want to track my habit, I want to have some sort of productivity focus', to even be into it at all, but once that foundation is laid it's pretty much anyone. (K. Richey, personal communication, May 6, 2020, l. 675)

Ultimately the users that these two developers imagine are people that have already determined what their general area of concern is: Do they want to change their eating habits? Is the goal to read books more regularly instead of watching videos on YouTube? Or is it about being more productive at the workplace? These questions have already been dealt with by the people that start to look for a tool that could help them to achieve this in the view of the developers.

Actually, this is an imagination that is also shared by Lars Arendt who told me that one category of users comprises “people who like me are willing to change myself, but they just need a tool.” (L. Arendt, personal communication, September 24, 2020, l. 147) As described in the paragraphs above, people from this group have already decided that they want to change and what their goals are. He then gave me this interesting metaphor for this group of users: “You know, they want to build the house. They just need the tools. And they download the app.” (L. Arendt, personal communication, September 24, 2020, l. 148) Besides this group of users he described a second one:

> And then you have people who think that the app can magically do it all for you and they might get disappointed because it doesn't, it does take some effort some, investment and they will just quickly drop it. But, it's hard to say what kind of, there might be other kind of users too, but I think that's the two, like, poles. (L. Arendt, personal communication, September 24, 2020, l. 149)

In terms of how Lars Arendt imagines his users one part of our interview is especially interesting to display in my view. When I asked him how he imagines a typical user of his habit tracking application, his reply began like this:

> So, that would be me, yeah, and my wife because she has no clue about computers or smartphones. So, she can use it, if I find it a helpful feature because I'm… a tracker then it's good and if she manages to figure it out and use it, well, it's a win-win. Obviously joking, but it's more or less the, the way I think about it and it's.. a lot of stuff I don't put in there because it's, because I think of the user as not necessarily tech savvy users, right? (L. Arendt, personal communication, September 24, 2020, l. 494)

Even though he added to his statement the ‘obviously joking’ part it still seems as if he bases his imaginations of users and specifically the process of deciding about new features for these imagined users, very much on himself and his wife.

Jack Cao also told me that *Habitify* is targeting those people as users that are “interested in their personal development” and more specifically people that “care about their productivity.” (J. Cao, personal communication, May 8, 2020, ll. 35, 36) In terms of the age groups that are especially interested in engaging with their productivity he contradicted himself during our interview. At one point he told me that people from their mid-thirties to forties are their most active group of users and that they are engaging with tracking their productivity. Later he told me that users from this age group are more interested in tracking their personal health and well-being, while users from their mid-twenties to mid-thirties are interested in tracking their productivity.

While Jack Cao named these specific age groups, Kyle Richey told me that his users come from a ‘wide range of ages’ and that also elderly people are using his habit tracking application. In general, for Kyle Richey the users are not specifically interested in the topic of productivity, but they “like being organized and […] they are generally a little more analytical I would say” (K. Richey, personal

communication, May 6, 2020, l. 647). For him the users of his app are thus not so much comprised based on the purpose of what they want to track, but rather based on who they are and what they value.

In terms of the professional background of the users the developers name a wide range of occupations including finance, business, and start-ups. Kyle Richey and Jack Cao both told me that a major part of their user base has a 'tech-based interest' or comes from the 'tech community'. This is something that I also noticed when engaging with the online communities around the Quantified Self movement and self-tracking in general. Not every user of a habit tracking application has this background, but it seems that they make up one of the largest groups to do so.

Besides imagining the users, the developers of habit tracking applications also have to imagine specific ways of engagement by these users with their apps. The first thing I learned was that the frequency with which the developers imagine their users to engage with the habit tracking application differs. Lars Arendt for example told me that he takes a look into his app one time per day in the evening to enter his data. This is also what he imagines for his users to do: "I think most people they take a moment of contention at the end of the day." (L. Arendt, personal communication, September 24, 2020, l. 517) In terms of specific usage data he could only tell me that the users "on average spent 30 seconds in the app, on a daily basis." (L. Arendt, personal communication, September 24, 2020, l. 504)

In contrast, Jenny Talavera told me that she advises people to take a look at the habit tracking application one time in the morning to check which habits have to be done throughout the day. Then she tells me that some users like to go to the app one time at the end of the day to check everything they have done, which is not the approach that she would choose. For her it is more about a 'continuous interaction' with the app throughout the day. This is an approach that Kyle Richey also favored:

> the simplest way to say would be that they [the users] check-in in the morning, to kind of see what they have for the day, what they need to log based on the schedule that they have set for each thing to repeat. And then they would, throughout the day, get reminders at the times that they have scheduled and they would track the progress as they go throughout the day on each of those things (K. Richey, personal communication, May 6, 2020, l. 128).

For him the best way of using his app is by tracking the habits consistently and gradually through the day instead of just engaging with them one time per day. He also stated that the users of his app on average open it at least five times per day.

The frequency of use is similar for *Habitify* as Jack Cao told me: "And most people use it multiple times a day also." (J. Cao, personal communication, May 8, 2020, l. 332) As stated by him some users do only engage with the app once a day to track their daily progress in the evening, but it is much more common that they will engage with it several times throughout the day to check what they have to do.

All of these ways of engaging with the habit tracking applications are thereby not only imaginations, but they are based, reinforced, and altered by the statistics the developer collect about the actual usage behavior of their users. For some habit tracking applications this only includes metadata, that is for example the amount of time a user spends in the app per day, for other apps it seems that the developers have access to basically all user data. Kyle Richey told me that he intends to switch the storage and synchronization infrastructure that runs in the background of his app to use the iCloud service by Apple for synchronization. On the one side this means that he himself doesn't have to host a database for the synchronization of user data across devices and on the other side it means that he won't have access to the user's data anymore, as the iCloud service is end-to-end encrypted and only allows access for the owner of the respective Apple-ID.

6.3.2. Habit tracking as a social activity

> I find myself on Reddit, a popular message board that offers spaces, the 'boards', for every topic that one can imagine. Currently I find myself on the board 'Quantified Self'[30] and read through the latest posts that deal with the best ways of tracking oneself, the best tools to use, and questions concerning how specific behavior or information about the body can be tracked or interpreted. The discussions here range from the question if smartphones or smartwatches are the better companions to track oneself, to the question how much caffeine in the blood is bad. According to Reddit's own statistics this board has over eight thousand members and because of my earlier recherche I'm aware that it's just one of many boards that deal with the topics of self-quantification and self-tracking.
>
> While some of the discussions seem alienating to me, I'm also astonished by the level of engagement that the users of this and other online communities display. Ultimately these communities provide a space for questions and uncertainties. At the same time, they create a collective understanding about what habit tracking is, how it can be done, which tools can be used to do it, and how the generated data can be used.

Self-tracking might seem like an individual practice, probably also because of the term itself. While this might be true for the moment of collecting and entering the data about oneself into a habit tracking application for instance, it holds not true when looking at the online communities that have formed around practices of self-tracking, habit tracking, or the Quantified Self movement. These communities,

[30] Quantified Self. (n.d.). *Quantified Self* [Reddit board]. Retrieved from https://www.reddit.com/r/QuantifiedSelf/

like the one I described in the vignette above, are actively engaging as a collective with self-tracking and questions resulting from it.

To give a recent example from April 2, 2021 where the user 'Cymbelmine' posted the following post with the title "Heart rate variability questions"[31] on the Quantified Self board on Reddit:

> I have been tracking my HRV (heart rate variability) for almost a month, everyday, several times a day and I noticed something which I have been unable to interpret.
>
> So, I am using Welltory, an app that measures heart rate variability and gives several related stats.
>
> My coherence index is low almost all the time. Ditto for my HRV score. My coefficient of variation is also most of the time/often very low. My total spectral power is often poor or very poor, and average at best.
>
> (I am in my early 30s.)
>
> I wondered if there are any studies or any articles were I can learn about what it means if these numbers are low but I cannot find anything good or comprehensive.
>
> Does anybody have information on low HRV scores or any experience with measuring HRV?

While the first user that replied to this post stressed that the score the questioner asked for is relative and thus there is no way of generally telling if it is a good or bad score, the following answerers were giving insights into the data that they had tracked about their own heart rate variability. One user replied that she/he is also interested in this topic and posted a link to a self-quantification podcast episode that engaged with exactly the topic of the heart rate variability. In this discussion and many others on Reddit the users do share information about their own habits or body and ask for help or tips on what to do with this information or how they could be changed. These online communities are thus places where knowledge is exchanged and data that has been tracked, for example with a habit tracking application, is interpreted and discussed collectively.

Even though some of the developers I talked to were aware of these online communities and the discussions that are going on there, they were not actively engaging with them. Nevertheless, Kyle Richey told me the following about one of his most active users, who is tweeting a lot about his attempts of self-quantification with *Strides*: "he actually created a Strides app sub-Reddit and he started putting things on there and so people talk on there" (K. Richey, personal communication, May 6, 2020, l. 742). Even though not much engagement has happened on this particular sub-Reddit board (as of May 2021

[31] Cymbeline [Reddit]. (April 2, 2021). *Heart rate variability questions* [Reddit post]. Retrieved from https://www.reddit.com/r/QuantifiedSelf/comments/miimd4/heart_rate_variability_questions/

the last post is over one year old) online communities of different forms are part of the efforts to engage with the own habits just as the habit tracking applications are.

While these online communities are very active, Kyle Richey also pointed me to the fact that the engagement with habit tracking applications is something that takes place in the immediate surroundings of the users. He even added the possibility to individually change the notification sounds for his app, because he observed that these sounds can become the starting point for a conversation about habit tracking and his app:

> my family started saying like 'oh you use that one?' and like people started saying like, like they would get a reminder while they were, you know, hanging out at a party or something and be like 'what was that?' and they would just say like 'oh it's my reminder to, you know, drink some water' or whatever it is or 'follow my diet for dinner' or whatever something, and, they'd say 'oh let me see' and then they would just start talking (K. Richey, personal communication, May 6, 2020, l. 705).

Then he also added that he hopes that people start to engage with his habit tracking application because they see the success that their family or friends have with it. While Kyle Richey does not actively push an exchange between users, other developers of habit tracking applications do. Jack Cao for example told me that their company has set up a blog[32] where they on the one side share information and instructions on how to use habit tracking as a method of personal development and how habit tracking applications are important in this context. On the other side they share so-called 'Success Stories' where users, most of the time they are working as managers in some ICT company, share how they use *Habitify* to change their habits and become more productive. The reason for sharing this, according to Jack Cao, is that "For the blog and community, basically that is the, our attempt at educating people on habit tracking, like, how they should do it." (J. Cao, personal communication, May 8, 2020, l. 256)

Lastly, Lars Arendt told me that he isn't aware of any online communities that engage specifically with his app, but he also mentioned that: "I think it would be beneficial to, to users to talk to other users on how they use the app, you know. What's a successful strategy?" (L. Arendt, personal communication, September 24, 2020, l. 535) The thought that users would benefit from exchanging with each other is important to him. The reason for this is probably that when users form a community that is centered specifically around his habit tracking application, it is more likely that they will stick with it. Beyond this I got the feeling during the interview that he is personally so convinced by tracking habits, that he sees a real advantage for the users when they not only stick to themselves, but also engage with other users and their approaches to habit tracking.

[32] Habitify. (n.d.). *Habitify Blog*. Retrieved from https://www.habitify.me/blog

7. Discussion of the findings

Having presented the results from my empirical materials which include the interviews as well as my autoethnographic accounts the following discussion centers around the connection between the insights from these materials, the state-of-the-art research, as well as my theoretical framework. Generally, habit tracking applications are presented by their developers as solutions for specific problems of people living in a 'modern' society. People cannot cope with all the tasks they ought to do? People feel like they spent their time wrong or they want to save time? People are not happy with themselves, their body, or their habits? According to the developers, the answer to all these questions is simple: Be and stay motivated and use a habit tracking application. Obviously, this approach does not consider the premises for the situations that people are stuck in. It does for instance not question why people feel 'pressed for time', as Judy Wajcman (2015) has asserted, why they have constantly the feeling or even the fear of missing out on something. While habit tracking applications are presented as technological fixes that can be applied relatively easy on the individual level to correct social problems, it is pivotal to highlight that the developers of these apps do define specific habits to be problematic or desirable as prerequisite for providing a solution to these problems through their habit tracking applications.

In specific, the analysis of my empirical materials points to the importance of addressing four findings in detail: *First*, there is the relation of the personal experiences and background of the developers to the scripting of their habit tracking applications (see chapter 7.1). *Second*, the process of framing habits as something that can either be good or bad and that in consequence leads to the imagination of the users as deficient (see chapter 7.2). *Third*, the way habit tracking applications act as echo chambers that reinforce existing ways of thinking instead of questioning them (see chapter 7.3). And last, *fourth*, the framing of habit tracking applications not only as tools for self-tracking, but much more as tools for the formation of habits (see chapter 7.4).

7.1. Scripting based on personal experiences

The development of habit tracking applications is a process of abstracting from a situated problem to a generalized solution for it. What has become clear through my interviews is that the personal experiences of the developers have first of all guided their decision to create a habit tracking application. The personal experiences thereby include problems that some of the developers had with their own habits, but also problems that they have witnessed through friends or family members. In the case of Jenny Talavera, the first version of her habit tracking application was specifically created to help her husband quit his habit of smoking. At this point in time she was already developing mobile applications, but for a totally different purpose and audience: To help children learn how specific animals look like

and what kind of sounds they make. The reason to develop a habit tracking application in her case was thus on one side based on the fact that she had the necessary skills to do so because of her prior experiences *and* on the other side the specific call by her husband to develop something that would help him quit smoking. Even though this is not a classic instance of the *I-Methodology* (Akrich, 1995) where the developer is writing scripts and imagines users based on his/her own experiences, it still resembles the idea that the specific design and functionalities of a technology are not created based on an abstract understanding of a problem, but out of a specific instance of it. In the particular case of Jenny Talavera there was not even the intention at the beginning to build a habit tracking application that was available to everyone, but it was tailored to one specific user and use case at first. Only over time it evolved into a habit tracking application that addresses issues beyond those affecting the developer or her family directly. This instance shows that it is not always a 'Californian ideology' (Barbrook & Cameron, 1996) that spawns mobile applications, but that developing such apps can also be seen as a form of addressing close-to-home issues by 'making' a solution on your own.

The story of Jenny Talavera resembles what I have learned from Lars Arendt. For him the topic of habit tracking got personally important when he wanted to change his consumption of candy and also push his exercises. To support his own efforts, he developed a pen and paper-based system that allowed him to keep track of his habits and achievements by using a red and green highlighter as well as a journal. As soon as the technological possibilities were available, in his case in the form of the first iPhone that allowed the programming of own mobile applications, he decided to digitalize the pen and paper-based system that he had used so far. His case is a clear instance where the personal ambitions to change lead to the creation of a system for habit tracking that was then turned into a mobile application when the appropriate technology was available. For him self-tracking meant a way of becoming more aware of his own habits and as such the development of a habit tracking application by him was a way of creating a 'technology of visibility' (Miller, 2005). More than this the case of Lars Arendt demonstrates how he has turned his personal approach towards habit tracking into a *script* that was made available to basically everyone through the technology of the smartphone (Akrich, 1997). This finding is of particular importance in my view as it shows how the existence or non-existence of a technology can decide whether a specific practice is performed as a personal one or if it is scaled-up and generalized. The development and release of the iPhone, the first smartphone that was widely described as a 'smart' phone, was the premise for the development and circulation of generalized habit tracking applications. In this context Kyle Richey also explicitly told me that, "ten-, fifteen years ago or something it probably wouldn't even have worked" (K. Richey, personal communication, May 6, 2020, l. 83). The physical object of the smartphone in combination with the flexibility of the digital object, the habit tracking application, hence leveraged the practices of self-tracking.

Both cases that I just discussed are about habit tracking applications that are designed by developers who work alone – *Done* and *Way of Life*. Here it might seem obvious that they base their work on personal experiences, but what about habit tracking applications that are developed by companies with more than one employee? The case of *Habitify* as represented by Jack Cao offered interesting insights to this question. According to him, Peter the founder and CEO of the company, plays a central role for the development and advancement of their habit tracking application. His 'intuitive feel for what works and what not' is a central source for the implementation of new features to their app. Even though I have no detailed insights how the CEO comes to these assessments it seems fair to assume that they are also based on his own experiences in part. While the actual scripting in this case is distributed over a group of developers, the initial idea is still derived from an individual standpoint.

While the problematization of specific habits in the described cases took place on an individual level, they are nevertheless part of more general public debates. In a societal situation of ever-increasing individualization, self-reliance, and a push for 'auditing' oneself especially concerning the own diet and health status, it can be questioned if the wish to quit smoking or to eat less candy are really individual problems. I would rather suggest understanding these habits to be individually experienced while having been collectively defined to be problematic beforehand.

Even though the developers are certainly scripting their habit tracking applications, I still would argue for an extension to this theoretical approach to make it more robust for the explanation of my case. The scripting that the developers do is based on their *personal experiences*, but they are not personal in the sense of 'individual' but rather *'collective' experiences*. For example, smoking and the wish by some people to quit it is not an individual experience. Much more it is a collective experience that can be situated in a particular history of smoking and advancements that have been made in medical research. It is a collective experience in the sense that it draws on cultural symbols and stories that impact the way of thinking of those smoking or trying to quit.

In other words, the developers base the ideas for their habit tracking applications on 'proto-ideas', as Ludwik Fleck (1979) has called them in the context of investigating scientific practices. In my case these proto-ideas come from different thought collectives that the developers are part of – for example society as a whole, the professional background they have, but also the circle of friends and family. One thought collective that stands out particularly in this context is the community of people that believe in habit tracking as an important and valuable practice to pursue. This thought collective is bound together by a specific way of reasoning, thus a specific thought style: 'People lack the will power to change. If they want to live a happier and healthier life, they have to change.' Using this insight as an extension renders the collective forces that impact the decisions of the developers more visible. From a theoretical standpoint, it means to understand the I-Methodology as proposed by Madeleine Akrich (1995) as a '*collective* I-Methodology' where the actions of the developers are rooted in their personal experiences

that are in turn grounded on collective experiences, aspirations, and values of various overlapping thought collectives.

Besides the impact of personal experiences of the developers to the scripting I have to point to the fact that most of the developers that I interviewed are also relying on the feedback of their users for advancing their habit tracking applications. As Jack Cao told me for example their company conducts regular interviews with users to learn about their experiences with *Habitify*. In addition, they take the feedback that they receive on social media platforms and discuss in their team if and how this could be incorporated. As Lars Arendt and Kyle Richey do the support for their habit tracking applications themselves, they are also regularly confronted with the feedback of their users concerning the design, functionalities, or usability of their apps. Especially through the provision of support they get to know how the users engage with their apps, what works for them and what doesn't. Both developers told me that they consider every feedback when thinking about how to adapt and improve their habit tracking applications. In the case of *Strides*, it is even possible to publicly vote on the feature requests that other users have made. Nevertheless, it got clear in the interviews that the developers are those in charge of making the decision which of the feedback that they receive 'makes sense' for them and is thus eligible to be incorporated into their apps.

What is interesting here is how the imaginations of the developers and the actual usage behavior of the users come together. When receiving feedback on their habit tracking applications the developers actually get insights about how the users descript their apps. As Akrich (1997) has proposed users are not bound to the prepared scripts of the developers. They can appropriate the habit tracking applications for their own purposes, ignoring or altering specific scripts. If many users thus propose a specific change the developers might comply and thereby also alter their own ideas. Still, as the interviews have shown the developers always consider whether a user feedback is in line with their personal moralities. If this is not the case, changes will not be made to the habit tracking applications. At its core it hence stays a tool that the developers imagine to be useful for others. Also, the collection of public feedback is something that has not been there when the habit tracking applications where initially developed and released. It is something that evolved over time and doesn't reach back so far that it had an impact on the basic ideas for these apps (see also chapter 7.2 for more details on this aspect).

At this point I want to highlight once more that every habit tracking application includes some form of onboarding sequence for the users. When they start the app for the first time they are confronted with short explanations about key functionalities as well as terminology. This is more than just a transfer of knowledge, it is the moment when the users are exposed to the specific logic of the developer for the first time, so to the scripts that she/he has inscribed into the app. The onboarding sequence is as such an important step to align the expectations and the way of thinking of the users to those of the developers. It is an initial moment of 'moralizing the users' that is mediated by the habit tracking application

(Verbeek, 2006). When I was using *Habitify* for the first time, as described in the vignette at the beginning of chapter 6, the fact that the app told me how many hundreds of thousands of users were tracking a specific habit created a soft pressure for me to also engage with this habit. Not because I came there to engage with it, but because it made me question why I had not thought about tracking this particular habit while so many other people do. In addition, for those habits that were recommended to me within this onboarding sequence and that I had a prior interest in to engage with it sparked a feeling of belonging within me, as I suddenly knew how many other people were also tracking this habit. It gave me the feeling of being part of a larger community, even though I was not looking for it specifically when downloading the app.

The fact that users can provide feedback or request new features for the habit tracking applications highlights another aspect of mobile applications that define them at their core: They are digital objects and hence never finished. As I have explained in chapter 4.3 digital objects are always on the move and subjects to constant change by their developers. New functionalities can be and are added to them on the go. The characteristic of being a digital object makes mobile applications convertible while staying the same. Changes to the habit tracking applications do not require big financial investments, or resources, or the implementation of new assembly lines. Rather, they can be changed by their developers by distributing changed lines of source code to the devices the apps are already deployed on.

Another finding that I can derive from my interviews is that even though all of the developers seem to share a broad and general understanding for what habits are and why they are important (see chapter 7.2 for more) they still have diverse backgrounds. Jenny Talavera has a background in graphic design, Kyle Richey in systems engineering, and Lars Arendt did study computer science for some time but then ultimately worked in the movie industry for several years. None of these individual developers have had a formal training or education in creating mobile applications. They represent the type of appsmiths that Hansen Hsu (2015) has described in his book and that have benefited from the relatively low barriers of entry to a new market, that of mobile applications. In comparison to other areas where a formal training is a perquisite for successful participation, this digital space ignored some established mechanisms of gatekeeping (while creating new ones over time) that were common for classic lines of production.

7.2. The good, the bad, and the deficient

While the background of the developers I interviewed is diverse, they all came to the point where they engaged with the idea and concept of habits. A habit in their understanding is something that is action based and that is repeated in a specific rhythm, ‘every single day’ or ‘on a weekly basis’ for instance. As Jack Cao told me several habits can form a single routine. He used the example of a morning routine that consists of waking up at a specific time, taking a shower, meditate, read a book, and check

the work emails. Every single habit within this routine must be repeated again and again, based on the pre-defined rhythm. The example that he gave might feel close to home and like something that is easy to do and maintain. But if it would be easy to keep habits why do people then need habit tracking applications? Jenny Talavera told me that in her view habits are not a fun thing for people, they are nothing that they automatically want to do. Still people find their ways to habit tracking applications and use them to engage with their habits.

While it is difficult to locate the reasons for this in my materials, I can tell that a central way of dealing with habits is by dividing them into good and bad ones. In the community that has formed around habit tracking the division into habits that should be reduced or even stopped – for example smoking or eating candy – and habits that should be encouraged and done more regularly – for example doing sports or reading a book – is a central element of thinking and acting. Thereby the complexity of human desires and behavior is reduced to a bipolar variable. In such a simple account of human actions the specific *context of acting* and the *reasons for acting* (or the reasons for *not* acting) are neglected. The technology of the habit tracking application is a mediator that reinforces a popular view of habits as something that can be decontextualized by measuring it.

According to Peter-Paul Verbeek (2005) this can happen because modern technologies, especially digital technologies have established a rigid division between their production and usage. While the division into good and bad habits might have a specific meaning for the developers, its representation in the habit tracking applications is stripped of this specific meaning and turned into an element of moralization. While Verbeek (2006) describes a moralizing technology to be the overall technology, I would argue based on my research that specific sub-elements, like the pre-defined trackers with their preset values, are moralizing in themselves. They have specific moralities inscribed and pursue specific purposes. A technology like a habit tracking application is thus not only a moralizing technology as a whole but is rather constituted by several moralizing elements.

The representation of good and bad habits in the apps I investigated are matter-*ing* in the guise of the pre-defined trackers. When a user starts these apps for the first time and is asked to create his/her first habit tracker it will come together with a statement about whether this is a good or a bad habit. The standards that define what a good or bad habit is in the first place are not open for discussion anymore. This has already been decided by the developers. The power of this simple division thus also lies in the fact that it presents the specific moralities of the developers and the greater community of habit trackers as a common standard for all users. In addition, it is the simplest form of a classification system. One that only knows two manifestations, good and bad, and that by classifying habits in either of them exerts a great amount of power over those people using habit tracking applications.

While not all habit tracking applications that I have looked into use the terminology of 'good versus bad habits', all of them have the logic that this division implies build into them. When the app *Done* for example speaks of 'building or quitting' a habit, it ultimately is just another way of labeling this bipolar division. The same holds true for the approach of *Way of Life* where the users are asked whether the habit at hand is good for them or not (instead of ascribing one or the other status to it by default). Both still adhere to the logic of classifying human behavior in either a category of being important and thus worthwhile to perform or the category of being problematic and thus to be stopped.

A central argument for building good habits has been that they allow people to free resources and in turn spend them on other aspects of life. Within this understanding habits are a way of optimizing everyday life and practices while not taking into the account that human behavior is not just there to be functional, but also to relate to the world around us that is often messy and unpredictable. To take away the seemingly ineffective ways of engaging with the own environment or the own body by abandoning 'bad habits' also takes away individuality from people, as Verbeek has argued:

> Only then can *the* world become *their* world—an environment that allows not only the anonymous functioning of parts but also personal engagement and commitment; an environment in which human beings not only satisfy their needs but also realize themselves as authentic individuals. (Verbeek, 2005, p. 20)

To summarize this point, the a priori categorization of habits into good and bad ones, or habits that should be build or quit, by the developers is another element of moralizing the users of habit tracking applications. It takes away their ability to engage with their personal habits and environment based on their own set of values and instead raises existing collective standards and moralities into a position of power. Here, the technology disguises a specific set of values and presents itself as a reasonable approach for anybody.

The analysis of my materials has however shown that this anonymous 'anybody' is always imagined by the developers to have specific characteristics and therefore actually cannot be anybody but just 'somebody'. This somebody is imagined and described by the developers to be deficient. Deficient because the goals are clear, building good habits and quitting bad ones, but this somebody cannot achieve this. According to the developers that I have talked to the problem is that people lack willingness and will power. That's why, echoing the argumentation of the developers, people want to change their habits but can't do it on their own.

According to Kyle Richey it is difficult to change behavior when relying on will power because it is not always stable. For Lars Arendt will power is a weak spot as well that prevents people from changing their behavior. Jack Cao told me that people are not motivated over a longer period of time to change their habits. These deficient users, as imagined by the developers, can thus only reach their goals by

utilizing external tools to help them. The habit tracking applications are presented as these tools that strengthen the will power of their users by confronting them with their everyday behavior, first and foremost through visualizing the progress that they have made so far. In addition, notifications are used by the developers to compensate for the deficiency of the users and as they have framed it regularly 'bring them back on track' when they get off from it.

While it might actually be true that it is difficult for humans to stay motivated for a longer period of time I would argue that focusing solely on the aspect of will power as an explanation for why people can't achieve what they have set out to do falls short. This view does not consider that humans today are on the one side confronted with a limitless amount of information and on the other side are confronted with a diverse set of demands that are made towards them. Focusing on the will power as *the* weak spot of humans and their actions seems like focusing on the symptoms while not engaging with the underlying causes. The pressure of performing correctly and spending the own time most efficient is a common theme that not only applies to businesspeople today. It is a collective problem that can be patched temporarily by individuals, but not solved. Putting pressure on individuals to change, to quit 'bad habits' and to meet certain averaged standards will not solve the more systematic problems that lead to the establishment of such standards.

7.3. Echo chambers of moralities

While in theory the users of habit tracking applications could be anybody there are patterns in the actual imaginations that the developers hold about their users, about these somebodies. Specifically, two topics have come up repeatedly in the interviews as reasons for people to use habit tracking applications. The *first* one is the broader area of personal health with a specific focus on physical fitness and diet. This seems not surprising as especially the human body is regularly subjected to judgements. If it's through advertisements or medical procedures, the human body is presented as something that must be and can be healthy and beautiful. The premise for meeting these standards is personal motivation as discussed in the previous chapter.

The *second* topic is personal development and productivity which I consider to be two different entities, but as the interviews have shown they come together in the context of habit tracking applications. The logic that is transported here is that being productive is the precondition for becoming a better human. The community of habit trackers seems to be fascinated by the idea that idle time is inherently problematic and that the ability to perform and keep track of several tasks and duties is the most important skill one can possess. As far as I can tell this ideology of 'doing more in less time' is rooted in the feeling that we could miss out on something if we do not always engage in something. The ever-increasing possibilities that a globalized world offers, at least to those in the global north, create

the feeling for being pressed for time. (For detailed accounts of this phenomenon I recommend the works of Hartmut Rosa (2010, 2019) and Judy Wajcman (2008, 2015)). With every attempt that people make to live a *fulfilled* life by extensively self-tracking their body or habits, they instead seem more and more to get a *full filled* life that is aligned to and dependent on arrays of figures, statistical analysis, and graphs. Instead of becoming freer, people seem to become more caught in practices of self-tracking.

From my interview with Jack Cao from *Habitify* I know that both topics are connected to specific age groups. While the users between twenty-five and thirty-five seem to focus more on the building of habits around productivity, users between thirty-five and forty-five are more interested in building habits for their health and well-being. Even though this might not be surprising it still offers some valuable insights into the relationship between the lifestyles and the thought styles of the users of habit tracking applications. It seems that these age groups constitute different thought collectives that each share specific thought styles. Here it is interesting to question the specific understandings of what is seen as being productive or healthy. Either of them is ultimately part of a classification system that is not only reinforced through the habit tracking applications, but also through the various online communities that engage with self-tracking and habit tracking.

Earlier, in the methods section (see chapter 5.1), I explained how my initial recherche took me from Google to different blogs and websites as well as YouTube videos. In all these places, I have encountered active communities of people interested in some form of self-optimization and self-tracking. This ranges from people that seek to work more focused to those that want to drink more water per day. While the situations that these people experience as problems for themselves differ, they all try to find solutions for them in established online communities. From my observations it is impossible to get past habit tracking applications in these communities. Regularly habit tracking applications are presented there by other users as a solution for the problems of those seeking advice. I think it is fair to conclude from this that a lot of users of habit tracking applications have not started to use them by chance, but that they were guided there by established communities of interest.

The developers I talked to knew about some of these communities and were aware of the importance of them for getting new users to their apps. This shows that the users of habit tracking applications have already engaged with their own habits and have concluded that they want to change something about it. This may include general knowledge about the division of habits into good and bad ones and in addition more personal knowledge about which of their own habits are perceived to be bad and should thus be quit. Taking this legacy before using a habit tracking application into account means to acknowledge that these apps are places where people that already share the same or at least similar thought styles come together. As such habit tracking applications are not simply moralizing the users in a way that changes their way of thinking, but these apps rather *reinforce* already held believes and give them the appearance of truth. This effect was labeled in a different context – mainly to describe the effects that

algorithmically driven social media platforms have on the communities using them – as an echo chamber. A place where users are only confronted with believes they already hold and not such that question their current position.

If habit tracking applications are echo chambers this also helps to explain why people drop out of using them. As presented in the results, the developers position on this issue has been that people are not motivated, lack the will power, or don't focus enough on their goals. Another explanation could be that those users that drop out do not comply with the thought styles that are represented by the habit tracking applications. Their own thought styles and those represented by the particular app might contradict each other and in consequence lead to a feeling of discomfort and subsequently to drop out.

The central element of habit tracking applications that represents these thought styles are the pre-defined trackers and their default values. When the list of these trackers comprises specific habits and not others this can affirm users believe that what they want to change is important. By implementing these pre-defined trackers, the developers do classification work that is based on their standards and moralities (which are connected to more general ideas as discussed in chapter 7.1). For example, if the pre-defined tracker 'drink more water' is defined as a good habit with the default value to drink 'eight glasses per day' this not only reaffirms the wish to engage with this habit, but also creates the feeling that the number of glasses of water that the app recommends is the correct amount to strive for. The pre-defined trackers are thus one instrument that turn the habit tracking applications into moralizing technologies. By reinforcing existing thought styles about what good and bad habits are, they alter the behavior of the users and the perception of their own body and health.

7.4. From habit *tracking* to habit *formation*

The starting point for my thesis has been the interest in habit *tracking* applications and their developers. Through the interviews and my own engagement with these apps I noticed that the term habit tracking only describes a part that characterizes these apps. Using a habit tracking application is presented by the developers as a way of creating insights about yourself. Collecting data about the own habits or body is thereby not seen as a mean in itself. The users are led to engage with the collected data through the statistics and graphs that every habit tracking application provides in one form or the other. As a result, the users are imagined by the developers to quit certain habits and build others at the same time. That's why this type of mobile applications could also be labeled in my view as habit *formation* applications.

The idea that 'self-knowledge can be created through numbers'[33] is prominent in the Quantified Self movement. Through tracking and thereby generating data, they seek to create knowledge about themselves which then in turn can be used to change. This has also been highlighted by Nils Heyen (2020) who argues that practices of self-tracking are a form of creating expertise about oneself. Since well networked communities exist around these practices Heyen moves on to note that these practices can even be understood as a form of personal science. The systematic approach that is used by the members of these communities underscores this assessment in my view. On the homepage of the Quantified Self movement they feature a circular process that describes "a framework for personal science": "Questioning, designing, observing, reasoning, discovering."[34] In this context habit tracking applications are tools for self-tracking that allow their users to take back control over the interpretation of data about their own body and habits. In the past this has been a domain that was exclusively attributed to professionals of different kind, for example medical professionals or psychologists. Deborah Lupton (2016) connects this ability of taking back control in some areas to the loss of control that such practices can bring to the individuals performing self-tracking in other areas.

While the process of forming new habits takes place individually the way the habit tracking applications are designed influences this process deeply. As I have argued before, the fact that certain pre-defined trackers are presented to the users creates a 'tunnel of possibilities' for them. Certain habits are highlighted, most often those that are already common in public discourse, while others are rendered invisible due to their non-existence in these lists of pre-defined trackers. Even though these lists can be extensive, for instance in the case of *Strides*, they still tend to feature habits in the area of health, fitness, and productivity and the pre-defined trackers that fall in other categories, like relationships for example, also just include habits that are commonly shared.

In addition to the pre-defined trackers all habit tracking applications that I have looked into were using some form of bipolar division between good and bad habits or as they sometimes label it habits to build and quit. In the interviews the developers have acknowledged that every user can and should define his or her own goals as well as which habits they consider to be good or bad. The developers don't see themselves in a position of judgement, as they provide the possibility for the users to change any default settings that come with the pre-defined trackers. Nonetheless, there is a general accordance between the developers that a basic problem is that people don't 'stay on track'. The purpose of their habit tracking applications is then to 'get the users back on track'. This not only implies that there is *a* track that users simply have to follow to reach their goals, but that 'getting off this track' is something essentially negative that must be avoided.

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[33] Quantified Self. (n.d.). *What is Quantified Self?* Retrieved from https://quantifiedself.com/about/what-is-quantified-self/
[34] Quantified Self. (n.d.). *Self knowledge through numbers*. Retrieved from https://quantifiedself.com/

As I have described earlier in the discussion, the developers are aware that different users prioritize different habits that they want to engage with. If we think this further in their own logic it means that there cannot be one track for everyone, but there must be multiple tracks that people can take to form habits. Setting this aside the developers I engaged with are certain that users must stay on this pre-defined track, whichever it is, to be successful in forming new habits. This way of thinking about habits leaves no space for the fact that neither life nor human behavior are linear processes, but rather messy, often unpredictable, and also not always under control of those people affected negatively. The way the developers frame habit formation thus reveals a specific approach towards problem solving that they seem to share. It is a rather systematic approach that features rigid planning and regular controls of success, thus a specific form of self-auditing.

The question I was asking myself at this point was how those users feel that have 'failed' in this particular logic because they got 'off track' and didn't make their way back. As I have not collected empirical material about the users of habit tracking applications I can only suppose here based on my own experiences as a user. Users know from the websites of the apps and the onboarding sequence that it is important to stay focused to reach the set goals. When they can't meet these expectations, I assume that they do so with the feeling that it is their individual fault and by this the general notion of self-optimization as a matter of individual motivation is reinforced. Moreover, this fits the assessment of Lupton (2016) that self-tracking can be a way of regaining control, but that it can also create new dependencies that lead to an anew loss of this control. These dependencies are best described by the arguments I have made in chapter 7.1 and chapter 7.2. Developers design their apps based on their personal experiences and thereby create spaces that execute specific moralities, for example about the question what a good or bad habit is. There is no discussion, but it is decided by the developers and subsequently inscribed into their apps. The users hence lose control when they do not fit into the standards and categories that are the basis for the decisions of the developers.

The idea that users need to follow a specific path has been used in different ways in the design of habit tracking applications. There is one app/habit tracking program that is especially interesting in this context, but where I was unfortunately not able to schedule an interview with the developers: *Beeminder*[35]. They are special because their approach towards changing habits and their business model are turned around. While most habit tracking applications will make their users pay in advance to get more functionalities (as described in chapter 3.2), *Beeminder* has created a system that they call 'commitment contracts'. Briefly summarized this means that every user defines a specific goal that he/she wants to reach. Then the user must pledge money that he/she must pay to *Beeminder* when he/she fails to reach this goal. The goals are not only displayed as a data point, but as a gradual process that is

[35] Beeminder. (n.d.). *Beeminder - About*. Retrieved from www.beeminder.com/overview

represented through a line from the current day to the defined date for the goal. To give an example here[36], when a user wants to lose ten kilograms of weight he/she can tell the system until which point in time he/she wants to achieve this. Based on this information their system will calculate the linear progression that has to be achieved to reach the overall goal (for example the system might tell the user that he/she has to lose about one kilogram of weight per week to reach the goal of losing ten kilograms within the next three months). In this approach failing to stay on the track – that is portrayed by a literal line in a graph – is actively punished, even though the developers don't like to call it this way.

Even though this is a rather 'drastic' example in my view, the idea that *tracking habits* should ultimately lead to *forming habits* is ubiquitous in the cosmos of habit tracking applications. I think that's why the developers stress the metaphor of the 'track' from which one can get off but also come back to that much in their advertisements and the interviews. Albeit, it is easy according to the developers to get off track, their habit tracking applications are advertised as tools for either overcoming the reasons for this or at least reducing the chances for it to happen. According to them, the successful formation of new habits requires the tracking of the current habits in the first place. As this is difficult to do according to them, they suggest putting 'systems in place' and using 'the right tools' as a solution. This is interesting as it seems like they have provided a solution for a problem, while actually they have (at least to some degree) contributed to the definition of the problem in the first place.

[36] This example is loosely based on the following of their own examples: https://www.beeminder.com/example/weight2

8. Concluding remarks

I began this thesis with several statements by the developers of habit tracking applications. There they claimed among other things that their apps are tools for 'building the best version of yourself' or promised that their apps will help the users to focus on 'what truly matters' in their life. When reading them for the first time, both statements felt like exaggerated advertising promises to me. Nevertheless, I was interested in what is hidden behind these statements, especially whether the moralities that are transported through these statements are part of the habit tracking applications themselves. Here, the wording 'best version of yourself', reassembled for me the popular discourse of self-optimization which offloads the responsibility for having a 'good life' on the individual. Thus, I wanted to understand better which moralities the developers of habit tracking applications actually hold and how these moralities influence the development of their apps. To do so I first investigated the habit tracking applications by undertaking autoethnographies and then, second, conducted interviews with their developers.

While research from Science and Technology Studies (STS) scholars has shown in the past that technical artefacts are not neutral, but that they always exert power within sociotechnical networks (e.g. de Laet & Mol, 2016; Latour, 1994a), my research has extended this perspective to include those people that actually create these artefacts. By looking on the one side at the nonhumans – the habit tracking applications – and on the other side the humans – the developers – in a symmetrical way, I have demonstrated throughout this thesis how moralities travel between more general though styles, the developers and their apps. By applying my theoretical framework, as introduced in chapter 4, I was able to identify four central findings:

Through the interviews I learned, *first*, that developers base their work on personal experiences. The reasons for creating a habit tracking application were most of the time (except for *Habitify*, which is developed by a company with several employees) rooted in the personal engagement with habits and practices of self-tracking of the developers. This also included the experiences of family members who wanted to quit specific habits, as for example smoking. A certain problem perception of the developers was thereby distributed through their apps over time, hence from the initial idea to develop a habit tracking application for themselves to its current state where thousands of other people are using them. While the developers have stressed in the interviews that they envision their users to be 'anybody', they soon added constraints to this imagination which ultimately revealed a specific 'somebody' they were imagining. This somebody was envisioned to be similar in his/her traits and goals to the developers; for example, to be either a 'systematic person', or to be 'not a numbers person'. While this finding gives part of the answer to my third sub-question, the next finding includes another part of the answer to it.

Besides imagining the users to have similar traits and goals as the developers themselves, it got clear, *second*, that the users are imagined to be deficient. This assessment of the developers is based on their understanding of humans to generally lack will power and motivation when trying to change their habits. However, this can also be attributed to the strong reliance of the developers on the dichotomy of habits to be either good or bad. While this is a too simplified understanding of human behavior, it allows the developers to problematize specific habits whereas others are defined to be worth striving for. This specific view on habits could also be seen in the metaphor of the 'track' that is regularly referenced by the developers. Supposedly, if you have set yourself a goal to change a habit there is a track towards this goal that you should move along. When people 'get off track', for example because of the already described lack of will power, external tools can help them to 'get back on track' according to the developers. Concerning my first sub-question I am thus able to conclude that the developers problematize specific habits so that they can offer their apps as solutions for these allegedly problems.

Building on the previous finding I found, *third*, that the habit tracking applications act as echo chambers, as they reinforce existing thought styles concerning habits instead of questioning them. This is especially codified in the form of the predefined trackers that most habit tracking applications come with. These trackers highlight specific habits while rendering others invisible. Thus, speaking to my fourth sub-question I have shown within this thesis that habit tracking applications stabilize existing moralities, most notably the idea that being productive and optimizing oneself is a goal in itself to strive for. This is even amplified by the default settings that the predefined trackers in some habit tracking applications come with, because they are a mean of establishing new standards for the performance of habits. By predefining these standards, the developers eventually also define what is considered to be a 'normal' habit, thus a normal way of living and being for the users.

Last, *fourth*, I have discussed how the tracking of habits is only the basis for forming them. In the view of the developers generating data about the own habits is just the first step for understanding oneself. By transforming and reflecting the gathered data back to the users through statistics and graphs the developers aim at supporting the formation of new habits. Ultimately, this is connected to the idea that only good and bad habits exist, thus habits that should either be build or quit. This insight speaks to my second sub-question as it means that habits must be quantified as a premise for being included into the apps. The quantification is done by counting the number of repetitions for the habits in a defined timeframe. Often this quantification only incorporates the information whether a habit has been performed as planned or not. In consequence, this information is stripped of its qualitative modalities – for example, the reasons why a planned habit wasn't performed or the fact that it was only performed partially.

Investigating developers and their habit tracking applications on equal terms, hence using a symmetrical research approach towards the human and nonhuman actors involved in my case, rendered

previously hidden relations between them visible and accordingly allowed me to answer my main research question, 'how are the developers of habit tracking applications envisioning and framing users and usage of their apps?' In the previous paragraphs, I have summarized my findings and answers to this question, but in general it is important to highlight that the way the developers view habit tracking as a practice, influences how they imagine their users. While the developers might sometimes not be aware of the impact their work has on individual users, they still do 'politics by other means' (Latour, 1993a) through their apps. Whenever power is executed the questions of transparency and responsibility have to be posed. Albeit social practices have been formed and governed in the past by national and supranational political systems, where the citizens often have the chance to participate in the processes of decision-making, this does not hold true for the politics that are executed through mobile applications. The moralities that are inscribed into these apps are not the result of a deliberate and collective decision-making process, but the result of personal ruling of the developers. To balance this out it would be necessary for the developers to pursue a path of responsible innovation, as for example discussed by the European Commission (von Schomberg, 2011). This seems especially necessary in my view as mobile applications of all kind have permeated everyday life, while at the same time being out of scope for questions regarding their responsibility for the intended and unintended consequences they might cause.

While I have focused in my thesis primarily on the developers, I also highlighted the relation between them and more general thought styles. In a moment of ever-increasing individualization that is coupled with a pressure for rigorous self-auditing, the developers do portray a specific normality through their habit tracking applications. This normality includes a specific set of moralities. While it is not problematic in my view that the developers try to establish their normality as one of many options, it is much more a problem that the users might take the inscribed normality for granted. While habit tracking can be a form of self-empowerment, I am concerned about the long-term effects that an excessive form of self-quantification can have on the individual users as well as on social structures in general.

Beyond answering my research questions, my thesis has also contributed to the fields of research that I presented earlier in my state-of-the-art. First and foremost, I have demonstrated the importance of investigating human just as nonhuman actors when trying to grasp a social phenomenon within a digital society. To be precise, my research has illustrated that the developers of mobile applications act as 'agents of anticipation', as Adrian Mackenzie (2013) has labeled it. They create their apps by drawing on their personal experiences and hence apply a form of 'self-abduction'. This idea has also been highlighted by Madeleine Akrich (1995) within the concept of the 'I-Methodology', but in this thesis I have proposed to extend her view from focusing solely on the developers (the 'I') to the inclusion of the collective forces that shape the experiences and moralities of the developers in the first place. Such a *collective I-Methodology* is also more in line with a co-productionist understanding of the relation between habit tracking applications and the habits they ought to track. To quote Sheila Jasanoff (2004b,

p. 2) here: “the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it.”

I have also shown in this thesis that some developers do describe their users and the way they behave in rather technical terms. This has been particularly obvious in the stressing of the need to ‘put systems in place’ to change habits. David Berry (2012) has described this as the ‘computational concepts and ideas’ that form to world we live in. Here, the human and its habits are seen as a system comprised of specific elements that once identified through tracking can simply be ordered and reorder.

For this ordering the developers of habit tracking applications fall back to a simple system of classifying habits as good or bad. While classification work is something that we do all the time, as stated by Geoffrey Bowker and Susan Star (2000), the case of habit tracking applications shows that classification work can also be a deliberate choice of their developers to promote certain habits while suppressing others. In extension to this view, my findings also point towards the important *role that technologies play in enforcing specific systems of classification*. In addition, habit tracking applications can also be understood as institutions that are developed based on ‘standardized biographies’ to which reality does not conform (Beck, 1992). This aspect has become clear in the field of tension between the imagination of the users as anybody, while actually they were perceived to be somebody, thus carrying specific characteristics.

While Helga Nowotny (2018) has ascertained that clocks carry values, my research has shown that this can be extended to at least habit tracking applications, maybe even mobile applications in general. Just as clocks, habit tracking applications have established themselves on a global scale. This means that a technology that is produced in a specific context is generalized for a global audience. This is also connected to the effect that George Ritzer (2013) has described, the homogenization of products, services and lifestyles across the globe. While the clock time has historically been standardized due to the establishment of transnational railway systems, mobile applications can be seen as a contemporary driver of adapting the social time across different political, social, and cultural contexts.

Even though I have not analyzed the timescapes that are present in the context of habit tracking applications in specific, my research has contributed an example for the different timescapes that can be observed in the interaction between users and habit tracking applications. Following the classification of Roberto Cipriani (2013), it is possible to assert that individual habits are part of the micro-time, as they are experienced immediately by the individual users. Then, the habit tracking application does tie several habits together over the course of one day, which on the one side represents the meso-time and on the other side is a central timeframe for the engagement with these apps according to their developers. As habits are normally tracked over a longer period of time, the gathered data spans the macro-time and as such creates a digital body of the users based on temporally dispersed habits.

In the course of this thesis I have furthermore proposed to understand *mobile applications as digital objects* with distinct characteristics in comparison to physical objects. Herein, I have argued that digital objects do not possess a materiality on their own, hence always rely on physical objects to become accessible to human experience. This relation has been mirrored by some of the developers who told me how much the release of the first iPhone in combination with the possibility to create own apps for it, influenced the realization of digitized forms of habit tracking. Further I have argued that digital objects are in *constant flux*, thus always subjected to change. As it got obvious through the interviews, habit tracking applications are updated regularly by their developers. Changing the functionalities or the design of such an app can happen without the active approval of the users. This has not only implications for perceptions of ownership in a digital society, but also raises questions regarding the responsibility that the developers have towards their users. Following from all this, I have proposed that digital objects have a *living materiality*, which is due to their ability to use physical objects as brokers between themselves and human perception as well as the fact that they only exist by *matter-ing* for the users.

Although I was able to answer all of my research questions, there are still open questions to be addressed concerning habit tracking applications. For example, it would be an interesting inquiry to investigate more systematically who the users of these apps are, why and how they are using these apps and how this changes over time. Such a research project would allow for the application of the concept of description in addition to the process of inscription that I have been focusing on in this thesis. Furthermore, concentrating on the users would allow to get better insights into the online communities that have formed around practices of habit-tracking and self-tracking in general. From an STS perspective it would be valuable to know how the users interpret the data they gathered about their habits and how they incorporate the practice of habit tracking into their daily routines.

Finally, I want to highlight the fact that this research has been conducted almost entirely throughout a global pandemic. This situation has affected me as a researcher, just as my interview partners. Especially remembering the calls that have prevailed for a long time, namely that people should use this extraordinary time at home to engage with themselves, matched ironically with the topic at hand. While this was regularly called for, I actually often missed the opportunity to engage with other students face-to-face about my thesis project, which definitely made it a more difficult endeavor for me. Luckily my plan for the gathering of data was not affected by the pandemic, as all the developers of habit tracking applications I wanted to talk to were located in different parts of the world and were thus anyway only accessible for me through online interviews. I even suspect that the pandemic might have helped my efforts, as people were much more accustomed to the participation in online meetings and conversations with people they do not personally know. Nevertheless, I'm looking forward to return to an everyday research life that is based on face-to-face encounters.

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Annex

A. Index of Interviews

Identifier	Name of the interview partner	Name of the habit tracking application	Date and length of the interview
IP1	Kyle Richey	Strides	May 6, 2020 1:06:00
IP2	Jack Cao	Habitify	May 8, 2020 0:40:00
IP3	Lars Arendt	Way of Life	September 24, 2020 0:58:12
IP4	Jenny Talavera	Done	October 21, 2020 0:54:21

B. Abstracts

Abstract

Since the smartphone has become a ubiquitous companion for humans in the digital society, mobile applications have been deployed for a wide range of use cases. The new possibilities that these digital objects introduced have among others sparked interest in communities that engage with practices of self-tracking. Groups like the Quantified Self movement have put the quantification of their own bodies and/or habits at the core of their efforts to optimize themselves. While Science and Technology Studies (STS) research has focused on these groups and their practices of conducting 'personal science' in the past, there is a gap in investigating the technological arrangements that are used by them to do so. Habit tracking applications are such tools that make big promises about the ability to help their users in forming 'better' habits and by doing so they also introduce definitions about what good and bad habits are in the first place. This is in line with the idea of some self-tracking communities that habits, which are socially and culturally loaded actions that unfold over time, must be governed individually as the basis for becoming healthier, or more productive, or a better person. As prior STS research has shown, technologies are not neutral but hold and relay moralities of different kinds in the sociotechnical networks that bind social contexts together. These moralities are inscribed into technologies by their developers. Bringing these aspects together, I investigate in this thesis how the developers of habit tracking applications envision and frame the users and usages of their apps. To do so I have performed autoethnographies on different habit tracking applications and conducted interviews with the respective developers. By combining the insights drawn from these, I am able to show that even though the developers base the scripts for their apps on personal experiences, they still remain embedded in more general thought styles. At this point, I depart from Madeleine Akrich's concept of I-Methodology but suggest adding a collective component to it to better grasp the power relations that are at play when new technologies are developed. Further on, I demonstrate how the users of habit tracking applications are imagined by the developers to be deficient, especially when it comes to their will power, and how they are therefore in need of external support when attempting to change their habits. This is complemented by the finding that habit tracking applications act as echo chambers of moralities as they reproduce, for instance, existing ideas of what it means to be productive instead of questioning them. Finally, I display how practices of habit tracking are actually just the basis for the formation of these habits. Here, the developers establish a straight link between the practice of self-tracking and the aspirations to change habits. By defining specific habits as good or bad the developers ultimately make 'politics by other means' through their apps. Overall, this thesis is as a case study of the manifold relations of humans and nonhumans based on the example of habit tracking applications, their developers, and users. Through the immediate examination of this type of app and its developers I shed light on the process of inscribing moralities into a mundane artefact that permeates contemporary everyday life.

Zusammenfassung

Seit sich das Smartphone als alltäglicher Begleiter des Menschen in der digitalen Gesellschaft durchgesetzt hat, werden ‚Apps' für eine Vielzahl von Anwendungsfällen entwickelt und eingesetzt. Die Möglichkeiten von Apps haben unter anderem das Interesse von Gruppen geweckt, die sich mit Praktiken des ‚Self-Trackings' beschäftigen. Dazu gehört unter anderem die ‚Quantified Self' Bewegung, die die Quantifizierung des eigenen Körpers und der eigenen Gewohnheiten in den Mittelpunkt ihrer Bemühungen um Selbstoptimierung gestellt hat. Obwohl sich Forschung aus dem Bereich der Science and Technology Studies (STS) in der Vergangenheit bereits mit diesen Gruppen und ihre Praktiken der Selbstquantifizierung auseinandergesetzt hat, gibt es Lücken bei der Untersuchung der Technologien, die dazu eingesetzt werden. ‚Habit Tracking Apps' sind solche Technologien, die weitreichende Versprechungen über die Fähigkeit machen ihren Benutzer:innen bei der Formierung von "besseren" Gewohnheiten zu helfen. Dabei führen sie aber auch Definitionen darüber ein was gute und schlechte Gewohnheiten überhaupt sind. Wie frühere STS Forschung gezeigt hat, sind Technologien nicht neutral, sondern enthalten und vermitteln Moralvorstellungen. Genauer gesagt werden diese Moralvorstellungen von den App-Entwickler:innen in ihre Technologien eingeschrieben. In dieser Masterarbeit untersuche ich daher, wie sich die Entwickler:innen von ‚Habit Tracking Apps' die Anwendungsfälle für ihre Apps sowie ihre Nutzer:innen vorstellen. Zu diesem Zweck habe ich Autoethnographien mit ‚Habit Tracking Apps' durchgeführt sowie Interviews mit den jeweiligen Entwickler:innen geführt. Durch die Kombination dieser beiden Methoden kann ich zeigen, dass die Entwickler:innen ihre Arbeit und die damit verbundenen Entscheidungen zwar auf persönliche Erfahrungen stützen, diese aber dennoch in allgemeinere Denkstile eingebettet bleiben. Dabei gehe ich von Madeleine Akrich's Konzept der ‚I-Methodology' aus, schlage jedoch vor es um eine kollektive Komponente zu erweitern, um die Machtverhältnisse, die bei der Entwicklung neuer Technologien wirken, besser erfassen zu können. Im weiteren Verlauf der Arbeit zeige ich, wie die Nutzer:innen von ‚Habit Tracking Apps' von den Entwickler:innen als defizitär imaginiert werden, insbesondere was ihre Willenskraft und Motivation betrifft. Weiterhin kann ich feststellen, dass ‚Habit Tracking Apps' als Echokammern für Moralvorstellungen fungieren, da sie bestehende Wertvorstellungen, zum Beispiel in Bezug auf Produktivität, reproduzieren, anstatt diese zu hinterfragen. Schließlich zeige ich, wie Praktiken des ‚Habit-Trackings' die Grundlage für die Formierung neuer Gewohnheiten legen sollen. Indem die Entwickler:innen bestimmte Gewohnheiten als gut oder schlecht definieren, machen sie mit Hilfe ihrer Apps letztendlich „Politik mit anderen Mitteln" (‚politics by other means'). Insgesamt versteht sich diese Masterabeit als eine Fallstudie zu den vielfältigen Beziehungen zwischen Menschen und Nicht-Menschen am Beispiel von ‚Habit Tracking Apps', ihren Entwickler:innen und Nutzer:innen. Durch die unmittelbare Untersuchung dieses Typs von App und seiner Entwickler:innen beleuchte ich den Prozess der Einschreibung (‚inscription') von Moralvorstellungen in ein alltägliches Artefakt, das unser heutiges Leben nachhaltig beeinflusst.