Designing Consumer Technology for Sustained Wellbeing

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DOI
10.4233/uuid:4b961827-fc3a-4c91-8726-9ad96ea9a4c8

Publication date
2025

Document Version
Final published version

Citation (APA)
Wiese, L. (2025). *Designing Consumer Technology for Sustained Wellbeing*. [Dissertation (TU Delft), Delft University of Technology]. https://doi.org/10.4233/uuid:4b961827-fc3a-4c91-8726-9ad96ea9a4c8

designing consumer technology for sustained wellbeing

lisa wiese

Designing Consumer Technology for Sustained Wellbeing

Lisa Wiese

Designing Consumer Technology for Sustained Wellbeing

Dissertation

for the purpose of obtaining the degree of doctor

at Delft University of Technology

by the authority of the Rector Magnificus prof. dr. ir. T.H.J.J. van der Hagen,

Chair of the Board of Doctorates

to be defended publicly on

Monday 30 June 2025 at 15:00 o'clock

by

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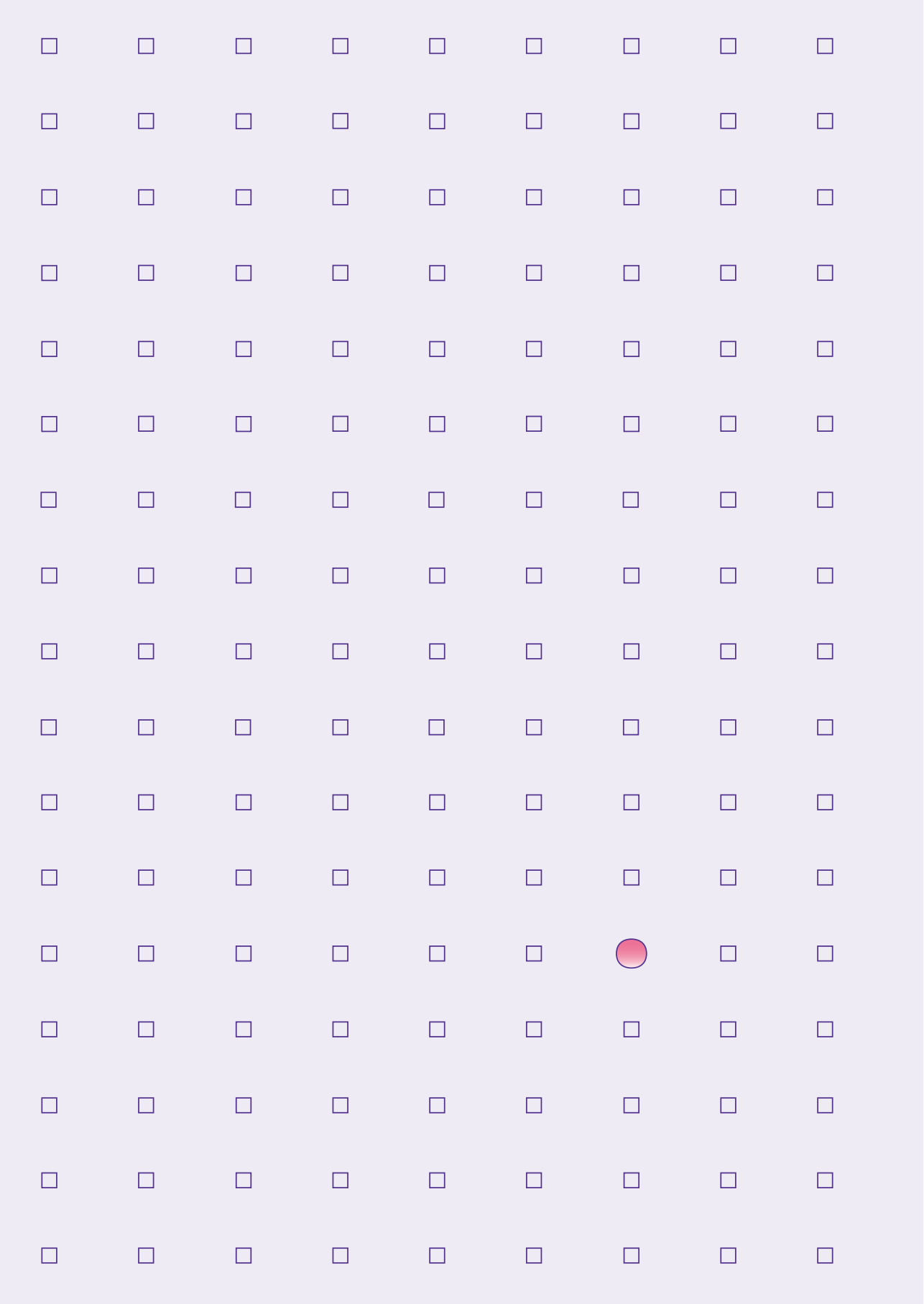
This research was partially funded by (external) funding provided by brands4friends.

ISBN/EAN:	978-94-6518-052-6
Keywords:	Design, wellbeing, positive psychology, digital well-being, consumer technology
Printed by:	Ipskamp Printing, Enschede
Layout:	Matt Huebert, Alexander Lipsius
Cover & chapter pages:	Timo Kamp, persoonlijkproefschrift.nl
Style:	TU Delft House Style, with modifications by Moritz Beller, https://github.com/Inventitech/phd-thesis-template

An electronic version of this dissertation is available at https://repository.tudelft.nl/.

To my parents.

Contents



1

Introduction

Parts of this chapter are based on:

Wiese, L., Pohlmeyer, A., & Hekkert, P. (2020). Design for sustained wellbeing through positive activities—A multi-stage framework. *Multimodal Technologies and Interaction*, *4*(4), 71. https://doi.org/10.3390/mti4040071

Wiese, L., Pohlmeyer, A., & Hekkert, P. (2024a). Daily doses of wellbeing: How everyday technology can support positive activities. In C. Gray, E. Ciliotta Chehade, P. Hekkert, L. Forlano, P. Ciuccarelli, & P. Lloyd (Eds.), *DRS2024: Boston*. https://doi.org/10.21606/drs.2024.795

Wiese, L., Pohlmeyer, A., & Hekkert, P. (2024c). Wellbeing by design: How social media and streaming platforms support user wellbeing. *International Journal of Design*. Manuscript submitted for publication

1.1 Designing consumer technology for sustained wellbeing

This thesis explores how everyday consumer technologies, such as social networking sites, communication platforms, and streaming services, can be designed to enhance human wellbeing in a lasting way, both on the screen and beyond. Grounded in my professional experience, this project was driven by a clear goal: to contribute to positive change in the tech industry. The aim was to develop practical tools and actionable insights that user experience (UX) researchers and designers, including myself, can apply directly to industry projects – solutions that help bridge the gap between academic research and real-world design practice. I undertook this PhD project part-time alongside my roles as a UX researcher at brands4friends, an eBay subsidiary, and later at eye square, a Berlin-based UX consulting agency. I spent the decade prior working with international clients across various industries, including five years with eBay's U.S. UX team. These experiences provided firsthand insights into industry practices, which profoundly shaped my research. Initially conceived as a formal industry collaboration, the PhD was financially and thematically supported by brands4friends, my then employer, until the company ceased operations in 2021. The project's close ties to industry offered continuous opportunities to refine and challenge my perspective.

My impression of the IT industry, when I started this PhD, was that it often overlooked the broader possibilities of what consumer technology can enable – the chance to create lasting positive impact on people's lives, beyond efficient and enjoyable interactions *within* the user interface. This perspective was shaped by many conversations with people who use these technologies. Yes, sometimes they shared frustration with unintuitive navigation menus or cluttered screens, but I also heard about deeply personal experiences *made possible* by consumer technology, stories that were not captured by the standardized measurement scales and research tools I was using. Consider these three examples from the field of e-Commerce: a private seller's pride in overcoming financial hardship by building a business on eBay; another seller's sense of accomplishment after receiving heartfelt positive feedback from a buyer delighted by their personalized packaging; but also, a seller's deep frustration when a buyer failed to show up at the agreed time to collect their purchase. These reflections prompted me to consider what I, as a researcher, can and wish to contribute to the design of consumer technology, ultimately leading me to join the Positive Design group at TU Delft to pursue this work.

Over the past seven years, nearly every conversation I had about this project, whether with designers, tech professionals, or family and friends, unfolded in a remarkably similar way: At first, there was confusion or disbelief: How is it possible to design consumer technology for wellbeing? After all, isn't consumer

technology itself "the problem"? How can something so entangled with distractions, misinformation, and financial interests possibly work *for* humans, let alone enhance their wellbeing? It was as if we had collectively accepted that this is simply the way technology is, and will always be: a threat to people's wellbeing. The second reaction usually followed closely: wondering about the link between *consumer* technology and wellbeing. Wasn't wellbeing design about meditation apps or health trackers – tools explicitly built for that purpose? When I explained my approach to wellbeing and shared examples of how it can be enhanced subtly yet powerfully through everyday technology, initial skepticism often gave way to curiosity – and even hope. Hope that future interactions with technology can be more enriching and life-enhancing. While this PhD project does not claim to resolve the tensions between technology and wellbeing once and for all, it outlines concrete opportunities for how technology *can* genuinely support and enhance human wellbeing.

When I began this project in May 2017, the term "wellbeing" was rarely present in the tech industry's vocabulary, nor was it, to my knowledge, widely considered in product development practices. Over the course of the project, however, the industry underwent a notable transformation (Pardes, 2018; Solon, 2018). Growing public awareness (Barry & Kang, 2024), high-profile U.S. Senate hearings (Paul, 2024), and evolving EU legislation (European Commission, 2022) focusing on technology-related harms pushed tech companies to take greater responsibility for users' wellbeing. Today, CEOs of companies like Meta and Pinterest openly reference "user wellbeing" in their business strategies (Zuckerberg, 2018; Pinterest, 2023), highlighting the growing importance of addressing wellbeing in technology design and the urgent need for research-based insights to guide this transformation.

This thesis is grounded in wellbeing research and the fields of Design and Human-Computer Interaction (HCI). The introduction situates the work within these disciplines, motivating its focus on designing consumer technology to promote sustained wellbeing. It then outlines the research objectives, approach, and outcomes, concluding with a brief overview of each chapter.

1.2 Background

The background section reviews relevant research in wellbeing psychology and HCI. It defines wellbeing, explores how to enhance and sustain it over time, and highlights the importance of intentional positive activities. It then discusses the role of design, particularly in the context of consumer technology, in supporting sustained wellbeing.

1.2.1 Wellbeing

Multifaceted. Wellbeing is a multifaceted psychological phenomenon characterized by significant theoretical and conceptual complexity (Huta, 2017, for an overview). Throughout human history, scholars from various disciplines, including philosophy, psychology, and religion, have studied wellbeing, each bringing their own worldviews, theories, terminology, and methodologies. This diversity has led to a wealth of perspectives and conceptualizations of wellbeing.

Multidimensional. Moreover, wellbeing is not just one single psychological factor; it is a multidimensional concept that encompasses various aspects of human experience, such as positive relationships, personal accomplishments, a sense of purpose, and self-acceptance (Diener et al., 2009; Ryff, 1989; Seligman, 2011). A person's wellbeing is shaped by their subjective experiences, feelings, personal goals, motives, values, daily activities, and overall lifestyle.

Context-dependent. Wellbeing also functions on different time scales and varies between contexts, from brief, situation-specific experiences like emotions (e.g., feeling joy while watching your child's dance performance) to more enduring, context-independent tendencies to react or interpret the world, such as personality traits, personal values, and character strengths (e.g., maintaining a generally positive outlook on life).

Subjective. Lastly, wellbeing is a subjective experience (Diener et al., 1999) that differs from person to person. It is influenced by factors such as age, gender, genetics, and personality, as well as by life circumstances, including income, marital status, and physical health (e.g., Lyubomirsky et al., 2005). Wellbeing also fluctuates between cultures, generations, and throughout the lifespan (Helliwell et al., 2024; Rauch, 2018). People pursue wellbeing in different ways, and the personal sources of wellbeing can vary widely. For some, the greatest joy comes from taking solitary walks in nature; others find fulfillment in helping those in need. There is no universal formula or "magic trick" to ensure happiness for everyone.

Malleable. Despite its complexity, wellbeing is malleable – it can be defined, measured, and intentionally improved. Research in psychology has identified universal factors that enhance wellbeing, including basic human needs (Ryan & Deci, 2000b, 2017; Sheldon et al., 2001), universal values (Schwartz, 1994), and universal virtues and character strengths (Peterson & Seligman, 2004). In addition, positive psychologists have developed targeted interventions that consistently improve wellbeing, as evidenced by controlled intervention studies (Bolier et al., 2013; Lyubomirsky, 2007; Sin & Lyubomirsky, 2009).

HEDONIC AND EUDAIMONIC WELLBEING

Wellbeing theories in psychology are often grouped into two main categories (see Figure 1.1): (a) subjective or hedonic wellbeing (Diener, 1984; Diener et al., 1999; Kahneman, 1999) and (b) psychological or eudaimonic wellbeing (Ryff, 1989; Ryff & Singer, 2008). These categories reflect hedonistic and eudaimonic philosophical traditions, each offering a distinct perspective on what constitutes a "good life". Hedonic or subjective wellbeing views the pursuit of positive experiences ("feeling good") and the avoidance of negative ones as the ultimate life goal. In contrast, eudaimonic or psychological wellbeing promotes a way of living focused on personal growth and self-actualization ("living well"), even if it involves challenges or uncomfortable emotions.

Figure 1.1: Three components of subjective wellbeing (left) based on Diener (1984). Six aspects of psychological wellbeing (right) based on Ryff (1989). Adapted from Jimenez et al. (2015).

In line with these viewpoints, subjective wellbeing, commonly referred to as "happiness", consists of three aspects: experiencing frequent positive emotions, infrequent negative emotions, and evaluating one's life positively overall (Diener, 1984; Kahneman, 1999). Psychological wellbeing, often described as "optimal functioning", encompasses six key aspects of self-actualization: autonomy (being self-determined and independent in thought and action), personal growth, self-acceptance, life purpose, mastery (working toward and reaching meaningful personal goals), and positive relationships with others (Ryff, 1989; Ryff & Singer, 2008).

FLOURISHING

Most wellbeing researchers agree that both hedonic and eudaimonic aspects of wellbeing are essential for individuals to flourish (Keyes, 2002). This complementary view is reflected in Seligman's (2011) PERMA model, a psychological framework for flourishing, which includes both hedonic and eudaimonic elements. Positive emotions (P) and engagement (E) represent the hedonic side, while positive relationships (R), meaning (M), and accomplishments (A) reflect eudaimonic influences. Each component enhances wellbeing on its own, but true flourishing occurs when all components are experienced together. Throughout this dissertation, "wellbeing" refers to a state of "flourishing" (Keyes, 2002), comprising both hedonic and eudaimonic factors. Accordingly, wellbeing is broadly defined as the combination of "experiences of pleasure and purpose over time" (Dolan, 2014, p.3). This holistic approach to wellbeing diverges from other "positive" design approaches, such as Hedonic UX (Diefenbach et al., 2014) and Design for Positive Emotions (Desmet & Hekkert, 2007), which focus primarily on short-term emotional responses.

The notion of wellbeing as "flourishing" is promoted by modern positive psychology (Seligman & Csikszentmihalyi, 2000), a relatively novel discipline dedicated to studying what makes life worth living. Unlike traditional clinical psychology, its main objective is not to repair damage, but to support positive human functioning (Seligman, 2002). The focus is on the non-distressed, general population (Seligman et al., 2004), positioning positive psychology closer to self-help than psychotherapy. Flourishing represents a *positive* state of optimal mental health that transcends the mere absence of mental illness (Keyes, 2007). Accordingly, design for wellbeing or positive design (Desmet & Pohlmeyer, 2013), as explored in this dissertation, aims to promote *positive* states, rather than solely prevent negative ones. This approach thus differs from online therapy and digital wellbeing strategies (e.g., Monge Roffarello & De Russis, 2019) that primarily seek to reduce illbeing.

SUSTAINED WELLBEING: THE ROLE OF POSITIVE ACTIVITIES

The explicit aim of this dissertation is to explore how the thoughtful design of everyday technology can contribute to *lasting* increases in wellbeing, a question that hinges on whether wellbeing can, in fact, be deliberately improved.

Hedonic adaptation. Research shows that even after major positive life events, such as winning the lottery (Brickman et al., 1978), getting married (Lucas et al., 2003), or starting a new job (Boswell et al., 2005), the initial boost in happiness is typically short-lived. Over time, individuals return to their personal, stable baseline level of happiness, often referred to as their "happiness set point" (Diener et al., 2006). This phenomenon, called "hedonic adaptation" (Frederick &

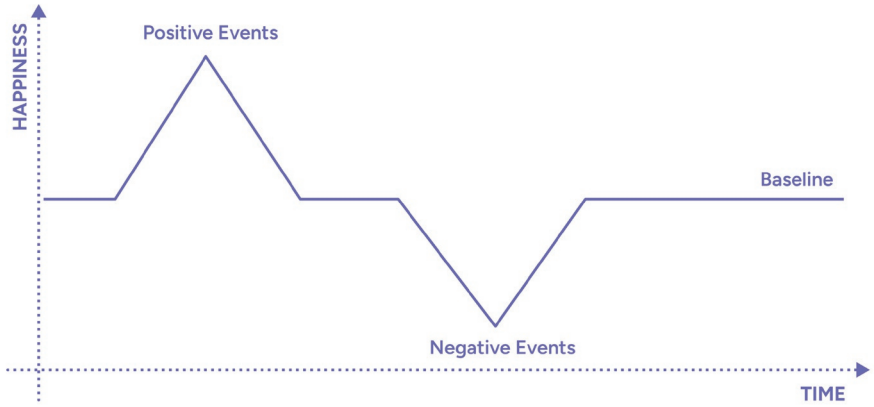


Figure 1.2: Hedonic adaptation based on Frederick & Loewenstein (1999). Adapted from Jimenez et al. (2015).

Loewenstein, 1999), also applies to negative events, enabling humans to adjust to changing life circumstances (see Figure 1.2). As a result, attempts to achieve long-term improvements in wellbeing through hedonic pleasures or life changes often prove ineffective, leaving individuals on a "hedonic treadmill" (Brickman & Campbell, 1971), in which they tirelessly pursue happiness, yet struggle to sustain it.

Intentional activities. Fortunately, research in positive psychology shows that people can actively enhance and sustain their wellbeing by adopting positive behaviors commonly practiced by those who flourish (Bolier et al., 2013; Lyubomirsky, 2007; Parks & Titova, 2016; Sin & Lyubomirsky, 2009). These positive practices include expressing gratitude, cultivating optimism, and savoring life's joys. The Sustainable Happiness Model (Lyubomirsky et al., 2005), also known as the "Happiness Pie Chart" (Figure 1.3), posits that individual wellbeing is not only determined by a person's genetic makeup and life circumstances, but also, to some extent, by deliberate engagement in wellbeing-enhancing activities (Figure 1.4). This implies that wellbeing is neither fixed nor reliant on having "ideal" life circumstances; instead, it is an ongoing, active process shaped by a person's daily actions.

Positive psychology interventions. Positive psychologists have developed specific interventions centered around these practices to cultivate positive behaviors, positive feelings, and positive thoughts that enhance long-term well-being (Parks & Biswas-Diener, 2013; Parks & Titova, 2016; Sin & Lyubomirsky, 2009). Examples of such Positive Psychology Interventions (PPIs) include writing gratitude letters (Lyubomirsky et al., 2011; Seligman et al., 2005), counting one's blessings (Emmons & McCullough, 2003; Lyubomirsky et al., 2005), engaging in acts of kindness (Lyubomirsky et al., 2005), and savoring life's joys

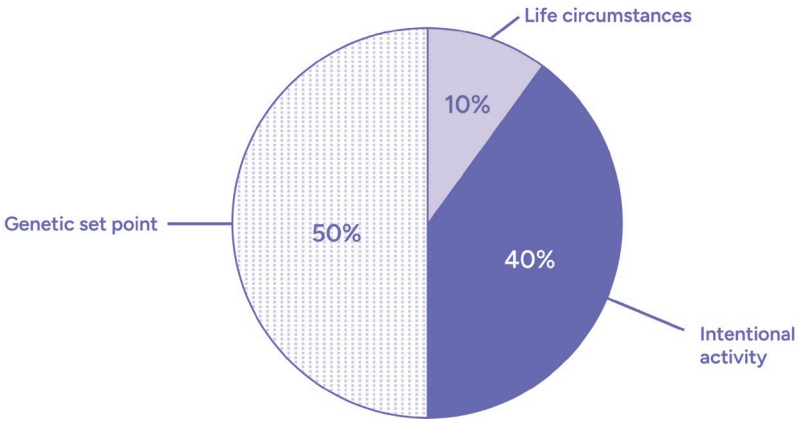


Figure 1.3: The Happiness Pie Chart based on Lyubomirsky et al. (2005). Adapted from Jimenez et al. (2015).

(Bryant & Veroff, 2007; Quoidbach et al., 2010). PPIs were initially developed for therapeutic settings and shared through face-to-face interactions. Their effectiveness has been rigorously tested in randomized controlled intervention studies (Bolier et al., 2013; Sin & Lyubomirsky, 2009). For optimal results, these interventions typically adhere to specific protocols regarding both their content and the recommended frequency of practice. For example, the gratitude intervention *Three Good Things* (Emmons & McCullough, 2003) instructs people to list exactly three things they are grateful for, ideally no more than once per week (Lyubomirsky et al., 2005). Research indicates that PPIs can remain effective outside of therapeutic environments and without strict adherence to the original protocols tested in intervention studies. Notably, they have shown similar benefits when delivered through online platforms (Schueller & Parks, 2012), self-help books (Lyubomirsky, 2007; Parks & Szanto, 2013), and physical design artifacts (Desmet & Sääksjärvi, 2016).

Positive activities. Beyond these specific therapeutic PPIs, each category of positive activities, such as practicing acts of kindness, offers many other ways to engage in that activity – for example, cooking dinner for a sick friend or volunteering at a neighborhood event. To highlight this broader perspective, which underpins this work, the term "positive activities" will be used throughout the thesis (see also Lyubomirsky & Layous, 2013). Positive activities can thus be understood as the overarching patterns that shape the specific forms PPIs take. Although they are common design targets for therapeutic and commercial wellbeing applications, positive activities have not been widely leveraged in the design of consumer technology, despite their strong link to sustained wellbeing. This thesis focuses on integrating positive activities into consumer technology. Rather than simply digitizing specific PPIs, for instance, by providing app-based

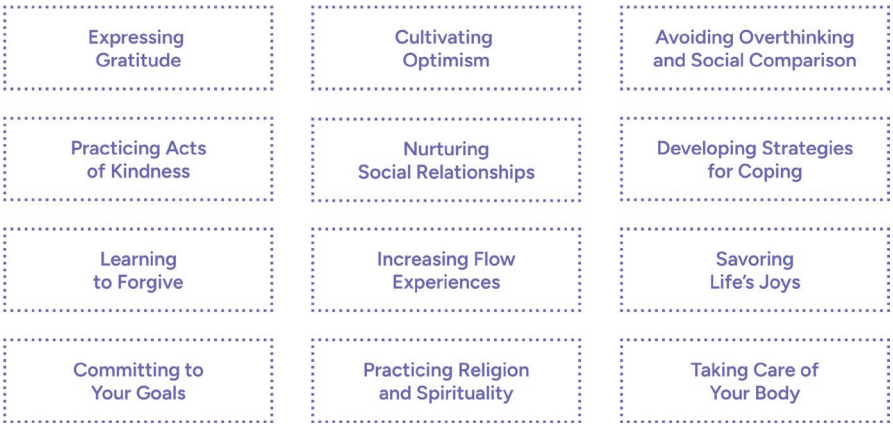


Figure 1.4: Twelve positive activities that are proven to enhance wellbeing longer-term (Lyubomirsky, 2007). Adapted from Jimenez et al., (2015).

instructions to "write a gratitude letter", the work explores how technology can enable diverse, engaging, and context-sensitive ways for users to practice positive activities in their daily lives. Sonja Lyubomirsky (2007) has compiled a comprehensive taxonomy of positive activities (see Figure 1.4), focusing on those most consistently shown to enhance wellbeing.

Lasting wellbeing effects. Engaging in positive activities can lead to lasting increases in wellbeing by counteracting the effects of hedonic adaptation (Sheldon & Lyubomirsky, 2006). However, these activities cannot entirely prevent hedonic adaptation. To effectively enhance wellbeing, they must generally be practiced intentionally and repeatedly (Lyubomirsky & Layous, 2013). Sustaining greater wellbeing thus requires people to continuously seek engaging, fulfilling, connecting, and uplifting experiences (Sheldon & Lyubomirsky, 2019).

Optimal conditions. The Positive Activity Model by Lyubomirsky and Layous (2013) outlines optimal conditions that can maximize the long-term impact of positive activities on wellbeing. The model highlights both individual factors of the person, such as motivation and effort, and characteristics of the activity, such as dosage and variety, that influence the effectiveness of these activities. To sustain engagement in positive activities, it is further essential that the activity aligns with a person's interest, values, and lifestyle. For instance, an outgoing person might benefit from social activities like volunteering, while an introverted person may find fulfillment in reflective practices such as meditation. A good person-activity-fit can be achieved by selecting positive activities that provide specific characteristics, such as (Lyubomirsky, 2007):

- **Fit with sources of unhappiness**: Activities that help individuals tackle spe-

cific challenges or problems. For example, a grouchy person could work on practicing acts of kindness.

- **Fit with strengths:** Activities that match a person's unique talents and strengths. For example, an extraverted person might enjoy expressing gratitude directly to someone, while an introverted individual might prefer quietly reflecting on what they are grateful for.
- **Fit with lifestyle:** Activities that can be adapted to a person's lifestyle and daily routines. For example, a busy parent might choose a short activity that can be easily integrated into their daily schedule.

These tailored approaches can inform design interventions for specific usage contexts and user groups.

Strategies for optimal practice. Lyubomirsky (2007) also outlined a set of strategies to enhance the effectiveness of each of the twelve positive activities in her taxonomy (see Table 1.1).

Table 1.1: Strategies for optimal practice for three positive activities (Lyubomirsky, 2007).

Positive Activity	Strategies for Optimal Practice
Practice Gratitude	• Set aside time and focus on the activity • Reflect what one is grateful for • Express gratitude directly to others • Express gratitude in various ways • Provide specific reasons for being grateful
Nurture Social Relationships	• Commit time to significant others • Communicate positive feelings • Celebrate others' successes • Manage conflicts constructively • Share one's inner life with trusted people
Savor Life's Joys	• Relish everyday activities • Share positive experiences with others • Foster vivid, detailed memories • Celebrate good news • Take pride in one's achievements • Focus attention on sensory experience

1.2.2 Human-Computer Interaction

Two main approaches inform the design of wellbeing-focused technology (Calvo & Peters, 2014; Vanden Abeele, 2021): (a) preventing harm, known as the non-maleficence approach, and (b) proactively promoting wellbeing, referred to as the beneficence approach. Calvo and Peters (2014) further differentiate these approaches into four specific strategies for integrating wellbeing into technology design (see Table 1.2).

Table 1.2: Four integration strategies for wellbeing design adapted from Calvo & Peters (2014).

Integration Strategy	Definition
Not Wellbeing Design	Wellbeing is not explicitly considered in the design of the technology (or its components).
Preventative Design	Compromises or obstacles to wellbeing are treated as errors, prompting interventions or a redesign of the technology.
Active Design	Specific components of the technology are intentionally designed to promote wellbeing (determinants) in an application that has a different overall goal.
Dedicated Design	The technology (as a whole) is purpose-built to enhance wellbeing (determinants) in some way.

PREVENTATIVE DESIGN

This strategy aims to reduce or mitigate the negative effects stemming from the current design of (consumer) technology. In line with this approach, tech companies (Pardes, 2018; Solon, 2018) and academic researchers (Lyngs et al., 2019; Monge Roffarello & De Russis, 2023) have developed various "digital wellbeing" tools to support users in self-regulating their technology use. Lukoff et al. (2021) position these digital wellbeing interventions on a spectrum, ranging from external to internal mechanisms. External mechanisms focus on restricting specific app or technology use, primarily aiming to reduce overall screen time. They encompass tools such as browser extensions, lock-out timers, or built-in phone settings that work identically across platforms and applications (see Figure 1.5). However, these tools target problematic user behavior without addressing the underlying "problematic" design of the technology itself (Peters et al., 2020). In addition, they often restrict not only harmful but also positive or meaningful experiences that technology can enable (e.g., Lukoff et al., 2018, 2023). In contrast, internal mechanisms work by redesigning the existing user interface, thereby reshaping the user experience. This involves selectively blocking or modifying potentially harmful design patterns (Lukoff et al., 2021; Zhang et al., 2022) and redirecting user behavior toward more positive interactions (Lukoff et al., 2023). Internal mechanisms allow for more targeted interventions. While external mechanisms focus on restricting overall technology use, internal

mechanisms can selectively "remove problematic aspects from an app, while still retaining its benefits" (Lukoff et al., 2021). Most existing digital wellbeing tools focus on *preventing harm* but do not actively promote *optimal psychological functioning*, a key aspect of general psychological wellbeing (Keyes, 2007). Rather, they aim to make technology use "not problematic" (Vanden Abeele, 2021). To address digital wellbeing more holistically, preventative approaches could be complemented by interventions specifically designed to create positive wellbeing outcomes (Almoallim & Sas, 2022; Calvo & Peters, 2014; Vanden Abeele, 2021). Tech companies like Pinterest share this perspective, asserting: "It's never enough to filter out the bad—we want to design in the good" (Pinterest, 2023).

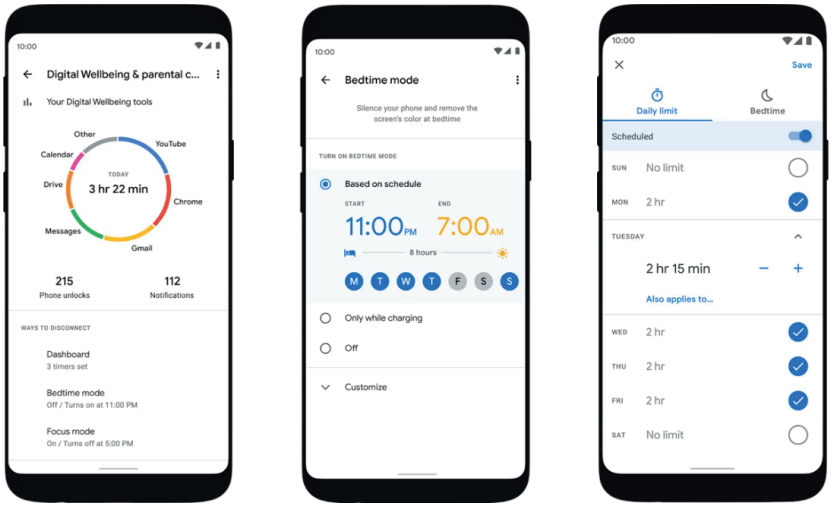


Figure 1.5: Some of Google's Digital Wellbeing features integrated into all Android phones. Image source: Google.

DEDICATED DESIGN

One common strategy for actively promoting wellbeing through technology is the use of Dedicated Designs – technologies intentionally created with the primary purpose of enhancing wellbeing. Such Dedicated Designs comprise (see Figure 1.6): (a) commercial wellbeing applications like meditation or gratitude apps; (b) behavioral intervention technologies (BITs) aimed at improving mental and physical health behaviors, including healthy eating, sleep hygiene, and mood regulation (Mohr et al., 2013); and (c) therapeutic applications (De Witte et al., 2021).

ACTIVE DESIGN

Another strategy for enhancing wellbeing through design, known as Active Design, involves integrating wellbeing-supportive features into existing technologies, products, or services that primarily serve a different purpose (Figure 1.6). For example, expressing gratitude could take the form of 'endorsing a colleague' on a professional platform like LinkedIn. Similarly, features such as Facebook's 'Memories' or Google Photos' 'Rediscover This Day' allow users to revisit meaningful experiences. These features can foster reminiscence, a key aspect of savoring (Konrad et al., 2016). On Pinterest, users may create 'Vision Boards' to set and commit to personal goals. On Spotify, listeners can browse 'Featured Playlists' to discover music that helps them "Kick-Start the Day", get "A Confidence Boost", or find "The Cure for Loneliness" (Eriksson & Johansson, 2017). Despite its potential, this Active Design approach has received relatively little attention to date. This appears to be a missed opportunity, as (re)designing (existing) technology with wellbeing principles in mind can reach many people and can do so in a context-sensitive manner (Ludden et al., 2015; Pohlmeyer, 2017). A feature-level approach can also be used for preventative interventions by addressing specific problematic uses within a platform, rather than imposing broad restrictions on technology use (Lukoff et al., 2021), as described above. This thesis focuses on promoting positive activities as Active Designs within consumer technology.

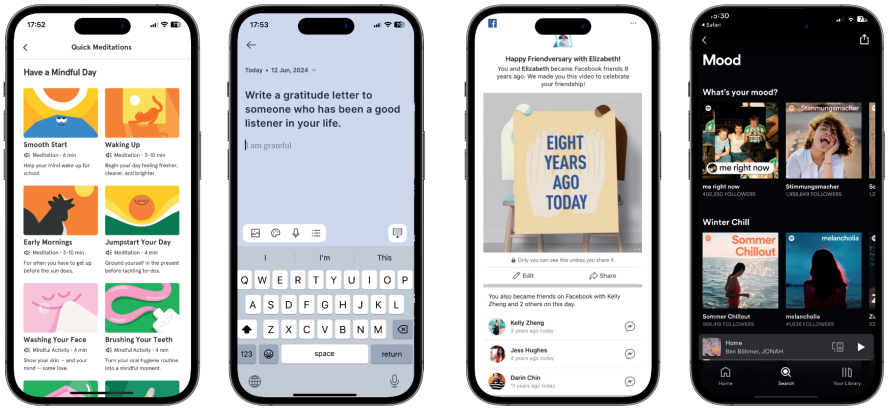


Figure 1.6: Two examples of Dedicated Design (left): the meditation app *Headspace* and the gratitude app *Gratitude*. Two examples of Active Design (right): the 'Memories' feature on Facebook and the 'Browse by Mood' feature on Spotify.

CONSUMER TECHNOLOGY

Definition. In this dissertation, the term "consumer technology" refers broadly to any digital or interactive technology designed for everyday use by the general public, as opposed to applications intended for business or government pur-

poses. This encompasses a wide range of technologies, such as smartphones, computer software, mobile applications, wearables, gadgets, digital games, and websites. The primary focus of this dissertation is on mobile applications, particularly those available in the Apple App Store or Google Play Store, due to their broad reach. Currently, most of these applications are not specifically designed or evaluated to promote wellbeing. Instead, they primarily serve other purposes such as entertainment, shopping, and communication.

Pervasive. Consumer technology has become nearly ubiquitous across the globe. As of 2024, approximately 70% of the world's population owns a smartphone, and around 67% has internet access (Statista). In the United States, people spend an average of 4 hours and 37 minutes per day on mobile devices – equivalent to about 70 days per year (Harmony Healthcare IT, 2024) – surpassing the time spent on social interactions and leisure activities (Our World in Data, n.d.). Consumer technology now permeates nearly every aspect of modern life, offering countless possibilities: from finding love and working remotely to navigating unfamiliar places and discovering cultural events. Digital services also bring many benefits, including fast access to information and communication, enhancing convenience, and enriching daily experiences.

Negative impact. However, certain uses of consumer technology have been linked to decreased wellbeing in correlational studies (e.g., Twenge et al., 2020). Modern technology increasingly appears to distract us (Ward et al., 2017), divide us (Brady et al., 2017), and take a toll on our mental health (Twenge, 2020). While these negative associations continue to spark scientific debate (Orben & Przybylski, 2020; Twenge et al., 2020; Vanden Abeele, 2021), it is essential to carefully assess any potential risks of technology use, given its pervasive presence in daily life. As a result, public discourse often centers on technology-related harms (Lewis, 2017) and strategies to mitigate them (Aggeler, 2024; Dennis-Tiwary et al., 2023). This discourse is further fueled by advocacy groups such as the 'Center for Humane Technology', technology-focused podcasts like 'Your Undivided Attention', and the Netflix documentary 'The Social Dilemma', which has reached over 100 million viewers in 190 countries. Technology-related harms often arise from two main sources: (a) exposure to harmful content and (b) problematic technology use (Office of the Surgeon General, 2023).

Harmful content. Harmful content includes misinformation, hate speech, cyberbullying, and unrealistic beauty standards. Exposure to such content can cause significant psychological distress, increased polarization, and mental health problems. Mozilla (2021) collected over 37,000 reports from YouTube users on their "most regretted" experiences on the platform, revealing that the majority involved exposure to misinformation, violent content, hate speech, and scams (Mozilla Foundation, 2020). Such content is often propagated through algo-

rithmic curation on social media and video streaming platforms (e.g., Horwitz & Seetharaman, 2020), which prioritize content likely to be clicked and shared, such as clickbait or emotionally charged posts (Brady et al., 2017; Vosoughi et al., 2018). Once a user shows interest in a topic, including harmful content, personalized recommender systems tend to display similar or even more extreme material, sending users down a "rabbit hole" of consuming content that can undermine their wellbeing (Harriger et al., 2022). For example, a study by the Center for Countering Digital Hate (CCDH) found that TikTok's recommendation algorithm starts suggesting self-harm and eating disorder content to teenage users within minutes of sign-up, if they show interest in these topics through clicks and other interactions (Milmo & Hern, 2022). This same mechanism also contributes to the formation of "echo chambers," where users are repeatedly exposed to beliefs and opinions that align with their own (Nguyen, 2020), narrowing their worldview and exacerbating societal polarization. Cyberbullying, amplified by the online disinhibition effect (Suler, 2004), is another significant concern. Humans are also naturally inclined to compare themselves to others (Festinger, 1954) and to seek out information about potential threats in their environment. Overexposure to such content can result in feelings of inadequacy (e.g., Tiggemann, 2022; Tiggemann & Anderberg, 2020), fear of missing out (Przybylski et al., 2013), and mental health problems (e.g., Twenge, 2020). These effects are particularly pronounced when the information is distorted, selectively showcases only the positive aspects of one's life, or contains misinformation.

Problematic use. Problematic uses of contemporary consumer technology, such as excessive or compulsive use (Kardefelt-Winther et al., 2017), can harm people's wellbeing by disrupting or replacing daily activities, including social interactions (Courtright & Caplan, 2020; Lapierre & Lewis, 2018; McDaniel & Coyne, 2016), sleeping (Li et al., 2015), driving (Caird et al., 2014; Gliklich et al., 2016), or studying (Felisoni & Godoi, 2018; Pew Research Center, 2024). Excessive use refers to spending extended periods of time using digital technology, often longer than intended (Woolley & Sharif, 2022). Common examples include binge-watching multiple episodes of a TV show consecutively (Flayelle et al., 2023), doom-scrolling, where users compulsively scan the internet for negative or disturbing information (Sharma et al., 2022; Watercutter, 2020), and passively scrolling through social media feeds (Cho et al., 2021). Excessive use can be triggered by features designed to maximize engagement, such as video autoplay or endless scrolling. Compulsive use involves repeatedly checking one's phone or revisiting platforms for updates. This behavior can disrupt parental bonding with their children (Kushlev & Dunn, 2019), diminish the quality of social interactions (Dwyer et al., 2018), and reduce productivity (Mark et al., 2015). The scale of the problem becomes evident in phone usage statistics: the

average user checks their phone more than 75 times a day and performs over 2,600 clicks, swipes, and taps daily – figures that nearly double among heavy users (Dscout, 2016).

Attention economy. These harms partly arise from synchronizing technology design with the business goals of the attention economy (Davenport & Beck, 2001). Companies like Google, Meta, and X/Twitter generate revenue by maximizing user engagement, as longer and more frequent visits to their platforms result in increased ad exposure. Consequently, user interface design is, at least in part, optimized for engagement metrics such as visits, clicks, and views. To boost engagement, tech companies sometimes employ potentially harmful design tactics, including push notifications and variable rewards, intended to capture users' attention and extend their time on the platform (Monge Roffarello et al., 2023). They also leverage algorithmic curation to prioritize highly engaging content, which may include harmful material such as clickbait, hate speech, and misinformation (Brady et al., 2017; Vosoughi et al., 2018). Given this context, any effort to foster wellbeing through consumer technology must operate within the constraints of this ecosystem. This thesis, therefore, focuses on strategies to promote user wellbeing within today's attention economy.

Meaningful use. Public and academic discourse often focuses on the negative effects of consumer technology on wellbeing. However, under the right circumstances, consumer technology can positively impact people's lives: it can foster social connection (Burke et al., 2010), promote body positivity (Rodgers et al., 2022), support social activism (Greijdanus et al., 2020), enhance learning (Abu-Taieh et al., 2022), and provide access to mental health resources (Naslund et al., 2019). HCI research has found that *meaningful* user experiences often arise when technology helps users achieve their personal goals (Lukoff et al., 2018; Mekler & Hornbæk, 2016). They may also emerge when technology is used intentionally for specific purposes such as productivity, information seeking, and communication (Lukoff et al., 2018). Other researchers emphasize that meaningful experiences with technology are often rooted in the activities and experiences it enables (Hassenzahl et al., 2013; Pohlmeyer, 2012). Overall, modern consumer technology can impact wellbeing both positively and negatively, depending on how it is used and by whom (e.g., Burke & Kraut, 2016; Yang, 2016). This thesis considers consumer technology not only as "part of the problem" but also a "part of the solution" (see also Calvo & Peters, 2014), offering a scalable platform to deliver wellbeing interventions.

REASONS TO SUPPORT POSITIVE ACTIVITIES THROUGH CONSUMER TECHNOLOGY

As a widely adopted medium, consumer technology presents unique opportunities for promoting wellbeing interventions, including positive activities, alongside Behavioral Intervention Technologies (BITs). While BITs can effectively

extend wellbeing interventions beyond therapeutic settings (Bolier & Abello, 2014), they face several challenges that consumer technology may help address (Ludden et al., 2015; Pohlmeyer, 2017; Schueller et al., 2013):

Reach. The wellbeing-promoting impact of BITs is often restricted to individuals who are actively pursuing personal change, such as happiness seekers (Bergsma, 2008) or highly educated women (Ludden et al., 2015), leaving large segments of the population underserved. To support human flourishing on a global scale, wellbeing interventions, such as positive activities, must reach more people, and widely used consumer technologies offer a promising channel for achieving this goal.

Adherence. BITs often face high attrition rates as user motivation and engagement tend to decline over time (Mohr et al., 2013). In contrast, consumer technology is already used by billions of people and seamlessly integrated into daily routines, offering opportunities to initiate positive activities organically during everyday technology use.

Context-sensitivity. By leveraging consumer technology, positive activities can be tailored to users' digital habits, delivering daily doses of wellbeing to a wide audience across multiple touchpoints in a personalized and context-sensitive manner (Calvo & Peters, 2014; Pohlmeyer, 2017).

Positive activities as design targets add further benefits for several reasons:

Tangible. Positive activities often follow clearly defined principles that can guide design decisions in a concrete way. For example, practicing gratitude can involve "listing three good things" or "writing thank-you notes", while "setting realistic goals" can help increase motivation to pursue personal goals.

Short-term predictors. Positive activities can serve as relatively short-term indicators of long-term wellbeing outcomes. For instance, the extent to which a person communicates kindly on a social media platform, which can be observed shortly after an intervention has been rolled out, may predict longer-term wellbeing effects, such as stronger relationships and a greater sense of connection, which typically take time to manifest.

Clear recommendations. Positive activities have been rigorously tested in controlled intervention studies, and many are accompanied by proven strategies to maximize their effectiveness, offering valuable guidance for designers (see Table 1.1).

WELLBEING DESIGN FRAMEWORKS

Momentary, hedonic aspects of wellbeing, like pleasure and positive emotions, experienced during human-product-interactions, have been extensively studied

in HCI (see Diefenbach et al., 2014, for an overview). In contrast, more enduring aspects of eudaimonic or psychological wellbeing, such as finding purpose, being deeply engaged in daily activities, and growing as a person, supported by human-product interactions, have only become research priorities in the past decade (Mekler & Hornbæk, 2016; Müller et al., 2015; Pohlmeyer & Desmet, 2017). Research in HCI has introduced theoretical frameworks rooted in (positive) psychology, identifying key determinants of wellbeing that can be addressed through design. These include work on Positive Technologies (Riva et al., 2012), Positive Design (Desmet & Pohlmeyer, 2013), Positive Computing (Calvo & Peters, 2014; Peters et al., 2018), and Experience Design (Hassenzahl et al., 2013).

Positive Design. Desmet and Pohlmeyer (2013) recommend fostering (a) pleasure, (b) personal significance, and (c) virtue, ideally simultaneously, through design. In line with Dolan's (2014) definition of wellbeing, Positive Design attempts to "mediate, create, and support meaningful and pleasurable experiences (over time)" (Pohlmeyer, 2017, p. 236).

Positive Computing. Calvo and Peters (2014) identified nine factors empirically shown to enhance psychological wellbeing, including gratitude, empathy, mindfulness, and self-awareness. Drawing from positive and clinical psychology, they outline evidence-based strategies for shaping these determinants, such as gratitude visits or perspective-taking exercises, along with validated measures for their assessment. Furthermore, the authors introduced the METUX model (Peters et al., 2018), which places the fulfillment of three basic psychological needs – autonomy, competence and relatedness – at the heart of wellbeing design (Ryan & Deci, 2000b, 2017; Sheldon et al., 2001).

Experience Design. Similarly, in their framework on experience design, Hassenzahl et al., (2013) emphasize that positive and meaningful interactions with technology arise from satisfying basic psychological needs during product use. They recommend studying exceptionally positive instances of daily practices, such as brewing coffee, and categorizing the related experiences based on the primary need they satisfy, such as 'relatedness experiences' (Klapperich et al., 2018). This understanding can then guide the (re)design of the embedded technologies to better satisfy these needs and enhance user wellbeing.

Positive Technology. Positive technologies (Riva et al., 2012) are designed to stimulate (a) affective quality, (b) engagement and actualization, as well as (c) connectedness in personal experiences. This approach has primarily gained traction in the fields of virtual reality, augmented reality, and online therapy. In contrast, other frameworks (Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013) explicitly advocate for integrating wellbeing principles into the design of

a broader range of physical and digital products, including everyday consumer technologies.

Indirect pathways. Wellbeing design frameworks highlight the nuanced ways in which products can enhance individual wellbeing: (a) *directly*, through interacting with the product and (b) *indirectly*, by supporting positive and meaningful activities (Fokkinga et al., 2020; Peters et al., 2018; Pohlmeyer, 2012). This thesis focuses the indirect pathway, where the product or technology acts as a mediator to create a positive impact on people's lives – often beyond the immediate interaction with the product itself.

Application in industry. While these frameworks provide valuable theoretical insights, their application in design practice is not always straightforward. One challenge is that they often list a broad range of wellbeing determinants derived from different theories, making it difficult for designers to compare frameworks and decide which aspects of wellbeing to address in a specific context. In addition, wellbeing design frameworks tend to provide limited practical guidance on how to shape specific wellbeing determinants at the interface level (Hekler et al., 2013). Designers could benefit from clearer direction on (a) which wellbeing factors to prioritize, and (b) how to address these factors effectively within specific technological contexts (e.g., Hassenzahl et al., 2013; Klapperich et al., 2018). To influence the design of everyday technology, these frameworks must thus be translated into actionable design practices and measurement tools that can be applied in industry contexts (Hekler et al., 2013; Monge Roffarello et al., 2024; Peters et al., 2018).

1.3 Research approach

This research aims to equip design practitioners in the tech industry with both theoretical knowledge and practical guidance for designing consumer technology that has a lasting positive impact on people's wellbeing. To ensure applicability, the research explores concrete opportunities for promoting wellbeing within the realities of today's attention economy.

1.3.1 Research questions

This research aim was organized around three main research questions, each further divided into two to three sub-questions. As the project progressed, R2 emerged as a more focused specification of R1. The different part of the research inform and complement each other.

R1: How can interactive technology foster sustained wellbeing?

- **R1a:** What are the determinants of sustained wellbeing in human-technology interactions?
- **R1b:** How can these determinants be shaped through specific product interactions?

R2: How can consumer technology support positive activities?

- **R2a:** How are positive activities integrated into consumer technology?
- **R2b:** Which positive activities does existing consumer technology support?
- **R2c:** Which design mechanisms are employed?

R3: How can we design for positive activities?

- **R3a:** How can positive activities be integrated into consumer technology?
- **R3b:** What are the challenges and opportunities of this approach?
- **R3c:** How can the design process be "optimally" supported?

1.3.2 Research methods

Designing consumer technology to promote long-term wellbeing is a relatively new approach that remains largely underexplored in both academic research and industry practice. Therefore, this research started with a broad exploration of how sustained wellbeing can be fostered through human-product relationships. The theoretical insights from this initial stage were then validated within the context of consumer technology to confirm their relevance to this domain. Finally, these insights were applied to design practice and translated into a practical design tool aimed at supporting designers in the tech industry. At its core, this PhD project represents research *for* design (Stappers & Giaccardi, 2017), with the primary goal of advancing design practice. The research adopts a combined bottom-up and top-down approach: theory-driven to ensure evidence-based insights and guidance, and empirically tested to guarantee practical relevance. The research consists of three phases, each aligned with one of the three overarching research questions.

Exploration (R1): The research began with an empirical investigation into how interactions with physical and digital products can enhance long-term wellbeing (Chapter 2). Using the laddering method and qualitative in-depth interviews, the study examined specific pathways through which product interactions contribute to sustained wellbeing. This exploratory approach helped identify wellbeing factors most relevant to product design based on empirical insights. Findings from the laddering study were then integrated with existing theoretical knowledge from various fields to develop a multidisciplinary conceptual

framework (Chapter 3). This combined theoretical and empirical approach was chosen to ensure practical relevance, while remaining theoretically grounded and evidence-based.

Confirmation (R2): The derived framework was then specifically validated for consumer technology through two empirical studies outlined in Chapter 4: (a) an expert analysis of six widely used consumer technologies, and (b) an online survey with 117 Instagram users. This validation step was considered essential to confirm that the framework is both practical and relevant for real-world application in the tech industry. Both studies also collected concrete technology examples, which were later integrated into a design tool (Chapter 6) to make the framework more accessible and actionable for design practitioners.

Application (R3): In the final stage of this PhD project, the framework was applied to design practice. Chapter 5 presents a design case study involving fourteen Master's students in Interaction Design, examining how designers use the framework to redesign existing consumer technologies to foster positive activities. Chapter 6 then translates the framework into a digital design tool.

1.3.3 Research outcomes

The research obtained the following outcomes:

Theoretical framework: The conceptual framework presented in Chapter 3 identifies positive activities as a theoretically grounded and empirically validated determinant of long-term wellbeing within human-product relationships (Chapter 2). Chapter 4 confirms its relevance for consumer technology. The framework synthesizes empirical insights with theoretical knowledge from Design/HCI research, Positive Psychology, and Behavior Science into a cohesive model that can help foster interdisciplinary collaboration. It also provides a foundation for guiding design strategies and advancing research on the role of technology in promoting sustained wellbeing.

Nuanced taxonomies: The framework further specifies nuanced taxonomies to provide concrete guidance for supporting positive activities through consumer technology: 14 positive activities, 18 design mechanisms, and 31 interaction patterns were identified, operationalized, and iteratively refined across Chapters 3, 4, 5, and 6, each illustrated through concrete feature examples. These taxonomies make the framework more tangible for designers. They are available as a codebook (Chapter 4) and are also integrated into the design tool (Chapter 6).

Online database: More than 160 feature examples from existing consumer technologies that support positive activities were collected and archived in an open-access database to showcase possibilities and current implementations

(Chapter 4). This database links common behavior change techniques, such as prompts, social support, and action planning, to concrete interface elements in consumer technology. Designers can use the database as a resource for inspiration and learning from real-world examples.

Digital design tool: The tool combines knowledge dissemination with practical support for design decision-making. Acting as a *navigation tool*, it is intended to help designers explore the stages and pathway connections outlined in the framework (Chapter 3) through various entry points. It also showcases real-world technology examples from Chapter 4 to make the framework more accessible and tangible to designers.

Recommendations: A set of eight recommendations for actively integrating positive activities into consumer technology, aimed at (a) fostering the 'right' mindset and objectives, and (b) preventing potential pitfalls and misuse.

Bright patterns: These represent early steps toward developing a targeted design approach for individual positive activities. In analogy to "dark patterns", which are linked to negative wellbeing effects, these "bright patterns" (Chapter 7) aim to guide positive interventions in consumer technology that can enhance user wellbeing.

1.4 How to read this dissertation

This dissertation is organized into seven chapters, divided into three parts, reflecting the overarching research approach (see 1.3). The first part, comprising Chapter 2 and 3, explores empirically how products can enhance long-term wellbeing, resulting in the development of a theoretical framework. The second part, detailed in Chapter 4, validates this framework through two empirical studies focused on consumer technology, confirming its relevance to the tech industry. The third part, consisting of Chapters 5 and 6, demonstrates the application of the framework within the design process through a design case study and the development of a practical design tool. The concluding chapter summarizes key insights, offers recommendations, and highlights opportunities for fostering "bright patterns" in technology design. The dissertation is based on four scientific papers and additional outputs, including an online database of technology examples, codebooks, and a digital design tool.

At TU Delft, it is standard practice to include published papers in their original form as chapters in a PhD thesis. Accordingly, Chapters 2, 3, and 4 consist of previously published or submitted papers that have been included verbatim. Chapter 5 has been extended from a published conference paper to provide a more comprehensive discussion of the research findings and their implications. Chapter 6 is also organized in paper format, as it is intended for publication

following the completion of the thesis. This paper-based format allows each chapter to stand alone and be read independently. However, this structure also results in some repetition, particularly in the introduction and discussion sections of the individual chapters. Additionally, the chapters are not arranged by publication date but rather according to their logical sequence within the overall thesis. To support the reader, each chapter begins with a preface that outlines its main objectives and situates it within the broader narrative of the dissertation, which can be summarized as follows:

Chapter 2 presents a laddering study that empirically investigates which wellbeing determinants are most relevant for promoting lasting increases in wellbeing through human-product relationships. The study identifies seven qualities of product experiences, six core motivations, and seven product-mediated activities that are empirically linked to long-term wellbeing and malleable through design. The chapter presents a hierarchical graph visualizing pathways from product experience qualities to wellbeing determinants and wellbeing outcomes across six levels. These levels span from concrete aspects of the product interaction that the designer can directly control, to more abstract psychological factors, such as motivations and activities, which are indirectly influenced by specific product attributes. One key finding from Chapter 2 is that most wellbeing outcomes related to products are mediated through specific positive activities. Therefore, the chapter advocates placing positive activities at the forefront when designing for sustained wellbeing.

Chapter 3 details the development of a theoretical framework that integrates empirical insights from the laddering study with established knowledge from three relevant disciplines: (a) HCI/Design, (b) Positive Psychology, and (c) Behavioral Science. The framework conceptualizes a multi-stage process, with positive activities at its center, through which technology can promote sustained wellbeing. The chapter illustrates the five main stages of the framework, outlines their multidisciplinary theoretical foundations, specifies the relationships between them, and further defines specific elements that characterize each stage. The chapter concludes by discussing how the framework can inform both design research and practice, offering guidance for the development of targeted design strategies and effective measurement approaches.

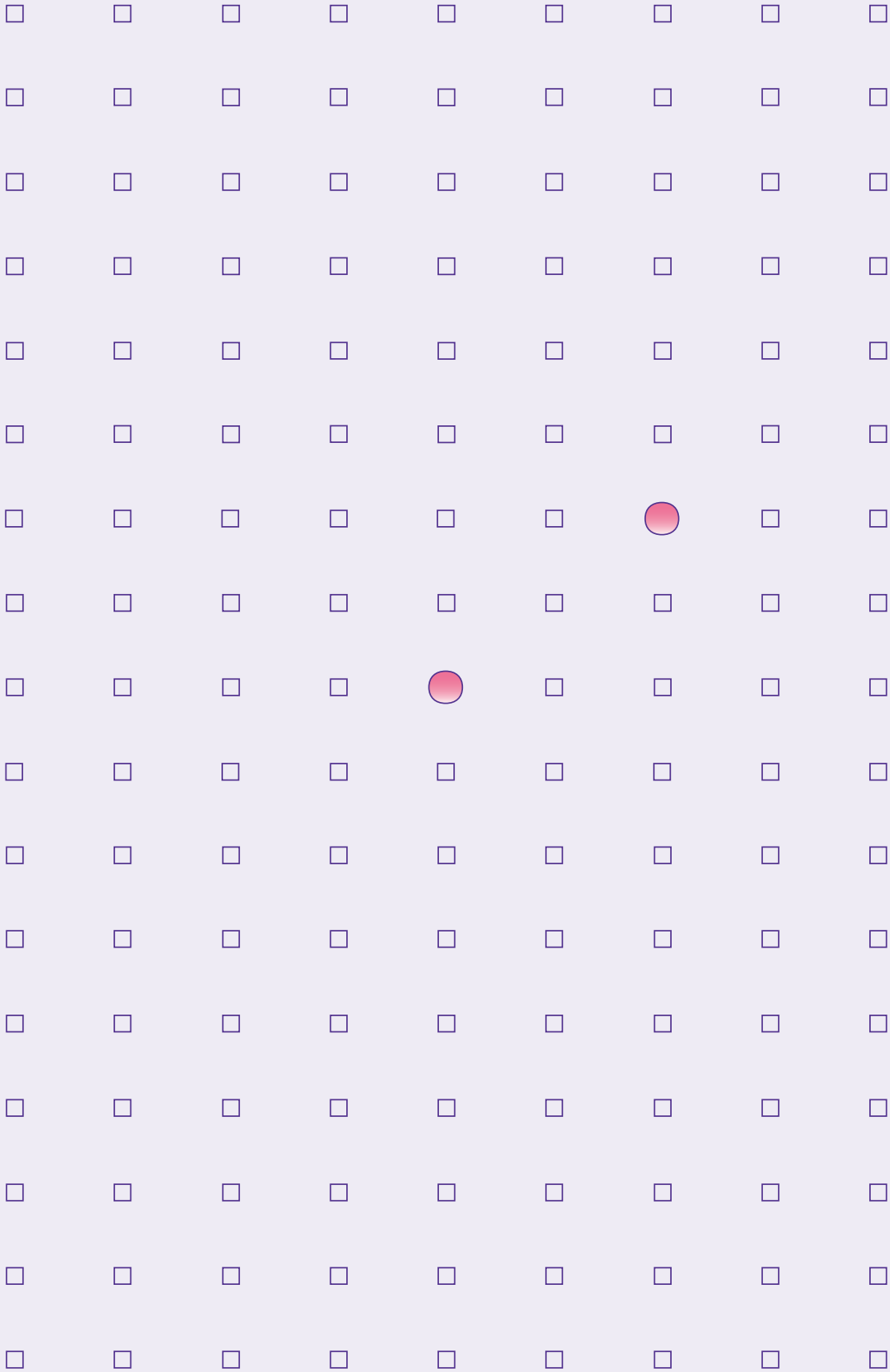
Chapter 4 presents two empirical studies, an expert analysis (4.4) and an online survey (4.5), that examine existing features and uses of contemporary consumer technology through the lens of the framework. These studies analyze Active Design solutions that promote positive activities through specific features or user scenarios across two product categories: social networking sites and video/music streaming platforms. The findings reveal numerous opportunities for consumer technology to foster positive activities, reaffirming their relevance

as design targets for promoting wellbeing in the tech industry. The chapter further refines the taxonomies of framework elements introduced in Chapter 3 and provides an online database cataloging the analyzed feature examples.

Chapter 5 presents a case study exploring how designers apply the framework to redesign features of consumer technology in ways that encourage positive activities. Unlike Chapter 4, which focuses on analyzing existing solutions, this chapter investigates how to design for positive activities and the specific challenges faced in the design process. The study identifies three integration strategies that can serve as practical guidelines for incorporating positive activities into consumer technology. The chapter discusses advantages and disadvantages of each strategy and provides in-depth explorations of representative design cases.

Chapter 6: Building on insights gained throughout the PhD project, the chapter substantiates four general challenges designers encounter when integrating wellbeing principles into the design of everyday technologies. To address these challenges, the chapter proposes six design directions informing the development of design tools. The chapter then introduces a concept and prototype for a digital design tool that incorporates these design directions, offering actionable guidance for industry designers aiming to integrate positive activities as Active Designs into consumer technology.

Chapter 7 concludes the dissertation by discussing its key insights more generally, offering eight recommendations for integrating positive activities into consumer technology, and outlining steps toward the development of "bright patterns" that can guide positive design interventions in consumer technology.



2

Activities as a gateway to sustained subjective wellbeing mediated by products

This chapter was previously published as: Wiese, L., Pohlmeyer, A., & Hekkert, P. (2019). Activities as a gateway to sustained subjective well-being mediated by products. In *Proceedings of the 2019 Conference on Designing Interactive Systems (DIS'19)* (pp. 85–97). Association for Computing Machinery. https://doi.org/10.1145/3322276.3322297

This chapter explores how everyday physical and digital products can promote lasting increases in individual wellbeing. Using a laddering approach, the research identifies seven product experience qualities, six motivations, and seven product-mediated activities empirically linked to sustained wellbeing and shaped through human-product-relationships. A hierarchical graph maps concrete pathways from product interactions to wellbeing determinants and wellbeing outcomes across six stages, spanning tangible design elements under the direct control of the designer to more abstract psychological concepts indirectly influenced by the product. The study reveals that most long-term wellbeing outcomes supported by products are mediated by specific positive activities. Consequently, the chapter advocates prioritizing positive activities in design efforts aimed at promoting sustained wellbeing. Insights from this research directly informed the theoretical framework detailed in Chapter 3.

2.1 Introduction

Due to technological advancements in recent decades, more and more aspects of our everyday lives are nowadays supported or accompanied by products and services, which creates the opportunity for designers to impact people's quality of life and wellbeing on a broad scale. In fact, some of the most widely used interactive products like social networks and communication technologies explicitly aim to improve core elements of psychological wellbeing such as having strong and intimate relationships with others (Ryff, 1989). Despite this great potential for positive impact, there is evidence linking specific ways of using interactive technology to impoverished social lives, e.g., reduced quality of face-to-face interactions, decreased measures of mental health, e.g., higher stress levels, and lower psychological functioning, e.g., increased loneliness (see Castellacci & Tveito, 2018 for an overview). This shows that the effects of technology use can reach far beyond mere product interactions, and create lasting effects on individuals and society. Consequently, design efforts should not stop at shaping human-product interactions in the present, but also consider long-term consequences on wellbeing. Growing awareness of potential risks has lead influential IT corporations to address *Digital Wellbeing* (Google, e.g. Pardes, 2018) and *Digital Wellness* (Apple, e.g. Gonzalez, 2018) in their product development efforts.

In parallel to these developments in industry, academic research on wellbeing design gained momentum within Human-Computer-Interaction (HCI) in recent years. Publications in this field contributed theoretically informed frameworks (Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013; Hassenzahl et al., 2013; Peters et al., 2018; Riva et al., 2012) grounded in psychology, and outlined possibilities to deliberately design for sustained wellbeing (Pohlmeyer & Desmet,

2017; Pohlmeyer, 2017). These approaches cover a wider range of psychological or eudaimonic wellbeing outcomes and emphasize the potential of products to mediate wellbeing-enhancing activities in the longer term. Some authors also explicitly point to potential negative side effects that need to be taken into account when designing for wellbeing (Desmet & Pohlmeyer, 2013). In their line of thinking, design that fosters engagement or triggers positive emotions in a given moment, but, for instance, makes individuals addicted in the long run cannot be considered design for wellbeing.

However, in order to shape the design of everyday products and technologies, these academic contributions have yet to be translated into actionable design practices and measurement tools that can be applied in industry contexts (Hekler et al., 2013; Peters et al., 2018). What is missing is a clear understanding of (causal) relations between product experience qualities, wellbeing determinants, and wellbeing outcomes in order to address these relations in the design process. In this paper, we will contribute to this understanding by enriching prevailing theoretical models in the field of wellbeing design with empirical insights. We do so by means of laddering interviews, which illustrate how specific product experiences are linked to (sustained) wellbeing. Furthermore, we visualize pathways from product experience qualities to wellbeing determinants and wellbeing outcomes. To show how product experience qualities are supported by concrete product attributes, we also refer to various ways in which products seem to support these experience qualities.

2.2 Related work

Momentary, hedonic aspects of wellbeing such as pleasure and positive emotions have been studied intensely in the context of human-product interactions (see Diefenbach et al., 2014 for an overview). Other more enduring aspects of eudaimonic or psychological wellbeing, i.e., optimal psychological functioning (Ryan et al., 2008; Ryan & Deci, 2001; Ryff, 1989; Ryff & Singer, 2008), such as having a sense of purpose in life, being fully engaged in one's daily activities, and growing as a person, have not explicitly been addressed by design research until the beginning of this decade (Desmet & Hassenzahl, 2012; Hassenzahl, 2010; Pohlmeyer, 2012) (see Huta & Waterman, 2014 for a more systematic definition of hedonia and eudaimonia). Related theoretical frameworks comprise work on Positive Technologies (Riva et al., 2012), Experience Design (Hassenzahl et al., 2013), Positive Design (Desmet & Pohlmeyer, 2013), and Positive Computing (Calvo & Peters, 2014). They draw from existing theories in (positive) psychology and specify determinants of psychological wellbeing that can be tackled by design, e.g., fulfillment of psychological needs (Hassenzahl et al., 2013; Peters et al., 2018), realization of self-concordant goals (Desmet

& Pohlmeyer, 2013), personal values (Partala & Kujala, 2016), and assignment of rewards (Calvo & Peters, 2014). Empirical studies on eudaimonic product experiences (Mekler & Hornbæk, 2016; Müller et al., 2015; Partala & Kujala, 2016) support the involvement of these theoretically suggested determinants in human-product-relationships. However, empirical research in this field is scarce and the exact nature of those relationships is poorly understood, e.g., what are distinct qualities of eudaimonic and hedonic product experiences. Even though these conceptualizations provide a broad theoretical basis for designers to draw from, they remain rather unspecific. In the current study, we will therefore take an exploratory, bottom-up-top-down approach to investigate wellbeing determinants and wellbeing outcomes empirically found to be supported in human-product-relationships and map these empirical insights with established theories and frameworks in psychology and HCI (*gap 1*). As requested by Peters et al. (2018), our objective is to take first steps towards establishing a library of empirically validated determinants shaping long-term wellbeing outcomes from human-product-relationships (*goal 1*).

Wellbeing design frameworks emphasize nuanced ways in which products contribute to individuals' wellbeing: (1) directly, during human-product interactions and (2) indirectly, by mediating, i.e., supporting or enabling positive and meaningful activities (Fokkinga et al., 2014; Peters et al., 2018; Pohlmeyer, 2012). On the indirect pathway, the product itself may no longer be in the focus of attention (Fokkinga et al., 2014) while performing the activity. Referring to research in positive psychology (Lyubomirsky et al., 2005; Sheldon & Lyubomirsky, 2006), activities have been proposed as a particularly promising starting point when designing for sustained wellbeing (Pohlmeyer & Desmet, 2017; Pohlmeyer, 2017). This line of research demonstrated that a significant proportion of inter-individual differences in wellbeing cannot be explained by genetics or life circumstances but by deliberate engagement in wellbeing-enhancing activities (Lyubomirsky et al., 2005; Sheldon & Lyubomirsky, 2006). Consequently, numerous cognitive (e.g., expressing gratitude, savoring life's joys), volitional (e.g., committing to one's goals), and behavioral (e.g., learning a new skill, practicing random acts of kindness) activities were empirically studied and found to be linked to lasting increases in wellbeing (Bryant & Veroff, 2007; Lyubomirsky, 2007; Quoidbach et al., 2010; Seligman, 2011). Literature points to a number of reasons why activities have these favorable effects on individuals' wellbeing. One reason is connected to the phenomenon of 'hedonic adaptation' (Frederick & Loewenstein, 1999), describing how people react to positive changes in their life, e.g., winning the lottery (Brickman et al., 1978), getting married (Lucas et al., 2003), or starting a new job (Boswell et al., 2005) by reverting to their individual happiness baseline level. This mechanism can be compared to running on a 'hedonic treadmill' (Brickman & Campbell, 1971) and was found to arise

particularly fast following material acquisitions compared to changes of one's experiential patterns. In addition, material purchases were found to lead to smaller increases in wellbeing compared to experiential purchases (see Patterson & Biswas-Diener, 2012 for an overview), e.g., because they are more likely to trigger social comparisons. Experiences on the other hand are phenomenologically unique to a person and may serve as means to identity construction and personal storytelling, e.g., describing oneself to other people by referring to personally relevant experiences. Compared to changes in material possessions or one's life circumstances, activities are per se more transient and varied and thus less prone to adaptation (Lyubomirsky et al., 2005). Moreover, engaging in specific activities such as practicing gratitude or savoring life's joys can counterbalance hedonic adaptation (Sheldon & Lyubomirsky, 2006). Another promising way to achieve enduring changes in wellbeing is to establish habits around wellbeing-boosting activities (Lyubomirsky et al., 2005). Research has further identified specific person characteristics (e.g., motivation, self-efficacy beliefs) and activity characteristics (e.g., dosage, variety) moderating the success of positive activities in terms of wellbeing enhancements (Lyubomirsky et al., 2005; Lyubomirsky & Layous, 2013). Even though theory and research suggest the importance of activities for sustainable wellbeing, few empirical studies have been devoted so far to the question if and how products support wellbeing-increasing activities beyond (the obvious) affordances, e.g., a ball is for kicking and throwing (*gap 2*). One explicit aim of the current work is therefore to derive a clearer understanding of the contribution of product-mediated activities to long-term wellbeing (*goal 2*).

Previous empirical studies (Hassenzahl et al., 2010; Mekler & Hornbæk, 2016; Müller et al., 2015; Partala & Kallinen, 2012; Tuch et al., 2013) used online accounts of qualitative, personal narratives to investigate positive and meaningful experiences mediated by products. However, these studies rarely analyzed the content of the qualitative narratives themselves in greater detail or reported difficulties in doing so due to the heterogeneous nature of user-generated narratives gathered in online studies (Hassenzahl et al., 2010). Consequently, major empirical insights derived from this line of research were primarily based on correlation analysis using quantitative ratings of product-mediated experiences rather than on a qualitative analysis of the personal narratives (Tuch et al., 2013). Hence, several HCI researchers call for more systematic qualitative analysis techniques to further investigate the essence of positive and meaningful product experiences (Hassenzahl et al., 2010; Müller et al., 2015; Partala & Kallinen, 2012; Tuch et al., 2013).

2.3 Methods & materials

To investigate (causal) relations between product experience qualities, wellbeing determinants and wellbeing outcomes more systematically, we conducted one-on-one, in-depth laddering interviews following the guidelines by Reynolds & Gutman (1988). Participants were probed about personal items and a meditation app. Interview data were analyzed based on means-end analysis (Gutman, 1982; Reynolds & Gutman, 1988). In order to help participants reflect on their wellbeing and products' potential contribution, a sensitizing booklet containing daily assignments was sent to participants prior to the interviews.

2.3.1 Participants

Due to the complexity of laddering interviews and the associated qualitative data analysis, we started with a small participant sample. 14 participants were recruited from the internal database of a German market research company. Two participants were excluded because they did not return the sensitizing booklet in time or did not show up at the interview. The data of the remaining 12 participants (median age: 31 years; range: 18-36 years; 8 female; higher education) was analyzed. Participants were video-recorded during the interviews. Written informed consent was obtained prior to the study and participants were compensated for their efforts (230 Euros).

2.3.2 Materials

The relationship between product experience qualities, wellbeing determinants, and wellbeing outcomes was examined using two types of products: a) *personal items* that participants selected based on a sensitizing booklet, and b) a *wellbeing product* used by all participants (meditation app). Personal items were expected to inform about product categories subjectively associated with wellbeing and to facilitate participants' reflection about linkages between product experience qualities and wellbeing outcomes. The meditation app was chosen to assure that the sample included at least one product used by every participant to support pattern extraction from the laddering interviews.

PERSONAL ITEMS (SELF-SELECTED)

Participants were asked to bring three products to the interview that they believed contribute to their wellbeing. They were further instructed to think of products as any kind of object, tool, service, or interactive experience that is created or designed by a human being (not a rock or other natural object, but websites and apps count). This instruction was used in a conference workshop (Pohlmeyer & Desmet, 2016) before and found to generate a diverse range of products. In order to assist participants in reflecting on their wellbeing and

select appropriate products, a sensitizing booklet was sent to participants via mail one week prior to the interviews (see Sanders & Stappers, 2012), containing 5-10 minutes long assignments (e.g., "*Describe your recipe for a happy life*", "*What was the nicest gift you ever received for your birthday?*", "*What products would you bring along if you were going to spend a long period of time on a faraway island?*") over the course of seven days (presented in German). At the end of the sensitizing period, participants were instructed to select three personal products that they believe contribute to their wellbeing and bring these items to the interviews.

WELLBEING PRODUCT (ASSIGNED)

In order to extract patterns across participants based on just a small sample, we further integrated one product all participants were familiar with. The meditation app *Headspace* (headspace.com) was chosen since it has been linked to improved wellbeing measures in smartphone-based mindfulness intervention studies (Bennike et al., 2017; Economides et al., 2018). All participants were regular users of the app (i.e., have used the app for at least six months; mean: 12.15; SD: 7.45 months). Ten participants reported to also use other mental health or wellbeing apps (e.g., yoga, running, nutrition) regularly.

2.3.3 Procedure

In order to link product experience qualities to wellbeing determinants and wellbeing outcomes, laddering interviews were conducted. Laddering is based on the assumption that consumers choose a product because they suspect specific attributes ('means') lead to beneficial consequences with regard to their personal values ('ends') (Gutman, 1982). Laddering combines specific interviewing techniques with a data analysis format to extract *means-end chains* (MEC) or *ladders* from the interview data (Reynolds & Gutman, 1988). MECs represent hierarchical sequences of product attributes (A), perceived consequences (C), and underlying personal values and goals (V), which increase in their abstractness from tangible product features to more general intrapersonal concepts such as motivational consequences and overarching personal values (Figure 2.2). The laddering interviews (90 minutes) were conducted at a user research facility in Berlin (Germany) and based on a semi-structured interview guide. To minimize order and familiarization effects, participants were first interviewed either about (a) their personal items or (b) the meditation app (randomly assigned). In order to extract MECs, the interviews started with eliciting key product *attributes*, i.e. concrete and/or experienced product qualities by asking participants (a) what is special about the product, (b) what they like about the product, and (c) which features they would not want to miss about the product. Since products' contribution to wellbeing was not expected to be easily accessi-

ble by participants, we encouraged them to further think about typical positive experiences associated with the product. This usually resulted in nominating motivational and behavioral *consequences* of product usage and facilitated generating insights about product-mediated activities. The link to personal *values* was derived by asking participants what these positive experiences meant to them.

2.3.4 Data analysis

Video recordings from the interviews were transcribed and analyzed following a four steps approach: (a) content analysis to generate an empirically derived category system, (b) extraction of MECs by linking attributes, consequences and values from individually reported experiences, (c) aggregation of individual MECs into an Implication Matrix (IM) to extract prominent MECs across participants, and (d) visualization of the most prominent MECs as Hierarchical Value Map (HVM).

CONTENT ANALYSIS

Interviews were transcribed and analyzed using qualitative open and axial coding (Corbin & Strauss, 1990). During content analysis, a category system was generated based on participant responses that reflect recurrent key elements related to attributes (A), consequences (C), and values (V) and iteratively refined. Overall, 40 key elements were identified (Figure 2.1). When possible, categorization and terminology were derived from existing theoretical frameworks in (positive) psychology and wellbeing design to incorporate prevalent knowledge in these respective fields (see Discussion). The aim was to establish a category structure that is neither too narrow (i.e., does not allow abstraction from individual responses) nor too broad (i.e., discards meaningful categories). The resulting category system is based on empirical input from the interviews (bottom-up) and theoretical considerations stemming from established frameworks (top-down); see Figure 2.1 and Discussion.

The generated categories were additionally clustered into different hierarchical levels following the A-C-V sequence proposed by Means-End Theory (Gutman, 1982; Reynolds & Gutman, 1988). We further derived more than the three basic levels (i.e., attributes, consequences, and values) as advised for the application of Means-End Theory in HCI contexts (Vanden Abeele & Zaman, 2009) (see Figure 2.2). More specifically, we differentiated the Attributes (A) level into concrete attributes (CA) and more abstract, experienced product qualities (EQ) to be able to extract patterns across product categories (via EQ) while keeping tangible information (via CA) to help designers deduce actionable insights for product design. Experience qualities indicate how a product (and its attributes) is perceived by an individual (Hassenzahl, 2003). The Consequences level

Experience Qualities

1. Context-Sensitivity
2. Ease of Use
3. Identification
4. Joy of Use
5. Moral Value
6. Optimal Challenge
7. Personal Relevance
8. Protection
9. Symbolic Value

Motivations

10. Autonomy
11. Broaden Attention
12. Competence
13. Concentration
14. External Pushes
15. Rewards

Activities

16. Contributing to the Greater Good
17. Managing Stress, Hardship, Trauma
18. Committing to One's Goals
19. Taking Care of Body & Mind
20. Investing in Social Connection
21. Learning
22. Living in the Present

Intrapersonal Orientations

23. Affiliation
24. Benevolence/Universalism
25. Hedonism
26. Power
27. Relaxation
28. Security, Health
29. Self-Actualization
30. Self-Direction
31. Self-Esteem
32. Stimulation

Wellbeing Outcomes

33. Comfort
34. Engagement
35. Mastery
36. Meaning
37. Personal Growth
38. Positive Emotions
39. Positive Relationships
40. Virtue

Figure 2.1: Key elements resulting from content analysis.

was distinguished into immediate motivational consequences (MO) of product usage and product-mediated activities (AV) promoted by these motivations. We added product-mediated activities as separate level because specific types of activities were hypothesized to play a crucial role in mediating durable wellbeing outcomes supported by products (goal 2, see above). Referring to the wellbeing literature (see Huta, 2017 for a conceptual overview), the Values level was further differentiated into intrapersonal orientations (IO) and wellbeing outcomes (WB). Intrapersonal orientations reflect psychological variables within the individual that ultimately drive their behavior (i.e., universal needs, personal goals, personal values). Wellbeing outcomes comprise (subjective) experiences and aspects of psychological functioning, i.e. how well a person is doing in life. For each product experience, we further captured whether reported increases in wellbeing were momentary (short-term) or persisted over longer periods of time (long-term).

MEANS-END CHAINS

Based on the generated category system (Figure 2.1) and the category structure outlined above (see also Figure 2.2), MECs were composed for each participant individually by scanning transcripts for coherent experiential episodes containing one or multiple MECs: 115 individual product experiences were analyzed overall; 51 of them were linked to personal items and 64 of them to the meditation app. The basic structure of MECs (left, middle), as well as an example MEC from an individual product experience can be found in Figure 2.2 (right).

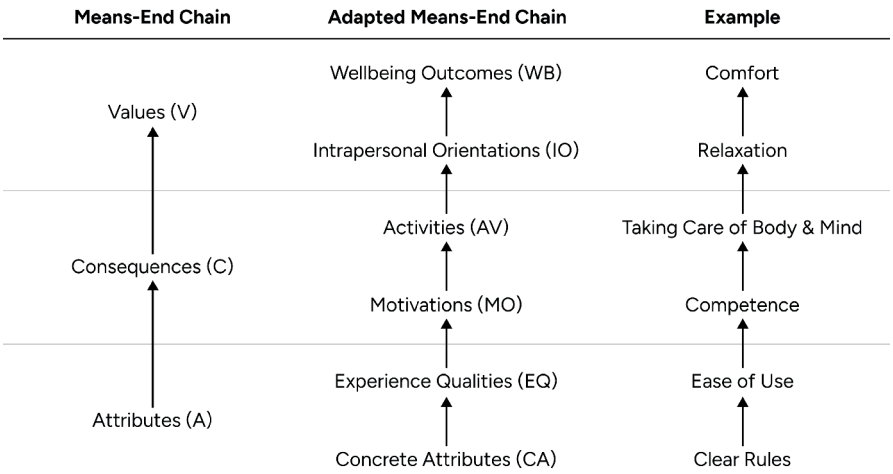


Figure 2.2: Means-End Chain, MEC (left), adapated MEC in the current study (middle), and example MEC (right).

IMPLICATION MATRIX

Individual MECs were then aggregated across participants into an Implication Matrix (IM). This matrix reflects the number of direct and indirect links between two corresponding elements within the combined MECs. Due to the large number of categories, this step was performed using a self-programmed analysis software based on Reynolds and Gutman (1988). Separate Implication Matrices were derived for (a) all products, (b) meditation app only, and (c) personal items only. Within the scope of this paper, we focus on the overall product sample only. Aggregating data into the IM marks the transition from a qualitative (i.e., category-based) to a quantitative, pattern generating analysis technique.

HIERARCHICAL VALUE MAP (HVM)

In a final step, the most dominant linkages were visualized in the form of a Hierarchical Value Map (HVM), which provides a graphical representation of prominent links between attribute, consequence, and value categories. To create this map, only those relations that occurred at least a minimum number of times (cutoff-level) are included. For the current study, a cutoff-level of three links delivered the most conclusive results with an appropriate level of granularity (i.e., neither too broad nor too narrow).

2.4 Results

The primary objective of this study was to empirically explore theory-based determinants for sustained wellbeing from human-product-relationships (*goal 1*) and to investigate the role of product-mediated activities (*goal 2*) in this context.

GOAL 1: DETERMINANTS OF SUSTAINED WELLBEING

Participants were each probed about three personal products; the product sample included 36 different products: 7 wellness products (e.g., shower gel), 7 digital services (e.g., social networks), 5 gifts (e.g., necklace), 5 household items (e.g., coffee machine), 4 sport items (e.g., running shoes), 2 tech gadgets (e.g., headphones), 2 lifestyle items (e.g., Waterman pen), 2 portable devices (e.g., smartphone), and 2 other items (organizer, book).

Outcomes (i.e., values) related to short-term and sustained aspects of wellbeing, *determinants* (i.e., consequences) enabling these outcomes, and *product qualities* (i.e., attributes) shaping these determinants were identified based on means-end analysis, that is: statements derived from product experiences were classified as attributes (concrete attributes and experienced qualities), consequences (activities and motivations), and outcomes (intrapersonal orientations and wellbeing outcomes) via content analysis and linked to determinants-outcomes pathways via means-end chains, and visualized in a HVM (Figure 2.3). As described above, connections between individual items within this map are depicted via links, with the line thickness representing the strength of the connection between two variables. Outcome items are further distinguished with regard to short-term (*white*) and long-term (*gray*) impact. Wellbeing outcomes, supporting activities and motivations, as well as product experience qualities that foster them are described in the following paragraphs. We further refer to ways in which concrete product attributes shape product experience qualities. Variables are defined in Figure 2.3 and are marked in italics in the following. Elements below the cutoff-level, i.e., mentioned less than three times, are shown with dotted outlines in the HVM. To indicate pathways including these elements, corresponding links are shown as dotted lines. All other links below the cutoff-level are not shown in Figure 2.3.

VALUES: HEDONIC AND EUDAIMONIC

Means-end analysis revealed that both hedonic and eudaimonic aspects of wellbeing manifest in self-reported product experiences: Of 115 product experiences, 77 (67%) were related to hedonic and 38 (33%) to eudaimonic outcomes. Hedonic outcomes were associated with *feelings of comfort* (56 statements; 49%), *positive emotions* (17 statements; 15%), and experiences of *engagement* (4 statements; 3%). Eudaimonic outcomes were associated with aspects of psychological functioning, i.e., a sense of *meaning* (12 statements; 10%), *personal growth* (11 statements; 10%), *mastery* (9 statements; 8%), strong *personal relationships* (4 statements; 3%), and *virtuous behavior* (2 statements; 2%). Eudaimonic outcomes were linked to intrapersonal orientations towards *self-actualization* (23 statements; 20%), *self-direction* (9 statements, 8%), *affiliation* (4 statements, 3%), and *benevolence/universalism* (2 statements, 2%).

Hedonic outcomes were associated with orientations towards *relaxation* (51 statements, 44%), *stimulation* (8 statements, 7%), *hedonism* (6 statements, 5%), *security/health* (5 statements, 4%), and *power* (4 statements, 3%).

CONSEQUENCES: ACTIVITIES AND MOTIVATIONS

Consequences mediate the relationship between wellbeing outcomes and experience qualities that are malleable through design, and can be subdivided in activities and motivations. Activities and motivations identified via content analysis are summarized below and their hierarchical relationship to low-level product experience qualities and high-level outcomes derived from means-end analysis is shown in Figure 2.3.

ACTIVITIES

The *Activities* level comprises groups of activities empirically found to be supported by products and services. The following section describes these activities and highlights links to (a) determining factors, i.e., motivations and to (b) outcomes, i.e. intrapersonal orientations and wellbeing aspects.

Taking Care of Body and Mind. Establishing healthy habits, routines and rituals such as exercising regularly, keeping a nutritious diet, cultivating self-care (e.g., beauty rituals), and meditating was related to sustained wellbeing outcomes, such as *comfort*, and intrapersonal orientations towards *relaxation* and *security/health* (46 statements). Four pathways were particularly relevant with regard to habit-supportive design: (1) offering an opportunity for individuals to flexibly (*autonomy*) integrate the activity into their daily lives (*context-sensitivity*), (2) allowing products to facilitate continuous engagement in the activity (*ease of use*) and offer *optimal challenges* in line with people's current level of expertise (*competence*), (3) designing products that assign *rewards* in form of pleasurable (*joy of use*) and safe (*protection*) interactions as well as external *feedback*, and (4) fostering focused attention (*concentration*) on the activity.

Example: *"I decided to use the [meditation] app because it is quite practical as it allows me to [meditate] when I really need it (...) and I can use it here and there (...) when I am feeling acutely overwhelmed."* (participant #3)

Committing to One's Goals. About one out of seven activities (17 statements) linked to sustained wellbeing were concerned with goal setting (e.g. identifying areas of personal development) and goal execution (e.g. taking concrete next steps to advance one's professional career). Well-documented in the literature (Sheldon & Elliot, 1999), pursuing personal goals provides individuals with a general sense of purpose and meaning, helps them orient their daily lives towards these goals and ultimately fosters personal development. Goal-oriented activities were linked to wellbeing outcomes such as *self-actualization* (i.e.,

related to personal goals like expressing creativity, building self-confidence) and *self-direction* (i.e., self-directed exploration of new opportunities like taking steps to advance a professional career), which resulted in elevated feelings of *meaning* and *mastery*. In order to support the pursuit of personal goals, means-end analysis showed that products need to (1) provide *feedback* on goal progress (*rewards* → *competence*), (2) reduce distractions (*concentration*) and (3) provide activities in line with individuals' goals (*autonomy*) by offering relevant content (*personal relevance*).

Example: *"Every app [on my phone] is relevant to me. I have deleted all the pre-installed apps. [They are just] a distraction (...) and our time is too precious to spend it on useless things. I have been trying for months to focus only on things that are good for me and that help me make progress in my life."* (participant #1)

Managing Stress, Hardship, Trauma. Another group of activities comprised establishing effective coping strategies (e.g., practice mindfulness, seek social support) to be able to deal with emotionally stressful situations such as mental health problems or adapting to new life circumstances (11 statements). Implementing and applying these strategies regularly resulted in more enduring feelings of *comfort* and inner peace. Products supported coping activities by (1) encouraging (*rewards*) individuals through eliciting positive emotions (*joy of use*, e.g., playful Headspace characters), by providing *feedback* on previous accomplishments (e.g., reflecting the total amount of time spent meditating), and by directly reducing tension and negative emotions (*protection*, e.g., headphones preventing sensory overstimulation). These rewards functioned as positive reinforcement and fostered feelings of *competence*. Individuals' perceived level of competence (2) was also promoted by making product interactions easy and efficient (*ease of use*, e.g. through clear instructions) and by suggesting *optimal challenges*, e.g. short duration of meditation sessions.

Example: *"When I am feeling acutely tense, I also use the [short] SOS meditation sessions. It helps me to distance myself from the immediate, stressful situation."* (participant #5)

Learning. An enduring sense of *personal growth* was promoted by activities related to *learning* (e.g., tracking one's activity level and energy consumption), *skill building* (e.g., specific meditation techniques), and *adopting new perspectives* (e.g., when ruminating over a relationship problem). The most significant way products supported learning activities was by (1) making individuals feel *competent* through easy-to-use interfaces (*ease of use*) and by enabling them to adapt the difficulty of the activity (*optimal challenge*). In addition, products supported individuals in (2) focusing on the learning activity (*concentration*) by providing relevant content (*personal relevance*).

Example: *"I started meditating for only five minutes using the 'Basics' module because meditating can be daunting at the beginning. At some point, I increased the duration to 10 minutes depending on how competent I felt. When I took a meditation class [in the past], they started with 25 minutes sessions right away which was overwhelming for me."* (participant #2)

Living in the Present. Products also supported individuals to live in the present by savoring positive and meaningful experiences (3 statements) through intensifying (e.g., adding sensory pleasures such as candles or chocolate), prolonging (e.g., functioning as a tangible symbol of a personally meaningful goal), or anticipating (e.g., pleasant voice of the meditation teacher facilitating relaxation) these experiences (see also Pohlmeyer, 2014) which functioned as *rewards*. Savoring was linked to both hedonic and eudaimonic wellbeing outcomes, i.e., *positive emotions*, feelings of *comfort*, and a sense of *personal growth*.

Example: *"I put a lot of effort into making myself comfortable in my new apartment. Now I am able to relax on my couch and I regularly perform a little ceremony. I light lots of candles which gives me the feeling that I finally have a home."* (participant #7)

Contributing to the Greater Good. Virtuous behavior (*virtue*) concerned with the welfare of others such as sustainable and ethical consumption was linked to durable wellbeing (2 statements). This group of activities was associated with products that resonate with a person's *moral values*, e.g., are manufactured following decent labor standards. Acting in accordance with one's personal values promotes feelings of *autonomy* and increases intrinsic motivation to engage in the activity.

Example: *"It's important to me that [the thermos] is made from BPA free plastic (…) and that I can always bring the thermos with me (…) and reuse it. That way I am not contributing to a throwaway society."* (participant #10)

Investing in Social Connection. Lastly, products supported individuals in strengthening social relationships with others (1 statement) by providing opportunities for social affirmation (*rewards*).

Example: *"I upload my own photos to a photography interest group on Facebook (…). This way I am sharing my happiness with others (…) and it makes me happy to see that others enjoyed my photos."* (participant #4)

As the research focus is primarily on wellbeing-enhancing activities, only those motivations included in prominent MECs (cutoff value: N=3) are described in more detail below, i.e., competence, rewards, autonomy, and concentration; all empirically derived motivations are listed in Figure 2.3 (with a short description).

MOTIVATIONS

Motivations describe psychological effects of product usage including support of wellbeing-enhancing activities. Product experience qualities shaping these motivations are described below and depicted in Figure 2.3. Links to supported types of activities are visualized in Figure 2.3.

Competence. The most common way for a product to support wellbeing activities (30 statements) was to make individuals feel capable and effective when performing an activity. Products supporting competence motivations (1) offer *optimal challenges,* (2) are *easy to use,* and (3) encourage participants to keep performing an activity through *rewards* (e.g., feedback on goal progress).

Rewards. Products also fostered wellbeing-related activities via external rewards (28 statements) and increased the likelihood that desired behaviors occur again in the future. Experience qualities linked to reward motivation include (1) *joy of use* (i.e., positive emotions generated through direct interaction with the product), (2) *protection* (i.e., reduced negative emotions), and (3) *feedback* (e.g., "likes" on social networks).

Autonomy. Another way products supported activities was by enabling people to act independently (26 statements) and in accordance with deeply-held personal goals and values. Experience qualities that support autonomy motivations include (1) *context-sensitivity* (i.e., allowing adaptation of the activity to fit into a person's daily life) and (2) *personal relevance* (i.e., choosing activities matching one's personal goals and values, offering relevant content and functionalities).

Concentration. In addition, products supported individuals to focus on the activity (11 statements) by reducing distractions and maintaining states of flow through providing *personally-relevant* content (i.e., in accordance with personal values and goals).

EXPERIENCE QUALITIES

Experience qualities that were mentioned at least three times (cutoff-level) are described in more detail below. We further illustrate various ways in which concrete product attributes may support these experience qualities. That relationship, however, has been subject to many studies on product experience and is beyond the scope of this study. All mentioned experienced and concrete product attributes are shown in Figure 2.3.

Personal Relevance. One major contribution of products (19 statements) to wellbeing was to enable individuals to choose activities that match their personal goals and interests. Concrete product attributes that were found to support personally-relevant activities include (1) a *variety* of functions (e.g., diverse med-

itation packages, multiple settings), (2) relevant *content*, and (3) opportunities for *customization* (e.g., deciding which apps to install on one's phone).

Ease of Use. Products further facilitated activities by making the product interaction easier and more efficient (16 statements). Ways to do so were by (1) providing *structure* (e.g., modular meditation packages), (2) using clear *content* (e.g., metaphors, instructions), and (3) defining *clear rules* (e.g., step-by-step introduction, takeaway messages).

Joy of Use. Products also fostered sustained wellbeing through *joy of use* including sensual delight, intellectual stimulation, and aesthetic pleasure (15 statements). Concrete product attributes increasing joy of use include (1) *sensory qualities* (e.g., smell, texture), (2) instilling a sense of *social connectedness* (e.g., friendly cartoon characters in Headspace), (3) *typicality* (e.g., familiar voice of the meditation teacher), (4) *novelty* (e.g., surprising interactions, new editions), and (5) offering a broad *variety* of contents and functions.

Context-Sensitivity. In order for individuals to integrate activities into their daily lives and engage in them regularly, products need to be adaptive to people's lifestyle (15 statements) by (1) offering flexible time-settings (*dosage*) and (2) allowing them to perform the activity when needed, such as portable items or digital services available as app (*ubiquity*).

Optimal Challenge. Products further supported wellbeing by enabling people to choose activities that match their current level of expertise thereby supporting states of flow and continued engagement in the activity (8 statements). One way for products to do so is by (1) offering helpful communication and an appropriate level of guidance (*content*; e.g., metaphors) and by (2) allowing individuals to adjust frequency and duration of the activity (*dosage)* according to their skill level.

Protection. Products further encouraged individuals to engage in wellbeing-increasing activities by reducing negative emotions and dispelling concerns (5 statements), e.g., ecological materials, noise-canceling headphones.

GOAL 2: ACTIVITIES AS PATHWAY TO SUSTAINED WELLBEING

The second goal of this research was to visualize pathways that link product experience qualities to wellbeing determinants and wellbeing outcomes, and to understand which role activities play along these pathways. 24 product experiences (21%) were focused on direct product interactions and 19 of these experiences were limited to short-term increases of hedonic wellbeing (17%), i.e., positive emotions, engagement (see Figure 2.3). An astonishingly large number of 96 self-reported product experiences (83%), however, were associated with lasting increases in wellbeing, and 91 of these experiences (79%) were linked

to activities that extended beyond the mere product interaction. Most importantly, these activities were offered (e.g., various themes), initiated (e.g., through reminders), and/or maintained (e.g., through rewards, optimal challenges) by elements of design. The favorable long-term impact of these activities was related to performing them regularly (e.g., habits, hobbies), their association with longer-term, meaningful pursuits (e.g., working towards personal goals, learning a new skill, shaping one's personality), and/or resulting persistent changes of one's character (e.g., self-development). A considerable number (30%, N=34) of activity-based, lasting increases in wellbeing mediated by products were eudaimonic in nature, i.e., related to wellbeing outcomes such as personal growth, meaning, and mastery. Note that, in our sample, the majority of activities (47%, N=54) contributing to enduring wellbeing were associated with *daily habits* (esp. regular meditation practice) leading to an increased sense of inner peace and serenity (*comfort*). A small number of long-term wellbeing outcomes were not linked to activities (3%, N=4) but rather to symbolic representations of connectedness and personal growth conveyed by souvenirs and gifts (see also Casais et al., 2016).

2.5 Discussion

The goal of this research was to take first steps towards a library of empirically validated determinants of sustained wellbeing in human-product-relationships (*goal 1*). We also explored the specific contribution of product-mediated activities by inspecting (causal) pathways from experience qualities to wellbeing outcomes derived from means-end analysis (*goal 2*).

GOAL 1: DETERMINANTS OF SUSTAINED WELLBEING

Supporting theoretical claims in wellbeing design (Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013; Hassenzahl et al., 2013; Peters et al., 2018; Riva et al., 2012), the current study provides empirical evidence that products are capable of shaping a diverse range of sustained wellbeing outcomes beyond temporary pleasures. Long-term outcomes comprised both hedonic and eudaimonic aspects, e.g., positive emotions, personal growth, and meaning. Derived from a bottom-up-top-down-approach, determinants delineated in this paper stem from a theoretical and empirical basis. The current work thereby refines purely theory-driven recommendations (e.g., Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013) how to design for sustained wellbeing. It further adds two layers of determinants not explicitly considered in previous theoretical work, i.e., experience qualities and activities. In our view, these determinants provide a particularly promising starting-point for wellbeing design as they are comparatively tangible and thus effectively malleable through design. In contrast, wellbeing design frameworks focus primarily on rather abstract motivational determinants, e.g., psychological

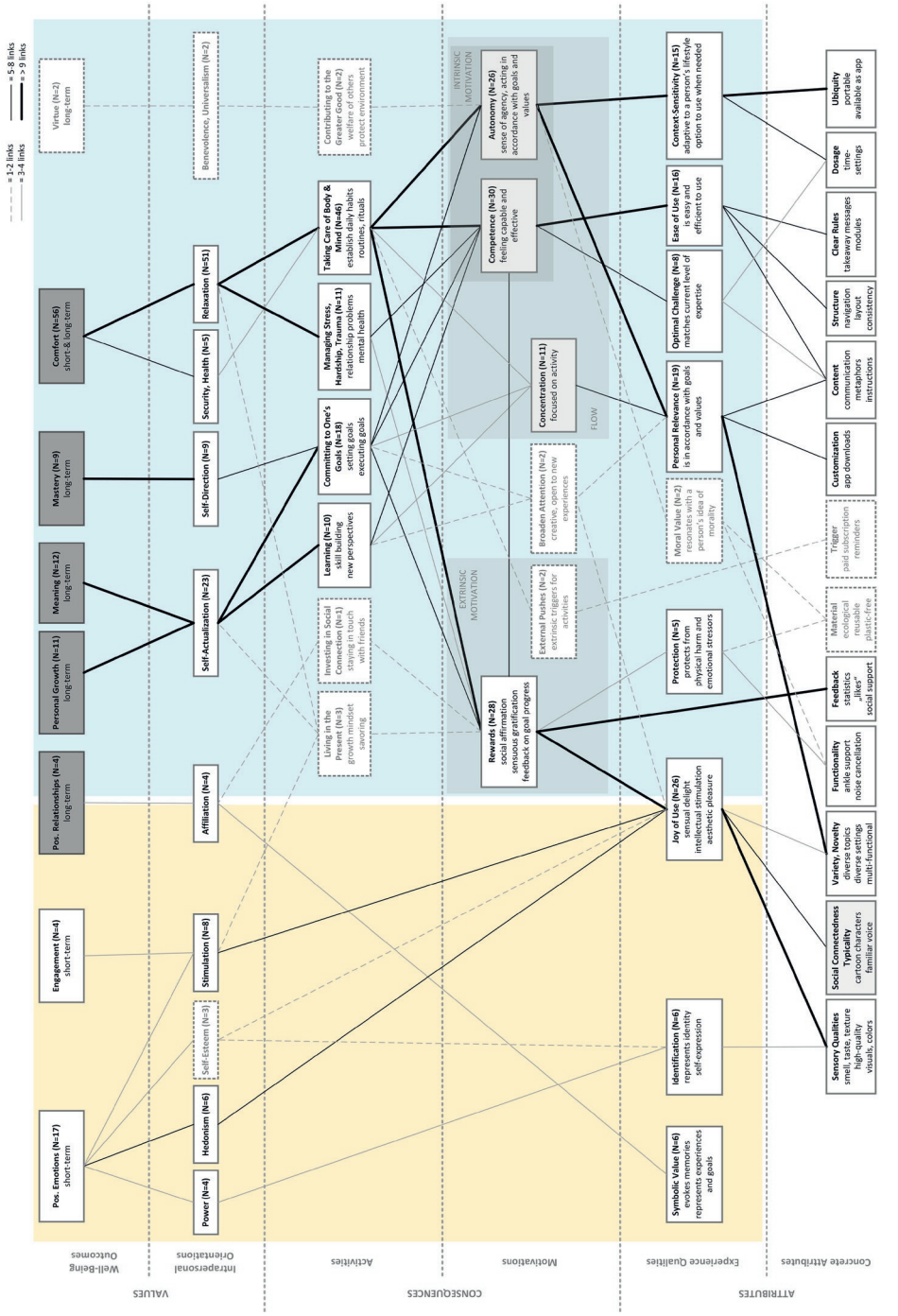


Figure 2.3: Hierarchical Value Map (HVM) depicting Attributes (A), Consequences (C), and Values (V). The graphic visualizes products' direct (left, yellow) and indirect contributions (right, blue) to wellbeing mediated via activities. Products supported short-term (white) and long-term (gray) wellbeing outcomes.

needs (Hassenzahl et al., 2013; Peters et al., 2018), personal goals (Desmet & Pohlmeyer, 2013), or rewards (Calvo & Peters, 2014). This being said, following (causal) pathways from experience qualities to motivations, the current study also shows how abstract determinants may be linked to specific realizations of product attributes.

The reported findings are in line with previous research in psychology and wellbeing design: The detected list of *Activities* coincides with taxonomies of Positive Psychology Interventions (PPIs) (Fordyce, 1977; Lyubomirsky, 2007) which have empirically been linked to lasting increases in wellbeing (e.g., Sheldon & Lyubomirsky, 2006). The broadest overlaps were identified with Lyubomirsky's classification of PPIs (Lyubomirsky, 2007), i.e., '*taking care of body and mind*', '*committing to one's goals*', '*managing stress, trauma, hardship*', '*living in the present*', and *'investing in social connection'* (see Figure 2.3). We discovered two additional types of product-mediated activities, i.e., '*learning*' and '*contributing to the greater good*' linked to long-term wellbeing outcomes. Virtuous activity, i.e. contributing to the greater good has also been linked to lasting increases in wellbeing in positive psychology before (Peterson & Seligman, 2004; Seligman, 2011). Previous research found similar types of activities to be associated with hedonic and eudaimonic wellbeing outcomes (Hassenzahl et al., 2013; Mekler & Hornbæk, 2016) in human-product-relationships. However, the current study illustrates specific ways how to shape these distinct activity types through design.

Motivations that were empirically derived in the current work overlap with four prevalent motivation theories: (a) intrinsic motivation (Ryan & Deci, 2000a), (b) extrinsic motivation (Deci & Ryan, 1985), (c) flow (Csikszentmihalyi, 1990), and (d) Broaden-and-Build-Theory (Fredrickson, 2001). These theoretical overlaps are indicated in Figure 2.3. Consistent with Self-Determination Theory (Ryan & Deci, 2000b, 2017) and theoretical claims in wellbeing design (Hassenzahl et al., 2013; Peters et al., 2018), products fostered intrinsic motivation by supporting wellbeing-enhancing activities in a way that satisfies basic psychological needs for *autonomy*, *competence*, and relatedness (herein referred to as *affiliation*) (Sheldon et al., 2001). Relatedness was further linked to symbolic product interactions, e.g., gifts reflecting meaningful personal relationships (see also Casais et al., 2016). In line with Organismic Integration Theory (Deci & Ryan, 1985), specific types of extrinsic rewards such as feedback on goal progress and social support further promoted intrinsic motivation by increasing feelings of competence. Our findings suggest that extrinsic rewards allocated by products are particularly effective when individuals lack initial skills or deliberation (*committing to one's goals*), are confronted with challenging life situations (*managing stress, hardship, trauma*), or face difficulties integrating an activity into their daily routines and habits (*taking care of body and mind*). Besides

intrinsic motivation, products shaped further characteristics of flow experiences (Csikszentmihalyi, 1990), such as deep *concentration* on the task, *clear rules*, and immediate *feedback*. Lastly, in line with Fredrickson's (2001) Broaden-and-Build-Theory, pleasure-evoking design stimulated motivation in beneficial ways by expanding users' thought-action-repertoires.

Besides well-known constituents of hedonic and pragmatic qualities (Hassenzahl, 2003), i.e., *joy of use*, *identification*, *symbolic value*, and *ease of use*, the list of product experience qualities includes additional variables proven to increase the efficiency of PPIs (Lyubomirsky & Layous, 2013) and characteristics of flow experiences (Csikszentmihalyi, 1990). This indicates that existing user experience frameworks (e.g., Hassenzahl, 2003) and measurement tools (e.g., Hassenzahl et al., 2003) might need to be extended to incorporate all relevant categories of experienced product qualities promoting sustained well-being. Consistent with previous empirical research (Mekler & Hornbæk, 2016) and theoretical claims (Pohlmeyer, 2017), our data support the involvement of pleasure-evoking design in mediating long-term hedonic and eudaimonic wellbeing outcomes. Previous studies did not find substantial correlations between pragmatic qualities and hedonic and eudaimonic wellbeing outcomes (Hassenzahl et al., 2010; Mekler & Hornbæk, 2016; Müller et al., 2015). In contrast, wellbeing-increasing activities were substantially facilitated by pragmatic product qualities in our study. The laddering approach taken in the current study might have been particularly well-suited to capture this facilitation effect as it differentiates multiple levels of product impact and explored self-reported product experiences in more detail.

GOAL 2: ACTIVITIES AS PATHWAY TO SUSTAINED WELLBEING

As outlined above, participants' self-reported product experiences were linked to short-term (19 statements, 17%) and long-term (96 statements, 83%) wellbeing outcomes. Most intriguingly, sustained wellbeing was to a large extent mediated via activities (91 statements, 79%). Considering the strong empirical evidence linking activities and sustained wellbeing in previous research (e.g., Sheldon & Lyubomirsky, 2006) and findings from the current study, we propose to regard activities as the most essential determinant in design for sustained wellbeing and to focus design efforts on activities accordingly. In our view, the taxonomy of activities discussed in this paper provides a good starting point. This collection may function as an inspiration to design for the "right" activities, i.e., those most robustly linked to lasting increases in wellbeing. In order to prevent detrimental effects on individual or societal wellbeing, this list could further be complemented with activities empirically shown to detract from wellbeing, e.g., unfavorable social comparisons (Lyubomirsky, 2007).

IMPLICATIONS FOR POSITIVE DESIGN

The current study provides straightforward guidance for practioners to design for lasting increases in wellbeing. Besides streamlining the list of theoretically derived determinants, we visualized (causal) pathways from experienced product qualities to wellbeing determinants and wellbeing outcomes in a HVM. Design for long-term impact may tackle any component along these pathways. Low-level elements linked to a dedicated component constitute opportunities to shape this component through design. The strength of association between connected elements further indicates the most promising starting points for design efforts. As outlined above, we particularly like to encourage practitioners to start the design process with thinking about product-mediated activities first. Ingredients on the *Motivations* and the *Experience Qualities* level can then be derived from the HVM. For example, if a product aims to support individuals in establishing effective coping strategies (i.e., *managing stress, hardship, trauma*), designers may preferably focus on addressing users' perceived level of competence by keeping the product interaction as simple as possible (*ease of use*) and by providing *optimal challenges* matching the person's current skills. Extrinsic rewards such as social affirmation may further increase feelings of competence. Other types of rewards, e.g. sensuous gratification represent promising levers as well but due to their weaker association with coping activities (indicated by line strength of the direct link between *rewards* and *managing stress, hardship, trauma* in Figure 2.3) may be targeted with a lower priority. Another example deductible from the HVM is that products should not interfere with individuals' intrinsic drive to perform wellbeing-enhancing activities but rather promote feelings of *autonomy* and *competence*. Effective ways to address these needs by means of design are focusing on pragmatic product qualities, (esp. *ease of use*, *context-sensitivity*) and to synchronize the product with users' personal goals and values (*personal relevance*).

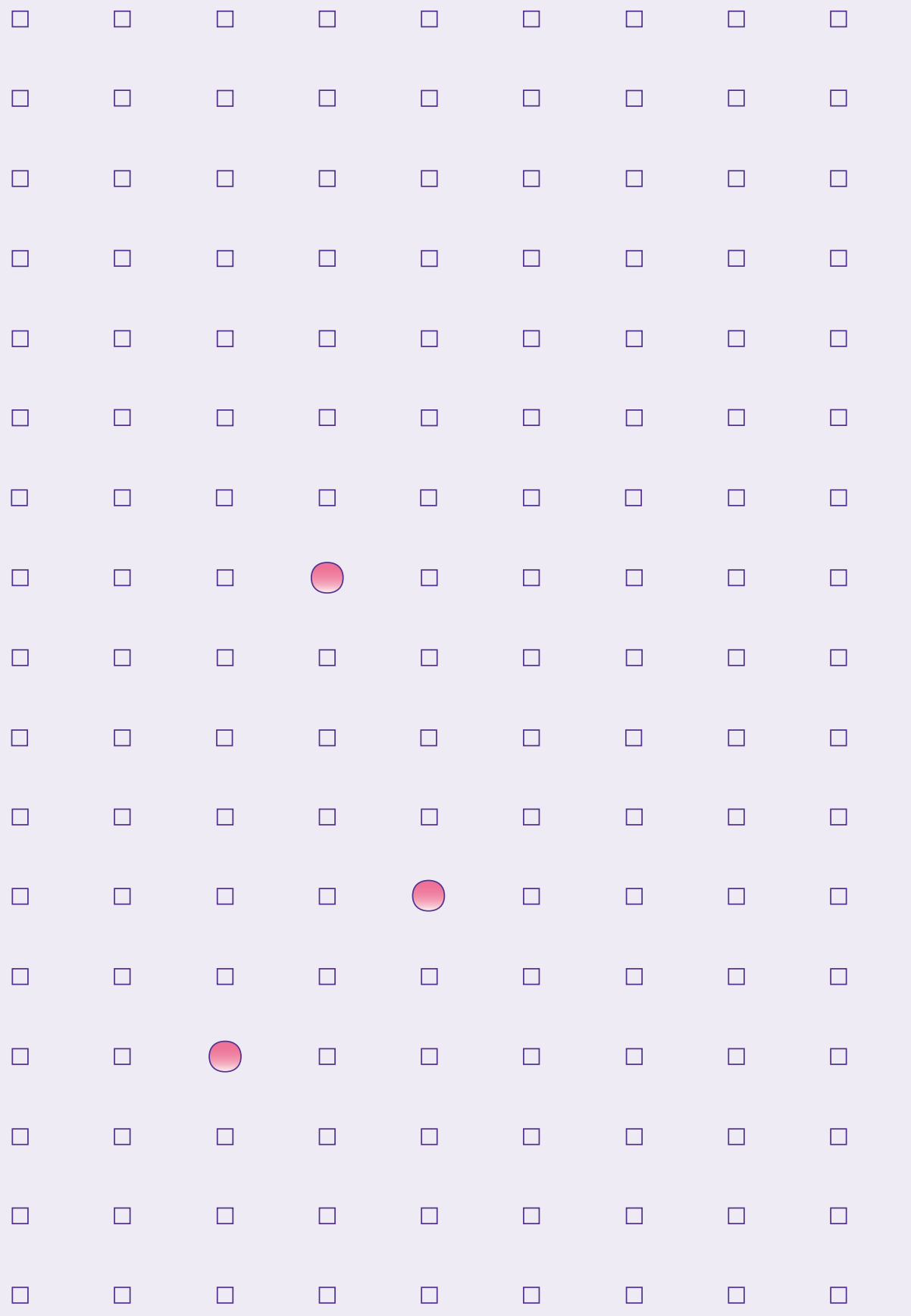
2.6 Limitations & further work

A major limiting factor of the current work is the small product and participant sample the study is based on. The deduced HVM might further overemphasize pathways related to meditation apps. Selection bias is another potential concern as participants were selected based on their previous usage of a specific meditation app. This selection might be associated with specific socio-demographic characteristics and motivational orientations within the tested sample, e.g., towards relaxation and self-actualization. Therefore, the current findings must be interpreted with caution and future research is needed to extrapolate results to a broader range of product categories and participants. It is important to note that laddering represents an established method in marketing to study

consumer decision making. In HCI, laddering has been applied less frequently and with different purposes, i.e., to understand user motivation and to derive design recommendations (Vanden Abeele & Zaman, 2009) which limits the current state of knowledge regarding its validity in this context. Lastly, laddering and means-end analysis pose diverse methodological challenges including subjectivity associated with content analysis and data reduction (Grunert & Grunert, 1995; Modesto Veludo-de-Oliveira et al., 2006; Sorensen & Askegaard, 2007). As with any exploratory research, insights derived from this study thus need to be validated in future research.

2.7 Conclusion

Research in Positive Psychology has confirmed intentional engagement in specific activities to be a crucial determinant of sustained wellbeing. So far, design research has theoretically acknowledged the opportunity to shape wellbeing-enhancing activities through products and services but has not yet provided actionable guidance how to do so. The current research establishes product-mediated activities as the most crucial determinant when designing for long-term impact. It further proposes a taxonomy of activity types malleable through design and illustrates opportunities to shape these activities through specific realizations of product attributes and a range of determining factors. This research supports decision-making for practitioners in industry contexts and will thus facilitate the transfer of academic contributions in wellbeing design into real-world applications.



3

Design for sustained wellbeing through positive activities - A multi-stage framework

This chapter was previously published as: Wiese, L., Pohlmeyer, A. E., & Hekkert, P. (2020). Design for sustained wellbeing through positive activities—A multi-stage framework. *Multimodal Technologies and Interaction*, *4*(4), Article 71. https://doi.org/10.3390/mti4040071

This chapter presents the development of a multi-stage theoretical framework that combines empirical findings from the laddering study in Chapter 2 with theoretical knowledge from HCI/Design, Behavioral Science, and Positive Psychology, offering a conceptual model of how technology can promote sustained wellbeing. The chapter describes the stages of the framework, their interdisciplinary theoretical foundations, the relationships between them, and the specific elements defining each stage. It concludes by highlighting how the framework can guide design research and practice, providing direction for creating targeted design strategies and effective measurement methods. The framework serves as the theoretical foundation for two empirical studies reported in Chapter 4, a design case study outlined in Chapter 5, and the development of a practical design tool in Chapter 6.

3.1 Introduction

The quest to improve wellbeing for individuals and society at large has become one of the most ambitious missions of our time. In 2015, the United Nations (UN) proclaimed a list of 17 goals, ratified by all UN member states, to foster prosperity and transform the world in a sustainable manner by 2030 (United Nations, n.d.). Among these goals, they list the promotion of wellbeing and mental health worldwide. In a similar vein, positive psychologist Martin Seligman (Seligman, 2011) demands that 51% of the world population should be flourishing by 2051. His mission is supported by empirical evidence suggesting that it is possible for humans to become and remain lastingly happier (Lyubomirsky, Sheldon, et al., 2005), and a wealth of knowledge on how this can be achieved (e.g., Bolier et al., 2013; Lyubomirsky, 2007; Sin & Lyubomirsky, 2009).

In order to foster wellbeing on a global scale, this knowledge needs to be shared and acted on as widely as possible. Besides obvious avenues such as psychotherapy, public education, policymaking, academic, and self-help literature, design researchers also believe that our daily interactions with technology pose a promising opportunity to contribute to this goal and promote global human flourishing (e.g., Desmet & Pohlmeyer, 2013; Pohlmeyer, 2017). One of the main arguments is the widespread availability and adoption of technologies in our professional and private lives. There is hardly any (daily) activity that is not—or cannot be envisioned to be—shaped by technology. Interactive systems wake us up in the morning, manage our appointments, help us stay in touch with family and friends, influence our decisions as consumers, and help us promote our professional careers. The emerging challenge is how to (re)design these daily interactions so that they foster *sustained wellbeing*. Digital technologies in the form of smartphones or portable gadgets are particularly well-suited to master this challenge as they are often multi-purpose, i.e., offer a broad range

of functionalities that are suitable to support multiple (daily) activities, and context-sensitive, i.e., flexibly adaptive to a person's lifestyle.

Over the past two decades, human–computer interaction (HCI) research has demonstrated that designed artifacts can create pleasurable moments and stimulate positive emotions, i.e., foster *hedonic wellbeing* (Kahneman, 1999) in the short term (see Diefenbach et al., 2014 for an overview). The question of whether and how these artifacts can be designed to also make people's lives more meaningful, enable them to grow as a person, or behave in morally good ways, i.e., support more enduring aspects of *eudaimonic* or psychological wellbeing (Ryff, 1989), is, on the contrary, a fairly recent one (e.g., Desmet & Hassenzahl, 2012; Hassenzahl et al., 2010; Pohlmeyer, 2012). While hedonic or subjective wellbeing (feeling good) focuses on maximizing positive experiences, eudaimonic or psychological wellbeing (functioning well) emphasizes a way of living that promotes the fulfillment of human potentials and self-actualization, even if this may be challenging or accompanied by negative feelings (for a more thorough definition see Section 3.3.3).

The claim that design can contribute to individuals' psychological wellbeing (at all) might evoke skepticism at first glance. Often, this skepticism is grounded in a limited view of products as material objects. Materialistic value orientations have been found to be linked to lower levels of life satisfaction (Kasser, 2002; Richins & Dawson, 1992), and material purchases reportedly lead to smaller increases in wellbeing than experiential purchases (see Carter & Gilovich, 2014 for an overview). In order to become lastingly happier, it seems wise to invest in positive activities and experiences rather than accumulating material goods (Nicolao et al., 2009). Research in positive psychology confirms the relative advantage of intentional positive activities over changes in one's life circumstances (such as material acquisitions) when aiming to maintain boosts in wellbeing over time (Lyubomirsky, Sheldon, et al., 2005; Lyubomirsky & Layous, 2013). In the remainder of this paper, simple, intentional activities and strategies that have been found to enhance wellbeing will be referred to as *positive activities* (see also Lyubomirsky & Layous, 2013). Here, the term "activities" not only includes activities that are clearly manifested in behavior, but also mental activities, such as thought patterns or attitudes (e.g., being optimistic, savoring). Positive activities were first observed in exceptionally happy people (Lyubomirsky, 2001) and were later on also empirically validated in so-called positive psychological intervention studies (e.g., Bolier et al., 2013; Seligman et al., 2005), in which people who are not exceptionally happy deliberately engage in certain activities known to increase wellbeing. Examples of positive activities include expressing gratitude, adopting a more optimistic perspective on life, strengthening personal relationships, savoring a positive life change, and

contributing to something greater than oneself (Borgonovi, 2008; Dunn et al., 2008; Lyubomirsky, 2007).

Drawing from these findings, design researchers believe that one promising way to foster sustained wellbeing is to support wellbeing-enhancing activities through technology (e.g., Fokkinga et al., 2014; Peters et al., 2018; Pohlmeyer, 2012; Wiese et al., 2019). However, technology has also been associated with detrimental effects on individuals' wellbeing such as technology addiction (Kuss et al., 2014), increased feelings of loneliness (Burke et al., 2010), and reduced mental health (Keles et al., 2020). These adverse effects have become a topic of growing public interest (e.g., https://humanetech.com) and have impelled the IT industry to take preventative steps to reduce harm, e.g., by introducing features to monitor and reduce screen time (e.g., https://wellbeing.google.com). We argue that in addition to (only) preventing negative outcomes, activity-supportive technology offers a proactive entry point to design for sustained wellbeing. To some extent, contemporary technologies already feature wellbeing-enhancing activities. For instance, expressing gratitude can take the form of endorsing a colleague in a professional network (e.g., Microsoft Yammer, LinkedIn) or leaving a positive rating for a service provider (e.g., AirBnB host). Reminiscence, an aspect of savoring, can be fostered by sharing meaningful past experiences with a group of friends via a social network (e.g., 'Memories' on Facebook) or browsing through old pictures in a photo app (e.g., 'Rediscover This Day' on Google Photos).

There are two ways positive activities can be stimulated by technologies (Calvo & Peters, 2014). First, existing technologies or services whose main purpose is not to promote wellbeing can be enriched with wellbeing-enhancing features, e.g., a social networking platform that encourages their users to post respectful comments. Second, a technology or application can be built deliberately to foster a particular activity or intervention that increases wellbeing, e.g., an app that teaches people to be more mindful. Calvo and Peters (2014) call the former "Active Design" and the latter "Dedicated Design" (p. 90). In both cases, the technology itself is not the direct source of (sustained) wellbeing but rather it promotes it indirectly through the support of wellbeing-enhancing activities. The direct product interaction thus becomes just one step in a chain of events, with activities at its center, that ultimately fosters wellbeing. The way in which technologies support positive activities can take on many different forms. For instance, technology can inspire (e.g., personalized content), trigger (e.g., context-dependent and well-timed cues), motivate (e.g., feedback on task performance), or facilitate (e.g., clear guidance) engagement in activities (see Pohlmeyer, 2017). The 'Rediscover This Day' feature in Google Photos, for example, reminds users to reflect upon past experiences (captured in the form of digital photos and video) and encourages them to share these memories

with their loved ones—thereby facilitating positive activities like savoring and reminiscence.

There is extensive knowledge on (a) people's experiences while interacting with a technology, from work in user experience (UX) design and HCI, on (b) sustained wellbeing, from research in positive psychology, and on (c) possible ways to impact people's behavior (including their daily activities), from literature in behavioral science. However, to our knowledge, these individual perspectives have not been explicitly combined to date, i.e., how to design interfaces in a way that they optimally foster specific kinds of activities that, in turn, boost sustained wellbeing. Understanding these relationships requires interdisciplinary cross-fertilization that is currently mostly lacking (e.g., Diefenbach, 2018; Peters et al., 2018). Therefore, we have outlined a process which combines the individual pillars, as seen in Figure 3.1, in a sequence of stages. The elements within each stage have been specified by integrating theoretical and empirical knowledge from a broad range of disciplines to describe the respective phenomenon in more depth. As a result, we derived a multidisciplinary conceptual framework consisting of five distinct stages (referred to as "pillars" in the visual framework of Figure 3.1).

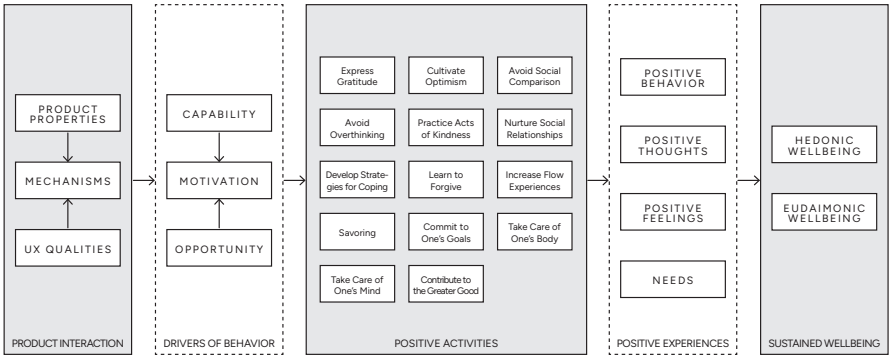


Figure 3.1: The multi-stage framework for sustained wellbeing promoted by technology. Pillar 2 (drivers of behavior) and pillar 4 (positive experiences) have a dashed outline to indicate they represent mediating stages in the process (see text for explanation).

3.2 Design for sustained wellbeing

WELLBEING DESIGN FRAMEWORKS

Design for sustained wellbeing aims to create a lasting positive impact on people's lives and society (Pohlmeyer & Desmet, 2017). Theoretical contributions in this field comprise work on positive technologies (Riva et al., 2012), experience design (Hassenzahl et al., 2013), positive design (Desmet & Pohlmeyer, 2013; Pohlmeyer, 2017), and positive computing (Calvo & Peters, 2014). These

frameworks are grounded in (positive) psychology (Seligman, 2011; Seligman & Csikszentmihalyi, 2000) and delineate how design can foster wellbeing and human flourishing. They enumerate determinants of (sustained) wellbeing that can be supported by design. For instance, Desmet and Pohlmeyer (2013) advised to foster (a) pleasure, (b) personal significance, and (c) virtue, preferably at the same time, through design. Calvo and Peters (2014) addressed nine factors that are known to increase wellbeing in empirical studies, e.g., gratitude, empathy, mindfulness, and self-awareness. Drawing from the literature in positive and clinical psychology, they further specified evidence-based strategies on how to shape these determinants, e.g., through gratitude visits or perspective taking exercises, and enumerated validated measures for their assessment. The authors also specified the METUX model (Peters et al., 2018), which considers psychological need satisfaction, such as autonomy, competence, and relatedness (Ryan & Deci, 2000b, 2017; Sheldon et al., 2001), as the most basic determinant of wellbeing (Ryan & Deci, 2000b, 2017). Similarly, in their framework on experience design, Hassenzahl et al. (2013) emphasize that positive and meaningful experiences with technology are created by fulfilling basic psychological needs during the product interaction. For instance, they propose to study exceptionally positive examples of people's practices, i.e., everyday routine activities such as brewing coffee, and to classify related experiences based on the most salient need they satisfy (e.g., relatedness experiences) (Klapperich et al., 2018). This information is used to redesign embedded technologies in a need-fulfilling way in order to increase a user's wellbeing. Lastly, positive technologies (Riva et al., 2012) are meant to stimulate (a) affective quality, (b) engagement/actualization, and (c) connectedness of personal experience. Meanwhile, positive technology has mainly been popularized in the domains of virtual and augmented reality as well as online therapy, whilst other frameworks (e.g., Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013) explicitly advocate to embed wellbeing principles into the design of all physical and digital products including everyday consumer technologies.

In the context of HCI, wellbeing can be fostered (a) directly, during human–product interactions (Hassenzahl et al., 2013), and (b) indirectly, by creating products that stimulate positive and/or meaningful experiences (Fokkinga et al., 2014; Peters et al., 2018; Pohlmeyer & Desmet, 2017; Pohlmeyer, 2012). Accordingly, wellbeing design frameworks differentiate between nuanced levels of product impact (Fokkinga et al., 2014) or spheres of experience (Peters et al., 2018) when interacting with a product. The model of product impact (Fokkinga et al., 2014) looks at a wide range of experiential and behavioral effects resulting from human–product interactions. It formulates two levels: (a) the direct product interaction level and (b) the overall effect level (2). At the overall effect level, the model distinguishes more immediate, direct consequences of product

usage on individuals' behavior, experience, knowledge and attitude from more far-reaching, indirect effects on people's life and society. The METUX model (Peters et al., 2018) details five distinct spheres of experience including direct product interactions and technology-supported behavior. Both models highlight the importance of differentiating direct and indirect effects of technology usage at multiple levels. One main argument is that beneficial wellbeing effects at one level, e.g., a pleasurable and engaging experience while interacting with a technology, might be accompanied by harmful effects in other areas of people's lives, e.g., reduced face-to-face interactions or technology addiction.

While existing frameworks can undoubtedly stimulate design, they provide little detail on how to influence the respective wellbeing determinants at an interface level, i.e., "*which functionality to support and how to implement such functionality*" (Hekler et al., 2013) (p. 3309). For instance, it is unclear how and when to reward users for intended changes in their behavior (Diefenbach, 2018). As outlined above, wellbeing design frameworks often focus on a small number of theory-based determinants, i.e., they are reductionist to some extent and oftentimes not validated empirically in the context of human–technology relationships. This makes existing frameworks hard to compare and leaves the designer with the challenging task to decide which model is appropriate for tackling a given design problem. Remarkably, one of the most promising determinants of sustained wellbeing based on the literature has so far not been scrutinized in detail by wellbeing design frameworks: positive activities. Thus, the exact nature of these activities in relation to technology and the nuanced mechanisms to promote them by means of design remain relatively unclear.

The framework proposed in this paper extends existing work in several ways. First, the current framework focuses on how to increase and sustain wellbeing over time by means of stimulating positive activities through design. Second, the framework provides a typology of stages that lead up to sustained wellbeing and specifies a process through which these factors are logically connected. Starting with interaction patterns, the framework further illustrates clear ways for the designer to influence this process. Positive activities, a strong determinant of wellbeing based on the positive psychology literature, are posed to be the central element directing the effects of the product interaction on sustained wellbeing. Third, rather than choosing one theory and focusing on a limited set of determinants, the framework takes an interdisciplinary approach that considers theoretical insights from various fields and enriches them with empirical data.

3.3 The Framework for Sustained Wellbeing Promoted by Technology

We begin by illustrating how the framework (Figure 3.1) was developed and by describing (a) its structure, (b) its main process stages including their theoretical foundation, and (c) the relations between these as part of a process from direct *product interaction* to indirect wellbeing outcomes. Lastly, we elaborate three major areas of application, namely (a) design research, (b) design strategies and (c) measurement approaches. The overall purpose of this framework is to enhance the understanding of the relationships between the product interaction, wellbeing determinants and wellbeing outcomes, and consequently provide actionable guidance for researchers and IT practitioners to design technologies that foster sustained wellbeing.

3.3.1 Framework development

The framework was developed following a bottom-up–top-down approach, integrating theoretical and empirical insights. Specifically, we performed a comprehensive scan of the literature across multiple relevant fields and synchronized this existing knowledge with insights from a previous laddering study (Wiese et al., 2019) that investigated the relationships between products and sustained wellbeing. This bottom-up–top-down approach was chosen for several reasons: First, when studying the wellbeing literature, we noticed a considerable lack of conceptual and terminological clarity, such as an abundance of conceptual frameworks, a multitude of (partially overlapping) definitions of wellbeing determinants and outcomes and inconsistent use of terminology (see Huta, 2017; Huta & Waterman, 2014 for an overview). Instead of selectively focusing on one theoretical framework, we sought to take an open approach and prioritize wellbeing concepts based on their empirically determined relevance for the field of HCI.

Second, theoretical knowledge is fragmented between the fields of design/HCI, positive psychology and behavioral science, i.e., each discipline has its nuanced focus but also shares similar goals. One objective was therefore to take an interdisciplinary approach and integrate findings from various disciplines into one overarching framework. As this is not a trivial task, we wanted to validate theory-based assumptions with empirical data.

Third, the range of possibilities for technology to contribute to sustained wellbeing and behavior change has so far been conceptualized in a rather limited way in positive psychology and the behavioral sciences (see Diefenbach, 2018 for an overview). For instance, face-to-face interventions are often simply translated into digital instructions and behavioral intervention technologies focus on cog-

nitive behavior change mechanisms such as goal setting, planning and sending reminders rather than on emotional or motivational aspects of the behavior change process (Conroy et al., 2014; Diefenbach, 2018; Hollis et al., 2015; Yang et al., 2015). We wished to gain a better understanding of the various ways through which designed artifacts can foster sustained wellbeing and behavior change. For this purpose, we previously studied links from product interaction patterns to wellbeing outcomes in an exploratory laddering study including a wide array of products (Wiese et al., 2019). In addition to dedicated wellbeing designs, such as behavioral intervention technologies or health-oriented consumer technology (e.g., self-trackers), we are particularly interested in active design solutions that foster wellbeing. These have in-built features or functionalities that foster wellbeing but serve otherwise a different overall goal (e.g., professional networks, email clients or video conferencing tools).

The literature study consolidated work from three major disciplines: (a) HCI/design, (b) positive psychology and (c) behavioral science. Each discipline has significant contributions to make to design for sustained wellbeing but also has its own, specific focus. Positive psychology explores how individuals can become and stay lastingly happier (Bolier et al., 2013; Lyubomirsky, 2007; Lyubomirsky, Sheldon, et al., 2005; Sin & Lyubomirsky, 2009). Previous research suggests that this is not an easy undertaking but typically requires effort to initiate and maintain positive changes to one's daily routines and activities (Lyubomirsky et al., 2011; Lyubomirsky, Sheldon, et al., 2005; Sin & Lyubomirsky, 2009). Behavioral science, in turn, provides well-studied taxonomies of strategies that can be applied to help people change their behavior for the better (see Michie et al., 2013 for an overview). However, these strategies have mostly been studied in the context of specific domains, such as physical and mental health, as well as sustainability, e.g., keeping a nutritious diet, exercising regularly (Bull et al., 2018; Michie, Williams, et al., 2011), managing a chronic disease (Cradock et al., 2017), or changing recycling behavior (Gainforth et al., 2016). While it is undoubtedly worthwhile to improve people's behavior in these domains, there are many additional activities known to contribute to the wellbeing of individuals and society that are usually not in the focus of behavioral science, e.g., trying to become a kinder and more understanding person, practicing to look at the bright side of every situation, and pursuing meaningful personal goals (Lyubomirsky, 2007). Finally, HCI/design has gained a thorough understanding of people's experiences when handling designed artifacts (Desmet & Hekkert, 2007; Hassenzahl, 2005; Hassenzahl et al., 2010; Jordan, 2000), e.g., how to make product interactions pleasurable, engaging, and aesthetically pleasing. This knowledge is crucial when attempting to support any kind of behavior (change) through design. Despite this rich knowledge and the potential for

collaboration, synergies and shared efforts between disciplines are scarce so far (Diefenbach, 2018; Peters et al., 2018).

In a previous empirical study (Wiese et al., 2019), we investigated how physical (e.g., sports equipment, household items) and digital products (e.g., social networks, communication services, meditation apps) shape a variety of wellbeing determinants and (sustained) wellbeing outcomes. In order to understand the pathways from specific product attributes to (sustained) wellbeing, qualitative laddering interviews (Reynolds & Gutman, 1988) were conducted. Laddering constitutes a combined interviewing and data analysis technique that aims to identify means–end chains (MEC), i.e., hierarchical sequences (the so-called "ladders") consisting of product attributes, perceived consequences, and personal values within the interview data (Reynolds & Gutman, 1988). Reports of twelve participants and a total of 115 individual product experiences (related to 36 personal products and one meditation app used by all participants) were analyzed using (qualitative) content analysis and several steps of (quantitative) data aggregation as advised for the laddering method (Gutman, 1982; Reynolds & Gutman, 1988). The interview probed for past product experiences. All captured data are thus based on retrospective self-reports. With regard to emotional experiences, i.e., the affective component of wellbeing, it is important to note that this kind of memory-based assessment might rather reflect beliefs about one's emotions than details of the original emotional experience. Robinson and Clore (2002) provided an in-depth discussion of potential biases related to emotional self-reports depending on different reporting conditions. For further details on the empirical study, we refer the reader to the original paper (Wiese et al., 2019).

During content analysis, recurring themes (i.e., categories) were identified based on the interview data. Whenever possible, category definition and terminology were adopted from established theoretical frameworks. For each product experience, we further captured whether reported increases in wellbeing were momentary (short-term) or persisted over longer periods of time (long-term). This categorization was performed based on self-reports. For instance, if participants indicated that a product helped them to change their behavior in a sustainable way, e.g., by supporting them to establish a habit (e.g., regular meditation practice) or by leading to a lasting change in perspective (e.g., through self-reflection), we classified the impact as long-term. If participants reported one-time increases in wellbeing that did not persist or brief moments of pleasure derived from product usage, we coded this as short-term. Again, assessing the temporal dynamics of psychological effects through self-reported data may be subject to biases (e.g., memory effects, lack of awareness) and results should thus be interpreted with caution.

Figure 3.2 depicts the original MEC (left), an adapted version of an MEC (middle) and a specific example (right) from the laddering study. In the example shown in Figure 3.2, the participant reported about her experience using a meditation app. The app provides clearly structured meditation packages (i.e., clear rules) that differ in terms of theme and duration. This clear structure helped the participant to get a good overview of the available content and to decide efficiently (i.e., ease of use) which session to take on a particular day—depending on what is important to her in that moment and how much time she has to practice meditation. Consequently, she was not overwhelmed with the decision-making process (i.e., competence) and felt encouraged to engage herself in meditation (i.e., taking care of the body and mind). The meditation exercise itself helped her to accomplish her personal goal to feel calmer and more relaxed (i.e., relaxation) and thus to derive a sense of inner peace (i.e., comfort). The first two steps of the adapted MEC (from bottom to top), i.e., concrete product attributes (1) and experience qualities (2), specify technology-based mechanisms that increase a person's motivation (3) to engage in an activity (4) which, in turn, are in line with intrapersonal orientations, e.g., goals, needs and values (5), and thus ultimately affect wellbeing (6).

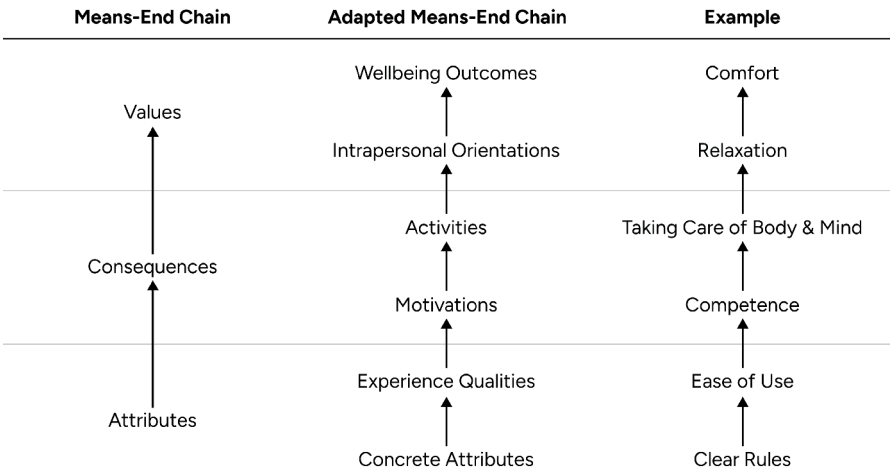


Figure 3.2: Means–end chain, MEC (left), adapted MEC used in the laddering study (middle) and example MEC (right); visualization adapted from Wiese et al. (Michie et al., 2013; Michie, van Stralen et al., 2011).

To arrive at the current framework, the six different levels of the adapted MEC (see Figure 3.2) were hypothesized to form the main stages of the framework. Prominent (i.e., the most frequent) elements within each stage were included in a first version of the framework. Since the framework is thought to describe ingredients of, and pathways to, sustained wellbeing promoted by technology, we only considered elements that were linked to long-term wellbeing outcomes. A total of 95% of these pathways included positive activities. We therefore

conceptualize positive activities as being at the heart of design for sustained wellbeing and the key determinant in the current framework (see Figure 3.1).

The resulting taxonomy of interaction patterns (i.e., concrete attributes, experience qualities), wellbeing determinants (motivations, activities, intrapersonal orientations) and wellbeing outcomes had two shortcomings: it was (a) too granular and (b) based on a small participant sample. In a last step, we thus leveraged input from the laddering study again with the literature and iteratively refined the framework structure and taxonomy of elements within each stage. Upon further inspection, the first (i.e., product properties), the second (i.e., experience qualities) and the third stage (i.e., motivations) were not well differentiated. For instance, clear rules, classified as product properties in the example above, represent a combination of true properties, i.e., structured meditation packages, and experienced qualities, i.e., clear. Another example is rewards which were classified as motivations but rather represent a mechanism that fosters motivation. When reviewing taxonomies of behavior change techniques (Michie et al., 2013; Michie, van Stralen, et al., 2011), that were initially not included in the literature study, it became apparent that they overlap significantly with concepts identified at the first three levels of the extracted MECs in the laddering study but are at the same time distinct from product properties and experience qualities.

We therefore added *mechanisms* as a separate element to the first pillar of the framework (Figure 3.1). Specifically, the way these mechanisms were implemented (= *product properties*) in a specific product, e.g., in the form of visuals, functions and interactive elements, resulted in nuanced user experiences (= *UX qualities*), e.g., were perceived as exciting, appealing or surprising, which moderated their effectiveness to motivate action. It is thus the interplay of mechanisms, product properties and UX qualities that determines the overall effect of the direct product interaction on individuals' behavior. Furthermore, when revisiting behavior change models, we realized that effects of interacting with a product (initially classified as motivations) not only comprised motivational aspects but also ways to facilitate and/or trigger wellbeing-enhancing activities. We therefore introduced a dedicated stage, i.e., drivers of behavior, that is based on prevalent behavior change models (Fogg, 2009; Michie, van Stralen, et al., 2011) and comprises psychological and/or context factors that determine whether (any kind of) behavior is performed. Intrapersonal orientations subsumed factors that describe why a certain activity is linked to wellbeing, i.e., because they are in accordance with an individuals' personal goals, needs and values. When revisiting the literature on positive activities, we noticed that other factors (apart from needs) mediate the relationship between those activities and wellbeing, e.g., positive behaviors, thoughts and feelings that can be stimulated by positive activities (Lyubomirsky & Layous, 2013). We therefore

decided to extend the framework with these aspects. Results and implications of this iterative process are presented below (Section 3.3.2) and depicted in Figure 3.1.

3.3.2 Framework structure

As discussed above, the link from product interactions to sustained wellbeing is not clear-cut but thought to involve several, also indirect, routes (Fokkinga et al., 2014; Peters et al., 2018; Pohlmeyer, 2012, 2017; Wiese et al., 2019). The current framework introduces a multi-stage process from product interaction (1), drivers of behavior (2), positive activities (3), and positive experiences (4) to sustained wellbeing (5).

The main trajectory (bold lines, highlighted in gray) runs from product interaction to positive activities to wellbeing. The effects of interacting with a designed artifact support specific positive activities that are, in turn, linked to sustained wellbeing. The framework explicitly posits positive activities as a central bridging factor. The intermediary pillars (dashed outlines in Figure 3.1), in turn, mediate the relationships between the three main pillars: Firstly, *drivers of behavior* comprise psychological factors influenced by design and context factors that determine whether an activity is performed, and secondly, *positive experiences* encompass intrapersonal consequences of engaging in (product-supported) activities which ultimately lead to wellbeing. Put differently, while product interaction, positive activities and sustained wellbeing constitute stages that define the what, i.e., what is designed and what to achieve, drivers of behavior and positive experiences represent stages of the how, i.e., they mediate how stages to and from positive activities are connected.

The process can be conceived as a logical, interdependent chain of determinants and outcomes. Each stage is a determinant/consequence of the following/previous stage. Stages 3 and 4 represent direct wellbeing determinants based on the literature. Stages 1 and 2 describe how products affect these determinants.

3.3.3 Framework stages

The following section describes the framework stages in more detail. Since the framework is centered around positive activities, we start with these activities and outline how they are linked to sustained wellbeing, i.e., we focus first on the right-hand side of the framework (positive activities → positive experiences → sustained wellbeing). We then explain how positive activities can be stimulated by designed artifacts, i.e., we address the left-hand side of the framework in reversed order (positive activities ← drivers of behavior ← product interaction).

The relations on the right-hand side of the framework are well-established in the

literature of positive psychology. We do not intend to validate this part of the framework empirically but rely on the literature instead. The first part of the chain integrates insights from the three disciplines: HCI/design, behavioral science and positive psychology. This integration of knowledge is novel in two ways: (a) we combine distinct framework stages from different disciplines and thereby outline a unifying process direction to sustained wellbeing. Secondly (b), we take an exploratory approach to study the many different ways in which designed artifacts can shape behavior and detail promising categories/components in the respective stages.

POSITIVE ACTIVITIES

Positive activities are at the core of the framework. The main reason for positioning them at the center is their reported link to sustained wellbeing in the literature (Bolier et al., 2013; Sin & Lyubomirsky, 2009 for recent meta-analyses). The sustainable happiness model (Lyubomirsky, Sheldon, et al., 2005) postulates that individuals' wellbeing is not only determined by genetic predispositions or life circumstances but, to a certain extent, also by deliberate engagement in wellbeing-enhancing activities. This implies that we are, at least in part, in control of our own wellbeing by choosing which activities we engage in on a regular basis. The model originally claimed that 50% of inter-individual differences in wellbeing can be attributed to genetics, 10% to life circumstances and 40% to intentional positive activities. Even though recent research has shown that the effect of positive activities on wellbeing might be less substantial than initially assumed (Brown & Rohrer, 2020; White et al., 2019), the broader premise that positive activities pose one of the most promising pathways to sustained wellbeing is still believed to hold (Sheldon & Lyubomirsky, 2019). Consistent with this premise, in the laddering study, 95% of long-term wellbeing effects that were brought about by technology were linked to positive activities (Wiese et al., 2019). We therefore view technology to be an important medium in fostering wellbeing-increasing activities. With regard to the three postulated determinants of wellbeing according to the sustainable happiness model, they can also be perceived as an evolving part of our life circumstances that pave the way for activity-supportive design promoted by modern technologies. It is therefore the interaction of both determinants, i.e., life circumstances, and activities that can be shaped through design (Pohlmeyer & Desmet, 2017).

However, not any kind of activity holds the potential to increase wellbeing in a sustainable way. Research has identified specific categories of positive activities and strategies that embody this quality and are based on empirical evidence, i.e., shown to be effective in positive psychological intervention studies (Bolier et al., 2013; Lyubomirsky, 2007; Sin & Lyubomirsky, 2009). Positive activities are aimed at cultivating positive behavior, positive feelings and positive cognition

(Sin & Lyubomirsky, 2009). Each category of positive activities listed in Table 3.1, e.g., practicing acts of kindness, contains a large set of potential activities, e.g., taking the dog of a sick friend for a walk, share overheard compliments, get groceries for an elderly neighbor or surprise your loved one with a small note.

For maintaining engagement in positive activities, it is beneficial to have a good fit with a person's interests, values and lifestyle (Lyubomirsky & Layous, 2013). An outgoing person might benefit from activities that involve other people, e.g., volunteering, whereas an introverted person may thrive when performing contemplative or reflective activities, e.g., loving-kindness meditation. In order to enhance wellbeing, these activities typically need to be performed intentionally and require repeated or habitual practicing (Lyubomirsky et al., 2011; Lyubomirsky & Layous, 2013; Sheldon & Lyubomirsky, 2019). What is needed to become and stay happier, it seems, is that people strive to continuously create engaging, satisfying, connecting and uplifting positive experiences (Sheldon & Lyubomirsky, 2019). With (digital) technologies having pervaded numerous areas of our professional and personal lives, design can and perhaps even should facilitate such experiences.

A comprehensive taxonomy of positive activities is provided by Lyubomirsky (2007). She describes twelve categories of positive activities that have been shown to be effective (see Table 3.1). Activities that were found to be supported by products in the empirical study (Wiese et al., 2019) overlapped to a significant degree with this taxonomy; five out of seven product-mediated activities matched Lyubomirsky's classification. One additional activity that we observed in the study and that has also reportedly shown to enhance sustained wellbeing in the literature (Borgonovi, 2008; Dunn et al., 2008) is "contributing to the greater good". Furthermore, for a better differentiation, we decided to split the activity "taking care of your body and mind" as defined by Lyubomirksy (2007) into two separate activities, i.e., "taking care of your body" and "taking care of your mind", considering that we found distinct pathways leading up to these types of positive activities in the laddering study. As a result, 14 different categories of positive activities were considered for the framework. Seven of these activities were both based on theory and empirical data. The remaining seven activities were solely derived from theory. To investigate whether all 14 activities can potentially be supported by design, we conducted an informal exploratory online study with a convenience sample of n = 54 participants who were digitally literate. Each participant was interviewed about four or five out of fourteen positive activities that they reported to engage in on a regular basis, resulting in a total of 252 individual user narratives. For each of the selected activities, participants were asked to think of products that were involved in these activities and to describe these products and/or their features in as much detail as possible. Our findings suggest that there is no reason to discard any of

the activities since designed artifacts were found to support all of them in one way or another. Consequently, we include 14 (categories of) positive activities as promising determinants of sustained wellbeing promoted by technology. These activities cover a broad range of life domains (see Table 3.1).

It is not our aim to merely create digital or online versions of specific positive psychological interventions from research studies, e.g., present written instructions to "write a gratitude letter" in an app (see also work on behavioral intervention technologies for mental health, e.g., Mohr et al., 2013). Instead, we understand positive activities as the overarching patterns that underlie the concrete manifestations of positive psychological interventions. In other words, positive activities are everyday activities and strategies that range across different life domains and that have theoretical and empirical support regarding beneficial effects on people's happiness (Lyubomirsky, 2007). We also do not want to limit design efforts to dedicated solutions that have the primary function to support wellbeing-enhancing activities, e.g., meditation apps. Instead, we see great potential in technology-based forms of positive activities that make use of platforms and products with a different primary function (see also Calvo & Peters, 2014, 2019). (Re)designing (existing) technology with wellbeing principles in mind can reach more people and can do so in a context-sensitive manner (Pohlmeyer, 2017). For instance, the activity "expressing gratitude" can be performed by "endorsing a colleague" in a professional network (e.g., Microsoft Yammer) or by "leaving a positive rating" for one's AirBnB host. Reminiscence, an aspect of savoring, can be fostered by "sharing meaningful past experiences" with a group of friends via a social network or by the "On this Day" feature on Facebook. Further technology-based examples of positive activities are provided in Table 3.1.

We acknowledge that the set of positive activities proposed in this framework does not necessarily represent an exhaustive list and might need to be extended in the future. It is also important to bear in mind that most technologies listed in Table 3.1 were neither developed nor evaluated with respect to wellbeing. Furthermore, they support variations of the original interventions that were thoroughly tested with regard to efficacy. Without further evaluation, it remains unclear whether these versions of positive activities will have the same beneficial effects on wellbeing. Despite this limitation, we believe that the examples listed in Table 3.1 provide a valuable source of inspiration for how positive activities can be incorporated into everyday technology.

To summarize, the third stage in the framework encompasses wellbeing-increasing activities that can be promoted by design. These activities represent a set of behavioral, cognitive and emotional strategies that are fairly simple and can be

Table 3.1: Wellbeing-enhancing activities (Borgonovi, 2008; Dunn et al., 2008; Lyubomirsky, 2007) supported by designed artifacts (including examples of digital technologies).

Positive Activity	Definition[1]	Digital Technologies
Express Gratitude	Express gratitude for what you have and/or convey your appreciation to one or more individuals whom you have never properly thanked.	Host ratings (AirBnB), seller feedback (eBay, Etsy), endorsements (Yammer), "Say Thanks" videos (Facebook), gratitude apps (e.g., Grateful)
Cultivate Optimism	Imagine the best possible future for yourself and/or practice to look at the bright side of every situation.	Listen to encouraging music, watch inspiring documentaries, journaling
Avoid Social Comparison	Attempt to cut down on how often you compare yourself to others.	Reduce passive browsing on social networks, set time limits, "You're All Caught Up" (Instagram)
Avoid Overthinking	Attempt to cut down on how often you dwell on your problems.	Reduce obsessive information seeking ("Doctor Google")
Practice Acts of Kindness	Do good things for others, whether friends or strangers, either directly or anonymously, either spontaneously or planned.	Encouraging kind comments on social media platforms
Nurture Social Relationships	Work on a relationship in need of strengthening, and/or invest time and energy in healing, cultivating, affirming and enjoying it.	Communication with friends (WhatsApp), joining a local community (e.g., Facebook), team collaboration (e.g., Slack), "Online Movie Nights" (Netflix), online dating platforms, video calls
Develop Strategies for Coping	Learn or practice ways to endure or surmount a recent stress, hardship or trauma.	Managing a chronic disease with an app, online therapy, online forums, self-help groups on social media, "School of Life" (educational videos)
Learn to Forgive	Work on letting go of anger and resentment towards one or more individuals who have hurt or wronged you.	Journaling, notetaking
Increase Flow Experiences	Increase the number of experiences at home or at work in which you "lose" yourself, which are challenging or absorbing.	"Mute" notifications, white noise apps, online hackathons, adaptive learning platforms (e.g., Coursera)
Savoring	Pay close attention, take delight and go over life's momentary pleasures and wonders—through thinking, writing, drawing or sharing with another.	"Your Upcoming Trip" (AirBnB), "Rediscover The Day" (Google photos), "Memories", "On This Day"(Facebook), journaling apps
Commit to One's Goals	Select significant goals that are meaningful to you and/or devote time and effort to pursuing them.	Time management (e.g., Trello), budget planning
Take Care of One's Body	Take care of your body, e.g., exercise, keep a healthy diet.	Running apps, nutrition apps, activity trackers
Take Care of One's Mind	Meditate, relax, laugh and get plenty of rest	Meditation apps (e.g., Headspace), sleep trackers
Contribute to the Greater Good	Giving back to society, e.g., protect the environment, support one's local community, volunteering, charitable giving	Eco-friendly shopping, offset carbon emissions for flights or online purchases, "Birthday Fundraiser" (Facebook)

[1] Definitions adapted from the Berkeley Greater Good Science Center (https://ggsc.berkeley.edu/).

integrated in everyday practices (Borgonovi, 2008; Dunn et al., 2008; Lyubomirsky, 2007; Lyubomirsky, Sheldon, et al., 2005).

POSITIVE EXPERIENCES

Positive experiences mediate the relationship between positive activities and sustained wellbeing (Lyubomirsky & Layous, 2013). More precisely, positive activities stimulate further (a) positive behaviors, (b) positive thoughts, (c) positive emotions, and (d) the fulfillment of basic psychological needs which, in turn, boost wellbeing. For instance, Fredrickson et al. (2008) showed that meditation (i.e., "taking care of one's mind") increases people's daily experiences of *positive emotions* which leads to improved personal resources such as social relationships and physical health. These gains in personal resources then ultimately bring about increases in wellbeing. Other positive activities such as "practicing gratitude" prompt an individual to *think* about life *in a more positive way* (Dickerhoof, 2007) which again results in higher levels of wellbeing. "Practicing gratitude" also stimulates further *positive behaviors* such as exercising more (Emmons & McCullough, 2003) which then promotes wellbeing through improved physical health. In a similar vein, charitable behavior (i.e., "contributing to the greater good") reportedly *satisfies* people's *needs* for relatedness and ultimately increases both hedonic and eudaimonic wellbeing (Jiang et al., 2018).

Other examples of positive experiences that can result from positive activities are reflected in the list of wellbeing determinants specified in the positive computing framework (Calvo & Peters, 2014, 2019), e.g., increased levels of self-awareness, gratitude, mindfulness, empathy, compassion, altruism and resilience. Calvo and Peters (2014) (p. 85) suggested to use these determinants as starting points for wellbeing design efforts and list examples of strategies (including positive activities) that could inform design. While very similar in its approach, the current framework proposes to focus the design process directly on the activities that lead up to those positive experiences, i.e., to go one step back in the logical chain presented in Figure 3.1. There are several advantages of this approach: First, activities are more tangible and concrete than experiences and mindsets at the "positive experience" level. They typically follow a clearly defined structure that can guide design strategies in a more actionable way, e.g., "listing three good things" or "writing thank you notes" as examples of "practicing gratitude", or "setting realistic goals" as a way to support "committing to one's goals". Second, positive activities are more closely linked to the product interaction itself, i.e., further on the left in the proposed framework. It is therefore easier to determine how concrete design decisions (stage 1) affect drivers of behavior (stage 2) and thus ultimately foster engagement in an activity (stage 3). Focusing on the left-hand side of the logical chain when designing for sustained wellbeing also facilitates measurement along those

pathways. More specifically, we hypothesize that respondents can attribute effects at the activity level (e.g., how often they are practicing the activity or how much they enjoyed the activity) more easily to specific interface components, e.g., how effectively the technology reminded them to practice or to which extent it triggered their interest in the activity. Third, effects at the activity level will manifest earlier than effects at the positive experiences level as those typically take time to build up. For instance, we can evaluate how often a person engages in a positive activity shortly after adopting a specific technology or new feature, e.g., how often they communicate in a kind (vs. unkind) way on social media platforms. Whether a kinder way of communicating strengthens their relationships with others and makes them feel more connected to their friends and family (in the long run) may not become apparent immediately but takes some time to establish.

SUSTAINED WELLBEING

Sustained wellbeing represents the ultimate design goal in the proposed framework. One reason positive activities are thought to have such favorable, longer-lasting effects on individuals' wellbeing is related to a phenomenon called "hedonic adaptation" (Frederick & Loewenstein, 1999). Researchers have observed that even after very desirable changes in people's lives, e.g., winning the lottery (Brickman et al., 1978), getting married (Lucas et al., 2003), or starting a new job (Boswell et al., 2005), the initial boost in happiness cannot be maintained. On the contrary, people seem to revert to their individual happiness baseline level, i.e., are as happy as they were before these positive events took place. Different from changes in one's life circumstances, individuals adapt to positive changes related to activities less quickly since activities are naturally more transient and can be practiced in various ways (Lyubomirsky, Sheldon, et al., 2005). While activities slow down adaptation processes for longer, they cannot inhibit them altogether. This is mainly related to decreased positive emotions resulting from an activity over time and increased aspirations after experiencing initial gains in wellbeing (Bao & Lyubomirsky, 2014; Sheldon & Lyubomirsky, 2012). Consequently, the attempt to maintain increases in wellbeing over extended periods of time, i.e., sustained wellbeing, needs to counterbalance hedonic adaptation processes (Bao & Lyubomirsky, 2014; Sheldon et al., 2013; Sheldon & Lyubomirsky, 2012), and continued engagement in wellbeing-enhancing activities (Lyubomirsky & Layous, 2013).

Established wellbeing theories and frameworks in psychology can be divided into two broader groups, i.e., (a) subjective or hedonic wellbeing (Diener, 1984; Kahneman, 1999) and (b) psychological or eudaimonic wellbeing (Ryan & Deci, 2001; Ryff, 1989; Ryff & Singer, 2008). This distinction stems from hedonistic (e.g., Aristippus, Bentham, Mill) and eudaimonic philosophical traditions (e.g.,

Aristotle, Nichomachean Ethics, 4th century BCE/1985) that make different assumptions on what constitutes a "good life". The hedonistic perspective considers striving for pleasure and an enjoyable life as the ultimate goal. However, while positive emotions can lead to beneficial outcomes such as increased creativity, more satisfying social relationships and better physical health (see Lyubomirsky, King, et al., 2005 for a review), research has shown that focusing excessively on the positive and trying to achieve happiness above all else can be counterproductive, e.g., promote risk-taking behavior or even have detrimental effects, e.g., decrease happiness overall due to higher expectations (Gruber et al., 2011). Eudaimonic philosophers have long argued that it takes more than being happy to live a full life. They equate wellbeing with a state of self-actualization and the fulfillment of human potential.

In accordance with these philosophical viewpoints, hedonic or subjective wellbeing is conceptualized as experiencing frequent positive and infrequent negative affect and evaluating one's life as good overall (Diener, 1984; Kahneman, 1999). Psychological or eudaimonic wellbeing comprises six aspects of self-actualization: autonomy (i.e., being self-determined and independent in thought and action), personal growth, self-acceptance, life purpose, mastery (i.e., working towards and reaching meaningful personal goals) and positive relationships with others (Ryff, 1989; Ryff & Singer, 2008).

Most wellbeing researchers agree that both ingredients of wellbeing are necessary in order for individuals to flourish (Huta, 2017). In their view, subjective and psychological wellbeing are not mutually exclusive but rather complementary psychological functions (Huta, 2017). Accordingly, Dolan (2014) (p. 3) defines wellbeing as the combination of "*experiences of pleasure and purpose over time*". Both hedonic and eudaimonic aspects of wellbeing are considered in the proposed framework and were found to be fostered by design in previous empirical work (Wiese et al., 2019).

DRIVERS OF BEHAVIOR

However, how do people change their daily routines and their lives for the better? Behavioral science offers a wealth of knowledge on this question. In the behavioral change literature, we can find a plethora of models describing the antecedents of behavior (change). According to the influential COM-B model (Michie, van Stralen, et al., 2011), any kind of behavior occurs through the interplay of three basic components: (a) capability, i.e., a person's psychological and physical capacities to perform the behavior, (b) motivation, i.e., intrapersonal processes, including goals, values and deliberate decision making, that stimulate behavior, and (c) opportunity, i.e., external or context factors that enable or prompt behavior. These three components can be further subdivided into more fine-grained drivers of behavior. For example, for the motivation compo-

nent, the equally popular stages of change model (Prochaska & DiClemente, 1992) subdivides individuals in five categories that represent different "levels of motivational readiness". Since individuals at the same stage should face similar problems and barriers (Nisbet & Gick, 2008), designers of technology should take these stages into consideration when promoting a particular activity (Ludden & Hekkert, 2014).

Along similar lines, Fogg (2009) posed that three factors must be present at the same time to evoke a specific behavior: (a) motivation, (b) ability, and (c) a trigger. Motivation and ability are interrelated in an indirect proportional manner, i.e., lower ability requires higher motivation and vice versa. Triggers are particularly effective if a person's ability outweighs their motivation. The COM-B model and the Fogg behavior model overlap significantly regarding the assumed basic components of behavior. A given technological intervention might change one or more components in the behavioral system. These components also provided a concise way of classifying the activity-promoting effects of the direct product interaction observed in our earlier laddering study (Wiese et al., 2019).

The framework thus subdivides the stage "drivers of behavior" into three components, namely (a) *capability*, (b) *motivation*, and (c) *opportunity*, as specified by the COM-B model (Michie, van Stralen, et al., 2011). Drivers of behavior thus comprise the set of psychological and context factors that determine whether an activity is actually performed. For a given activity in a given context, it provides a way of identifying how far changing particular components or combinations of components could promote the desired activity.

In the proposed framework, drivers of behavior are conceptualized to be activated by specific mechanisms during the product interaction (stage 1).

PRODUCT INTERACTION

Wellbeing design frameworks emphasize the activity-supporting role technology can take to foster sustained wellbeing, e.g., they can "stimulate", "facilitate", or "inspire" activities (e.g., Pohlmeyer, 2017). In other words, they can foster capabilities, motivation, and opportunities as defined by the second stage in the framework. However, most existing wellbeing design frameworks do not specify the exact mechanisms by which technologies can accomplish that (Fokkinga et al., 2014; Peters et al., 2018; Pohlmeyer, 2012). The framework proposed here explicitly addresses such links, and we list a multitude of such mechanisms based on theoretical and empirical insights in Table 3.2.

In our framework, *mechanisms* represent specific ways, processes or techniques to stimulate psychological and contextual drivers of behavior. Typical—and much-used—examples of such mechanisms are feedback, coercion, rewards,

goal setting, priming, and social support (see Table 3.2). Mechanisms are realized through combinations of product properties and user experience (UX) qualities (see Figure 3.1) and are therefore directly related to the technology and the product interaction. *Product properties* refer to observable or tangible aspects of a technology such as colors, visuals, icons, images, functions, typography and interactive elements like controls, gestures or alerts. *UX qualities* reflect a person's subjective perceptions while interacting with a technology, i.e., how the technology and its attributes are experienced by an individual (Desmet & Hekkert, 2007; Hassenzahl, 2005; International Organization for Standardisation, 2019; Jordan, 2000). According to ISO 9241-210 (International Organization for Standardization, 2019), these perceptions include affective and cognitive reactions, e.g., beliefs, preferences as well as behavioral responses. Hassenzahl (2005) differentiated hedonic UX qualities, i.e., how pleasant/enjoyable it is to interact with a technology, from pragmatic UX qualities, i.e., how efficient and easy it is to use a technology, illustrating direct links to drivers of behavior. Desmet and Hekkert (2007) conceptualized UX qualities as consisting of three subcomponents: (a) product aesthetics, i.e., the extent to which a product delights or irritates the human sensory system, (b) product emotions, i.e., positive and negative emotions evoked by a product, and (c) product meaning, i.e., semantic interpretations or associations ascribed to a product.

In the context of the framework, product properties and UX qualities together shape mechanisms that drive human behavior, i.e., positive activities: any mechanism is implemented into a technology by means of specific product properties that the designer is in control of. For instance, in order to support a person to keep track of their daily calorie intake (= mechanism), a designer can ask them to (a) enter the amount of calories manually as numeric values, (b) make them select the food items they consumed from a predefined list or (c) let them scan the bar code on the product package to automatically register the respective amount of calories (= product properties). Depending on the chosen implementation, the interaction may be perceived as more or less efficient, engaging, pleasant or appealing (= UX qualities) and motivate or facilitate (= drivers of behavior) engagement in the positive activity of "taking care of one's body" to varying degrees.

Table 3.2: Mechanisms rooted in behavior change and positive psychology literature as well as in empirical findings from Wiese et al. (2019).

Mechanism	Goal?	Literature	Examples
Education	Enhance knowledge and understanding needed to perform the activity[2]	Michie et al. (2011, 2013)	Mood tracking, metaphors
Training	Support a person to build up necessary skills to perform the activity[2]	Michie et al. (2011, 2013)	Teach meditation techniques through tutorial videos
Persuasion	Use communication to prompt positive or negative feelings or trigger the activity[2]	Michie et al. (2011, 2013)	Daily affirmations or mantras provided by a meditation app
Rewards	Provide positive incentives (e.g., material, social) for showing effort and/or progress in performing the activity[2]	Michie et al. (2011, 2013)	Receive supportive comments for a post in a special interest social media group
Modeling	Introduce a role model to aspire to or imitate[2]	Michie et al. (2011, 2013)	Personally introduce the teacher in a meditation app
Goal setting	Define favorable (e.g., specific, realistic, intrinsic) goals related to performing the activity[2]	Michie et al. (2011, 2013) Sheldon & Elliot (1999)	Break goals down into subgoals with the help of checklists (e.g., Trello)
Action planning	Support detailed planning of the activity, e.g., duration, frequency, context, intensity[2]	Michie et al. (2011, 2013) Schwarzer (1992)	Structure activity in different (learning) modules
Feedback	Provide (helpful, informative) feedback on the performance of an activity[2]	Michie et al. (2011, 2013)	Indicate progress and achievements, e.g., through badges, levels, etc.
Monitoring	Provide opportunity to track and record the outcomes of an activity[2]	Michie et al. (2011, 2013)	Provide opportunity to track frequency, duration and/or outcome of an activity, e.g., through timelines, dashboards, statistics, etc.
Social support	Provide support or praise from close social contacts for performing the activity[2]	Michie et al. (2011, 2013) Lyubomirsky & Layous (2013)	Practice meditation together with a "meditation buddy"
Prompts / Cues	Define a stimulus to prompt/cue the activity[2]	Michie et al. (2011, 2013)	Reminders, notifications

Continued on next page

(cont'd)

Mechanism	Goal?	Literature	Examples
Variation[3]	Allow to practice the activity in varied ways	Sheldon & Lyubomirksy (2012) Lyubomirsky & Layous (2013) Bao & Lyubomirsky (2014)	Themed meditation packages
Frequency, Timing[4]	Allow to adjust frequency and duration of the activity	Lyubomirsky & Layous (2013)	Create training schedules and/or choose duration of a training session
Personal relevance	Allow to align the activity with a person's goals and values	Lyubomirsky & Layous (2013)	Personalization, customization, offer a broad variety of content, modules, etc., to choose from
Early positive reactivity	Early onset of pos. emotions after starting to practice an activity	Cohn & Frederickson (2010) Lyubomirsky & Layous (2013) Proyer et al. (2015) Diefenbach (2018)	Make activity fun or playful, e.g., by adding humor, visually appealing design
Efficacy beliefs	Promote a person's belief in their ability to perform the activity	Lyubomirsky & Layous (2013) Schwarzer (1992) Bandura (1977)	Differentiate beginners vs. expert levels

[2] Descriptions are based on definitions formulated by Michie et al. (2011, 2013) and the BCT website (*BCTs Taxonomy*, n.d.)

[3] Originally called "variety" by Lyubomirsky & Layous (2013)

[4] Originally called "dosage" by Lyubomirsky & Layous (2013)

We consider mechanisms from both behavioral science as well as from positive psychology to be relevant for our framework. When attempting to foster positive change through digital technologies, these need to be translated into "technological features" or "interaction patterns" by choosing a specific implementation (= product properties) that ultimately determines how a mechanism is experienced by the individual (= UX qualities). One and the same mechanism can thus have nuanced effects on the individual, based on the chosen technological realization—including negative outcomes. One example of such negative outcomes is Facebook's 'On This Day' feature that reminds users of past experiences they have shared on their timeline. While this can serve as a prompt (= mechanism) for savoring in the case of positive experiences, the feature also inappropriately forces painful memories about personal losses and

traumatic events upon users without their consent ("algorithmic cruelty"). So, despite good intentions, designers cannot necessarily assume that their designs will result in the intended positive effects which calls for thorough evaluation.

The behavioral science literature offers extensive taxonomies of mechanisms shown to be effective in promoting behavior change (Michie et al., 2011, 2013). Some behavior change mechanisms have been studied in HCI before, e.g., effective ways to provide feedback and monitor behavior (e.g., Hermsen et al., 2016). For instance, ubiquitous technologies such as smartphones make it possible to provide positive feedback (= mechanism) right after a user accomplished an activity-related goal leading to stronger feelings of competence (= motivation) and thus increased activity adherence.

Mechanisms rooted in behavioral science often focus on cognitive and educational strategies, but disregard emotional as well as motivational aspects of behavior change and long-term engagement (Conroy et al., 2014; Diefenbach, 2018; Hollis et al., 2015; Yang et al., 2015). Due to hedonic adaptation processes, long-term engagement is an important concern for sustaining wellbeing increases over time. For instance, a study by Diefenbach et al. (2016) showed that participants stopped using self-improvement technologies mainly because they did not feel motivated in the right way by the technology but instead perceived it as bossy, demanding or too dominant.

We argue that behavior change techniques can be complemented by emotional and motivational mechanisms rooted in (positive) psychology. A number of variables were found to influence the effectiveness of positive psychological interventions (Bao & Lyubomirsky, 2014; Lyubomirsky & Layous, 2013; Sheldon et al., 2013). On the one hand, there are characteristics of the activity itself that moderate its success, e.g., practicing an activity in diverse ways, with different people or in combination with other activities (i.e., variation), choosing an activity that resonates with a person's value system (i.e., personal relevance), practicing at the appropriate frequency and timing and receiving encouraging feedback by close others (i.e., social support). For instance, Sheldon et al. (2013) found that performing different acts of kindness increased individuals' level of wellbeing more substantially than repeatedly engaging in the same kind acts. On the other hand, there are intrapersonal variables that moderate the effects of positive activities on wellbeing, e.g., a person's affective state (i.e., positive emotions) and their perceived capacity to perform an activity (i.e., efficacy beliefs). For instance, a fast and strong increase in positive emotions after an attempt for positive change (i.e., early positive emotional reactivity) was shown to be a valid predictor of long-term adherence to the corresponding intervention (Cohn & Fredrickson, 2010; Proyer et al., 2015). These findings can inform design decisions in such a way that technological realizations of

these mechanisms ideally facilitate, motivate or trigger (stage 2) engagement in positive activities. For instance, social support can be implemented in the form of "likes" for having completed an activity or by encouraging the user to choose a partner to practice the activity with. Depending on the specific user and the context, these implementations will be perceived as more or less helpful or encouraging and thus make the user feel connected to others to differing degrees (Ryan & Deci, 2001). In the laddering study, participants reported that variation in the themes of meditation packages and the option to decide for how long and how frequently they wanted to practice meditation enabled them to adapt their meditation sessions to their current needs and integrate them flexibly into their daily lives, i.e., context sensitivity). Table 3.2 shows the most prevalent mechanisms that are based on theory and were empirically found to be linked to (digital) products in the laddering study (Wiese et al., 2019). Since this list is based on empirical data from a small sample of participants and products, it potentially needs to be expanded in the future.

It should be noted that the relationship between components in the first stage depends on the chosen perspective. From a design point of view, the designer may first decide on the mechanism (e.g., provide feedback) to next determine the properties (e.g., a timeline, a dashboard, or a notification) by which they will make the mechanisms work. However, from a user's point of view or when analyzing an existing interactive technology, one may first describe the properties to discover the mechanisms applied. For the visualization of the framework, we chose the latter perspective.

3.3.4 Relationships between stages

As outlined above, the five stages can be understood as a logical, interdependent process linking product interaction and their immediate effects to a series of wellbeing determinants (i.e., activities, positive experiences) and wellbeing outcomes. The proposed direction runs from left to right, i.e., each stage influences the next. The final stage is wellbeing itself. We therefore understand the general tendency of direct technology involvement—and therefore the potential to predict its effect—to decrease from left to right. In addition, we postulate an underlying temporal continuum from short-term (left) to rather long-term (right) effects in the framework. Short-term determinants, e.g., direct product experiences, can serve as early predictors for later (i.e., long-term outcomes) such as positive experiences from the activity. Thereby, stages further on the left are more tangible/concrete and more directly under the influence of a designer than stages further on the right.

Even though the logical direction of the process is thought to proceed from the product interaction to sustained wellbeing, i.e., from left to right, we acknowl-

edge the occurrence of feedback loops and effects in the opposite direction. For instance, indirect positive experiences (stage 4), e.g., higher levels of competence or self-esteem resulting from engagement in wellbeing-enhancing activities (stage 3), may increase a person's motivation (stage 2) to practice the activity. Lastly, we acknowledge that the strength of relationships between individual aspects along the five stages, i.e., individual pathways, depend on (a) the activity type and (b) the stage of behavior change, e.g., whether an activity is supposed to be initiated or maintained. For instance, cues or prompts represent important mechanisms to initiate an activity, while rewards or social support are potentially more relevant for adherence to an activity. In a similar vein, activities such as savoring might only need a reminder or trigger to be practiced more frequently, while other activities such as developing strategies for coping potentially require more extensive skill building.

3.4 Discussion

Frameworks can make three major contributions to the field of HCI: they can (a) advance the understanding of a phenomenon, (b) illustrate ways to design for it and (c) provide opportunities to measure it. In this section, implications of the current framework will be drawn for each of these areas.

3.4.1 Understanding technologies' contribution to sustained wellbeing

The framework promotes the understanding of technologies' contribution to sustained wellbeing in multiple ways. It argues for positioning positive activities as the stepping stone from product interaction to sustained wellbeing and introduces related mediating factors, i.e., drivers of behavior and positive experiences. It thereby deconstructs the complex phenomenon of wellbeing by design into a process of five stages and specifies logical relations between them. In addition, the framework positions these factors on a continuum of short- and long-term effects.

Furthermore, the framework discriminates different components/elements within each stage that inform the field of HCI/design, e.g., which positive activities to support or possible mechanisms to apply to foster engagement in these activities. Such tangible information has been largely missing in existing wellbeing design frameworks (Hekler et al., 2013; Peters et al., 2018). Distinguishing between a mechanism itself (e.g., prompt), its specific implementation in a given technology (= product properties, e.g., push notification) and how this implemented or technological mechanism is perceived by an individual (= UX qualities, e.g., helpful, annoying, patronizing) fosters cross-disciplinary understanding and consistent use of terminology. Mechanisms in the first stage are based on the literature study and our own empirical findings, but it is possi-

ble that the list presented in Table 3.2 will be expanded in further studies and applications. In a similar vein, elements within the remaining stages may need to be extended or revised in the future as well.

More (design) research is required to establish the nuanced relationships between individual elements across the different stages. Based on the literature in positive psychology and our own empirical findings, we have reasons to believe that such nuanced pathways across stages exist. For instance, the laddering study (Wiese et al., 2019) has shown that in order to foster strategies for coping, individuals need to develop appropriate skills (i.e., capability) to do this effectively, whereas activities aimed at contributing to the greater good can rather be promoted by appealing to an individual's set of personal values (i.e., motivation). Once a deeper understanding of individual pathways is achieved, it can be used to derive targeted design strategies.

3.4.2 Designing for sustained wellbeing

Theoretical conceptualizations need to be translated into hands-on design strategies that can be applied efficiently in academic and industrial settings in order to create real-world impact. Most existing wellbeing design frameworks provide relatively loose guidance by specifying determinants of (sustained) wellbeing that can be tackled by design (e.g., Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013). Oftentimes, these frameworks remain descriptive and do not explain how exactly a particular (set of) determinant(s) can be addressed in the design process, nor what brings about or mediates an intended psychological effect. While descriptive frameworks are useful due to their simplicity and inspirational potential, they are harder to transform into concrete action in everyday design practice. For this reason, we developed a framework that outlines the process from design to wellbeing with its intermediary stages. This basic yet detailed overview will hopefully equip designers to (a) devise clearer design goals, e.g., which determinant to design for and how to design for it, and (b) make more educated predictions regarding the intended impact of their designs at different points in time.

Furthermore, theoretical wellbeing design frameworks often propose to foster ingredients further on the right through design, e.g., mindfulness or empathy (Calvo & Peters, 2014) and psychological needs (Hassenzahl et al., 2010), within positive experiences or wellbeing outcomes directly, e.g., pleasure, personal significance and virtue (Desmet & Pohlmeyer, 2013). We argue that the design process does not always need to address the whole chain but can focus on positive activities to ultimately bring about lasting changes in wellbeing. More generally, we propose that design for sustained wellbeing can tackle any stage in the proposed framework. Starting from the targeted stage, the designer

can follow the flow backwards to the direct product interaction (i.e., from right to left) to determine how to influence this stage through design. In order to facilitate and guide this process, we added more granular information on how to shape each stage, e.g., which types of activities evidently increase wellbeing (stage 3), what drives human behavior in general (stage 2) and how behavior can be shaped through specific mechanisms (stage 1).

In our view, a design strategy consists of at least four parts: (a) which positive activity to foster, e.g., acts of kindness, (b) which driver of behavior to influence, e.g., motivation, (c) which (combination of) mechanism(s) to apply, e.g., modeling, and (d) how to implement these mechanisms, e.g., social media post showing a friend donated money for a good cause. One can further widen the scope by integrating specific positive experiences of stage 4 in the design goal, which could, in turn, influence the choice and implementation of mechanisms. Once we gain a better understanding of the nuanced pathways between individual elements across stages, the outlined approach to design can become even more targeted.

3.4.3 Measuring sustained wellbeing in relation to products

Design research and practice alike would benefit from assessment strategies to capture a technology's impact on wellbeing. Measuring long-term effects of technology usage is, however, not an easy endeavor. Established measurement scales for the assessment of short-term pleasure and positive emotions evoked by products in direct product interactions exist (e.g., PrEmo (Desmet, 2005); AttrakDiff (Hassenzahl et al., 2003); Aesthetic Pleasure in Design Scale (Blijlevens et al., 2017)). In contrast, less attention has been paid on how to measure long-term wellbeing effects (beyond pleasure) associated with technology-supported experiences and activities (Desmet & Pohlmeyer, 2013; Kamp & Desmet, 2014).

Klasnja et al. (2011) described major obstacles when evaluating digital technologies aimed at fostering sustained behavior change in the context of HCI. First, changing one's behavior might take a considerable amount of time (Prochaska et al., 1998). Consequently, long-term effects related to technology-supported changes in behavior may only manifest years from when a person initially started using a technology. Second, becoming lastingly happy is not a straightforward process but involves setbacks and relapses. Multi-year, longitudinal studies including repeated follow-ups are required to reliably capture long-term effects. Third, in order to demonstrate that changes in wellbeing can be attributed to one particular technology, intervention studies, ideally with randomized controlled trails, need to be performed. This evaluation method, where participants are randomly allocated to different intervention or control conditions, is commonly

applied in behavioral science to prove that a specific health-related intervention has been effective. However, within HCI, this is often not feasible, especially when evaluating early or novel technologies, e.g., due to fast-paced product development cycles (see also Hekler et al., 2013). Fourth, for designers of technologies, it is not only important to know that a product contributed to sustained increases in wellbeing but also why and how. This includes gaining a thorough understanding of how the respective technology is used, which experiences it elicits, and which barriers hinder adoption of or engagement with the technology (Hekler et al., 2013). HCI researchers (Hekler et al., 2013; Peters et al., 2018, p. 20) therefore call for the development of alternative measurement approaches to study long-term effects of technology usage on individuals' behavior and wellbeing.

Based on the specified relations within the framework, we propose a rationale for assessing long-term wellbeing effects of technology usage that attempts to overcome existing measurement challenges. The basic idea that we would like to promote here is to measure short-term predictors (i.e., stages 2 and 3) rather than long-term effects (stage 4) and wellbeing outcomes (stage 5) directly. We can infer these effects according to the logical relations mapped out in the framework. For instance, we can explore to which extent a given feature (e.g., a reminder in the form of a push notification) triggers participants' interest (i.e., opportunity) to start their daily meditation practice (i.e., positive activity). Determining whether a technology triggers or motivates a desired behavior (stage 2) can be assessed real time, i.e., either while interacting with the technology or in a short time interval after the interaction took place. Evaluating whether continuous engagement in wellbeing-enhancing activities through design makes a person more grateful, optimistic or prosocial over time (stage 4) requires, by contrast, longer measuring intervals and multiple check-ins. Real-time assessment of short-term predictors may also reduce measurement biases related to retrospective (memory-based) assessment of wellbeing outcomes including emotional experiences (Robinson & Clore, 2002). They are further under the direct control of the designer which makes insights derived from measurement more actionable. Lastly, we argue that the closer an entry point to the measurement is to the direct product interaction (i.e., the further to the left in the framework), the easier it is for a respondent to attribute a probed effect to using (aspects of) a particular technology. Consequently, we consider stages 2 and 3 to be especially well-suited as starting points for measurement. Although there is a chance that positive experiences and wellbeing might not be supported in the end, we consider this to be a suitable approach for early stages of product development.

With regard to selecting and optimizing design strategies, an opportunity for measurement is thus to assess how a specific implementation of a mechanism

is perceived by an individual, e.g., if a technology teaches skills (i.e., training mechanism) in an efficient and comprehensive way, helps to plan the activity (i.e., action planning = mechanism) in a way that fits into one's daily life or to which extent a designed feedback feature (= mechanism) makes the product appear to be optimally challenging. This approach can be used to compare early prototypes that feature a specific mechanism in different ways. At the activity level (stage 3), we can measure the level of engagement (e.g., frequency, duration, immersion) with a target activity. For a more complex technology, we can also assess to which extent a product promotes each of the 14 categories of positive activities, e.g., how much a social networking platform fosters acts of kindness, optimistic thinking, nurturing social relationships, or contributing to the greater good.

Once the feature or technology has been matured and rolled out, products' impact on sustained wellbeing should also be measured directly at the wellbeing level (stage 5) or at the level of positive experiences (stage 4). For both options, designers can draw from established and validated measurement scales in positive psychology. For different aspects within stage 4, such scales would, for instance, assess a person's level of gratitude (e.g., Gratitude Questionnaire; McCullough et al., 2002), mindfulness (e.g., Mindfulness Attention Awareness Scale; Brown & Ryan, 2003), or empathy (e.g., Empathy Quotient; Lawrence et al., 2004). For the components within stage 5, measurement tools that capture hedonic wellbeing, e.g., Satisfaction with Life Scale (Diener et al., 1985) and Affect Balance Scale (Bradburn, 1969), and eudaimonic wellbeing, e.g., Scales of Psychological Wellbeing (Ryff, 1989; Ryff et al., 1995), can be used. As outlined above, measuring long-term wellbeing effects (stages 4–5) is associated with a number of challenges—especially in relation to products and within fast-paced product development cycles.

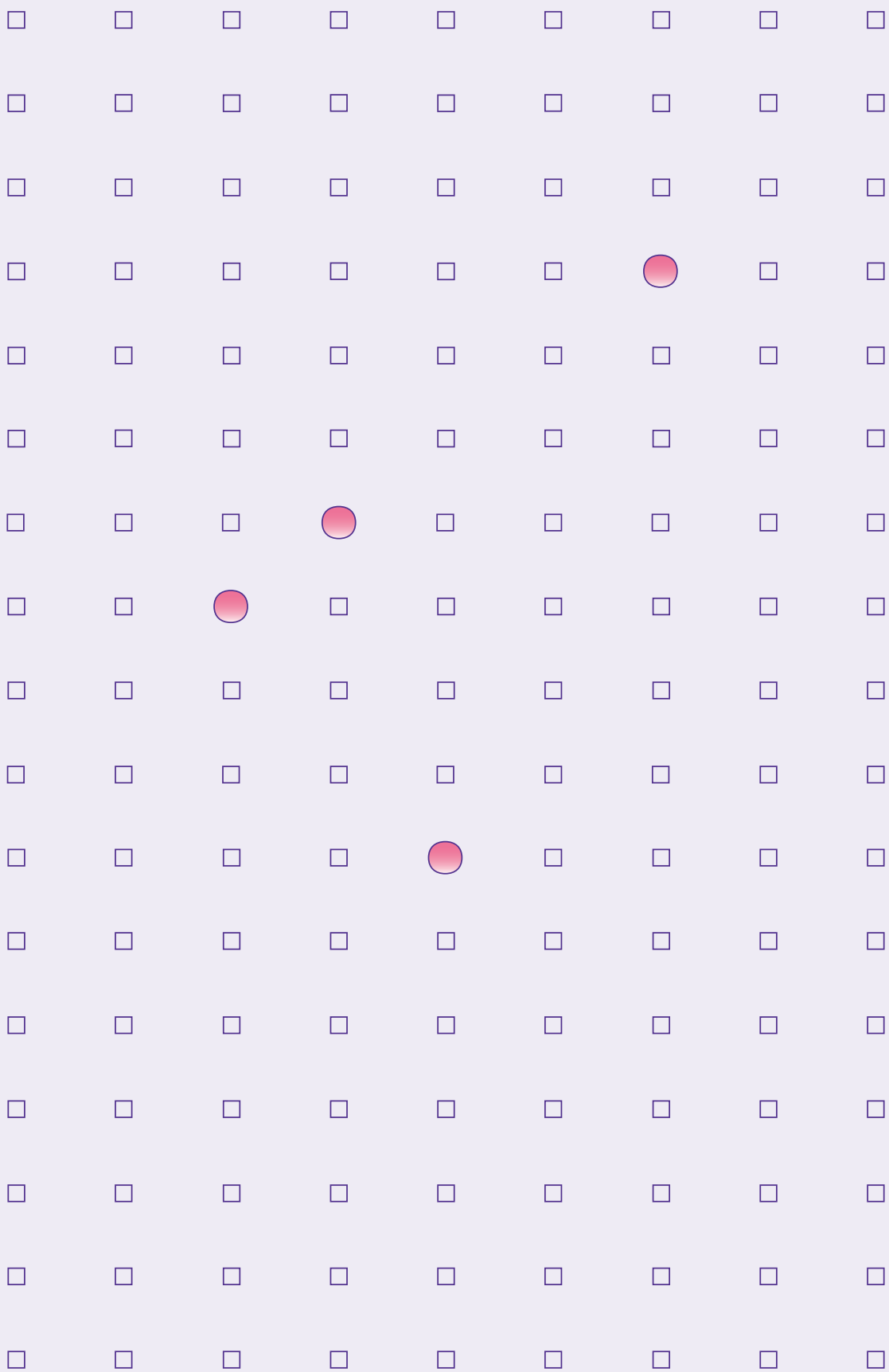
In sum, assessment of short- and long-term effects along the process described in the proposed framework poses valuable entry points to measure technology-supported sustained wellbeing. In design practice, short-term effects (stages 2 and 3) might be more suitable when a technology is still being built and refined (i.e., in the early stages of product development), while long-term measurement options become more relevant once the technology is fully rolled out to track its actual impact on sustained wellbeing. In design research, both advance our understanding of whether and how precisely (novel as well as existing) technologies impact people's wellbeing.

3.5 Conclusion

Positive activities are at the centerpiece of this framework for wellbeing by design. These activities broadly cross major life domains and are quite specific at

the same time. They cover a rich set of targets for designers while being reliable predictors of sustained wellbeing. We find this to be a promising combination of broad applicability and refined actionability.

The framework integrates and organizes knowledge from multiple disciplines that is typically scattered across a wealth of publications. In doing so, it makes this broad knowledge more accessible to designers and reduces some of the conceptual and terminological obscurities that we observed in the literature. We hope this will help designers to approach projects with more clarity, to systematically explore pathways, and possibly inspire interdisciplinary collaboration. Ultimately, our framework could contribute to a designed world that fosters the wellbeing of future generations.



4

Wellbeing by design: How social media and streaming platforms support user wellbeing

This chapter is under review for publication at International Journal of Design as an article titled "Wellbeing by Design: How Social Media and Streaming Platforms Support User Wellbeing".

This chapter presents two empirical studies – an expert analysis and an online survey – that examine how features and actual uses of two specific types of consumer technologies, social networking sites and streaming platforms, currently support positive activities, using the theoretical framework as a basis for analysis. The findings show that these technologies already include numerous features and are used in various ways that promote positive activities. The chapter explores how these technologies achieve this, focusing on the design mechanisms they employ and their impact on user behavior. It also identifies two distinct types of Active Designs, each promoting positive activities in unique ways. The features identified in the expert analysis were subsequently incorporated into the design tool described in Chapter 6.

4.1 Introduction

Global mental health is deteriorating, with the most significant decline reported at the start of the Covid-19 pandemic in 2020. This emphasizes the need for well-being interventions that have a widespread reach among the public. Common avenues for disseminating such interventions include psychotherapy, public education, and policymaking. Another promising, but less obvious, opportunity to enhance global wellbeing is transforming our daily interactions with consumer technology, including instant messaging services, social networks, and entertainment platforms. These technologies are widely adopted and seamlessly integrated into our daily lives, giving them the broad reach needed for global impact. When designed to foster wellbeing, they could create meaningful benefits for individuals and society (Calvo & Peters, 2014; Schueller & Parks, 2012). In this paper, we identify concrete opportunities to enhance individual wellbeing through everyday consumer technology. As a first step, we examine how existing consumer technology already supports wellbeing. Based on our findings, we outline clear pathways from specific product interactions to positive activities, illustrating how these activities are currently supported in consumer technology and offering inspiration for designers to further integrate them into future applications.

4.2 Background

4.2.1 The impact of consumer technology on wellbeing

The impact of consumer technology on wellbeing has been the focus of intense scientific debate (Orben & Przybylski, 2020; Twenge et al., 2020; Vanden Abeele, 2021). When used actively and intentionally (Lukoff et al., 2018, 2021), consumer technology has the potential to strengthen social connections (Burke et al., 2010), encourage prosocial behavior (Lysenstøen et al., 2021), and promote

healthier lifestyles (Stellefson et al., 2020). From the beginning, tech companies have emphasized wellbeing objectives in their mission statements: Facebook promises to "give people the power to build community", Instagram encourages users to "express themselves", Pinterest aspires to help people "create a life they love", and YouTube wants to "give everyone a voice". Despite this great potential – and "good" intentions – certain uses of modern technology can significantly harm people's wellbeing. More than ever, it fuels distraction (e.g., Ward et al., 2017), division (e.g., Brady et al., 2017), and mental health struggles (e.g., Twenge, 2020). These harms partly stem from aligning technology design with the business goals of the attention economy (Davenport & Beck, 2001). Companies like Google, Meta, and X/Twitter profit by maximizing user engagement, as more time spent on their platforms increases ad exposure and, in turn, leads to higher revenue. To achieve this, they sometimes use "damaging" design tactics, such as infinite scrolling, video autoplay, and push notifications, which are aimed at capturing and holding users' attention, often longer than intended (Monge Roffarello et al., 2023). In addition, they use algorithmic curation to promote content likely to attract clicks and shares, including harmful material like clickbait, hate speech, or misinformation (Brady et al., 2017; Vosoughi et al., 2018). Over time, personalized recommendation systems can reinforce these patterns by suggesting similar or increasingly harmful content, drawing users into a "rabbit hole" that can harm their wellbeing (Harriger et al., 2022). Overall, modern consumer technology can have both positive and negative effects on wellbeing, depending on how it is used and by whom (e.g., Burke & Kraut, 2016; Yang, 2016). Currently, consumer technology is often "part of the problem", as it frequently promotes excessive and problematic technology use, but it also has the potential to be "part of the solution" by promoting wellbeing to a large audience (Calvo & Peters, 2014).

4.2.2 Design for wellbeing

There are two main approaches to designing technology that fosters wellbeing (Calvo & Peters, 2014; Vanden Abeele, 2021): (a) the prevention of harm (i.e., non-maleficence approach) and (b) the proactive promotion of wellbeing (i.e., beneficence approach).

PREVENTION OF HARM

While not all technology can or must enhance wellbeing, it should at minimum "do no harm" to users' mental health (Peters, 2022). The prevention of harm, referred to as *Preventative Design* by Calvo and Peters (2014), seeks to mitigate the negative effects on wellbeing that arise from the current design of consumer technology. Following this approach, tech companies (Pardes, 2018; Solon, 2018) and academic researchers (Lyngs et al., 2019; Monge Roffarello et al.,

2023) have developed various *digital wellbeing* tools to help users self-regulate their technology use. These tools often focus on reducing overall screen time or limiting specific app usage through external solutions, like browser extensions, lock-out timers, or built-in phone settings. They target problematic user behavior, but do not change the "problematic" design of the technology itself (Peters et al., 2020). In addition, most tools not only restrict harmful technology use but also prevent users from positive and meaningful experiences that technology can enable (Lukoff et al., 2023; Vanden Abeele, 2021). Lastly, and perhaps most importantly, current digital wellbeing tools mainly focus on preventing harm but do not actively promote optimal psychological functioning, a core aspect of general psychological wellbeing (Keyes, 2007). At best, they make technology use "not problematic" (Vanden Abeele, 2021). A more holistic approach to "digital wellbeing" could combine existing preventative strategies with design interventions that actively foster positive wellbeing outcomes (Almoallim & Sas, 2022; Calvo & Peters, 2014; Vanden Abeele, 2021). Most recently, digital wellbeing researchers have begun to shift their focus toward selectively (a) reducing problematic use by modifying harmful design patterns (Lukoff et al., 2021; Zhang et al., 2022) and (b) enhancing positive uses of technology (Lukoff et al., 2023). Tech companies like Pinterest share this view, stating: "It's never enough to filter out the bad - we want to design in the good" (Pinterest, 2023).

PROMOTION OF WELLBEING

The proactive promotion of wellbeing aims to enhance (determinants) of wellbeing by means of technology design (Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013; Hassenzahl et al., 2013; Riva et al., 2012). This includes technologies that are intentionally designed to promote wellbeing as their main purpose. These so-called *Dedicated Designs* (Calvo & Peters, 2014) encompass: (a) commercial wellbeing applications, such as meditation or gratitude apps; (b) behavioral intervention technologies (BITs) designed to enhance mental and physical health behaviors, including healthy eating, a good sleep hygiene, and mood improvement (Mohr et al., 2013); and (c) therapeutic applications (De Witte et al., 2021). Although BITs are powerful tools for translating wellbeing interventions from therapeutic settings into real-world applications (Bolier & Abello, 2014), they often reach only a limited audience and face high attrition rates (Ludden et al., 2015; Pohlmeyer, 2017; Schueller et al., 2013).

Another promising approach to fostering wellbeing through design involves integrating wellbeing-supportive features into existing technologies, products, or services that primarily serve other purposes. Calvo and Peters (2014) refer to this approach as *Active Design*. For example, expressing gratitude might include actions like 'endorsing a colleague' on a professional platform such as LinkedIn. Features like 'Memories' on Facebook or 'Rediscover This Day' in Google Photos

encourage users to revisit meaningful life events, thereby potentially fostering reminiscence, a crucial aspect of savoring (Konrad et al., 2016). To date, this Active Design approach has received comparatively little attention, despite its many benefits. (Re)designing (existing) technology with wellbeing principles in mind can reach more people and can do so in a context-sensitive manner (Ludden et al., 2015; Pohlmeyer, 2017). Such a feature-level approach can also be applied to protective interventions that address specific problematic uses within a platform, rather than imposing broad restrictions on technology use (Lukoff et al., 2021). Although these protective interventions can be seen as preventative – in Calvo and Peters' (2014) terminology – they also actively promote wellbeing by helping users avoid certain (negative) activities such as overthinking or social comparison (see section on positive activities). For that reason, we treat both proactive and protective interventions as variants of Active Design. This paper explores whether and how these two types of active wellbeing interventions are currently integrated into existing consumer technology.

WELLBEING DESIGN FRAMEWORKS

Wellbeing is a multifaceted concept that encompasses various aspects of human experience, such as having meaningful social relationships, pursuing important personal goals, and savoring the present moment (Diener et al., 2009; Ryff, 1989; Seligman, 2011). A key challenge for designers is determining which aspects of wellbeing are most relevant to their specific design context, including the platform to design for, the feature being developed, or the user behavior they aim to influence (Wiese et al., 2024a). Research in human-computer interaction (HCI) has developed theoretical frameworks grounded in (positive) psychology, highlighting key determinants of wellbeing that can be targeted by design. Relevant contributions include work on Positive Technologies (Riva et al., 2012), Positive Design (Desmet & Pohlmeyer, 2013), Positive Computing (Calvo & Peters, 2014; Peters et al., 2018), and Experience Design (Hassenzahl et al., 2013). While these frameworks can inspire designers, applying them in everyday design practice is not always straightforward because they offer limited insight into how to shape a (specific set of) wellbeing determinant(s) at the interface level (Hekler et al., 2013). Therefore, designers would greatly benefit from more targeted guidance on (a) which wellbeing factors to focus on and (b) how to effectively support these factors within specific technological contexts (e.g., Hassenzahl et al., 2013; Klapperich et al., 2018).

4.2.3 Using positive activities to design wellbeing features

To reduce the gap between theory and practice, we developed the Design for Sustained Wellbeing framework (Wiese et al., 2020), which outlines a five-

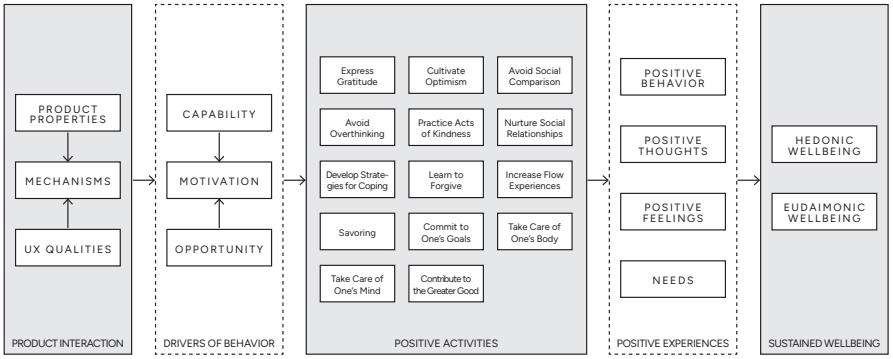


Figure 4.1: Design for Sustained Wellbeing Framework (Wiese et al., 2020)

stage process for how products (stage 1) can promote sustained wellbeing (stage 5) by fostering engagement in positive activities (stage 3) (Figure 4.1). Positive activities increase wellbeing by stimulating (a) positive behaviors, (b) positive thoughts, (c) positive feelings, and (d) the fulfillment of basic human needs (stage 4). Products (stage 1) can promote positive activities by activating psychological drivers of behavior (stage 2) through specific mechanisms, such as prompts, feedback or social support (see Table 4.1). These mechanisms are implemented through concrete product properties, such as buttons, text or colors, which affect how users experience them in terms of user experience (UX) qualities.

Positive activities are simple strategies that, when practiced regularly, can enhance wellbeing in a sustained way (Lyubomirsky & Layous, 2013). Examples include practicing gratitude, cultivating optimism, avoiding overthinking, and nurturing social relationships (see Wiese et al., 2020, for details). These activities have been rigorously tested in controlled intervention studies and consistently shown to improve wellbeing (Bolier et al., 2013; Lyubomirsky, 2007; Sin & Lyubomirsky, 2009). Although positive activities are common design targets for therapeutic and commercial wellbeing applications (e.g., Heckendorf et al., 2019), they have not been widely utilized for designing wellbeing interventions in consumer technology.

Rather than directly targeting abstract wellbeing outcomes (stage 5), the framework suggests focusing the design process on these concrete, evidence-based determinants of wellbeing, and therefore, on the first three stages of the framework. It offers practical guidance at each stage, detailing (a) which activities are proven to enhance wellbeing (stage 3), (b) what are key drivers of human behavior (stage 2), and (c) how to shape behavior through specific mechanisms (stage 1, Table 4.1). To apply the framework effectively in practice, designers must establish clear pathways from stage 1 to stage 3, making four intercon-

nected decisions: (a) which positive activity to focus on in a given context, (b) which driver of behavior to influence, (c) which (combination of) mechanism(s) to apply, and (d) how to implement these mechanisms effectively within the user interface (Wiese et al., 2020). Designers do not need more theory, but assurance that and guidance on how theories are applicable in practice. Given the abundance and popularity of consumer technologies that claim to promote wellbeing, it is striking how little these are systematically analyzed with academic frameworks.

Table 4.1: A non-exhaustive list of mechanisms from behavioral science and positive psychology. These mechanisms can activate psychological drivers of behavior (see Wiese et al., 2020, for more details).

Design Mechanism	Definition
Optimal Challenge	Ensure the challenges posed by the activity align with the user's current skill level
Focus Attention	Support users in focusing on the activity and resisting distractions
Education	Help users understand why it is important to practice the activity
Training	Teach users how to perform the activity
Goal Setting	Help users set clear and meaningful goals related to the activity
Action Planning	Support detailed planning of the activity
Social Support	Provide support from social contacts when performing the activity
Prompts	Define a stimulus to trigger the activity
Persuasion	Use communication to evoke emotions that motivate engagement in the activity
Rewards	Provide positive incentives for engaging in the activity
Feedback	Provide feedback on the performance of the activity
Self-Monitoring	Enable users to track the outcome of the activity
Personal Relevance	Enable users to tailor the activity to their personal interests
Modelling	Introduce a role model to aspire to or imitate
Variation	Encourage practicing the activity in new or varied ways
Joy of Use	Make the activity enjoyable
Self-Reflection	Encourage users to reflect on personal experiences
Self-Expression	Encourage users to share thoughts and feelings with trusted others

In this research, we empirically investigate whether the framework can be applied to existing consumer technologies. To this end, we conducted two studies to assess *how consumer technologies currently support positive activities* (**Main RQ**).

4.3 Research approach

In Study 1, we conducted an expert analysis of popular apps to identify and examine features that appear to be purpose-built, i.e., intentionally designed, to promote positive activities, such as 'Memories' (Facebook) or 'Rediscover This Day' (Google Photos). Specifically, we investigated (a) which positive activities are currently supported (**RQ1**), and (b) which design mechanisms are used to support them (**RQ2**). In other words, we examined specific pathways from the user interface to positive activities.

In Study 2, we conducted an online survey with active Instagram users to investigate whether and how they actually use the platform to engage in positive activities (**RQ3**), either through purpose-built or other functionalities. Previous research suggests that people often engage in positive "digital practices" (Hagen, 2015; Brewster & Cox, 2019) that enhance their wellbeing or benefit others. Our goal was to explore (a) what these practices entail in relation to positive activities and (b) how Instagram features initiate and sustain them.

4.4 Study 1: Expert app analysis

Study 1 examines, through an expert app analysis, how specific built-in features of consumer technologies (a) actively promote positive activities (*Proactive Designs*) and/or (b) help reduce or avoid behaviors that undermine wellbeing (*Protective Designs*).

4.4.1 Method

APP SELECTION

We analyzed six widely used apps in the United States: four social networking platforms (Facebook, Instagram, LinkedIn, Pinterest) and two music and video streaming platforms (Spotify, YouTube). The apps were chosen based on three criteria: (a) their popularity (measured by monthly active users), (b) their claims to support aspects of wellbeing (as stated in PR/marketing or mission statements), and (c) the researchers' familiarity with them. To ensure our findings could inform the design of wellbeing interventions with a broad reach, we focused on popular apps ranked among the top 10 most-used apps in their respective categories on the U.S. Google Play Store. As of 2024, the selected apps had monthly active users ranging from 310 million (LinkedIn) to 3.06 billion (Facebook). Furthermore, the selected platforms vary in their wellbeing claims, suggesting they may support a wide range of positive activities. Researcher familiarity with the platform was considered important to facilitate the detail-oriented feature selection and analysis. We chose platforms with differing business models, user interfaces, and motivations for use, as these

differences suggest they offer distinctive user experiences (Alhabash & Ma, 2017; Lee et al., 2015; Sheldon & Bryant, 2016).

FEATURE SELECTION

Before starting the feature selection process, the first author (a) conducted a thorough literature review on positive and negative uses of consumer technology and (b) scanned company websites (e.g., about.instagram.com), technology blogs (e.g., wired.com), and scientific publications for feature discussions. This was done to better contextualize design intentions for features she encountered. Building on methods used in similar app reviews (Almoallim & Sas, 2022; Jake-Schoffman et al., 2017; Qu et al., 2020), we systematically examined each app through direct use to identify features designed to support positive activities. The first author personally used each app with her own user accounts. The deliberate screening for features took place between January and June 2024.

Our approach differs from recent reviews of *dedicated* digital wellbeing tools that rely on app store data (e.g., Lyngs et al., 2019) or systematic literature reviews (e.g., Monge Roffarello & De Russis, 2023). Since our focus is on the integration of *active design* solutions, we could not depend on wellbeing-supportive features being prominently highlighted in app store descriptions. Instead, we identified relevant features through direct interaction with the apps.

The first author initially documented the features, which were then reviewed and discussed with the second author to assess their alignment with positive activities. Only features that both authors agreed supported positive activities were included in the final list. These features were cataloged in a Google Spreadsheet, noting (a) feature name, (b) feature description, (c) design type, i.e., Proactive or Protective Design, and (d) platform. Additionally, a visual record, along with links to feature announcements or blog articles explaining the design intent (when available), was archived for each feature.

FEATURE ANALYSIS

We categorized the identified features in line with their attributed design intentions (Crilly et al., 2008). These intentions were inferred from (a) the explicit design goals communicated by the technology companies (when available) and/or (b) the researchers' judgment, informed by a review of the literature. For each feature, we recorded (a) the positive activity it supported and (b) the design mechanisms employed to achieve this support.

In addition, we differentiated two design approaches: (a) Proactive Design and (b) Protective Design. Since our focus is on internal wellbeing interventions, i.e., features integrated directly into a platform, as opposed to standalone wellbeing applications, both are considered variants of Active Design, as defined by Calvo

and Peters (2014). Both approaches *promote* wellbeing by "activating" positive behaviors, thoughts or feelings, collectively referred to as positive activities. *Proactive Design* includes features that directly encourage or promote positive activities. *Protective Design* includes features that (a) allow users to set conditions not to engage in negative activities, (b) strengthen users' capability to counteract negative behavior directly, and (c) shield positive activities from harmful content or other risks. These features reduce the likelihood of negative behavior to occur, positioning them closely to preventative wellbeing interventions (Calvo & Peters, 2014). However, unlike traditional preventative interventions, often implemented as dedicated app-overarching solutions, Protective Designs are embedded directly within the platform itself (see also Lukoff et al., 2021).

We further categorized features within each activity category into more specific subgroups reflecting more concrete user behavior. For instance, doom-scrolling, defined as excessive and repetitive seeking out of negative or anxiety-inducing online content, was interpreted as a digital manifestation of overthinking. Correspondingly, features designed to mitigate doom-scrolling were classified as Protective Designs aimed at avoiding overthinking. Each feature was assigned to a single positive activity but could utilize multiple design mechanisms. The first author conducted an initial analysis of all selected features. Her classification was then reviewed and discussed with the second author. Together, the authors iteratively developed a codebook for (a) positive activities (Table A.1, Appendix) and (b) design mechanisms (Table A.2, Appendix), starting from the taxonomies specified in the Design for Positive Activities framework (Wiese et al., 2020) and other previous work (Wiese et al., 2024b).

4.4.2 Results

POSITIVE ACTIVITIES IN EXISTING CONSUMER TECHNOLOGY

The main objective of Study 1 was to assess how purpose-built features in existing consumer technologies support positive activities. A total of 165 features were identified across the six applications: 35 from Facebook, 57 from Instagram, 25 from LinkedIn, 12 from Pinterest, 14 from Spotify, and 22 from YouTube. The complete list of features, including detailed descriptions, is available here: https://doi.org/10.4121/ffbabc01-43d0-4d4f-961f-c584399a2e58.

Following RQ1, we found that nine of the fourteen positive activities specified in the Design for Sustained Wellbeing framework were supported by the 165 identified features (Table 4.2). Five activities were exclusively promoted proactively (Practicing Gratitude, Nurturing Social Relationships, Developing Strategies for Coping, Savoring, Committing to Goals), three primarily through protective features (Avoiding Overthinking, Avoiding Social Comparison, Taking

Care of One's Mind), and one both proactively and protectively (Practicing Acts of Kindness), see also Table 4.3. On the selected platforms, we did not identify any features designed to promote Cultivating Optimism, Learning to Forgive, Increasing Flow Experiences, and Taking Care of One's Body.

Table 4.2: The total number of purpose-built features for each activity across platforms. Activities marked with an asterisk (*) were supported either partially or exclusively by protective features.

Positive Activity	Facebook	Instagram	LinkedIn	Pinterest	Spotify	YouTube	Total
Nurture Social Relationships	9	14	7	2	6		38
Take Care of Mind*	8	11	3	3		7	32
Practice Acts of Kindness*	8	13	6	1		3	31
Commit to Personal Goals	2	5	5	3		3	18
Avoid Overthinking*	2	5		1		8	16
Practice Gratitude	2	2	4		1	1	10
Avoid Social Comparison*	1	5		1			7
Savoring	3	2			2		7
Develop Strategies for Coping				1	5		6

Overall, 59% (97/165) of the features were classified as Proactive Designs and 41% (68/165) as Protective Designs. Figure 4.2 shows a breakdown of these design types by (a) platform and (b) product category. Notably, all of Spotify's 14 features promoted positive behavior proactively, while all other platforms incorporated a combination of protective and proactive measures.

The four social networking platforms Facebook, Instagram, LinkedIn, and Pinterest (129/165 features, 78%) most commonly used Proactive Design features (77/129 features, 60%) to promote the activities of Nurturing Social Relationships (32 features), Committing to Personal Goals (15 features), and Practicing Acts of Kindness (13 features). Among the Protective Design features on these platforms (52/129 features, 40%), the primary focus was on addressing cyberbullying (15 features, Practicing Acts of Kindness), excessive technology use (13 features), and harmful content exposure (9 features, both Taking Care of One's Mind).

The music streaming platform Spotify (14/165 features, 8%) incorporated features to Nurture Social Relationships (6 features), primarily through shared listening experiences, and to support emotion regulation, an aspect of Coping (5 features). The video streaming platform YouTube (22/165 features, 13%), on the other hand, predominantly employed protective features (16 features),

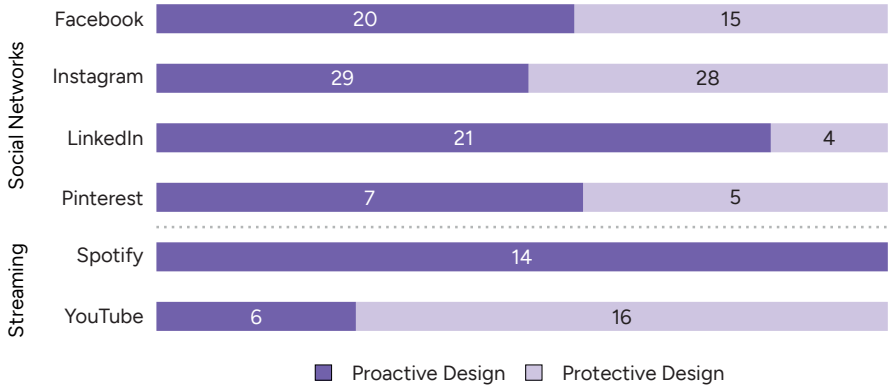


Figure 4.2: Total number of Proactive and Protective Designs (a) per platform and (b) product category.

including features to reduce doom-scrolling (9 features), mitigating excessive platform use (4 features), and minimizing harmful content exposure (2 features), all manifestations of Taking Care of One's Mind.

PATHWAYS AND DESIGN MECHANISMS

Next, we analyze the design mechanisms employed (see Table 4.1) to support each positive activity (**RQ2**), tracing the pathways from the product interaction to positive activities. In the section below, we describe these pathways, highlighting general patterns. For each activity, we provide (a) a brief definition, (b) a description of associated user behavior (see Table 4.3, for an overview; Table A.1, Appendix for definitions), (c) relevant features, and (d) the design mechanisms involved (Table A.2, Appendix for definitions). For a more detailed analysis, including descriptions of specific features, readers are encouraged to explore the data set at: https://doi.org/10.4121/ffbabc01-43d0-4d4f-961f-c584399a2e58.

Practice Gratitude *(10/165 features, 6%).* Practicing gratitude involves privately reflecting on or openly expressing (to another person) what one is thankful for or appreciates (Emmons & Shelton, 2002; Lyubomirsky, 2007). In the technology sample we examined, all features promote **expressions of gratitude** by acknowledging the achievements, contributions, or positive behaviors of colleagues, friends, and followers. Examples include showing appreciation to a colleague on LinkedIn through Skill Endorsements, Recommendations, or Kudos, or expressing gratitude to family and friends on Facebook or Instagram using Stickers and Gratitude Post Frames. Most features (9/10 features) encourage users to (exclusively) share these peer-to-peer acknowledgments publicly, such as in team chats, comments, or wall posts, rather than privately through direct

messages (*Self-Expression*). Public expressions of gratitude can model positive behavior (*Modelling*) and inspire others to join in, thereby strengthening social support (*Social Support*). Besides such social prompts, gratitude was encouraged through automatic or user-initiated status updates (*Prompts*), like LinkedIn's Job Updates. Gratitude-supportive features prompt users to express their appreciation (*Self-Expression*) through fast interactions like clicking buttons for Endorsements and Reactions or using system-generated interface elements like Smart Suggestions or Stickers (7/10 features). A smaller number of features (3/10 features) also encourage more thoughtful expressions of gratitude by prompting users to write free-text statements, such as LinkedIn's Recommendations, Kudos, or Comments as reactions to Job Updates.

Avoid Overthinking *(16/165 features, 10%).* Overthinking involves persistently dwelling on problems, often without taking constructive steps to solve them (Nolen-Hoeksema et al., 2008). Similarly, **doom-scrolling** refers to the excessive and repeated consumption of distressing or anxiety-inducing online content (Watercutter, 2020), including misinformation, polarizing opinions, sensitive material, and clickbait. Features designed to combat doom-scrolling aim to reduce exposure to such content through (a) flagging content with labels (*Prompts*, e.g., Content Warning), (b) guiding users toward trusted information sources via behavioral nudges (*Prompts*, e.g., Fact Check Panel), and (c) providing controls to customize the newsfeed (*Self-Monitoring*, e.g., Show More/Less). Anti-doom-scrolling features were most commonly found on YouTube (8/16 features) and Instagram (5/16 features).

Avoid Social Comparison *(7/165 features, 4%).* Social comparison occurs when individuals evaluate their skills, opinions, feelings, looks, or achievements against those of others (Festinger, 1954). Upward social comparisons, where others appear to be doing better, can evoke feelings of inadequacy and harm mental health. On social networks, such negative social comparisons can reduce wellbeing (Verduyn et al., 2020), contribute to body dissatisfaction (Holland & Tiggemann, 2016), and increase fear of missing out (Przybylski et al., 2013). Most identified features are protective in nature, aiming to **reduce negative comparisons** (5/7 features) by limiting exposure to or raising awareness of triggering content. These features include (a) content controls like Newsfeed Preferences (*Prompts*), (b) disclaimer labels or hashtags like #InstagramvsReality (*Prompts*), (c) behavioral cues like Harmful Content Nudges (*Prompts*), (d) social controls like Snooze or Mute (*Self-Monitoring*), and (e) settings to hide popularity metrics such as Like and Share Counts (*Self-Monitoring*). However, a smaller subset of features (2/7 features) focus on fostering more **authentic self-presentation** (1/7 features) through private interactions with close connections like Instagram's Candid Stories (*Self-Expression*) and embracing **diverse beauty standards** (1/7 features), such as Pinterest's Inclusive Beauty Searches (*Focus Attention*).

Table 4.3: Total number of purpose-built features supporting positive activities, categorized by user behavior. Categories of protective features are marked with an asterisk (*).

Positive Activity	User Behavior	Number of Features
Practice Gratitude	Express gratitude	10
Avoid Overthinking	Reduce doom-scrolling*	16
Avoid Social Comparison	Reduce negative comparisons*	5
	Authentic self-presentation	1
	Embrace diverse beauty standards	1
Practice Acts of Kindness	Reduce toxic interactions*	16
	Prosocial spending	5
	Support others	5
	Respectful interactions	5
Nurture Social Relationships	Direct exchange	17
	Connect with others	10
	Collaborative use	7
	Self-disclosure	4
Develop Strategies for Coping	Emotion regulation	6
Savor Life's Joys	Reminiscence	7
Commit to Goals	Set goals	13
	Focus on goals	5
Take Care of Mind	Reduce excessive use*	18
	Reduce harmful content*	11
	Reduce mental health threats*	2
	Promote mental health	1

Practice Acts of Kindness *(31/165 features, 19%).* Practicing acts of kindness encompasses voluntary prosocial behaviors that benefit others (Lyubomirsky, 2007). Digital technologies can promote prosocial actions, such as online donations, volunteering, or mentoring (Dunn et al., 2008; Lysenstøen et al., 2021; Wright & Li, 2012), but they can also foster antisocial behaviors, including cyberbullying, online toxicity, and hate speech (Saveski et al., 2021; Thomas et al., 2022; Verma et al., 2023). In our technology sample, about half of the features were designed to *prevent* unkind behavior by **reducing toxic interactions** (16/31 features), while the other half proactively *promoted* acts of kindness (15/31 features). Specific features that encourage acts of kindness include those that promote **prosocial spending** (5/31 features), such as Fundraisers and Donations. These features motivate contributions by displaying the number of donors (*Modelling*), evoking empathy through personal stories and images (*Persuasion*), setting clear fundraising goals (*Goal Setting*), providing progress updates (*Feedback*), recognizing contributors publicly (*Rewards*), and simplifying donation processes (*Action Planning*). Acts of kindness also include **supporting others** (5/31 features) through reactions to status updates or offering help and mentorship (*Social Support*). Lastly, features that encourage **respectful interactions** (5/31 features) include Pinned Comments that highlight positive behavior (*Modelling*) and behavioral nudges like Kindness Reminders and Respectful Post Nudges (*Prompts*).

Nurture Social Relationships *(38/165 features, 23%).* Supportive and meaningful relationships are widely recognized as one of the most important factors for wellbeing (e.g., Umberson & Montez, 2010). Features designed to nurture social relationships encompass those that promote **direct exchange** (17/38 features) with others. These features facilitate social interactions both privately and publicly, whether with friends or strangers (*Social Support*, e.g., Direct Messaging, Comments), remind users to reach out (*Prompts*, e.g., Birthday Reminders, Message Nudges, Celebrations), and trigger conversations based on shared content (*Prompts*, e.g., Nominations, Notes, Tags & Mentions). Consumer technologies also create opportunities (*Prompts*) to **connect with others** (10/38 features), including rekindling friendships (e.g., Find Friends), engaging with business partners (e.g., Connections), and discovering like-minded individuals (e.g., Follow). In addition, they support staying in touch with close social ties by offering features to prioritize content from family and friends (*Self-Monitoring*, e.g., Favorites, Close Friends). Another set of features aimed at fostering social relationships includes those that support **collaborative use** (7/38 features), such as Collaborative Collections and Playlists, Group Profiles, and shared music experiences like Blend or Friends Mix (*Social Support*). Lastly, features encouraged **self-disclosure** (4/38 features) by enabling users to share personal information, thoughts, and feelings with others (*Self-Expression*, e.g., Emojis, Story & Mes-

sage Effects) while also offering privacy controls (*Self-Monitoring*, e.g., Choose Audience).

Develop Strategies for Coping *(6/165 features, 4%)*. Coping refers to individuals' strategies to respond and adapt to stressors and negative events (Carver et al., 1989). Psychologists typically differentiate two types of coping: (a) problem-focused and (b) emotion-focused coping. Problem-focused coping involves taking concrete steps to actively solve a problem or tackle the underlying source of distress. Emotion-focused coping involves managing one's emotional reaction to a distressing event (Gross, 2015). Individuals habitually turn to digital technology to **regulate their emotions** (Smith et al., 2022; Verma et al., 2023), for instance by selecting an upbeat playlist to boost one's motivation to work out, seeking help in online communities, or watching an entertaining movie to unwind after a long day at work (Lukoff et al., 2018; Siles et al., 2019; Verma et al., 2023). In our study, features supporting digital emotion regulation include tools for exploring content tailored to users' current or desired emotional state (*Personal Relevance*), such as mood-based search options (e.g., Browse by Mood on Spotify) and algorithmically curated playlists designed to evoke specific moods (e.g., Featured Playlists like 'Smooth Mornings' or 'Workday Zen' on Spotify). These features were most commonly found on Spotify (5/6 features). Spotify also offers Featured Playlists for a variety of daily activities, including work, leisure, and exercise (Eriksson & Johansson, 2017), which can help users integrate music for emotion regulation into their daily routines (*Action Planning*). Pinterest's Compassionate Search feature nudges (*Prompts*) users, who search for terms indicating they may be feeling down, to explore activities that enhance their emotional wellbeing.

Savor Life's Joys *(7/165 features, 4%)*. Savoring involves cognitive and behavioral strategies to extend and intensify positive experiences by anticipating them in the future, fully enjoying them in the present, and reflecting on them afterward (Bryant, 2021; Bryant & Veroff, 2007). Savoring represents specific methods for upregulating positive emotions (Nelis et al., 2011; Quoidbach et al., 2010) and typically requires both (a) recognizing positive experiences and (b) intentionally focusing attention on them. Digital technologies can support savoring by helping users (a) remain present (Courtright & Caplan, 2020) and (b) capture and reflect on meaningful experiences, a process called reminiscence (Konrad et al., 2016). **Reminiscence** features (7/7 features) identified in this study enable users to record personal experiences as wall posts or status updates, using rich data formats like photos, videos, and text descriptions (*Self-Expression*). Users can revisit these records anytime (*Action Planning*) on their Wall or Timeline for ongoing reflection (*Self-Reflection*). Platforms also encourage users to review their entries through *prompts*, such as Memories or Life Events on Facebook. Spotify triggers reflection with features like its annual

Wrapped review, which displays the user's most-listened-to songs, artists, and genres (*Prompts*). The Playlist in a Bottle promotes positive anticipation for the upcoming year by inviting users to create playlists based on reflective prompts, such as "a song you are going to kiss someone to this year". Engagement with these features is enhanced through creative interactions and visually appealing design (*Joy of Use*).

Commit to Personal Goals *(18/165 features, 11%).* Setting and pursuing meaningful personal goals has been consistently linked to higher levels of wellbeing (e.g., Brunstein, 1993; Sheldon & Elliot, 1999). The consumer technologies examined can support **goal setting** (13/18 features) by offering inspirational content for users to follow (*Personal Relevance*, e.g., Follow, Hashtags, Subscribe) and enabling them to save content individually or organize it into thematic collections (*Goal Setting*, e.g., Save for Later, Watch Later, Collections, Pin Boards). They can also help users stay **focused on their goals** (5/18 features) by reducing distractions (*Focus Attention*, e.g., Focused Inbox), reminding them of their goals (*Prompts*, e.g., Job Alerts), encouraging support from others (*Social Support*, e.g., Mentorship), and providing feedback on goal progress (*Feedback*, e.g., Milestones).

Take Care of One's Mind *(32/165, 19%).* This activity includes strategies for achieving a balanced state of mental wellbeing. The vast majority of features were protective (31/32 features), helping users reduce (a) **excessive use** (18/32 features, e.g., Daily Time), (b) **harmful content** exposure (11/32 features, e.g., Sensitive Content Controls), and (c) **mental health threats** (2/32 features, e.g., Take a Break), mostly by limiting distractions (*Focus Attention*, e.g., Quiet Mode), screen time and content controls (*Self-Monitoring*, e.g., Time Spent), and reminders (*Prompts*, e.g., Break Reminder). However, one feature proactively supported **mental health**: Instagram's Wellbeing Guides provides access to wellbeing tips and resources from trusted sources (*Education*).

DRIVERS OF BEHAVIOR

As outlined in the framework, design mechanisms promote positive activities by targeting three drivers of behavior: they enhance *capability*, create *opportunities*, or boost *motivation* to engage in positive activities (see Figure 4.1). Design mechanisms can be mapped onto these drivers of behavior based on the COM-B model of behavior change (Michie et al., 2011, 2013, see Figure 4.3 and Table A.3 in the Appendix). Overall, the examined social media and streaming platforms put a strong emphasis on motivating users to engage in positive activities (134/165 features), followed by creating opportunities (90/165 features), and fostering capability (83/165 features). Table A.2 (Appendix) provides a detailed breakdown of the interaction patterns that implement each mech-

anism at the interface level. These patterns are in *italics* in the following sections.

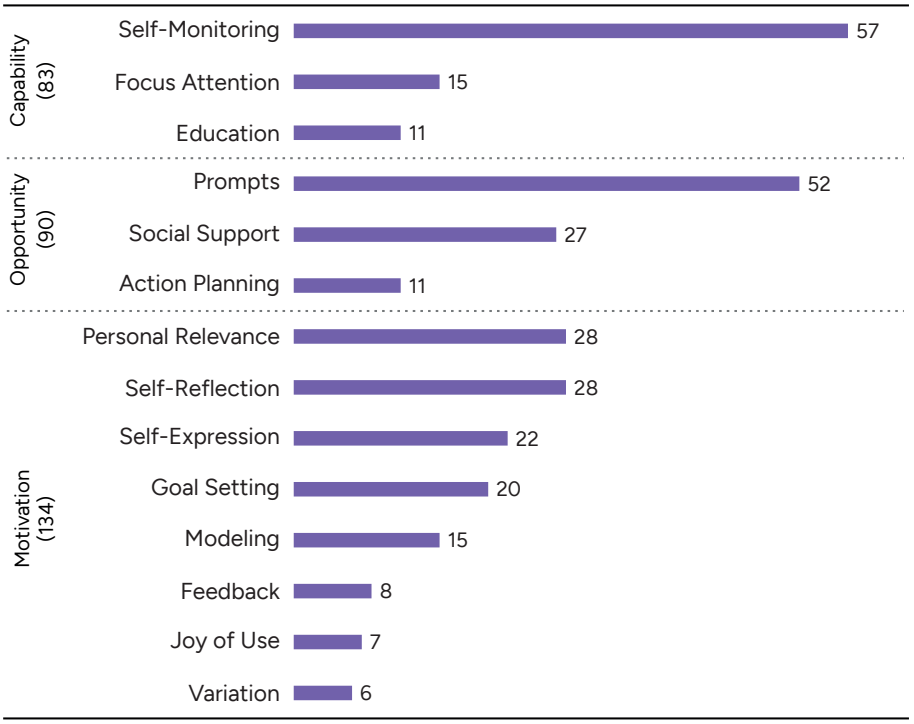


Figure 4.3: Design mechanisms grouped by drivers of behavior. Only mechanisms utilized by more than five features are included. Note that a single feature may employ multiple mechanisms.

Capability *(83/165 features):* Features that *"facilitate"* engagement in positive activities enhance a person's psychological or physical ability to perform the activity. This requires sufficient knowledge, skills, attention capacity, and behavior regulation ability. Our study identified three key mechanisms through which consumer technology fosters capability: First, users are supported in **self-regulating** their technology use (*Self-Monitoring*, 57 features) through controls and settings that help *manage behavior* (53 features), e.g., Unfollow, Mute, Hide Reaction Count, and *visualizations* (4 features) that highlight patterns to encourage behavior change, e.g., Memories, Wrapped. Second, consumer technologies help users **focus attention** (*Focus Attention*, 15 features) on the activity by *minimizing distractions*, e.g., Quiet Mode, and promoting *intentional focus*, e.g., Inclusive Beauty Searches. Lastly, they **educate** users (*Education*, 11 features) about the *impact of their actions*, e.g., Comment Warnings, and *provide knowledge* needed for practicing the activity, e.g., Wellbeing Guides.

Opportunity *(90/165 features):* Features that *"trigger"* positive activities create a supportive environment for practicing them by offering sufficient time, social

support, and reminders to encourage engagement. This study identified several ways consumer technologies can foster such an environment: They can **prompt** positive activities (*Prompts*, 52 features) by *triggering interest*, e.g., Memories, acting as *reminders*, e.g., Job Alerts, *nudging positive behavior*, e.g., Nighttime Nudges, and displaying *social prompts*, e.g., Add Yours. Additionally, they can foster **social support** *(Social Support*, 27 features) by creating *opportunities for connection*, e.g., Groups, providing *emotional support*, e.g., Reactions, and encouraging *collaboration*, e.g., Collaborative Collections. Lastly, they can encourage **action planning** (*Action Planning*, 11 features) by integrating positive activities into users' *daily routines*, e.g., Hashtags, Subscriptions, and offering *flexible access* to relevant content, e.g., Save for Later, Personal Playlists.

Motivation *(134/165 features)*: Features that *"stimulate"* positive activities support both 'reflective motivation', which involves deliberate, conscious decision-making based on reasoned thought and explicit intentions, and 'automatic motivation', which is driven by habits, emotional reactions, or learned associations (see Michie et al., 2011, 2013). Consumer technologies foster reflective motivation through several design mechanisms: First, they encourage **reflection** on personal experiences (*Self-Reflection*, 28 features), fostering *self-awareness*, e.g., Screen Time reports and *mindful technology use*, e.g., Focus Mode. In many instances, self-reflection was coupled with **self-expression** (*Self-Expression*, 22 features, e.g., Reactions). They also support **goal setting** (*Goal Setting*, 20 features) by helping users *pursue meaningful goals*, e.g., Collections, or *(re)direct user behavior*, e.g., Nighttime Nudges toward (more) desired actions. Another mechanism was **modelling** positive behavior by showcasing desirable actions (*Modelling*, 15 features, e.g., Pinned Comments). Positive behavior is further encouraged through **feedback** (*Feedback*, 8 features*) for reflection*, e.g., You're All Caught Up, and on *goal progress*, e.g., Milestones. Automatic motivation is promoted by showing **personally relevant** content (*Personal Relevance*, 28 features), either through *algorithmic curation*, e.g., Explore, or by allowing users to *choose content directly*, e.g., Browse by Mood. It can be further enhanced by offering **various ways** to practice the activity (*Variation*, 6 features, e.g., Kudo types) and ensuring **joy of use** (*Joy of Use*, 7 features) by making the *activity itself enjoyable*, e.g., Get Ready with Spotify, and the technology interaction *aesthetically pleasing*, e.g., Wrapped.

SUMMARY OF MAIN FINDINGS

We found that current technologies already incorporate many features that support a wide range of positive activities. Specifically, we identified 165 features that support nine positive activities: five of these activities were promoted proactively, three (primarily) in a protective way, and one both proactively and protectively. Perhaps unsurprisingly, the most commonly promoted positive

activities align with the wellbeing objectives of each platform, as outlined in their mission statements. Social networks focus on strengthening social relationships, with kind interactions and expressions of appreciation for others potentially contributing to this goal. The music streaming platform Spotify encourages users to listen to music for digital emotional regulation. YouTube promotes (educational) content that users can browse based on their personal goals.

4.5 Study 2: Online survey

With so many built-in features, the question arises whether people intentionally use them to nurture their wellbeing. Study 2 therefore investigates how individuals actually use existing consumer technology to engage in positive activities (**RQ3**). To explore this question, we conducted an online survey with Instagram users. Instagram is a social media platform centered on sharing images and videos, with 2 billion monthly active users. People mainly use Instagram to interact with others, archive personal experiences, express themselves, escape reality, and explore others' lives (Lee et al., 2015). We chose Instagram for this study, because the platform featured the highest number of purpose-built features and supported the broadest variety of positive activities in Study 1. The study was approved by the Human Research Ethics Committee of TU Delft.

4.5.1 Method

PARTICIPANTS

We recruited 117 Instagram users aged 18 to 55 years from the United States via the platform Prolific Academic (www.prolific.com), see demographics in Table 4.4. Participants were prescreened based on their platform use, selecting those who actively use the platform at least a few times per week. Active platform use was defined as (a) viewing others' posts, (b) creating their own posts, and (c) interacting with others. Only participants who regularly engage in all three activities qualified for the study. We focused on this user group because some research suggests that active social media use may be more consistently associated with increased wellbeing (e.g., Hancock et al., 2022). All participants gave informed consent before joining the study. Data were collected in August 2024. Two further participants had to be excluded due to concerns that their responses might have been generated by AI technology. The sample size was considered adequate as our primary focus was on obtaining qualitative insights.

Table 4.4: Demographics of the 117 study participants.

Demographics	Details
Gender	Man (24%), Women (72%), Non-binary (4%)
Age	18-24 years (9%), 25-34 years (35%), 35-44 years (32%), 45-55 years (24%)
Education	High school (18%), Associate's degree (23%), Bachelor's degree (43%), Graduate degree (16%)

PROCEDURE

After joining the study, participants first completed a short screening survey. Eligible participants were then forwarded to the main study. The online survey was programmed using the software Qualtrics (www.qualtrics.com). We included seven positive activities that were actively promoted by Instagram in Study 1: (1) Practicing Gratitude, (2) Practicing Acts of Kindness, (3) Nurturing Social Relationships, (4) Developing Strategies for Coping, (5) Savoring Life's Joys, (6) Committing to Personal Goals, and (7) Taking Care of One's Mind. We did not include Avoiding Overthinking and Avoiding Social Comparison to concentrate on opportunities for proactive support that have received less attention in prior research.

TASK

Participants first assessed Instagram's overall impact on their wellbeing using a 5-point Likert scale. They answered questions about their digital practices on the platform related to the seven positive activities. For each activity, participants indicated whether Instagram helped them engage in that activity (responding with "yes", "no", or "don't know"). Those who answered "yes" were prompted to provide open-ended responses explaining how Instagram supports their practice, including which specific aspects or functionalities of the platform help them engage in the activity. The activity probes were presented in randomized order. Median time to complete the survey was 7 minutes (interquartile range: 5-14 minutes). Participants were compensated with £3.75 for answering all survey questions (£9/hour).

DATA ANALYSIS

From the 117 participants and seven activities, we collected a total of 449 open-ended responses. Responses that did not align with the activity descriptions were excluded from the analysis (45 responses, 10%). The remaining 404 responses were analyzed based on: (a) the content of the practice and (b) how Instagram's features supported the practice. The content analysis was initially

guided by the coding scheme developed in Study 1 for classifying user behavior (see Table 4.3). This scheme was then expanded as needed to incorporate themes emerging from participants' reports (see Table A.1, Appendix, for the final coding scheme). Individual responses often encompassed multiple themes and were thus categorized under multiple subcodes (see Table 4.5).

4.5.2 Results

Participants expressed mixed views on Instagram's impact on their wellbeing: 44% stated it has no impact, 46% rated it as rather positive (37%) or very positive (9%), and only 10% indicated a rather negative effect. On average, participants reported engaging in 3.41 positive activities (SD=1.69). Those who viewed Instagram as having a rather or very positive impact on their wellbeing reported engaging in significantly more positive activities on the platform (Mean =3.94, SD=1.55) compared to those who perceived no or a negative impact (Mean =3.00, SD=1.70), t(114)=-3.13, p=.002.

HOW INSTAGRAM USERS ENGAGE IN POSITIVE ACTIVITIES

Our results indicate that active Instagram users frequently engage in the examined positive activities on the platform (Figure 4.4). The most commonly reported activities were Nurturing Social Relationships (94 of 117 participants, 80%), Savoring (71 of 117 participants, 61%), and Practicing Acts of Kindness (57 of 117 participants, 49%).

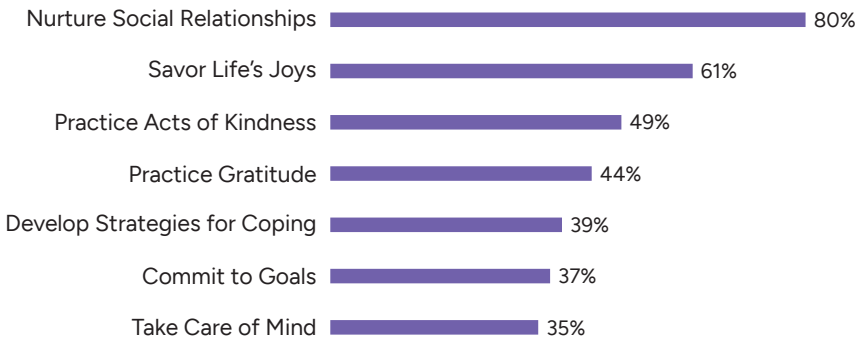


Figure 4.4: Proportion of participants (N=117) who reported engaging in each positive activity on Instagram.

USER BEHAVIOR PER POSITIVE ACTIVITY

In this section, we provide a detailed overview of users' self-reported positive digital practices, highlighting specific features that support them. Table 4.5 shows associated user behaviors for each positive activity (multiple coding).

Table 4.5: Number of participants (N=117) reporting digital practices on Instagram related to positive activities.

Positive Activity	User Behavior	Participants
Practice Gratitude	Gratefully reflect	44
	Express gratitude	8
Practice Acts of Kindness	Prosocial behavior	35
	Support others	22
Nurture Social Relationships	Direct exchange	46
	Connect with others	46
	Stay up to date	28
	Self-disclosure	7
Develop Strategies for Coping	Emotion regulation	24
	Distract from problems	22
	Seek social support	10
	Self-help	3
Savor Life's Joys	Reminiscence	54
	Reflection	22
Commit to Goals	Focus on goals	36
	Set goals	8
Take Care of Mind	Overlap with behaviors above	26
	Promote mental health	15

Practice Gratitude *(52/117 participants, 44%).* User-initiated gratitude practices include (a) reflecting on their blessings (44/52 participants) and (b) directly expressing gratitude to others (8/52 participants). **Grateful reflections** are either based on personal experiences (25/44 participants) or inspired by learning about others' experiences (19/44 participants). When based on personal experiences, reflections occur when *creating a post*, including selecting photos and writing Captions. They also occur when *revisiting previous posts* on the user's Wall or in Story Highlights: *"I love sharing pics I take on hikes, but also just of little*

interesting things I notice all around on walks in the neighborhood. I tend to post these on my main feed and seeing the totality of such posts reminds me of what I can too-often forget." (participant #41). Another important trigger for grateful reflections is *viewing others' posts* (19/44 participants) in Stories or the Newsfeed. In these instances, gratitude for one's own blessings can arise from seeing "*others living in worse conditions*" (participant #110) or from cherishing posts from family and friends: "*Because I follow a lot of family and friends, I find myself being filled with gratefulness for those in my life when I see their posts*" (participant #52). Some participants reported intentionally following accounts that regularly share gratitude-related content. Participants also use Instagram to **express gratitude** directly to others (8/52 participants) by *creating posts* or *writing comments*: "*I will comment or write on a post that I consider to be something I appreciate or am grateful for*" (participant #27). This includes special occasions like birthday tributes: "*I can tell people I appreciate them by posting about them for their birthdays or just because.*" (participant #15).

Practice Acts of Kindness *(57/117 participants, 49%)*. Instagram users frequently engage in acts of kindness on the platform by participating in or identifying opportunities for **prosocial behavior** (35/57 participants). Instagram *inspires prosocial behavior* (26/35 participants) by helping users discover specific opportunities for volunteering or social activism, and by modelling kind behavior. Participants reported drawing inspiration from *viewing posts* in their Newsfeed. As one participant noted: "*It lets me see there are good people in the world, making me want to be better*" (participant #13). Other participants expressed their intention to model positive behavior in their posts and comments to spread kindness: "[...] *Just being a good dude in the social space. I believe that positive energy is contagious. I enjoy promoting good causes and people when they're up and down. Even if it's just a reply or a like on their posts*" (participant #115). Instagram also encourages prosocial behaviors by enabling users to follow and connect with charitable organizations: "*Following accounts that are also involved in animal rescue helps me to stay involved in the rescue community and helps foster a network of people committed to the same goal as me.*" (participant #86). In addition, users leverage Instagram's social sharing features to advocate for important causes, as expressed by another participant: "*It's a great way to connect with other people to recruit for doing positive things.*" (participant #109). One specific form of prosocial behavior reported is *prosocial spending* (7/35 participants), such as donating to charities or supporting fundraisers. Instagram promotes prosocial spending by raising awareness of causes to support and streamlining the donation process. Another way participants engage in acts of kindness is by **supporting others** through Comments, Reactions, and Direct Messages, offering encouragement and sharing helpful information (22/57 participants): "*I like to comment on*

friends' posts to compliment them. Whether that be that I like their outfit, or their new haircut, writing a quick compliment is an easy way to do something nice for someone." (participant #21).

Nurture Social Relationships *(94/117 participants, 80%)*. Participants reported using Instagram to nurture social relationships in various ways, often through purpose-built features. Many participants **directly exchange** communication with family and friends (46/94 participants) using Comments, Direct Messages, Story Replies, and Likes/Reactions. Posts by others often serve as a "conversation starter", as one participant explained: "*It makes it easy to see what my friends are doing when they post in their Stories. Then I can comment and talk to them.*" (participant #25). Second, Instagram helped participants to **connect with others** (46/94 participants): reconnecting with old friends they had lost touch with, maintaining relationships with people living further away, and meeting like-minded individuals who share similar interests, both online and offline. In addition, participants used the platform to **stay up to date** (28/94 participants) about other people's lives by viewing their posts, Stories, and Feed. One participant noted: "*Without having to ask too many questions, you can tell what they have been up to by simply checking out their feeds and keeping up with their daily updates on the Instagram story feature*" (participant #40). Lastly, a few participants (7/94 participants) reported using Instagram for **self-disclosure**, expressing personal thoughts and feelings to strengthen their relationships: "[...] *It gives me the ability to share moments/memories from my life I may not have shared with anyone otherwise. Thus, giving my inner circle a chance to see into my world more*" (participant #88).

Develop Strategies for Coping *(46/117 participants, 39%)*. Instagram users adopt various strategies to alleviate stress, one of which is intentionally searching for positive content to **regulate their emotions** (24/46 participants): One participant explained how she deliberately seeks out different types of content depending on her emotional state: "*Sometimes I go to feel nostalgia and will connect with old friends from childhood and see what they are up to. Sometimes I will go to Reels to find relatable content to laugh at or feel included. I will go search art and watch people draw or view paintings [...] to see things that are beautiful and uplifting.*" (participant #87). Another common strategy is **distracting themselves** (22/46 participants) from problems by passively browsing their Newsfeed, Stories, or Reels. "*Watching Reels and Stories helps me relax when I am feeling stressed or overwhelmed. It helps me distract my mind from difficult situations or things I don't want to think about.*" (participant #17). Participants also seek **social support** (10/46 participants) by (a) sharing their thoughts and feelings through Stories and Direct Messages or (b) connecting with others who share similar experiences. One participant stated: "*Instagram holds a lot of my friends and family [...] and strangers as well. This helps with*

coping with stress because I can get feedback and advice from others when I need it. They can provide resources across the internet to help" (participant #54). A smaller group of participants (3/46 participants) reported using Instagram for **self-help**, exploring educational resources on the platform to manage stress.

Savor Life's Joys *(71/117 participants, 61%)*. Users report utilizing purpose-built features like the Wall or Story Highlights to document and **reminisce** about positive life experiences (54/71 participants): "*It helps me remember things clearly since I have a visual record of positive things that have happened in the past. I only use the main grid, not Stories, so my photos are always there and are easy to find years later*" (participant #24). Documenting these moments on Instagram helps preserve them, as one participant noted: "*By posting special events in my life, I will always have those memories. I upgrade my phone every so often and those pictures could be lost. But on social media I know they are there for good. When I am feeling sentimental, I enjoy looking at all my old posts of happy moments in my life*." (participant #28). Users also **reflect on positive experiences** (22/71 participants) by sharing them through Posts or Stories, either individually or with others: "*When I post pictures from events, I am reflecting on them, as when I read the comments from those who have participated in those events with me*." (participant #23). In addition, positive reflections are triggered by viewing posts from others in the Newsfeed or Stories. These posts serve as advice, reminders of similar personal experiences, or a way to savor positive moments shared by close others. As one participant stated: "*When I see others' joy [...] it serves as a reminder when something similar has occurred with myself or others*" (participant #115).

Commit to Goals *(43/117 participants, 35%)*. Participants reported that Instagram helps them **stay focused** on their goals (36/43 participants) in several ways: (a) providing concrete information and practical advice (e.g., on exercise routines or gardening projects), (b) offering social support from like-minded people sharing similar goals, (c) inspiring motivation through upward social comparisons (e.g., viewing posts from others who have achieved similar goals), and (d) reinforcing motivation through social feedback (e.g., receiving Likes or positive feedback for an achievement). For instance, one participant stated: "*I have lost 120 pounds through diet and exercise over the past couple of years, so I definitely used it to post before and after pics. It was very motivating and heartwarming to see the love and support of people on there.*" (participant #70). Instagram also helps users discover and **set personal goals** (8/43 participants) by offering inspiration through posts and Stories. They noted deliberately following accounts that align with their goals: "*It helps me to create goals for myself by seeing other people doing things and becoming inspired*".

Take Care of Mind *(41/117 participants, 35%).* For this activity, participants mentioned many strategies that overlap with other positive activities (26/41 participants), such as seeking out positive content for *emotion regulation* (13/41 participants), browsing Instagram to *distract themselves from problems* (9/41 participants), and *connecting with others* when feeling lonely (6/41 participants). Apart from these strategies, participants used Instagram to **promote their mental health** by following or searching for accounts that post about mental health or self-development (15/41 participants). One participant stated: *"I've learned a lot about setting boundaries, dealing with toxic behaviors and avoiding things that hurt my heart. This has helped improve my mental health."* (participant #101).

SUMMARY OF MAIN FINDINGS

All selected positive activities identified as being supported by Instagram in Study 1 were also confirmed in this study. Participants were most aware of support related to Nurturing Social Relationships, followed by Savoring, Acts of Kindness and Practicing Gratitude. However, the way users reflected on wellbeing-support through the platform partly differed from the intentionally built-in features. For instance, users took time to browse, discover, reflect on and get inspired by posts of others. Interestingly, some features or possibilities on the platform supported multiple positive activities. In this study, participants predominantly reported of proactive features. This may be attributed to the setup of the study: for one, Avoiding Overthinking and Avoiding Social Comparison were not included, and second participants have likely focused on what they actually do on the platform rather than on what they refrain from doing. Additionally, there might be a general tendency to be less aware of protective features.

4.6 Overall discussion

BROAD VARIETY OF FEATURES

The two studies revealed that existing consumer technologies already include a wide array of features that support diverse positive activities. In Study 1, 129 features of social networking sites supported six to eight positive activities per platform, whereas 36 features of music and video streaming services supported four to five. The most commonly promoted positive activities aligned with the platforms' stated wellbeing objectives, as outlined in their mission statements. However, there is potential to address additional positive activities that are less directly connected to these objectives. Study 2 found that participants engaged in multiple positive activities on Instagram, with approximately two-thirds reporting using the network for more than three of the seven positive

activities examined. Participants who reported higher levels of wellbeing engaged in a greater number of these activities. This underscores the potential to address multiple positive activities within a single technology context. With this adaptability, consumer technologies can effectively deliver wellbeing interventions to a broad and diverse audience, catering to varied intentions and preferences, thereby significantly extending their reach. Together, the findings suggest that modern consumer technologies offer numerous opportunities to support positive activities through small, feature-based interventions. While each intervention may yield a modest effect individually, their combined impact could substantially enhance user wellbeing.

Building on these insights, we propose providing industry designers with a comprehensive taxonomy of positive activities to inspire widespread application. While our findings identify specific contexts in which positive activities *could* be applied, their application is not limited to these contexts. However, it is crucial to acknowledge that overstimulating wellbeing (Calvo & Peters, 2014, p. 269) may lead to unintended adverse effects, emphasizing the importance of implementing such interventions with moderation. The list of positive activities presented in this paper is not exhaustive but serves as a foundation for further exploration and expansion. It is primarily based on Lyubomirsky's (2007) selection of positive activities, supplemented by empirical investigations regarding their relevance for consumer technology (see Wiese et al., 2020). In addition, the activities are not entirely distinct, with notable conceptual overlaps particularly among the following groups (see also Lyubomirsky, 2007): (a) Avoiding Overthinking, Avoiding Social Comparison, and Taking Care of One's Mind, (b) Practicing Gratitude, Practicing Acts of Kindness, and Nurturing Social Relationships, (c) Practicing Gratitude and Savoring, and (d) Developing Strategies for Coping and Taking Care of One's Mind. Furthermore, engaging in one positive activity can often lead to others. For example, feeling grateful for one's life circumstances may inspire prosocial behavior toward those who are less fortunate (Romani et al., 2013). Similarly, expressing gratitude to a friend can strengthen social bonds by fostering altruistic behavior (McCullough & Tsang, 2004). Designing for one activity could thus create ripple effects, fostering additional wellbeing-enhancing behaviors.

BALANCING PROACTIVE AND PROTECTIVE FEATURES IN CONSUMER TECHNOLOGY

Study 1 found that five of the six applications examined employed a combination of proactive and protective features, highlighting the potential – and perhaps the necessity – for these approaches to coexist and complement each other. Unlike dedicated wellbeing technologies, consumer technologies are not "neutral" environments; they are rife with "noise" in the form of constant distractions, misinformation, and online toxicity. Without protective measures

to manage this noise, proactive features risk being overshadowed or rendered ineffective. Protective features are essential for reducing or avoiding harm stemming from the current design of consumer technology, though they may only make technology use "less problematic" (Vanden Abeele, 2021). In contrast, proactive features have the potential to actively promote positive states and enhance user wellbeing. Together, these two approaches form a comprehensive framework for tackling challenges and seizing opportunities for wellbeing design embedded into consumer technology.

Previous research on digital wellbeing interventions has primarily focused on *dedicated*, external tools designed to limit technology use across platforms or specific apps. More recently, research attention has expanded to *active* design solutions (Lukoff et al., 2021; Monge Roffarello & De Russis, 2023) that integrate wellbeing interventions directly into the design of the technology itself. Our findings show that existing consumer technologies already incorporate a broad variety of such protective internal features. Compared to external tools, these features can be more seamlessly embedded into contexts where harm is likely to occur, offering targeted interventions that selectively address specific problematic user behaviors (e.g., discouraging disrespectful comments in a social media feed) while still preserving the technology's core benefits, such as access to information and communication (see also Lukoff et al., 2021).

In addition, these internal features leverage a diverse array of mechanisms, extending beyond merely restricting and self-monitoring behavior: Some features passively protect users through default settings (e.g., disabling notifications during Quiet Mode), while others require active user involvement to adjust settings (e.g., setting time limits for app usage). Yet other features empower users to make conscious choices to avoid negative behaviors (e.g., hiding toxic content with specified keywords) or even transform them into positive behaviors (e.g., Inclusive Search Results) (see also Wiese et al., 2024). Many of these features work by fostering user capabilities (e.g., teaching digital etiquette) or creating favorable conditions (e.g., providing a distraction-free environment) that enable users to engage in positive activities. Together, these mechanisms offer broad potential for internal features to integrate wellbeing support into everyday technology.

SHORT- VS. LONG-TERM ENGAGEMENT

Purpose-built features identified in Study 1 relied heavily on short-term prompts to trigger positive behaviors but offered limited support for ensuring these activities were carried out effectively and sustained over time to maximize wellbeing benefits. On the contrary, many features appeared to be optimized for short-term user engagement, as reflected in specific interaction patterns: (a) promoting frequent but brief interactions between users (e.g., expressing

gratitude through Emoticons or Quick Reactions), (b) leveraging social prompts (e.g., transforming private self-reflection into a shareable social media post), and (c) driving positive behavior through extrinsic rather than intrinsic rewards (e.g., sharing personal experiences to obtain Likes or Reactions).

However, experiencing wellbeing benefits from practicing positive activities generally requires consistent effort and sustained practice (Lyubomirsky & Layous, 2013). Although prompts in context-aware consumer technology can be useful for encouraging positive behavior in the right situations (e.g., when a user is about to post a hateful comment), they are not sufficient on their own to ensure meaningful wellbeing enhancements derived from engaging with a "positive" feature. Instead, users may benefit from slowing down their interactions with technology, fostering deeper reflection and longer-lasting engagement. One example of such longer-lasting engagement is browsing a social media feed. Study 2 revealed that a significant portion of the reported wellbeing benefits from using Instagram was associated with passive content browsing – a surprising result, given that passive social media use is often linked to poor digital habits and negative wellbeing outcomes in the literature (e.g., Hancock et al., 2022). Furthermore, wellbeing cannot simply be "consumed"; it must be actively "shaped".

Yet, our findings suggest that this seemingly "passive" behavior can be understood as "active" in two important ways: First, while "passive" at a behavioral level, content browsing can be cognitively and emotionally "active" by engaging users in meaningful ways. Consistent with previous work, participants in our study reported that content browsing served as an active form of relaxation (see Lee et al., 2015; Lukoff et al., 2018), helped upregulate positive emotions (see Kramer et al., 2014), provided inspiration and opportunities for social learning (Koay et al., 2020; Sciara et al., 2021), and fostered a sense of connection with other users (Pittman & Reich, 2016). Second, the wellbeing benefits of "passive browsing" clearly depend on the type of content consumed. Instagram users in Study 2 reported actively curating their feeds to prioritize posts from family and friends, filter out negative or harmful content, and follow accounts that promote positivity.

EMPIRICAL VALIDATION OF THE FRAMEWORK

One key objective was to empirically validate the Design for Sustained Wellbeing framework within the context of consumer technology. The taxonomy of positive activities proved useful for classifying both (a) purpose-built features (Study 1) and (b) user practices (Study 2) based on their support for positive activities. Study 1 found that popular social media platforms and streaming services already include numerous features that promote a wide range of positive activities, using a combination of proactive and protective features. Study 2

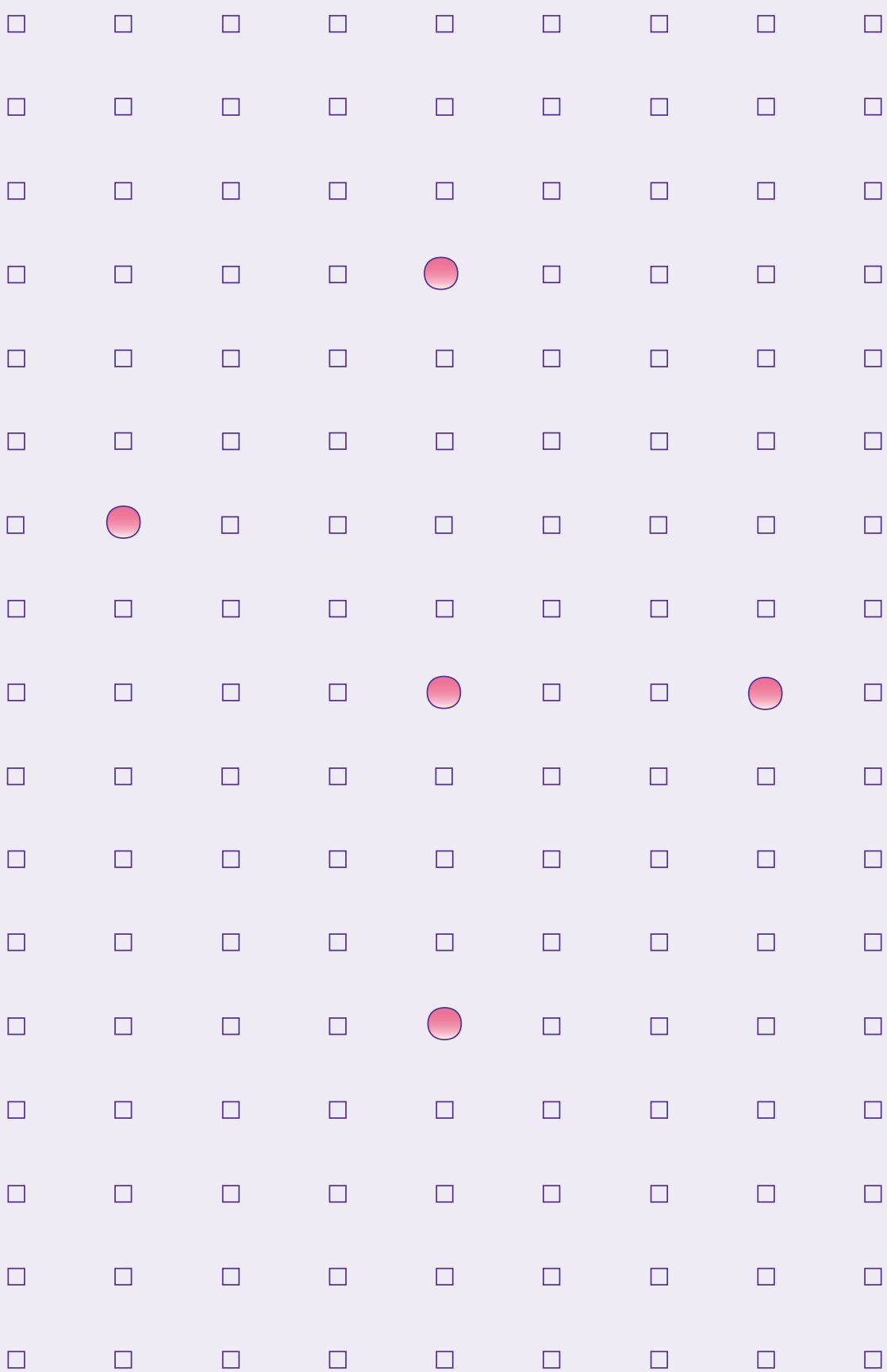
revealed that active Instagram users engage in multiple positive activities on the platform, often going beyond the scenarios envisioned by purpose-built features. For instance, users reported additional practices related to grateful reflections, seeking distraction from daily stressors, and following mental health-focused accounts. These findings suggest that users may bypass purpose-built features or repurpose other features to engage in positive activities. This highlights the value of an open-ended design approach that leaves room for appropriation.

The framework also proved effective for classifying the employed design mechanisms and summarizing them by drivers of behavior. Together, based on the empirical analyses, we have demonstrated that the framework is relevant and applicable to widely used consumer technologies with millions of users. Given the framework's effectiveness in analyzing existing features and uses of these platforms, we also consider it useful for guiding the design and evaluation of future applications. Concrete examples from this research enhance the framework's accessibility for designers, enabling them to better understand the framework and its components, even without prior knowledge of the underlying wellbeing concepts (Lockton et al., 2010).

4.7 Conclusion

This work makes significant contributions to both practice and the design research community: First, it demonstrates that and how positive activities are currently supported in large-scale consumer technologies through built-in features, and thereby by intention of the designer. Furthermore, user feedback illustrates how these technologies are actually used in real life to support wellbeing. These examples make the abstract concept of design for wellbeing more tangible, offering design practitioners both inspiration and a practical foundation for implementation. Furthermore, this work empirically validates positive activities as meaningful design targets for wellbeing interventions in consumer technology and presents the framework as a 'navigation aid' to help designers determine which ingredients to consider when creating opportunities for wellbeing through design. Design research has gained more depth and nuance by incorporating different perspectives across the two studies and systematically documenting pathways from design mechanisms to drivers of behavior (change) and positive activities. The findings expand research on digital wellbeing (e.g., Monge Roffarello & De Russis, 2019) and the concept of Active Design (Calvo & Peters, 2014) by showcasing the need for a balanced portfolio of protective and proactive features, both integrated directly into the platform itself. This can lay the groundwork for future improvements and opens up new intriguing research questions. However, we do not propose the current solutions as "best practices", nor do we prescribe specific solutions. Instead, this work analyzes

the status quo to inspire designers and encourage critical reflection on how positive activities are currently and could potentially be integrated into everyday consumer technology.



5

Daily doses of wellbeing: How everyday technology can support positive activities

This chapter is an expanded version of a previously published paper, including minor wording changes: Wiese, L., Pohlmeyer, A., & Hekkert, P. (2024a). Daily doses of wellbeing: How everyday technology can support positive activities. In C. Gray, E. Ciliotta Chehade, P. Hekkert, L. Forlano, P. Ciuccarelli, & P. Lloyd (Eds.), *DRS2024: Boston*. https://doi.org/10.21606/drs.2024.795.

Effectively enhancing user wellbeing through consumer technology requires design approaches that are both theoretically grounded and practically applicable, offering designers realistic and actionable design goals. The first phase of this research established a theoretical framework linking product interactions to positive activities, while the second phase confirmed its relevance to consumer technology through empirical research. The third phase now tackles the question of how this theoretical knowledge can guide the design of real-world applications. This chapter presents a case study where Interaction Design students applied the framework to redesign features of existing consumer technologies, promoting positive activities through an Active Design approach. Through observations and the analysis of the design concepts created by the students, the case study identifies three distinct opportunities for integrating positive activities into consumer technology, examines design mechanisms employed, and explores how students navigated key challenges in the design process.

5.1 Introduction

Consumer technologies, such as messaging services and social networking platforms, are deeply ingrained in our daily lives. This creates the opportunity to impact people's quality of life and their wellbeing on a broad scale through the design of everyday technology. However, for most contemporary consumer technologies, wellbeing is not an explicit design goal (yet). On the contrary, driven by the financial incentives of the attention economy (e.g., Davenport & Beck, 2001), these technologies often employ techniques like push notifications or video autoplay that exploit human psychological vulnerabilities to maximize the time people spend on their devices (Monge Roffarello et al., 2023). As a side effect, this over-optimization for user engagement can promote unhealthy patterns of behavior (e.g., reinforce excessive technology use; van Deursen et al., 2019), distort the way we see ourselves (e.g., lower our self-esteem; Marino et al., 2018), and the world around us (e.g., fuel polarization and spread misinformation; Brady et al., 2017; Vosoughi et al., 2019), ultimately compromising individual wellbeing and proper functioning of society (Cunningham et al., 2021; Haidt, 2022).

To mitigate such negative effects, tech giants like Google (https://wellbeing.google) and Facebook (Ranadive & Ginsberg, 2018), as well as academic researchers (e.g., Kim et al., 2017) developed so-called "digital wellbeing" tools that assist users in managing their screen time and their online activities (Monge Roffarello & De Russis, 2022). With some notable exceptions (e.g., Lukoff et al., 2021; 2023), these interventions have primarily concentrated on changing the user, i.e., their ability for digital self-control (e.g., Lyngs et al., 2019) rather

than the harm-inducing technology itself (Peters et al., 2020). However, design researchers believe that technology can also be (re)designed to actively support individual wellbeing and positive advancement of society (e.g., Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013; Riva et al., 2012). These design for wellbeing initiatives shift the focus from the prevention of harm to the promotion of meaningful human experiences with and through digital technology.

5.2 Related work: Design for positive activities

Among other approaches, design for wellbeing has explored the potential of positive psychology interventions (PPIs) to inform the design of consumer technology (e.g., Calvo & Peters, 2014; Pohlmeyer, 2014; Wiese et al., 2020). PPIs comprise a set of intentional positive activities that aim at cultivating positive feelings, behaviors, or cognitions (Sin & Lyubomirsky, 2009, p. 468) which, in turn, promote individual wellbeing in a lasting way (Bolier et al., 2013; Sin & Lyubomirsky, 2009). Typical examples include expressing gratitude (Emmons & McCullough, 2003), savoring life's joys (Bryant & Veroff, 2007), or practicing acts of kindness (Lyubomirsky et al., 2005).

PPIs were originally developed for therapeutic use and disseminated through face-to-face interactions. To enhance their effectiveness, they often follow a clearly defined protocol regarding the content and frequency of practice. However, besides these "classic" therapeutic PPIs, each category of positive activities, e.g., expressing gratitude, includes a broad variety of other opportunities for practicing the activity, e.g., leaving a 'thank you' note for a friend or giving them a thoughtful gift. To emphasize this broader perspective, which informed our work, we refer to PPIs as "positive activities" in the remainder of this paper (see also Lyubomirsky & Layous, 2013).

Positive activities can be stimulated by technology in two different ways: First, through Behavioral Intervention Technologies (BITs) (Schueller et al., 2013) that are deliberately built to promote wellbeing-enhancing interventions as their core function (referred to as *Dedicated Design* by Calvo & Peters, 2014). Examples are meditation or gratitude apps. Second, through consumer technology that is not purpose-built to increase wellbeing but contains specific wellbeing-enhancing features, e.g., a social networking site that encourages kind comments (referred to as *Active Design by* Calvo & Peters, 2014). While BITs are effective means (Bolier & Abello, 2014) to bring positive activities out of the therapy room into real-world applications in a scalable and cost-effective way, they face a number of challenges, including limited reach and high attrition rates (Schueller et al., 2013; Ludden et al., 2015; Pohlmeyer, 2017), that could, in part, be overcome by harnessing consumer technology as an additional channel to disseminate positive activities as Active Designs.

However, it is neither obvious nor trivial to integrate positive activities into consumer technology. While BITs can tailor the whole application to their promotion, embedding them into consumer technology that serves a different overall purpose supported by its own user flows and functionality, requires a creative reinterpretation of positive activities in the design process. In this paper, we explore the potential of consumer technologies to promote positive activities in the form of Active Design solutions. Specifically, we ask the following research question:

RQ: How can design support positive activities integrated into consumer technology?

To explore this question, we conducted a case study, embedded in an Interaction Design Master's course, where we briefed students to design for positive activities. Throughout the course, we observed how students approached three key challenges in the design process a) acquiring knowledge on positive activities, b) identifying a fitting technology context, and c) selecting and implementing effective design mechanisms to support positive activities. In addition, we analyzed the final design concepts to examine the strategies and design mechanisms students used to support positive activities. In the following, we describe details of the methodological approach taken. In the results section, we present our analysis of the final design concepts. We then discuss the main insights from this analysis regarding implications for the design (for wellbeing) research community as well as for stakeholders from design practice.

5.3 Method

The case study was carried out as part of the 'Design for Interaction' course at TU Delft, teaching the Vision in Product Design method (Hekkert & Van Dijk, 2011) to students. The course was chosen because the Vision in Product Design method, like design for positive activities, aims to create a longer-lasting positive impact. It also puts a strong emphasis on the quality of the interaction which we consider crucial in the context of wellbeing interventions.

Fourteen design students (7 female, 7 male) participated in the two-month course (10 sessions of 4 hours). At the start of the course, positive activities were introduced as a design domain through a) a 45-minutes talk and b) a self-guided literature study (Pohlmeyer, 2014; Pohlmeyer, 2017; Wiese et al., 2020).

The Design for Sustained Wellbeing framework (Figure 5.1, see Wiese et al., 2020) served as a theoretical basis for the course. The framework describes a multi-stage process through which digital technology can promote positive activities and ultimately sustained wellbeing. It specifies a set of fourteen positive

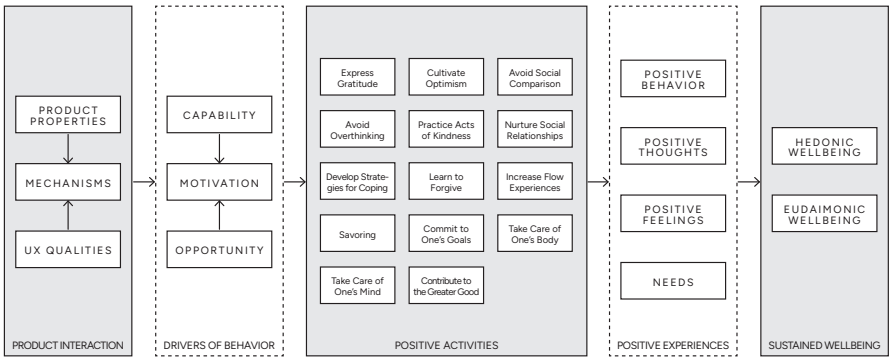


Figure 5.1: The Design for Sustained Wellbeing framework (adapted from Wiese et al., 2020)

activities (stage 3) that can be targeted by design and a taxonomy of sixteen design mechanisms (stage 1) to support them. This taxonomy comprises common behavior change techniques such as feedback, prompts, and social support (Michie et al., 2011; 2013). Design mechanisms represent specific strategies to stimulate psychological drivers of behavior (stage 2) that can promote positive activities. At the interface level, they are realized through combinations of product properties (i.e., tangible aspects of a technology) and UX qualities (i.e., people's subjective experience of the interaction). Technologies can support positive activities in multiple ways, e.g., by inspiring (e.g., personalized content), triggering (e.g., context-dependent, well-timed cues), motivating (e.g., feedback on task performance), or facilitating (e.g., clear guidance) engagement in these activities (see Pohlmeyer, 2017). For a full list of design mechanisms, positive activities, and technology examples see Wiese et al. (2020).

Students were briefed to redesign existing consumer technology to support one of seven self-selected positive activities specified in the framework (see also Lyubomirsky, 2007): 1) practice gratitude, 2) cultivate optimism, 3) avoid overthinking, 4) avoid social comparison, 5) practice acts of kindness, 6) nurture social relationships, and 7) commit to one's goals. For each activity, a brief definition, technology examples, and references to academic papers were provided. In addition, students received a detailed taxonomy of design mechanisms. Students were given the freedom to utilize these design mechanisms in their projects and were also encouraged to explore additional design mechanisms they found suitable.

The design process was based on the Vision in Product Design method (Hekkert & Van Dijk, 2011). This method was thought to guide design students step-by-step towards developing a personal perspective (i.e., a new frame) on the domain of positive activities by considering both scientific and popular knowledge. Only after students have clearly articulated a) the effect they aimed to achieve,

i.e., which specific aspect of the activity they intended to foster, and b) the interaction qualities they wished to promote, i.e., how the intervention was supposed to be experienced by the user, they started thinking about specific technologies into which the activity could be integrated. At the end of the course, students submitted and presented their final design concept.

To address the research question, the first author (LW) analyzed the final fourteen design concepts. The analysis focused on a) how the concepts integrated the positive activity, b) which design mechanisms were employed to support the activity, and c) how these design mechanisms were implemented. LW created a codebook from the framework's taxonomy, incorporating any additional mechanisms applied by the students (see Wiese et al., 2024b). LW then analyzed all design concepts using this codebook. The resulting classification was reviewed and discussed with the second author (AP). Any disagreements in coding were resolved through discussion. In addition, the course organizers (LW, PH) reflected on any observations they made throughout the course.

5.4 Results

5.4.1 Strategies for integration

All fourteen design concepts incorporated positive activities as Active Design solutions, with different levels of disruption to existing user flows. Table 5.1 provides an overview of the final design concepts (for more details, see Wiese et al., 2024b). We recognized three distinct strategies that students used to integrate positive activities into consumer technology:

- **Addition (4 out of 14 concepts):** Active Designs that add a self-contained feature that addresses the positive activity without changing the core function or user experience of the technology otherwise. Additions can be interpreted as small, dedicated solutions disseminated within a consumer technology that follows a different overall purpose. Prompts for charity donations (D12) during one's daily commute are an example of such additive integrations.
- **Enrichment (6 out of 14 concepts):** Active Designs that aim to rebuild a core function or user experience of the platform in a positive way. This can comprise positive activities that are already supported by a technology, e.g., donations or related activities that can be enhanced to (also) foster wellbeing, e.g., an interface that fosters kind communication. An example from our study is sharing one's LinkedIn account with others to create career opportunities for them (D3).
- **Transformation (4 out of 14 concepts):** Active Designs that aim at transforming known or suspected negative usage patterns into "less damaging" or

even positive ones. Some students used this integration strategy to foster optimism (D5-D7) and mitigate unfavorable social comparison (D11).

Table 5.1: Overview of the design concepts including the supported positive activity, the (re)designed feature, the product category of the selected technology, and the chosen integration strategy.

ID	Positive Activity	Feature Description	Product Category	Integration Strategy
D1	Practice Gratitude	An extra tab on a petitions page displaying supporters' reasons for backing the petition with a voice message and a photo.	Productivity	Enrichment
D2	Practice Gratitude	An add-on to a task management tool reminding users to express gratitude after the completion of certain tasks.	Productivity	Addition
D3	Practice Gratitude	The ability to contribute to others by temporarily sharing one's business network account to provide business opportunities to them.	Business	Enrichment
D4	Practice Gratitude	A module on the checkout page of an online shop that emphasizes the frequently overlooked convenience benefits of online shopping.	Shopping	Addition
D5	Cultivate Optimism	A visual feedback system reflecting the emotional impact of one's social media posts on one's followers.	Social	Transformation
D6	Cultivate Optimism	An altered ranking algorithm on a news website that emphasizes shared identity between users.	News	Transformation
D7	Cultivate Optimism	A pop-up notification encouraging users to reflect on their technology use and/or pursue alternative activities.	Social	Transformation
D8	Cultivate Optimism	An adaptive alarm clock inspiring users to reframe their outlook on each day in a positive way.	Tools	Enrichment
D9	Avoid Overthinking	An add-on to a notetaking app encouraging users to recognize and reflect on ruminating thoughts.	Productivity	Enrichment
D10	Avoid Overthinking	Comment and search features in a video streaming platform encouraging users to explore and reflect on movies related to personally relevant topics.	Entertainment	Enrichment

Continued on next page

(cont'd)

ID	Positive Activity	Feature Description	Product Category	Integration Strategy
D11	Avoid Social Comparison	A prompt on a social media platform triggering users to reflect on how they have been impacted by social comparisons in the past.	Social	Transformation
D12	Practice Acts of Kindness	A prompt for charity donations during daily commute checkouts.	Transportation	Addition
D13	Practice Acts of Kindness	A dynamic badge on a business network profile reflecting the user's frequency of kind actions on the platform.	Business	Enrichment
D14	Commit to One's Goals	Customizable graphic elements floating on the smartphone home and lock screen for setting and pursuing personal goals.	Productivity	Addition

5.4.2 Design mechanisms

Students employed a broad range of design mechanisms to support positive activities (Table 5.2, see Wiese et al., 2024 for a definition and analysis). Design mechanisms 1-15 were originally specified in the framework (Wiese et al., 2020). Our analysis revealed two additional mechanisms: self-reflection and self-expression. Self-reflection can be defined as reviewing and making sense of (past) experiences to provide insight and inspire future action (Baumer et al., 2014). Self-expression refers to people's ability to communicate and share personal feelings (Gonsalves et al., 2023), which can, in turn, trigger social support. The most frequently employed design mechanisms were a) prompts (13 concepts), b) self-reflection (9 concepts), and c) joy of use (6 concepts).

As specified in the framework (Figure 5.1), design mechanisms can activate three drivers of behavior: opportunity, capability, and motivation (see Table 5.3, for a definition). Table 5.2 shows how design mechanisms can be mapped onto drivers of behavior based on the COM-B model of behavior change by Michie et al. (2011; 2013).

In our analysis, we coded which driver of behavior was supported by each identified design mechanism. Table 5.3 shows how frequently each driver of behavior was supported by the fourteen design concepts. The concepts laid a strong focus on motivating engagement in the activity (50.8%).

Table 5.2: Overview of a) employed mechanisms, b) corresponding drivers of behavior, and number of concepts the mechanism was integrated in. For a definition of the mechanisms, see Wiese et al. (2024).

Design Mechanism	Driver of Behavior	# Concepts
1. Optimal Challenge	Capability	1
2. Focus Attention	Capability	2
3. Education	Capability	2
4. Goal Setting	Capability, Motivation	2
5. Action Planning	Opportunity	2
6. Social Support	Opportunity	2
7. Prompts	Opportunity	13
8. Persuasion	Motivation	2
9. Rewards	Motivation	2
10. Feedback	Motivation	5
11. Self-Monitoring	Motivation	2
12. Personal Relevance	Motivation	5
13. Modelling	Motivation, Capability	2
14. Variation	Motivation	1
15. Joy of Use	Motivation	6
16. Self-Reflection	Motivation, Capability	9
17. Self-Expression	Motivation	2

Table 5.3: Drivers of behavior (change): a) definition and b) frequency of support in design concepts.

Driver of Behavior	Definition	Frequency
Opportunity	External or context factors that enable or prompt behavior. Examples: having enough time, access, and social support.	28.6%
Motivation	Intrapersonal processes, including goals, values, and deliberate decision-making that stimulate or encourage the activity. Examples: relation to personal goals, belief in positive outcomes.	50.8%
Capability	A person's psychological or physical ability to perform the activity. Examples: having relevant knowledge and attention capacity.	20.6%

5.4.3 Design examples

In the following section, we present three design examples, one for each integration strategy (see 5.4.1). For each example, we briefly describe a) the chosen positive activity, b) the design vision, i.e., which aspect of the activity the student project focused on and how the interaction was intended to

feel, c) the technology context, and d) the specific implementation, i.e., which mechanisms were applied and how they were realized at an interface level. It is important to note that these examples were not tested with users regarding their effectiveness nor discussed with tech companies regarding their feasibility. The examples are intended to illustrate the specific ingredients students have chosen to translate positive activities into corresponding online activities.

ADDITION: PRACTICE GRATITUDE (D4)

Positive Activity. Gratitude is often conceptualized as a two-step process: To feel grateful, a person needs to a) recognize that a positive event, e.g., a gift, a benefit has occurred in one's life and b) acknowledge that someone or something, e.g., nature, a spiritual power outside of oneself has contributed to this positive event (Emmons & McCullough, 2003).

Design Vision. D4 focused on the first step of the process: fostering awareness of one's blessings. It aimed at creating a revealing "moment of realization", in which a person suddenly comprehends how blessed they are. This design goal was inspired by factors that hinder gratitude such as taking one's blessings for granted in a world of materialistic consumption (e.g., Richins & Dawson, 1992; Dunn et al., 2019). Accordingly, the design reminds people to appreciate their blessings by pointing out "how different life would be without them". Hence, the interaction was envisioned to feel eye-opening, confronting, and grounding, but at the same time not overly negative or guilt-inflicting.

Technology Context. The context of online shopping was deemed fitting as it directly relates to materialistic consumption, identified as one obstacle to gratitude. The design augments the standard online checkout by adding a 'free benefits module'. The module highlights overlooked perks when ordering online such as saving time and avoiding inconveniences (Figure 5.2). It thus intersperses an opportunity for reflecting on one's blessings into a moment of potentially mindless materialistic consumption.

Design Mechanisms. The concept applies the following mechanisms:

- *Prompts, Self-Reflection:* The unexpected nature of the 'free benefits module' is thought to capture users' attention and act as a prompt triggering reflection.
- *Joy of Use:* The module resembles a shopping basket item list, displaying "items" and their "price tags" (none or 0€ for free benefits). Since the item list usually shows what one owes rather than what gains, this reverse logic adds a joyful element to the interaction.

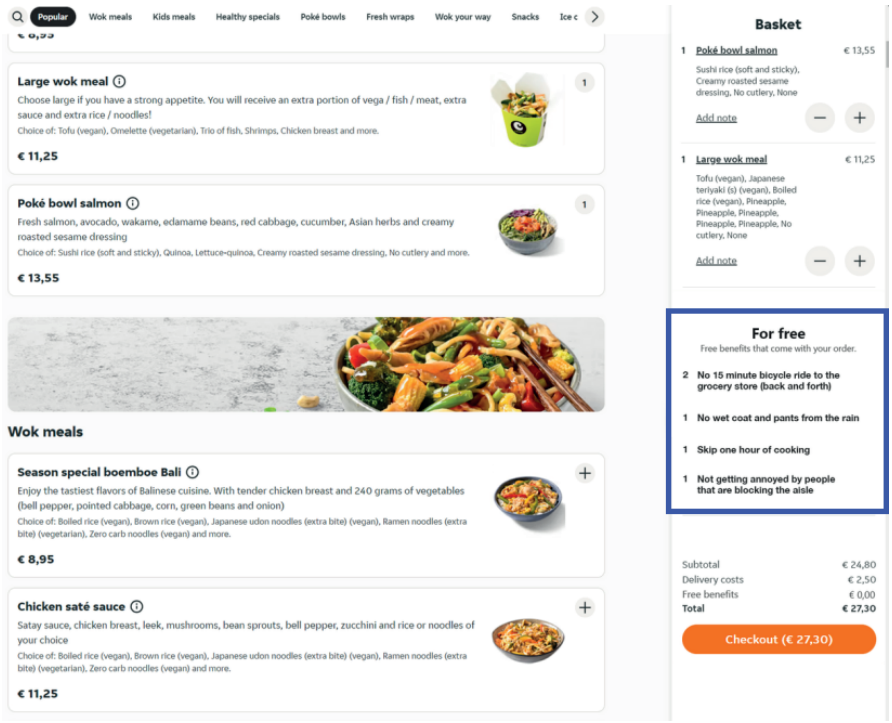


Figure 5.2: Screenshot of a gratitude-inspired online checkout that integrates a 'free benefits module' (highlighted in blue). Design by and image courtesy of Heleen Sinnige.

TRANSFORMATION: CULTIVATE OPTIMISM (D6)

Positive Activity. Optimism can be a powerful antidote to crisis as it promotes healthy ways of coping with stress (e.g., Carver & Scheier, 1985). Like the practice of gratitude, cultivating optimism aims at identifying positive aspects of a given situation which, in turn, encourages people to take action to improve their circumstances (Lyubomirsky, 2007).

Design Vision. D6 drew inspiration from the idea that individuals are more confident to tackle a problem when they feel supported by others, enabling them to work on it as a group. However, increasing societal polarization undermines this collective spirit, leading to pessimism regarding the prospects of addressing current crises. The project attempted to rebuild trust in a better future by fostering empathy for those holding different perspectives, thereby increasing social connection. In line with this goal, the interaction was envisioned to feel inviting, respectful, and open-minded.

Technology Context. The concept targets the Twitter (now X) newsfeed (Figure 5.3). This context warrants an optimism intervention because frequent exposure to disturbing news can cause significant psychological distress (APA Psycho-

logical Association, 2022). In addition, by prioritizing engaging content in their ranking algorithms, social media platforms are suspected to fuel the spread of misinformation and hate speech (e.g., Brady et al., 2017; Vosoughi et al., 2018), further deepening social and political divide. Consequently, the concept aims at transforming the Twitter news feed from a polarizing (negative) into a connecting (positive) experience by emphasizing what unites people (here: their taste in music) rather than what divides them (here: their political opinion).

Design Mechanisms. The concept builds on the following mechanisms:

- *Personal Relevance:* In a personalized 'For You' tab (1), the redesigned news feed ranking is determined by similarities in users' music taste.
- *Prompts:* Below the user's Twitter name, a prominent label (2) indicating similarities in music taste is displayed, e.g., 'also listened to' or 'you are both a fan of'.
- *Joy of Use:* Users can collect songs (3) related to a tweet by clicking on the Spotify logo (bottom right) and add them to their Spotify playlist ('Your Collected Songs'). This light-hearted activity of creating a music playlist adds an amusing element to the interaction.

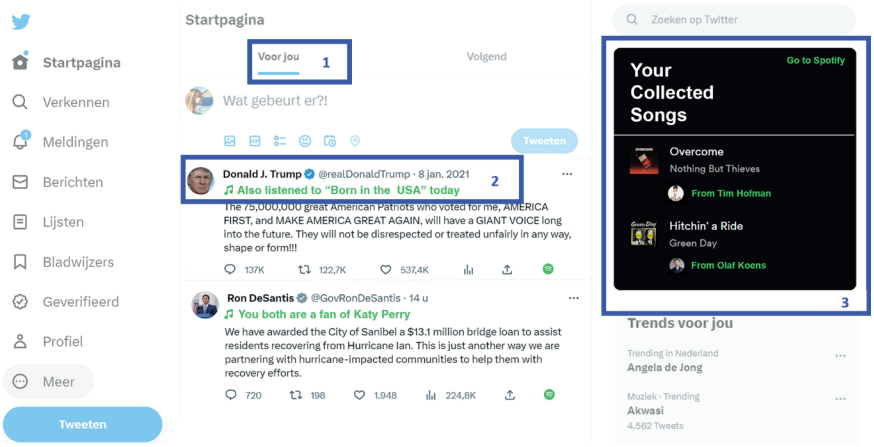


Figure 5.3: Screenshot of a Twitter/X newsfeed optimized for cultivating optimism by adapting the ranking algorithm. Design by and image courtesy of Iris de Lange.

ENRICHMENT: AVOID OVERTHINKING (D10)

Positive Activity. Overthinking involves passive, repetitive dwelling on one's problems rather than taking proactive steps to solve them. To combat overthinking, a person can apply several strategies, including distraction, mindful acceptance, confiding in others, solving the underlying problem, and identifying

triggers for one's overthinking (e.g., Lyubomirsky, 2007; Nolen-Hoeksema et al., 2008).

Design Vision. D10 drew from these strategies to reduce overthinking. Specifically, it aimed at helping individuals become more self-aware about the maladaptive nature of their ruminating thoughts by assisting them in recognizing similar patterns in other people's life experiences. In addition, the project sought to promote healthy ways of coping by encouraging self-acceptance and seeking support from others. The designer thus wanted the interaction to feel personal, empathy-inducing, inspirational, and thought-provoking.

Technology Context. He decided to turn passive entertainment on Netflix into an opportunity for active introspection, coping, and personal development (Figure 5.4).

Design Mechanisms: The concept involves the following mechanisms:

- *Personal Relevance:* In addition to conventional genre-based browsing (e.g., action, romance, thriller), the main menu guides users to discover movies related to their specific mental health concerns (e.g., loss, anxiety, perfectionism) (Figure 5.4, left), allowing them to explore these topics through the eyes of movie characters.
- *Social Support:* This personal 'My Space' (Figure 5.4, center) also contains a 'Community' tab (Figure 5.4, top right) in which users can explore the watch history and 'mental health reviews' from trusted others. These reviews mimic the layout of standard movie reviews but contain personal reflections about how the movie helped others cope with their mental health and possibly related personal movie recommendations.
- *Prompts, Self-Reflection:* By prompting users to write 'reviews' (Figure 5.4, bottom right), the interface triggers active processing and reflection on the content. To respect their privacy, users can either watch a movie privately or share their watch history and 'mental health review' with the community.
- *Modelling, Self-Expression:* The mental health reviews can model healthy cognitive reappraisals (Morris & Picard, 2012; Schueller et al., 2013) or function as encouraging peer testimonials that foster motivation to address one's own problems (Layous, Nelson, & Lyubomirsky, 2013).

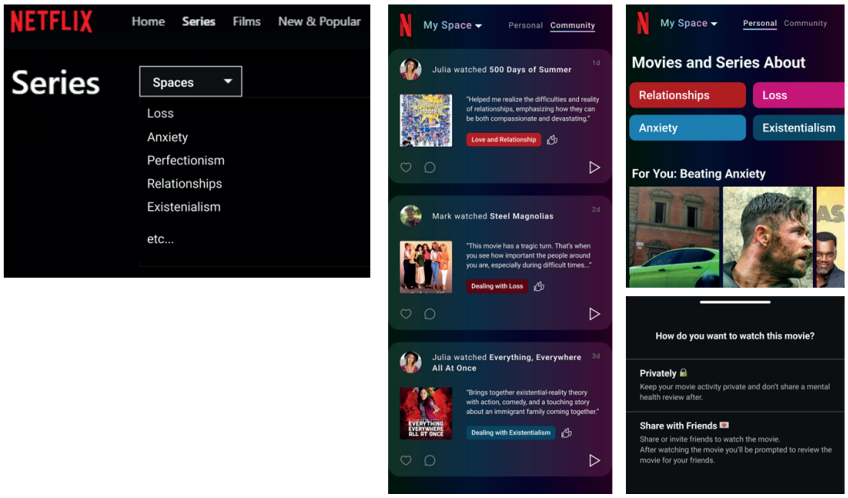


Figure 5.4: Screenshots of Netflix optimized for reducing overthinking. Design by and image courtesy of François Prévot.

5.5 Discussion

Our case study demonstrates that, when properly methodologically guided and fueled with relevant theoretical knowledge, designers are perfectly capable of integrating positive activities into consumer technology by way of Active Designs. It further shows that there are various integration strategies and concrete mechanisms to do so. In the following, we discuss concrete implications of our findings for the design (for wellbeing) research community as well as for stakeholders from design practice.

5.5.1 Integration strategies as design guidelines

The main goal of the case study was to understand how positive activities can be incorporated into everyday technology. We discovered three strategies for integration (5.4.1), that can serve as guidelines for designers working on the implementation of positive activities as Active Designs. In the following, we discuss advantages, disadvantages, and recommendations for each integration opportunity.

- **Addition:** *Use When:* Additions can be used to connect a positive activity to an unrelated online activity, such as prompts for donations during one's daily commute. *Advantages:* Adding a self-contained feature offers a simple, low-risk approach, as these small Additions are non-disruptive, cost-effective, and can be easily rolled back if needed. Their versatility allows them to be integrated into a wide range of platforms without needing to align directly

with the core technology's primary user behaviors. *Disadvantages:* Since Additions are typically small-scale interventions, it is crucial to carefully select a few highly effective design mechanisms to ensure their impact.

- **Enrichment:** *Use When:* Enrichment is a promising strategy when digital technologies already support positive or related online activities. To identify promising starting points, designers can analyze the context in which their technologies are embedded and the specific online activities they support. For example, technologies that facilitate social interactions, such as messaging services, team collaboration tools, or social networking platforms, could be enriched with features that nurture social relationships or foster kind communication. *Advantages:* Enrichments align with existing user behavior and can introduce a positive incentive or component to this behavior. *Disadvantages:* Enrichments can alter the core functionality of the technology, potentially disrupting user and business goals. Unlike Additions, enrichment integrations are harder to skip or ignore, which might make users feel they are being forced on them. However, this effect can, in part, be mitigated by separating enrichment features from the primary user flow in some way such as placing them in a dedicated tab (see D1) or making engagement in them optional (see D3).
- **Transformation:** *Use When:* Transformational designs can scaffold new (positive) ways for users to engage with or experience a technology, making it a sensible approach when a technology is known or suspected to negatively impact user wellbeing. Knowledge on positive activities can, for instance, directly inform design interventions to combat negative social comparisons or reduce cyberbullying by fostering kind interactions. Features like 'Reflect Before Sharing' on Instagram, nudging users to have healthier conversations online (e.g., Bryant, 2019), indicate a business need for that. *Advantages:* Transformational designs address negative behavior by changing the underlying design patterns within the technology itself, such as reducing harmful interactions like cyberbullying in comment sections. This approach contrasts with external harm mitigation tools, such as screen time restrictions, which aim to limit technology use rather than directly tackling the "problematic" design elements at their source. *Disadvantages:* Like Enrichments, Transformations can be more disruptive and may feel imposed on users, potentially leading to resistance if perceived as overly controlling or enforced.

These strategies highlight various opportunities for actively incorporating positive activities into consumer technology. It is important to note that distinct features within a platform may be suitable for different positive activities and corresponding integration strategies. For instance, in the context of social networking sites, addressing offensive comments may involve strategies to foster kindness, while direct messaging could be enriched through strategies to

nurture social relationships. Identifying potential starting points for integrating positive activities should, therefore, be approached at a feature level, aligning with the definition of Active Designs.

Active Designs presented here can resemble 'small, dedicated solutions' similar to BITs. Both active and dedicated approaches to designing for positive activities have their own strengths and challenges. While Active Designs may lead to smaller increases in wellbeing, they can, on the other hand, reach large user groups and may initiate behavior change more easily, since they are distributed 'along the way' to highly engaged users of the core technology, e.g., an email client or video streaming platform. By promoting positive states, Active Design for positive activities complements digital wellbeing approaches that aim to prevent or reduce harmful user behavior. Active Design can also inform the design of consumer technologies that do not create harm in the first place (i.e., addition, enrichment) and explores options to transform negative experiences into positive ones (i.e., transformation).

5.5.2 Combining design mechanisms and behavior change principles

The study also aimed to discern which design mechanisms designers choose to support positive activities, and how they implement them. The design concepts employed a broad variety of design mechanisms, demonstrating that despite the seemingly limited scope of Active Designs, consumer technology can promote positive behaviors in multiple ways. The taxonomy of design mechanisms introduced in the framework (Wiese et al., 2020) proved to be useful in supporting the design process, affirming the application of the framework. This suggests that common behavior change techniques can support positive activities within consumer technology. While designers of BITs may be familiar with these techniques, UX designers working on consumer technology may not be as familiar. Therefore, introducing the taxonomy as a (digital) design tool to UX designers may be beneficial. To further increase the applicability of the framework in design practice, knowledge on positive activities can be translated into targeted design strategies for each positive activity.

5.5.3 Implications for the design process

We anticipated three major challenges when integrating positive activities into existing consumer technology. Designers need to (a) acquire knowledge on positive activities, (b) identify a fitting technology context, and (c) select and implement well-suited design mechanisms to support positive activities. Based on our observations, students derived a good understanding of the wellbeing literature and perceived positive activities as an interesting/inspiring design target. Each positive activity led to a variety of design goals, integration strategies,

supporting mechanisms, and could be incorporated into different technology contexts.

Most design concepts addressed emotional and motivational aspects of the behavior change process that are often underrepresented in BITs (e.g., Conroy et al., 2014; Yang et al., 2015; Diefenbach, 2018). In our view, this was likely promoted by encouraging students to explicitly specify (a) the intended effect and (b) the quality of the interaction prior to the implementation (Hekkert & Van Dijk, 2011). Future design tools or methods to support the design for positive activities could build on these findings by emphasizing this aspect. Our findings illustrate that thoughtful Interaction Design can target the support of positive activities (see also Ludden et al., 2015; Pohlmeyer, 2017).

The biggest challenge students faced in the design process was to find a matching technology to implement their design vision, i.e., mapping positive activities to possible technology contexts. Future work could systematically map out opportunities to incorporate positive activities into major technology branches such as communication, entertainment, and social networking platforms. The mapping could consider the context of use (e.g., seeking entertainment for relaxation), supported online activities (e.g., communication, time-management), or negative effects associated with a specific technology or feature (e.g., cyberbullying, misinformation).

Lastly, we would like to point out that design scenarios in industry settings may differ from our study setup. In our study, students initially selected a positive activity to design for and next identified a suitable technology context to embed it into. However, in most industry settings, these steps are reversed. Practicing designers usually work on a given technology, e.g., an e-commerce platform, and would need to identify positive activities that fit into this context of use. Challenges encountered in this scenario could be different from those experienced by students in our course. We can imagine that starting from a deep understanding of a given technology could even facilitate the selection of suitable positive activities.

5.5.4 Size of the intervention

The results show that wellbeing can be supported even through small features. It does not always require large-scale interventions. The design concepts deployed 'minimal' design interventions that could offer substantial benefits for people, society, and design practice. In our view, they can thus be seen as an application of the Maximum Effect for Minimal Means (MEMM) principle (da Silva et al., 2016), a principle that originally highlights that a product is (aesthetically) appreciated when it achieves broad and significant impact with minimal effort.

Design interventions in our study can be considered minimal in several ways. First, they are economic, i.e., they expand upon existing functionality (e.g., the layout of an e-commerce checkout page (D4) or the ranking algorithm of a news platform (D6)). Second, they translate behavior change mechanisms (e.g., prompts) into unobtrusive user interface components (e.g., labels (D3)) that integrate seamlessly with the existing interface. Third, smaller-scope features require fewer technical and financial resources. They may thus be more feasible to deploy within the fast-paced product development cycles of the tech industry. Fourth, features that integrate seamlessly with the existing user interface may be less likely to distract users from their initial goals (often aligned with business goals) when using the technology, like ordering food (D4) or reading the news (D6). Fifth, by the nature of our design brief, they do not require a dedicated commercial (paid) application. Instead, they can be practiced 'for free' while using everyday technology.

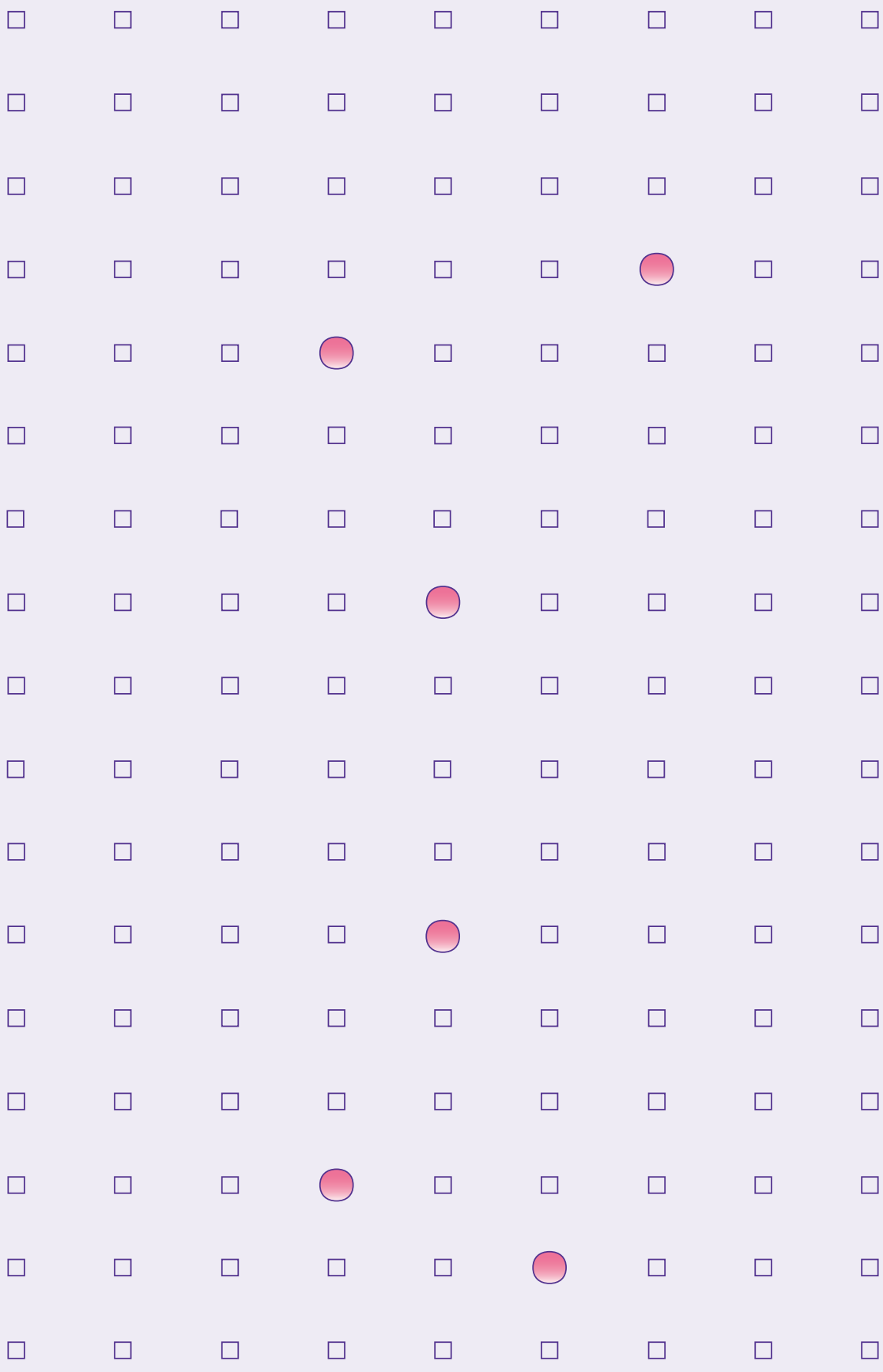
Although minimal in nature, these design interventions can generate significant impact. If integrated into a broad range of consumer technologies, they could reach many people, dispensing daily doses of wellbeing across multiple touch-points to a diverse group of users. The technical feasibility and minimal disruption caused by small features can make it easier for stakeholders to support and align wellbeing design goals with broader business objectives. This increases the practical applicability and acceptability of designing for positive activities in industry. Minimal design interventions may further lower the threshold for behavior change and promote adherence (e.g., Pohlmeyer, 2017; Ludden et al., 2015).

5.5.5 Need for caution

Good intentions do not always lead to good outcomes. Like any intervention aimed at changing user behavior, design for positive activities can inadvertently cause harm – ranging from minor annoyances to more severe consequences. This also applies to the design concepts discussed in this paper. To mitigate risks, it is crucial to rigorously test and iterate designs with users, considering both short- and long-term impacts. Moreover, users of consumer technology form a diverse group with varying vulnerabilities, motivations, and usage patterns. Unlike the more explicit needs of 'happiness-seekers' (Bergsma, 2008) using dedicated wellbeing tools, such as meditation apps, the needs of users of consumer technology may be less clear-cut. Designing for positive activities, therefore, demands sensitivity to this diversity, ensuring that solutions are inclusive, safe, and aligned with users' individual goals and values.

5.6 Limitations & future work

Due to the exploratory nature of the study, insights are based on only a small sample of examples and are mostly illustrative in nature. Nevertheless, in our view, even this limited selection of examples shows the broad applicability and potential of the approach. Given the time-intensive nature of the design process (literature study, design method), future work could focus on developing actionable design tools that break down research-based knowledge on positive activities into manageable chunks and develop (activity-specific) design guidelines.



6

Practical tools for wellbeing design

This chapter will be submitted for publication after finalizing the thesis.

The previous chapter explored the application of the framework in design practice, revealing three distinct strategies for integrating positive activities into consumer technology. It also found that designing for positive activities benefits from focusing on (a) intended effects, (b) interaction quality, and (c) assisting designers in mapping positive activities to specific technology contexts. Building on these insights and other learnings throughout the PhD project, the current chapter substantiates four key challenges that design practitioners encounter when designing for wellbeing and proposes six design directions to address these challenges through practical design tools. It then presents a design concept for a digital tool focused on promoting positive activities. This concept was subsequently prototyped, demonstrating how these design directions can be translated into concrete tool features. Together, design directions and tool features aim to support the development of future tools for wellbeing design.

6.1 Introduction

The impact of digital technologies on people's wellbeing has become a matter of growing public concern in recent years, accompanied by calls to (re)align "technology with humanity's best interest" (Center for Humane Technology, 2023). In response, major tech companies like Google (Pardes, 2018), Apple (Solon, 2018), and Microsoft (Ho, 2023) have taken steps to reduce technology-related harm by developing external tools (Lyngs et al., 2019) and built-in features (Lukoff et al., 2023) to monitor screen time, manage notification preferences, and educate users on healthy technology use. However, in addition to these preventative measures, digital technologies can also be designed to actively promote individual wellbeing and positively advance society (Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013; Riva et al., 2012).

To this end, research in Human-Computer Interaction (HCI) has introduced theoretical frameworks (Calvo & Peters, 2014; Desmet & Pohlmeyer, 2013; Hassenzahl et al., 2013; Peters et al., 2018; Riva et al., 2012) that outline specific ways to shape wellbeing through design. However, to influence the design of commonly used digital technologies, these frameworks must be translated into practical design tools that are applicable in industry contexts (Hekler et al., 2013; Peters et al., 2018).

First wellbeing design tools for practice have been developed in recent years (Delft Institute of Positive Design, 2017; Klapperich et al., 2018, 2019; Peters, Ahmadpour, et al., 2020; Peters & Ahmadpour, 2021; Wellbeing Supportive Design Toolkit, 2023; Monge Roffarello, 2024). They build on established formats, such as physical card decks, to support early stages of the design process, including knowledge acquisition, ideation, and concept generation. While these tools are promising, there are several key challenges in wellbeing design practice that

warrant further exploration, including how to (a) effectively convey rigorous "evidence and theory" from wellbeing psychology, (b) promote "understanding and reflection", (c) provide "actionable" guidance, and (d) foster "client buy-in" (Peters, Ahmadpour, et al., 2020).

Based on learnings from the literature (Klapperich et al., 2018; Lockton et al., 2009, 2010; Peters, Ahmadpour, et al., 2020; Peters & Ahmadpour, 2021; Wiese et al., 2019) and our own work, we elaborate on these challenges and provide targeted design directions for addressing them within design tools ("How To's"). We focus specifically on the unique opportunities arising from digital tools. In Section 6.4, we present a novel design concept for a digital design tool that demonstrates how the presented design directions can be translated into concrete tool features. These design directions and tool features aim to inform the development of other practical tools that support design for wellbeing. Ultimately, our goal is to inspire and support technology designers in incorporating wellbeing principles into their everyday design practices.

6.2 Related work

6.2.1 Research on wellbeing in HCI

Wellbeing can be broadly defined as "experiences of pleasure and purpose over time" (Dolan, 2014, p. 3). It comprises two complementary aspects: (a) subjective or hedonic wellbeing (Diener, 1984; Kahneman, 1999) and (b) psychological or eudaimonic wellbeing (Ryan & Deci, 2001; Ryff, 1989; Ryff & Singer, 2008). Subjective or hedonic wellbeing, often described as "feeling good", stems from the experience of frequent positive emotions, infrequent negative emotions, and an overall positive evaluation of one's life (Diener, 1984; Kahneman, 1999). Psychological or eudaimonic wellbeing, also referred to as "living well", involves optimal psychological functioning, marked by personal growth, self-determination, a sense of purpose, and the cultivation of positive relationships (Ryff, 1989; Ryff & Singer, 2008).

Wellbeing design frameworks build on these established psychological theories to identify factors that design can influence to improve wellbeing. Related HCI research programs include Positive Design (Desmet & Pohlmeyer, 2013), Positive Computing (Calvo & Peters, 2014; Peters et al., 2018), Positive Technologies (Riva et al., 2012), and Experience Design (Hassenzahl et al., 2013). For example, Desmet & Pohlmeyer (2013) suggest fostering subjective wellbeing by simultaneously stimulating (a) *pleasure*, or positive affect, (b) *personal significance*, which involves striving for personally relevant goals, and (c) *virtue*, achieved through moral actions by means of design. Calvo and Peters (2014) specify nine ingredients for psychological wellbeing such as *gratitude*, *empathy*, *mind-*

fulness, and *self-awareness*, that can be stimulated by design. Drawing on self-determination theory (Ryan & Deci, 2000b, 2017), they also developed the METUX model (Peters et al., 2018), which emphasizes the importance of fulfilling basic human needs for *autonomy*, *competence*, and *relatedness* when designing for psychological wellbeing. To illustrate the diverse ways technologies can impact wellbeing, the model identifies five distinct spheres of technology experience: interface, tasks, behavior, life, and society. Each sphere highlights areas where needs can be satisfied or frustrated. To facilitate the practical application of the framework, the authors list evidence-based measurement opportunities for each sphere, adapted to the technology context. These measures can be utilized to evaluate the nuanced impact of digital technologies on wellbeing and inform their design to foster positive outcomes. While these frameworks offer technology designers valuable insights from wellbeing psychology and support design decisions based on rigorous psychological knowledge, their impact on design practice remains limited (Klapperich et al., 2018; Peters, Ahmadpour, et al., 2020; Peters & Ahmadpour, 2021).

We believe there are three key reasons for this restricted influence on the design of real-world technologies. First, wellbeing design frameworks almost inevitably inherit some of the complexity associated with wellbeing taxonomies and terminology (see Huta, 2017; Huta & Waterman, 2014 for a discussion on wellbeing theory). To prevent overwhelming designers, it is essential to manage this complexity proactively, when translating theoretical knowledge into practice (Peters & Ahmadpour, 2021). Second, uncertainty remains regarding how and when to best incorporate insights from these theoretical frameworks into the design process, particularly concerning "which formats, content, and touchpoints for integration would be most effective" (Peters, Ahmadpour, et al., 2020). Third, there is a considerable gap between knowledge as conveyed in theoretical frameworks and the practical task of designing concrete interface elements and interactions with technology (Klapperich et al., 2018). While existing frameworks can without question inspire designers, they tend to remain descriptive, providing scant details on how to shape specified wellbeing determinants through concrete interaction patterns (Hekler et al., 2013, p. 3309).

6.2.2 Practical wellbeing design tools

One established method of bringing theoretical knowledge into practice is through the use of design tools (Peters, Loke, et al., 2020). Based on feedback from 15 technology designers (Peters, Ahmadpour, et al., 2020), valuable features of wellbeing design tools for practice include, amongst others, the ability to (1) convey rigorous "evidence and theory" from wellbeing psychology, (2) promote "understanding and reflection", (3) provide actionable guidance

(e.g., through "design strategies", "measures", "heuristics"), and (4) foster "client buy-in".

The first wellbeing design tools for practice have been developed in response to these needs. For instance, drawing from the METUX model (Peters et al., 2018), Peters, Ahmadpour, et al. (2020, 2021) iteratively developed the 'Wellbeing Supportive Design Toolkit' (2023). This toolkit features a 'Design for Wellbeing' card deck organized into four suites: (a) basic human needs, (b) spheres of technology experience, (c) indicators of basic need frustration, and (d) heuristics and associated design strategies to address wellbeing in the design process. These heuristics and design strategies are also available in a checklist and cheat sheet format (Peters, 2022).

Other examples of practical wellbeing design tools include the 'Design for Happiness' card deck (Delft Institute of Positive Design, 2017), which offers a granular typology for each of the three components of the Positive Design framework (Desmet & Pohlmeyer, 2013); the 'Positive Emotional Granularity Cards' (Yoon et al., 2015), which differentiate a broad range of distinct positive emotions to design for; and the 'Positive Practice Canvas' (Klapperich et al., 2018), a visual interview guide aimed at analyzing particularly positive aspects of daily practices, such as brewing coffee or taking a shower, to inspire designers to enrich these practices with wellbeing-enhancing products. Some tools are integrated into existing design and collaboration platforms used in the tech industry. For example, the 'Wellbeing Design Toolkit' (2023) provides a Miro template for guiding design teams through an educational workshop on wellbeing design. Monge Roffarello et al. (2024) developed a Figma plugin that helps designers identify interaction patterns within their Figma projects affecting users' digital self-control.

As stated above, the impact of wellbeing design frameworks on industry practice is, in our view, particularly hindered by three factors: (a) the complexity of wellbeing theory, (b) open questions about how and when to best integrate wellbeing theory into the design process, and (c) a lack of practical guidance on how to shape wellbeing determinants at the interface level. Existing wellbeing design tools address some of these challenges by building on established formats to (a) break down the complexity of wellbeing (design) frameworks into manageable chunks of information (e.g., physical card decks), (b) illustrate unfamiliar wellbeing concepts and their relation to design through written and/or visual examples, and (c) encourage designers to explore specific approaches to incorporating wellbeing into their work (e.g., heuristics). They are thus particularly valuable during the earlier stages of the design process, such as research, ideation, and concept generation.

While these practice-oriented tools provide a good starting point to bridge

theory and practice, more work is needed to ensure that designers and product owners effectively integrate wellbeing principles into the design of everyday digital technologies. Specifically, the later stages of the design process, such as prototyping and implementation, and their unique challenges have received comparatively little attention so far. This includes understanding how to translate abstract wellbeing determinants into concrete interaction patterns. However, including implementation details further increases the granularity that the respective design tools must manage. Existing design tools already contain detailed typologies of wellbeing determinants. For instance, the 'Design for Happiness' card deck (Delft Institute of Positive Design, 2017) features 72 cards, the 'Positive Emotional Granularity Cards' (Yoon et al., 2015) specify 25 distinct positive emotions to design for, and the 'Design for Wellbeing' toolkit (Wellbeing Supportive Design Toolkit, 2023) offers 15 heuristics along with 30 associated design strategies. Adding interaction patterns for each component may surpass the level of granularity that can be managed within conventional design tools such as physical card sets.

Given the identified gaps in design tool development, this paper focuses on wellbeing design tools characterized by two key aspects:

1. **Digital tools.** One objective is to explore innovative tool formats and concepts that leverage the unique capabilities of digital tools to accommodate high levels of granularity within a design domain.

2. **Supporting later design stages:** Another objective is to provide clearer guidance for concrete design decisions in later stages of the design process. In particular, we aim to support the design of digital wellbeing technologies – specifying a design domain may already serve as a first step in making design tools more actionable.

The current work, particularly the development of a digital design tool concept (Section 6.4), is based on the Design for Sustained Wellbeing framework (Wiese et al., 2020), which explicitly connects wellbeing determinants to interface elements. This framework will be briefly described below.

6.2.3 Framework: Design for sustained wellbeing through technology

The framework (Figure 6.1) describes a multi-stage process through which digital technology can promote sustained wellbeing (see Wiese et al., 2020 for more details). Derived from a bottom-up–top-down approach, the framework integrates theoretical knowledge from a comprehensive, cross-disciplinary literature review, spanning HCI/Design, Positive Psychology, and Behavioral science, with empirical insights from a laddering study (Wiese et al., 2019). This study analyzed how physical products, such as sports equipment or household items,

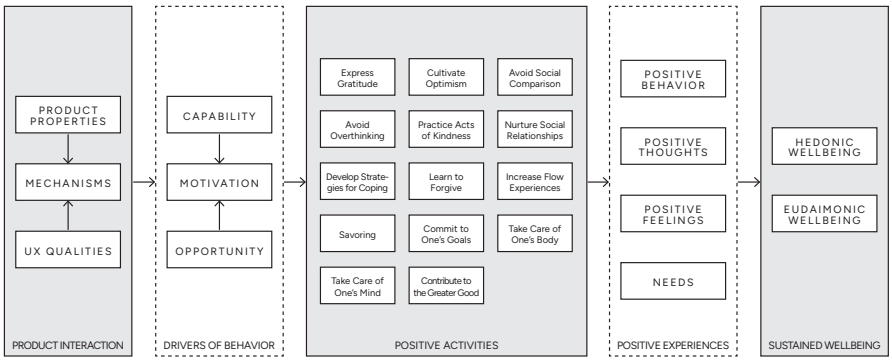


Figure 6.1: The multi-stage framework for sustained wellbeing promoted by technology (Wiese et al., 2020).

and digital technologies, such as social networks, messaging services, and meditation apps, can contribute to wellbeing.

This combined theoretical and empirical approach was chosen to address (a) the lack of conceptual and terminological clarity in wellbeing research (see Huta, 2017; Huta & Waterman, 2014 for an overview), (b) the fragmentation of knowledge on wellbeing and wellbeing design across disciplines, and (c) the limited conceptualization of the potential of digital technologies to foster wellbeing (see Diefenbach, 2018 for an overview). The framework aims to (a) identify empirically grounded wellbeing concepts relevant to HCI and (b) investigate how specific product interaction patterns can impact wellbeing determinants and wellbeing outcomes.

Laddering (Gutman, 1982; Reynolds & Gutman, 1988), a structured interviewing and data analysis method, was used to study pathways or "ladders" from specific product attributes to wellbeing determinants, and wellbeing outcomes. The final stages of the framework, i.e., product interaction, drivers of behaviour, positive activities, positive experiences, and wellbeing outcomes, match the steps of the empirically detected and theoretically refined pathways. The taxonomy of elements within the pillars, represented as small rectangular boxes in Figure 6.1, reflects relevant concepts identified for each pillar based on (a) content analysis and (b) literature review. For further details on the laddering study and framework generation, please refer to the original publications (Wiese et al., 2019, 2020).

At the core of the framework are 14 positive activities, such as expressing gratitude, taking an optimistic stance on life, and treating other people with kindness (see pillar 3 in Figure 6.1), which constituted a major stepping stone linking product interactions to wellbeing in the laddering study. In addition, these activities are also well-documented drivers of sustained wellbeing in the literature (see

Bolier et al., 2013; Sin & Lyubomirsky, 2009 for recent meta-analyses). Products can thus support wellbeing indirectly by fostering engagement in a set of evidence-based positive activities. Accordingly, the major pathway (i.e., boxes with solid outlines) of the framework connects product interaction elements (stage 1) to wellbeing (stage 5) via positive activities (stage 3). The intermediary stages (i.e., boxes with dashed outlines) mediate this relationship.

The key interaction element (stage 1) is a set of 16 mechanisms (see Wiese et al., 2020 for a detailed list) that represent specific methods or techniques to stimulate psychological drivers of behavior (stage 2), which in turn foster positive activities. Mechanisms comprise common behavior change techniques such as feedback, prompts, and social support. They are realized through combinations of product properties, i.e., tangible aspects of a technology, and UX qualities, i.e., people's subjective experience of the interaction. Positive activities, supported by these mechanisms, can promote positive experiences, such as (a) positive behaviors, (b) positive thoughts, (c) positive emotions, and (d) the fulfillment of basic psychological needs (stage 4), and ultimately promote sustained wellbeing (stage 5). Technologies can support positive activities in numerous ways. For example, they can inspire (e.g., personalized content), trigger (e.g., context-dependent, well-timed cues), motivate (e.g., feedback on task performance) or facilitate (e.g., clear guidance) engagement in these activities (see Pohlmeyer, 2017).

Two empirical studies analyzing existing consumer technologies through the framework (Wiese et al., 2024c), and a design case study investigating its application in concrete design projects (Wiese et al., 2024a), confirmed the framework's relevance and practical applicability in consumer technology. These studies further examined nine of the original fourteen positive activities specified by the framework in further detail, refining the taxonomies for (a) positive activities and (b) mechanisms, and enriching them with real-world technology examples. In this process, two additional mechanisms were identified and added to the taxonomy. For a complete list of the resulting 18 mechanisms and 14 positive activities, see Wiese et al. (2020); for a detailed overview of the collected technology examples, see Wiese et al. (2024c).

A specific example of a positive activity is 'savoring', defined as "paying close attention, taking delight and going over life's momentary pleasures and wonders" (see Wiese et al., 2020 adapted from the Greater Good Science Centre, 2023). Psychological research suggests that savoring can be fostered through strategies such as sharing positive moments with others, anticipating or remembering them vividly, and focusing on enjoying them in the present moment (Lyubomirsky, 2007). Technology can support these savoring strategies through mechanisms that facilitate their implementation (Pohlmeyer, 2014).

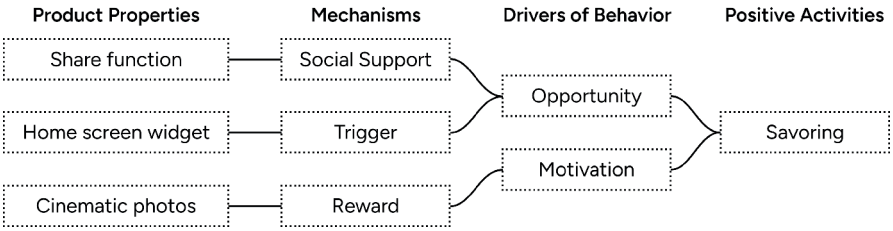


Figure 6.2: How Google Photos 'Memories' can support 'savoring' through the lens of the theoretical framework (Figure 6.1).

For instance, Google Photos' 'Memories' feature encourages users to relive meaningful moments by displaying a collection of personal photos in a widget on the phone's home screen. Videos and visual effects, such as 'cinematic photos', i.e., moving 3D images that create a movie-like experience, enable users to vividly recall positive moments and reward them through sensory pleasure. In addition, sharing these 'Memories' via the app's share function, enables social reminiscence with loved ones. Figure 6.2 illustrates how this 'savoring' example fits within the framework, showing the connections between technology-based mechanisms, behavioral drivers, and positive activities.

6.3 Design directions

Drawing from the literature (e.g., Peters & Ahmadpour, 2021), previous insights on practical wellbeing design tools, and learnings from our own work (Wiese et al., 2019; Wiese et al., 2020; Wiese et al., 2024a; Wiese et al., 2024c), we next reflect on challenges related to practice needs and offer six design directions for addressing them within design tools ('How To's').

6.3.1 How to facilitate knowledge acquisition

In their daily work, technology designers may lack the time, resources, and educational backgrounds to acquire complex, wellbeing-specific knowledge. To address this, wellbeing design tools must facilitate knowledge acquisition by presenting research-based knowledge in a concise and comprehensive way (Peters, Ahmadpour, et al., 2020; Peters & Ahmadpour, 2021; see also Jimenez et al., 2015). Complex taxonomies and terminology from wellbeing research can overwhelm designers and reduce their engagement with wellbeing design tools (Peters & Ahmadpour, 2021). In our own work, this need was reflected by the outcome of an online pilot study[1] with professional designers, which aimed at investigating how everyday technologies, such as messaging services and

[1]Details on the study set-up (incl. interview guide) and problems encountered will be published on the author's OSF page (https://osf.io/k3jce/).

social networks, mediate positive activities based on user narratives. The data analysis revealed a high mismatch rate (48%) between the content of the user narratives and the specific prompts provided for positive activities, along with overall poor data quality. This included many short or non-existent answers to open questions and responses that were unrelated to a specific question. We see three potential reasons for these issues: (a) the use of "unfamiliar" concepts and terminology from wellbeing literature, (b) the extensive amount of upfront information required to illustrate the activity-supportive effects of technology, and (c) difficulties in reflecting on indirect relationships between technology use and wellbeing. Peters and colleagues (2020) report similar difficulties when developing and testing design for a 'Wellbeing Taster Workshop' and 'Wellbeing Design Cards' with attendees of the CHI'19 conference. For the initial version of the workshop, only 56% of the participants agreed or strongly agreed that "the wellbeing design activity was a useful learning experience". In a second iteration with employees of a technology company (Peters & Ahmadpour, 2021), the authors simplified the workshop content, activities, and materials, using real-world examples of commonly used technologies, such as Slack, for the workshop activities. This adjustment significantly improved the perceived usefulness of the learning experience. Similarly, in a case study with interaction designers (Wiese et al., 2024a), a set of concise taxonomies for (a) positive activities and (b) mechanisms, illustrated with concrete examples, proved particularly helpful in supporting design for positive activities.

Design direction 1: Contextual learning (D1): Wellbeing design tools could also (a) offer learning opportunities "along the way" within the design process rather than upfront in a workshop, and (b) disseminate knowledge gradually, tailoring it to the designer's current task and prior input.

Design direction 2: Learning through examples (D2): Examples can facilitate understanding of wellbeing-related concepts, even when designers are unfamiliar with the terminology (Lockton et al., 2010). For instance, the 'Design for Wellbeing' card deck (Wellbeing Supportive Design Toolkit, 2023) recommends fostering feelings of competence through techniques like leveling in video games or ensuring good usability. In the card deck, recommendations are provided in written form. While useful, such text-based examples can remain abstract and do not specify how to address particular wellbeing determinants through design. Wellbeing design tools could improve knowledge acquisition by providing examples that (a) include implementation details in the form of screenshots, sketches, and notes, and (b) illustrate the concrete steps involved in the design problem-solving process, demonstrating how distinct interface elements address specific wellbeing determinants.

6.3.2 How to support a "nuanced approach" to design

Digital technologies can impact wellbeing in many different, intended or unintended, and often indirect ways (Fokkinga et al., 2020; Pohlmeyer, 2012; Wiese et al., 2020). Theoretical frameworks (Fokkinga et al., 2020; Peters et al., 2018) and previous empirical work (Wiese et al., 2019) specify nuanced levels of technology impact. Therefore, design tools should foster a "nuanced approach" to design, guiding designers to systematically consider the various ways through which digital technologies can affect people's wellbeing. For example, the 'Design for Wellbeing' cards (Wellbeing Supportive Design Toolkit, 2023) encourage designers to reflect on six spheres of technology experience: adoption, interface, tasks, behaviour, life, and society. Wiese et al. (2019) empirically investigated the complex relationships through which physical and digital products can impact wellbeing, visualizing them as a pathway diagram. The diagram maps (direct and indirect) pathways from concrete product properties to wellbeing determinants (esp. positive activities) and (short- and long-term) wellbeing outcomes and spans across multiple levels of technological impact (see Figure 6.1). A case study with interaction designers (Wiese et al., 2024a) found that designing for positive activities mediated by consumer technology benefits from focusing the design process on (a) the impact of the design on user behavior, and (b) the quality of the user interaction.

Design direction 3: Scaffolding and visualization (D3): Wellbeing design tools could facilitate "nuanced" reflection by: (a) providing scaffolds, such as canvases and templates, that reflect higher levels of granularity, including their technological and psychological impact, and (b) assisting designers in visually expressing complex relationships, such as mapping direct and indirect pathways from interface elements to wellbeing determinants through diagrams or graphs. Digital design tools could aim to provide a user experience similar to that of wireframing, flowcharting, or mind mapping tools, which designers are already familiar with.

6.3.3 How to make knowledge actionable

Technology designers need to further translate the acquired theoretical knowledge on wellbeing (design) into their daily design practice. To do so, this knowledge needs to be made "actionable", meaning it should be connected to "concrete opportunities" for design and evaluation (Klapperich et al., 2018; Peters, Ahmadpour, et al., 2020; Peters & Ahmadpour, 2021). This involves: (a) identifying which wellbeing determinants to prioritize or evaluate within a specific technology context, and (b) determining how to effectively address this determinant through design. Wellbeing design tools can support this process by (a) helping designers map wellbeing determinants to relevant technology contexts,

(b) proposing design strategies targeted at specific wellbeing determinants (Peters, 2022), (c) offering heuristics (Peters, 2022), and (d) linking abstract design recommendations to concrete interaction patterns (Lockton et al., 2009). A previous empirical study (Wiese et al., 2019) highlighted distinct ways to shape specific positive activities through design. For instance, fostering coping strategies requires individuals to develop the appropriate skills (i.e., capability), while activities aimed at contributing to the greater good can be encouraged by appealing to an individual's personal values (i.e., motivation). Peters (2022) presents a set of heuristics and associated design strategies available as a card set, checklist, or cheat sheet, targeting three wellbeing-promoting psychological needs for autonomy, competence, and relatedness in technology design. A case study involving interaction design students (Wiese et al., 2024a) found that one key challenge in the design process was identifying suitable technology contexts to support specific determinants of wellbeing.

Design direction 4: Contextualize wellbeing (D4): Wellbeing design tools can inspire and guide designers in understanding which aspects of wellbeing are relevant to their specific design context and demonstrate how wellbeing can manifest across various applications and technology categories (van der Maden, 2024). Building on D2, this can, for example, be accomplished by showcasing concrete examples of how similar technologies (e.g., other social networking platforms) or those supporting similar user behaviors (e.g., commenting, direct messaging) have integrated wellbeing principles.

Design direction 5: Embedded design strategies and interaction patterns (D5): Digital wellbeing design tools can guide the design process by (a) embedding context-sensitive suggestions for promising design solutions (i.e., design strategies, interaction patterns) or suitable evaluation methods (i.e., heuristics) within design activities, and (b) leveraging digital interfaces to visualize and highlight these suggestions through dynamic or graphical elements. Additionally, rather than describing interaction patterns verbally, digital tools can represent them visually and offer diverse examples in an interaction pattern library.

6.3.4 How to foster "client-buy-in"

Designers report struggling with securing "client buy-in", or persuading decision-makers that investing time and resources in wellbeing design is valuable (Peters, Ahmadpour, et al., 2020). Wellbeing design tools can (a) sensitize decision-makers to the potential risks and benefits of (not) integrating wellbeing design principles into their technologies, and (b) demonstrate the relevance of wellbeing design across a wide range of digital technologies. To address this challenge, Peters, Ahmadpour, et al. (2020) propose a concept for a 'Client Buy-In Toolkit', which is a customizable presentation template that includes case studies and

examples showing both the potential risks (e.g., negative publicity) and positive outcomes (e.g., increased user engagement) of wellbeing design for tech companies. Another strategy is to showcase how other tech companies and competitors integrate wellbeing features into their products. An expert analysis of six popular social networks and streaming platforms (Wiese et al., 2024c) revealed a diverse range of features designed to foster positive activities. Additionally, promoting wellbeing (determinants) through everyday technology may be more feasible than stakeholders assume. Empirical research shows that people naturally incorporate various physical (e.g., household items) and digital products (e.g., social networks, messaging services) into positive activities similar to those described in Figure 6.1 (Wiese et al., 2019; Wiese et al., 2024c), even when these products were not originally designed with wellbeing in mind (see also Klapperich et al., 2018). Related to D4, deconstructing wellbeing into concrete facets and aligning them with relevant technology contexts can make it a more tangible and achievable design goal in the tech industry.

Design direction 6: Library of real-world examples (D6): Designers often learn from peers and competitors, often through UI pattern libraries (e.g., www.ui-patterns.com) and creative networks (e.g., www.behance.net) where designers showcase examples of their work. A digital library of real-world wellbeing design examples could highlight design solutions across different technology categories, potentially sparking curiosity and motivation among decision-makers to explore how their technologies could be modified to (also) promote wellbeing. These examples could be enriched with information on potential positive or negative effects, user insights, and relevant business metrics. Unlike physical tools, a digital library could more effectively promote wellbeing design to a broader audience.

6.4 Design tool concept

To demonstrate how the proposed design directions translate into specific tool features, we developed a concept and prototype (see 6.5) for a new digital design tool based on the 'Design for Sustained Wellbeing Through Technology' framework (Wiese et al., 2020). The concept includes three main sections, each described and illustrated through mock-ups below: (1) a '**knowledge dissemination**' section providing information on framework elements across stages 1-3 (see 6.4.1), (2) a '**technology library**' with examples of wellbeing-supportive (features of) consumer technologies (see 6.4.2), and (3) a '**guided mind mapping tool**' (see 6.4.3) for use in (a) design and (b) evaluation.

6.4.1 Knowledge dissemination

The 'knowledge dissemination' section ('Knowledge Base' in Figure 6.3) provides a detailed typology of framework elements within stages 1-3, each accessible via its own tab: (a) 18 mechanisms and ways to implement these mechanisms through specific product properties, or interaction patterns (stage 1), (b) three drivers of behavior (stage 2), and (c) 14 positive activities (stage 3), see Wiese et al. (2020) and Wiese et al. (2024c) for more details. This typology is visualized as a digital card set (see Figure 6.3). To minimize visual clutter, the overview page only includes a title and short definition. The detail page then displays (a) more information on demand, (b) illustrative technology examples with thumbnails showing screenshots or sketches, (c) links to related elements in adjacent framework stages (e.g., promising mechanisms in stage 1 to support an activity in stage 3), and (d) references to related literature (see Figure 6.3, right). The card set can be browsed for knowledge acquisition (D2), inspiration purposes (D6), and contextualizing positive activities (D4) across different technology branches and applications (see also 7.6). The digital format of the tool allows designers to (a) explore connections between examples and related concepts and (b) view detailed implementation examples that illustrate each concept.

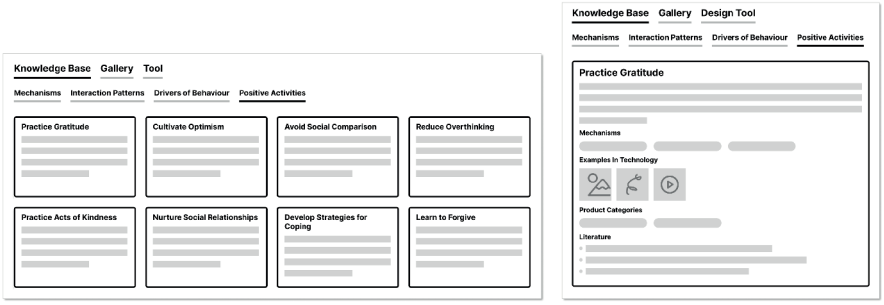


Figure 6.3: Knowledge dissemination section featuring a digital card deck: overview (left), details (right).

6.4.2 Technology library

For inspiration, the design tool prototype includes a 'technology library' ('Gallery' in Figure 6.3) showcasing examples (see Figure 6.4) of how widely used consumer technologies support positive activities (see D6). This library presents examples of (a) existing technologies, shown with a visual record, and (b) novel technology concepts, illustrated with sketches or prototypes. Contributions are expected from a community of academic researchers and practicing designers sharing an interest in wellbeing. The library can be browsed by (a) product category (e.g., Social, Business, News), (b) platform (e.g., Facebook, Spotify), (c) feature type (e.g., Comments, Notifications), (d) positive activity, and (e)

employed mechanism(s). To facilitate knowledge acquisition, each example (a) includes implementation details with text descriptions and visuals (for the product interaction stage), and (b) illustrates design problem-solving steps in the form of a visual graph (see D2). This graph (Figure 6.4) maps pathways across the first three stages of the framework, demonstrating how the specific implementation of a mechanism (*product properties*) (is thought to) influence(s) a person's thoughts, feelings, or behavior (*drivers of behavior*) toward a specific *positive activity*. Designers can annotate each pathway 'node' (i.e., rectangular box), with notes about the intended or observed psychological effects on users at that step (see D3). To reinforce the mental representation of the framework and its elements, a template reflecting its stages serves as a background (see also Figure 6.6). Community members can comment on, share, like, and save technology examples.

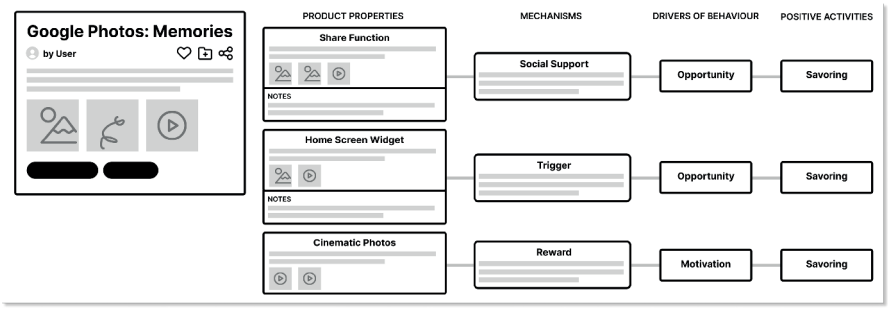


Figure 6.4: The technology library showcasing elaborated, real-world wellbeing design examples.

6.4.3 Guided mind-mapping

The design tool prototype features a 'guided mind mapping tool' ('Tool' in Figure 6.3) that can be used for (a) feature planning and (b) heuristic evaluation. In both use cases, designers can explore (a) the mechanisms (stage 1) the technology applies or could apply to influence user behavior (stage 2), (b) the experiences or interaction qualities that a specific implementation of the chosen mechanism (aims to) evoke(s), (c) how (effectively) these specific implementations are likely to shape drivers of behavior (stage 2), and (d) which additional mechanisms (stage 1) may be promising to apply. The interface and functionality of the tool are designed to foster nuanced reflection (D3). The starting point is a structured template that represents stages 1-3 of the framework and contains short definitions for each stage (see Figure 6.5). Designers can first specify technology details in the 'Technology' column on the left. Feature evaluation and planning are conducted by creating pathways across the first three stages of the framework: (a) product interaction, (b) drivers of behavior, and (c) positive activities. Similar to mind maps, a pathway consists of (a) items (i.e., 'nodes')

that define content elements within each stage, including specific product properties, mechanisms, drivers of behavior, and positive activities (as defined in the knowledge dissemination section, see 6.4.1) and (b) connectors that specify relationships between these items.

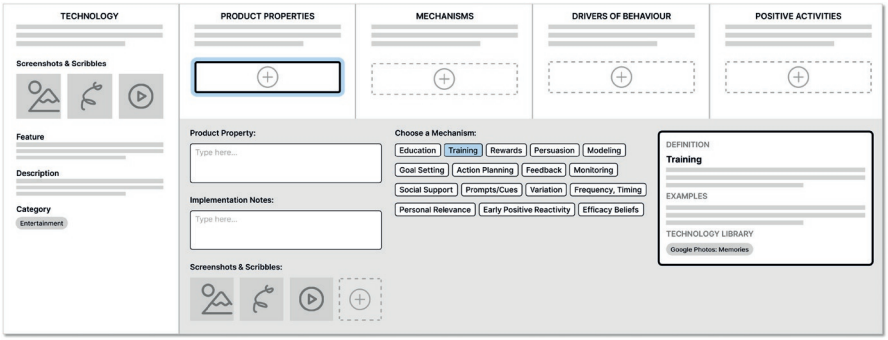


Figure 6.5: Template and display of contextual information in the 'guided mind mapping' tool.

Pathways can be created in two ways: (a) by first specifying content elements (e.g., all mechanisms currently employed by a technology) and subsequently organizing them into pathways, illustrating how these mechanisms influence user behaviour (stage 2) to foster positive activities (stage 3)) or (b) by creating individual pathways sequentially across all three stages. Pathway creation can either be started from the 'product interaction' level (stage 1) or the 'positive activities' level (stage 3), depending on the designer's specific approach or questions in mind. In addition, designers can add specific implementation details for a mechanism (stage 1) through screenshots, sketches, or images. Lastly, designers are prompted to reflect on and document details, such as insights from user research, regarding the intended or observed psychological impact of specific design decisions, particularly how product properties affect each step of the pathway, which includes the 'product interaction', 'drivers of behavior' and 'positive activities' levels.

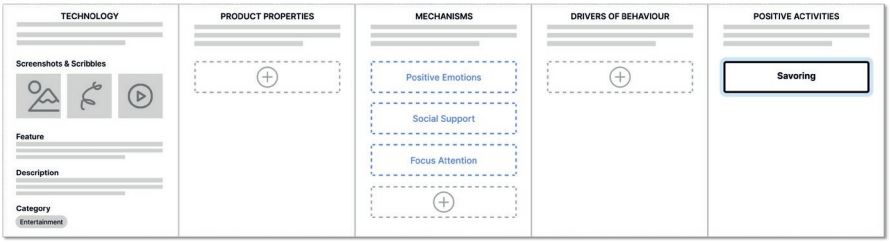


Figure 6.6: Suggestions for promising pathway connections in the 'guided mind mapping' tool.

The designer is guided through the pathway creation process step-by-step by: (a) providing contextual information (D1) and (b) suggesting promising pathway

connections (D5). For each step, contextual information is provided. When a designer selects an 'empty' item ('node') within a specific stage (e.g., positive activities, stage 3), a bottom drawer opens, allowing them to specify the item while displaying relevant background knowledge for that stage, such as a list of mechanisms with definitions and examples (see Figure 6.5). This method embeds background information within the design activity itself, offering it gradually and contextually (D1), relevant only to the current planning or analysis step. Additional layers of detail can be accessed on demand (D1), such as how a specific positive activity or mechanism has been supported by similar technologies (implemented as linked labels; see Figure 6.5). Pathway generation is further guided by illustrating research-based, promising connections to adjacent stages, such as links between mechanisms (stage 1) and drivers of behavior (stage 2), as well as between mechanisms (stage 1) and positive activities (stage 3). This is realized by displaying pre-filled pathway nodes that designers can select (see Figure 6.6). Final analyses can be saved and uploaded to the 'technology library' for sharing with the community.

6.5 Design tool prototype

The first iteration of the concept outlined in Section 6.4 was implemented as a digital design tool available on the website design-swell.com. The prototype was developed by the first author in collaboration with an independent software developer and an interaction designer, both familiar with the work. Currently, the prototype is under development and focuses on a subset of positive activities that have been shown to be relevant to and are supported by existing consumer technology (Wiese et al., 2024c). The main features of the prototype were implemented as described in Section 6.4. The prototype further includes the final taxonomy of 18 design mechanisms specified by Wiese et al. (2024c). In addition, the prototype features concrete technology examples, most of which were derived through an expert analysis of six widely used social networks and video streaming platforms (Wiese et al., 2024c).

6.6 Application in design practice

The primary goal of the tool is to bring theoretical knowledge into design practice, promoting a more widespread consideration of user wellbeing in the design of everyday technology. Specifically, the tool aims at helping designers (a) set clearer design goals for which positive activities to focus on and how to design for them, and (b) make more informed predictions about the (long-term) impact of their designs on user wellbeing.

As a 'navigation tool', the tool is intended to help designers explore the stages

and pathway connections outlined in the Design for Sustained Wellbeing framework (Figure 6.1) through its three main entry points: (a) 'knowledge base', including subcategories, (b) 'technology library', and (c) 'guided mind mapping' tool. Each stage is represented by a separate tab in the 'knowledge base,' corresponding filters in the 'technology library,' and a structured template in the 'guided mind mapping' tool. Pathway connections can be explored either (a) through interactive links within the 'knowledge base' and 'technology library' or (b) mapping pathways directly in the 'guided mind mapping' tool. While the framework and its pathways can be explored from any stage, we would like to highlight two important starting points that align with different design scenarios in industry settings.

The first approach begins from specifying the intended impact, focusing on the positive activity the design aims to promote. Designers can navigate to the 'positive activities' tab in the 'knowledge base' to explore (a) activity details, (b) strategies for optimal practice, and (c) related digital activities, (e.g., LinkedIn 'endorsements' as an example for 'practicing gratitude'). These modules on the 'activity detail page' can inspire concrete design solutions. To refine their ideas further, designers can work backward through the framework, from the activity (stage 3) to the product interaction (stage 1), by exploring (a) promising mechanisms suggested on the 'activity detail page' and (b) related feature examples in the 'technology library'. This approach is well-suited for strategic designers who can develop new technologies and/or have the flexibility to select the technology that best supports the intended activity.

The second approach begins from the technology itself, identifying design opportunities that align with existing services or platforms. Designers can filter the 'technology library' for feature examples within the same product category (e.g., social networks), similar platforms (e.g., Facebook, Instagram, Pinterest), or feature types (e.g., commenting function). Exploring these examples helps pinpoint which activities could be relevant for their design context. Designers thus move from the product interaction (stage 1) to positive activities (stage 3). This approach is particularly relevant for corporate UX designers focused on a specific platform (e.g., an online shop) or a particular user flow within that platform (e.g., the online checkout process). In such cases, designers often work within the constraints of product roadmaps, business goals, and stakeholder expectations.

Entry points may also differ based on (a) design tasks, (b) levels of expertise in wellbeing design, (c) learning preferences, and (d) available time. For instance, novices may start with the 'knowledge base', while experienced designers, familiar with positive activities and behavior change techniques, might prefer exploring 'technology examples' or using the 'guided mind mapping tool' to

develop their own solutions. To accommodate both groups, the tool presents high-level information by default (e.g., brief activity definitions), with additional details accessible on demand (e.g. through expandable modules) for deeper exploration of activities, mechanisms, or pathway connections. Additionally, some designers, whether due to personal preference or time constraints, may choose to study theoretical knowledge in the 'knowledge base,' while others may prefer a hands-on approach, using the 'mind mapping tool' to acquire knowledge while creating concrete designs.

6.7 Discussion

This work discussed various challenges related to practice needs for wellbeing-supportive design tools and proposed six design directions ('How-To's') to address these challenges. It is important to note that additional challenges and valuable features of practical wellbeing design tools, such as affordability and flexibility, have been identified in the literature (e.g., Peters, Ahmadpour, et al., 2020). The challenges and associated design directions presented here are therefore not exhaustive. Instead, they address a selection of commonly reported aspects that are crucial for any design tool aimed at promoting wellbeing, specifically reflecting our own approach to developing practical design tools. Ultimately, the proposed design directions and concepts demonstrate that it is possible to address the outlined (and potentially other) challenges of wellbeing-supportive design tools by exploring new tool formats and concepts.

Another point worth discussing is the value of physical and digital design tools in wellbeing design. Peters, Ahmadpour, et al. (2020) found that the 15 interviewed design practitioners preferred physical tools, likely due to greater familiarity and prior exposure, particularly in the early design stages. Yet, the widespread adoption of digital tools during the COVID-19 pandemic highlighted the appeal and utility of digital alternatives, with traditional physical brainstorming tools like whiteboards and post-it notes now complemented by attractive digital counterparts, such as the online whiteboard tool Miro (miro.com). Our work demonstrated that digital tools offer the unique potential to adequately manage the complexity of wellbeing theory and frameworks. They can present relevant background gradually and in-context, offer intuitive navigational structures (e.g., menus, filters, tags) that allow efficient browsing of digital card sets, and feature more detailed implementation examples (e.g., visualizations, screenshots, sketches) to inspire design solutions at an interface level. This makes digital tools particularly well-suited for tackling design challenges that arise in later design stages, while also offering advantages in reach, accessibility, and asynchronous collaboration. They may thus serve as a valuable means to

integrate wellbeing design into globally distributed, remote design teams and promote wellbeing design principles to a wider audience.

Regarding the format and content of practical wellbeing design tools, it is important to acknowledge that there is no 'one-fits-all' approach. Tools must be tailored to the specific design context, target audience, and design goal. For instance, some fairly reductionist but immediately graspable design tools, such as a one-page business canvas, may be necessary to initially persuade stakeholders. In contrast, more elaborate tools will be valuable for designers during feature implementation, and again others will be suitable to gather user feedback.

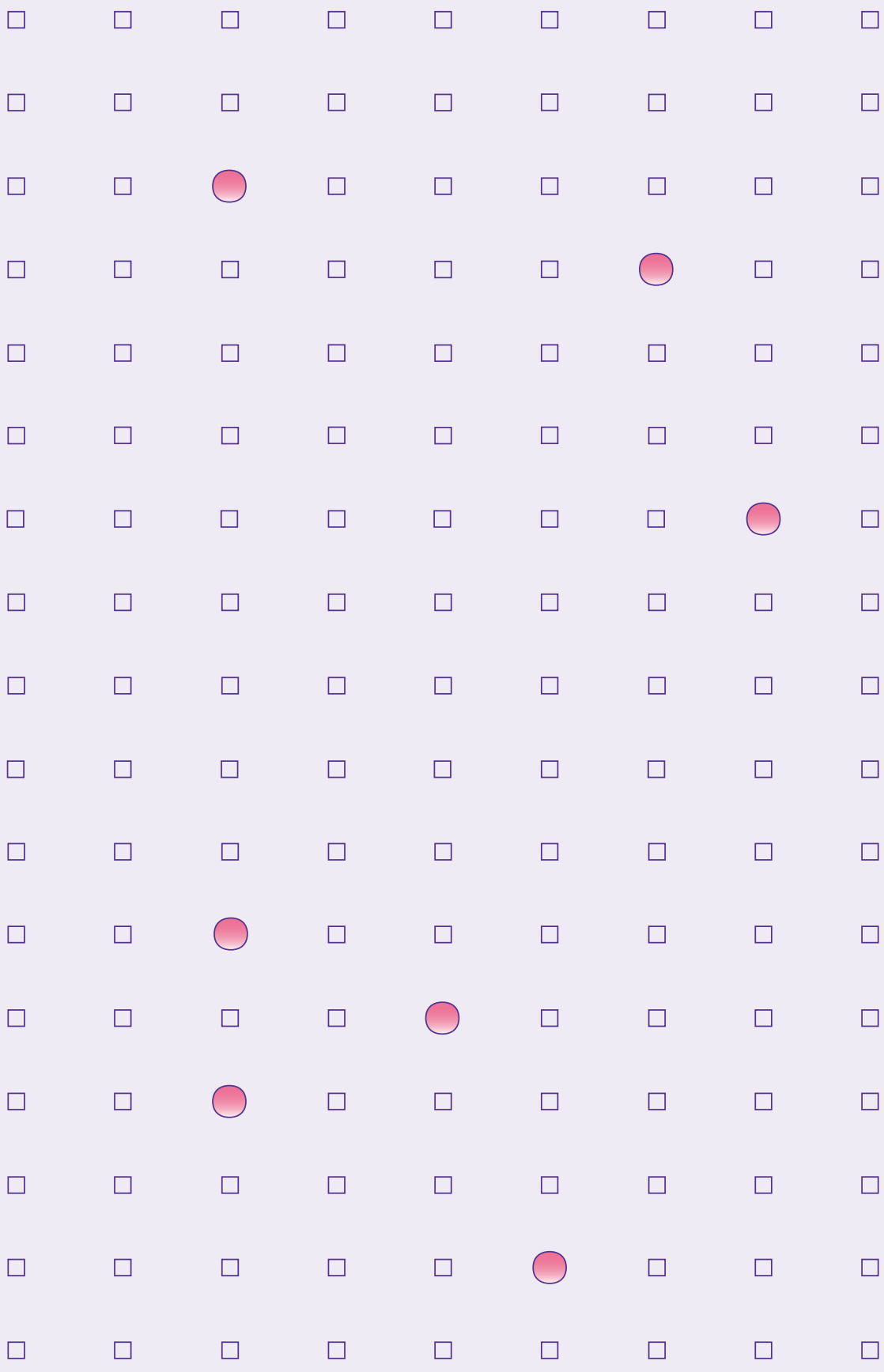
A notable limitation of our current work is that the presented prototype has not yet been evaluated by practicing designers. Within the scope of this paper, the prototype primarily serves to further illustrate the proposed design directions. Future work will concentrate on testing and refining the prototype in collaboration with design practitioners. Ultimately, like the design of any user-facing service or technology, the design of design tools should adopt a user-centered approach, requiring a deeper understanding of the specific context of use, domain and target user needs.

To promote wellbeing design in practice, we plan to release the final tool as open source and invite the HCI community to utilize it in their design projects. We hope the community contribute to its improvement by (a) adding to the tool's integrated 'technology library' and (b) providing feedback on its content and functionality to enhance its validity and practical applicability. Additionally, we aim to explore the integration of AI-assisted technology to support some of the proposed tool features, such as suggesting promising pathway connections during the 'guided mind mapping' process (see Figure 6.6).

6.8 Conclusion

Design tools can help integrate wellbeing theory into the design of everyday technology, thereby creating a meaningful impact on people's lives. In this paper, we have (a) compiled a list of common challenges related to the needs of technology designers for practical wellbeing design tools, (b) proposed five design directions to address these challenges, and (c) presented a design concept and prototype for a digital tool that serves as a practical reference for implementing the outlined design directions. We hope that the insights and tool features presented here can inform and inspire the future development of (digital) design tools that support wellbeing, ultimately helping to shift users' wellbeing into the focus of technology design. Although our current work focuses on wellbeing, we believe that the insights and implications of this paper

can be beneficial to any design discipline that deals with high levels of complexity and indirect design impact, such as Design for Behavior Change or Sustainability Design.



7

General discussion

The goal of this dissertation was to equip technology designers with both theoretical knowledge and practical guidance for developing consumer technology that creates a lasting positive impact on people's wellbeing. To achieve this, the research combined theoretical and empirical studies, progressing from exploratory to confirmatory and applied approaches. This final chapter briefly summarizes the key insights from this dissertation and examines their broader implications, extending beyond the individual discussion sections of previous chapters. It then provides eight recommendations for designers aiming to develop wellbeing-supportive features in consumer technology, fostering the right mindset and preventing misuse. Next, the chapter highlights future research opportunities by illustrating how research-based principles for optimally practicing positive activities can inform targeted design strategies. The final sections address the limitations of the work and conclude with overarching reflections.

7.1 Discussion of research questions

The following sections offer a general discussion of the key insights from this thesis, organized around the three main research questions introduced in Chapter 1, which align with the three phases of the PhD project: (a) exploration (R1), (b) confirmation (R2), and (c) application (R3). Each section highlights the main findings for its respective research question, links them to insights from other research stages, and discusses broader implications for the wellbeing design research community and industry design practice.

R1: HOW CAN INTERACTIVE TECHNOLOGY FOSTER SUSTAINED WELLBEING?

The first research phase, represented by Chapters 2 and 3, aimed to generally explore how lasting wellbeing can be fostered through human-product relationships, empirically refining the broader goals of Positive Design (Desmet & Pohlmeyer, 2013). Two sub-questions of R1 guided this research stage:

- **R1a:** What are the determinants of sustained wellbeing in human-technology interactions?
- **R1b:** How can these determinants be shaped through specific product interactions?

POSITIVE ACTIVITIES AS A KEY DETERMINANT OF TECHNOLOGY-MEDIATED SUSTAINED WELLBEING

The introduction chapter highlighted that wellbeing can be deliberately enhanced and sustained through engagement in specific positive activities which can help counteract hedonic adaptation. The laddering study in Chapter 2 empirically demonstrated that both physical and digital products can boost wellbeing

over time by promoting (repeated) engagement in such positive activities. In the study, 83% of product experiences were linked to long-term increases in hedonic and eudaimonic wellbeing, with 95% of these effects mediated by activities that closely aligned with established taxonomies of positive activities.

Building on these theoretical and empirical insights, positive activities were identified as a key factor in designing technology for sustained wellbeing and positioned at the core of the theoretical framework in Chapter 3. The framework and its components are thus grounded in theory and validated through empirical data. The laddering study in Chapter 2 further demonstrated that positive activities can be supported through design across a wide range of everyday products and technologies, extending beyond dedicated interventions like those implemented in Behavioral Intervention Technologies. This highlights the potential to embed positive activities as Active Design solutions to promote wellbeing, even in technologies not originally designed for this purpose.

Chapter 1 introduced a comprehensive taxonomy of twelve positive activities, recognized in the literature for their strong association with sustained wellbeing (Bolier et al., 2013; Lyubomirsky, 2007; Sin & Lyubomirsky, 2009). Of the seven product-mediated activities identified in the laddering study in Chapter 2, five aligned with this classification. Following further analysis, fourteen evidence-based positive activities were considered promising for fostering long-term wellbeing through human-product-relationships. An informal exploratory study with 54 participants confirmed that all fourteen activities could be supported by design in some form, leading to their integration into the framework.

While not exhaustive, this taxonomy of positive activities spans diverse life domains, indicating its broad applicability in product design. However, it primarily reflects the classification proposed by Lyubomirsky (2007). The taxonomy could be expanded in the future, for example by strength-based interventions (Proyer et al., 2015) or interventions tailored to specific user groups, such as children or older adults. As discussed in the introduction, positive activities are promising design targets because they are (a) tangible, (b) short-term predictors of long-term wellbeing, and (c) accompanied by clear guidelines for optimal practice to maximize wellbeing benefits.

TECHNOLOGY AS A MEDIATOR

Theoretical wellbeing design frameworks discussed in Chapter 1 suggest that product interactions can promote wellbeing through both direct and indirect pathways, particularly emphasizing the importance of product-mediated activities and experiences. The laddering study in Chapter 2 showed empirically that 79% of long-term wellbeing outcomes supported by products were indirectly mediated by activities, indicating that most of these effects extend beyond the

direct interaction with the product. This suggests that the product interaction serves as a 'means to an end', fostering engagement in positive activities rather than being a 'direct source' of lasting wellbeing (Pohlmeyer, 2012). In other words, technology may primarily act as a mediator, helping to initiate, motivate, or facilitate enjoyable and meaningful activities.

Accordingly, the framework for Design for Sustained Wellbeing Through Technology (Figure 3.1, page 55) outlines five stages through which technology can foster long-term wellbeing, with positive activities at its center, mediating the impact of product interactions on sustained wellbeing. The framework integrates knowledge from (a) HCI/Design, (b) Positive Psychology, and (c) Behavioral Science into a cohesive model, fostering mutual understanding and interdisciplinary collaboration. One key idea put forward in Chapter 3 is to focus the design process on the first three stages, assuming that once a user engages in positive activities (regularly), this will lead to long-term wellbeing. Advantages of this approach for design and research are discussed in Chapter 2.

NUANCED TAXONOMIES FOR FRAMEWORK STAGES

To offer designers clearer guidance in shaping positive activities through product interactions, the framework provided detailed taxonomies for the initial three stages: (a) activities that are proven to enhance wellbeing (stage 3), (b) key drivers of human behavior (stage 2), and (c) specific mechanisms to shape behavior (stage 1). Throughout the PhD project, these taxonomies were validated and applied within the context of consumer technology (Chapters 4 and 5). They were further enriched with real-world examples, strengthening their practical applicability and relevance. The final taxonomies for positive activities, drivers of behavior, and mechanisms are available in various formats, such as tables, codebooks, and digital card sets, to accommodate designers' personal preferences and project needs. The taxonomy of positive activities refines the general recommendation of theoretical wellbeing design frameworks to leverage technology for engaging users in positive and meaningful activities. It makes this abstract recommendation more concrete by identifying the 'right' activities – those most strongly associated with lasting wellbeing improvements – to target in product design.

The three drivers of behavior align with the antecedents of behavior (change) outlined in models like the COM-B model (Michie et al., 2011, 2013) and Fogg's (2009) Behavior Change Model, as designing for positive activities by means of Active Design, as proposed in this thesis, inherently involves behavior change. However, this approach differs from traditional behavior change design in two key ways: (1) everyday products act as the 'vehicle' for change, rather than dedicated Behavioral Intervention Technologies, and (2) the focus expands

beyond typical behavioral science domains, such as physical and mental health, to include a broader range of wellbeing-enhancing behaviors.

The taxonomy of mechanisms builds on existing taxonomies of widely used behavior change techniques, such as feedback, goal setting and action planning, by integrating specific factors that boost the effectiveness of positive activities, including a good person-activity fit and varied practice. It also deepens interdisciplinary understanding by providing concrete examples of how these well-known behavior change techniques are implemented in consumer technology.

PATHWAYS TO SHAPE POSITIVE ACTIVITIES THROUGH DESIGN

The framework describes a high-level process linking product interactions to sustained wellbeing through positive activities. Subsequent research stages established more concrete connections between the framework elements across different stages. Chapter 4 maps out some of these connections from (a) specific interaction patterns to mechanisms, (b) mechanisms to drivers of behavior, and (c) mechanisms to positive activities within existing consumer technology. Chapter 5 explores future opportunities, examining practical ways to shape these connections using science-based knowledge on positive activities by analyzing fourteen design cases. Section 7.3 further develops this approach by presenting a strategy for linking framework elements based on scientific principles for optimally practicing positive activities.

R2: HOW CAN CONSUMER TECHNOLOGY SUPPORT POSITIVE ACTIVITIES?

Given the unique advantages of consumer technology in delivering wellbeing interventions as discussed in Chapter 1 - including its wide reach among the public, strong user engagement, and seamless integration into daily life - this PhD project shifted to promoting positive activities in this specific subset of interactive technology. As a result, R1 evolved into R2. While R1 aligns with the broader mission of Positive Design and explores some of its objectives empirically, R2 narrows the focus to positive activities as a key determinant of long-term wellbeing, consumer technology as the medium for supporting these activities, and Active Design as a suitable integration strategy. The second research phase, comprising two empirical studies outlined in Chapter 4, aimed to confirm the framework's relevance to consumer technology and validate positive activities as a meaningful design target for the tech industry. To address R2, the second research phase, comprising two empirical studies outlined in Chapter 4, turned to analyzing the current support of positive activities in existing consumer technology. Another goal was to refine the taxonomies for (a) positive activities and (b) design mechanisms to fit this context and gather examples from existing

consumer technology that illustrate them. This confirmatory research phase addressed the following sub-questions of R2:

- **R2a:** How are positive activities integrated into consumer technology?
- **R2b:** Which positive activities does existing consumer technology support?
- **R2c:** Which design mechanisms are employed?

INTEGRATION OF POSITIVE ACTIVITIES

Number, type and diversity of features. The two empirical studies in Chapter 4 revealed that contemporary consumer technologies already incorporate many features that support a wide range of positive activities. Specifically, the expert analysis in Section 4.4 identified 165 features across six social networking and streaming platforms that support nine positive activities: five of these activities were promoted proactively (i.e., practicing gratitude, cultivating optimism, nurturing social relationships, savoring, committing to goals), three (primarily) in a protective way (i.e., avoiding overthinking, avoiding social comparison, taking care of one's mind), and one was supported both proactively and protectively (i.e., practicing acts of kindness). This showed that designers can, and already do, provide support for positive activities within consumer technologies. In the online survey (Section 4.5), Instagram users reported to actively engage in all seven selected positive activities on the platform, utilizing both generic features, such as social sharing, which have diverse applications, and purpose-built features, like those identified in Section 4.4, specifically designed to support positive activities. This suggests that people might find different ways to practice positive activities beyond the intended features. Taken together, the findings from both studies indicate that existing consumer technology presents numerous opportunities to promote positive activities through small, platform-internal features, whether or not they were originally designed with that intent.

Proactive and protective features. Existing features actively support positive activities both proactively (59%) and protectively (42%), emphasizing the importance of combining these two approaches to promote user wellbeing within the attention economy. Protective features help create a supportive environment for positive activities but may not improve wellbeing as much as proactive features. However, without protective features, proactive features risk being overshadowed by the negativity prevalent in today's digital environments. The analysis of protective features can also be informative for digital wellbeing researchers, as they reflect efforts to reduce technology-related harm through internal mechanisms (Lukoff et al., 2021), complementing existing research on external screen time tools.

Short- versus long-term engagement. Section 4.4 found that purpose-built

features supporting positive activities are often designed for short-term engagement but lack mechanisms to ensure these activities are practiced effectively and sustained over time. Section 4.5 revealed that seemingly "passive" longer-lasting behaviors, such as browsing social media content, can – under certain conditions – deliver meaningful wellbeing benefits when they "actively" engage users on a cognitive or emotional level.

TYPE OF POSITIVE ACTIVITIES

Number, type and range of activities. As noted earlier, feature-rich platforms like social networking sites and streaming services were found to support a wide range of positive activities, showcasing that diverse activities can be promoted within a single technological context. The positive activities most commonly supported on these platforms aligned with their stated 'wellbeing' objectives, as outlined in their mission statements. Each platform also supported multiple positive activities simultaneously through individual features. This underscores the potential to enhance user wellbeing through multiple, small interventions within one platform. As both studies focused exclusively on social networks and streaming platforms, the identified seven or nine activities may not capture the full spectrum of positive activities supported by existing consumer technology. For instance, other technologies, such as productivity or team collaboration tools, may include features that aim at fostering flow experiences. Future applications could also introduce new digital experiences that enable additional positive activities, reinforcing the need to retain all fourteen activities in the framework. However, certain activities, such as learning to forgive, may be inherently more challenging to design for, as they require more complex interventions that may be difficult to integrate into consumer technology.

Associated user behaviors. The app analysis identified specific user behaviors enabled by consumer technology that were linked to positive activities, showcasing distinct ways these activities manifest in the studied contexts. For example, avoiding overthinking might involve limiting doom-scrolling, while acts of kindness could include prosocial spending, providing emotional support, or encouraging respectful online conversations. Connecting positive activities to user behaviors makes the taxonomy more concrete and situates the activities within relevant technological contexts.

USE OF MECHANISMS

Type and range of mechanisms. The expert analysis demonstrated that consumer technology can promote positive activities through a diverse array of mechanisms that can be built into the platforms. The study refined a previous taxonomy of mechanisms (Chapter 5) by incorporating specific interaction patterns observed in the analyzed technologies, offering more concrete guidance

for implementing each mechanism (Table A.2). These mechanisms and their associated interaction patterns were compiled into an accessible codebook, providing designers with a practical reference tool. Similar to the taxonomy of positive activities, this list of mechanisms is not exhaustive. Behavioral science studies many additional mechanisms (e.g., Michie et al., 2013) that could be leveraged, and designers could develop further design interventions tailored to digital interfaces.

Activity-specific pathways. The study also identified mechanisms currently used to promote specific positive activities, mapping distinct pathways from product interactions to these activities. These pathways were documented for each feature in the database and visualized as graphs in the design tool's 'technology library' (see Figure 6.4, page 153). This analysis offers designers valuable insights into how specific positive activities (e.g., practicing acts of kindness) can be shaped by drivers of behaviors, mechanisms, and product properties within a given context (e.g., social networks) and through particular features (e.g., Comment Warnings). However, it is important to note that existing features and associated pathways may not necessarily represent 'optimal support' for a positive activity, as their effectiveness in promoting that activity was not empirically tested in the study. Despite this limitation, the feature examples can still serve as valuable prompts for designers to reflect and learn.

Links to drivers of behavior. Drawing on the COM-B model of behavior change, the study also mapped mechanisms (and related interaction patterns) to three drivers of behavior, highlighting targeted strategies for addressing each driver through specific mechanisms. Grouping mechanisms by their primary driver of behavior revealed that existing features emphasize motivating and prompting positive activities but offer less support for the educational aspects of behavior change, particularly in providing explicit instructions on how to perform the activity. In contrast, these educational aspects are often strongly pronounced in Behavioral Intervention Technologies (Conroy et al., 2014; Diefenbach, 2018; Yang et al., 2015). This difference may stem from delivering positive interventions in non-therapeutic or non-dedicated contexts, where the primary focus remains on the core user behavior supported by the consumer technology.

APPLICATION OF THE FRAMEWORK

Results from both studies empirically confirm positive activities as valid design target for wellbeing interventions in consumer technology and offers the framework as a 'navigation aid' to help designers determine how to approach design for positive activities.

R3: HOW CAN WE DESIGN FOR POSITIVE ACTIVITIES?

The third research phase, covered in Chapters 5 and 6, applied theoretical insights from earlier phases to design practice. While the second phase, summarized in Chapter 4, assessed how existing consumer technologies support positive activities, the third phase concentrated on (a) identifying opportunities and (b) determining approaches to optimally support the design for positive activities. This phase was guided by the following questions:

- **R3a:** How can positive activities be integrated into consumer technology?
- **R3b:** What are the challenges and opportunities of this approach?
- **R3c:** How can the design process be 'optimally' supported?

APPLICABLE TO A BROADER RANGE OF TECHNOLOGIES

The case study in Chapter 5 demonstrated that, with appropriate guidance, designers can successfully incorporate positive activities into a wider range of consumer technologies, extending beyond the social networking sites and streaming platforms analyzed in Chapter 4. The fourteen design concepts integrated seven positive activities into consumer technologies across eight product categories, including business, news and productivity applications, further emphasizing the broad applicability of this approach.

THREE INTEGRATION STRATEGIES

The case study also identified three integration strategies, ranging from 'small tweaks' to more significant changes in core functionality and user flows, which can be adapted to design projects of varying scopes and complexity. Section 5.5.1 (page 132) offers practical recommendations for applying each strategy, highlighting their distinct benefits and challenges. The three integration strategies can inform the design of both protective and proactive features like those identified in Chapter 4.

OPPORTUNITIES OF THE APPROACH

In the case study (Chapter 5), Interaction Design students found positive activities to be an inspiring focus for their design projects. Each of the seven predefined activities was adapted to different technology contexts, resulting in diverse design goals and integration strategies, underscoring the richness and broad applicability of the approach. Similar to existing features discussed in Chapter 4, the design concepts employed a wide range of mechanisms, further reinforcing that consumer technology can (effectively) promote positive activities in many ways and across various contexts. In summary, Chapters 4 and 5 highlighted ample opportunities for integrating positive activities into

consumer technology, with Chapter 5 showing that designers can apply different strategies to intentionally create such positive experiences using scientific principles.

CHALLENGES OF THE APPROACH

The main challenge for students in the case study (Chapter 5) was identifying a suitable technology context for integrating their chosen positive activity. Chapter 6 expanded on this by highlighting additional challenges encountered during this PhD project and connecting them to four broader challenges when designing for wellbeing reported in the literature. To address these challenges, the chapter proposed six design directions for practical design tools and translated them into concrete tool features, presented as mock-ups and integrated into an initial prototype, which will be tested with designers in future iterations.

SUPPORT OF THE DESIGN PROCESS

While the 'optimal' set-up of a design process that focuses on integrating positive activities into consumer technology was primarily in the focus of the third research phase (related to R3), other parts of this PhD project have also contributed valuable insights and recommendations on this topic, which will be consolidated below for a comprehensive overview.

Short-term predictors. Chapter 3 advocated concentrating the design process on the first three stages of the framework, based on the premise that continuous engagement in these activities, mediated by technology, naturally leads to lasting improvements in wellbeing, as supported by the literature (Bolier et al., 2013; Sin & Lyubomirsky, 2009). Rather than directly targeting abstract, long-term wellbeing outcomes, such as happiness or a sense of purpose, the proposed approach is to focus the design process on positive activities as more immediate and tangible predictors of these long-term outcomes.

Design decision-making. Building on this proposal, Chapter 3 outlines a high-level design strategy for integrating positive activities into consumer technology, focusing on stages 1-3 of the framework. This strategy involves four key decisions: (a) selecting a positive activity to foster, e.g., acts of kindness, (b) identifying drivers of behavior to influence, e.g., motivation, (c) determining a combination of mechanisms to apply, e.g., modelling, and (d) planning how to implement these mechanisms, e.g., pinning positive comments at the top of the commenting section. Insights and concrete deliverables from later stages of this dissertation then offer practical guidance for making informed decisions at each step:

Step 1: Selecting a positive activity: In this initial step, designers must identify positive activities that best align with their specific design project and the

technology context in which it is embedded. Chapter 6 outlines two main starting points for this mapping, tailored to different industry scenarios: (1) starting with the technology (stage 1) to identify entry points at the interface or user experience level, or (2) starting with the activity (stage 3) to explore ways to meaningfully integrate it into a technology. Once the connection between the technology and the positive activity is established, the remaining steps can be addressed in either direction – working from the activity to the interface or vice versa. The mapping can be supported as follows:

- **Starting with the technology (stage 1 → stage 3):** Designers can decide which activity to support by evaluating existing functionality and user experiences. To identify opportunities, they can explore technology examples based on (a) product categories (e.g., social networking sites), (b) specific platforms (e.g., Instagram, Facebook), and (c) feature types (e.g., comments, settings). These examples can be accessed in the database, the 'technology library' of the design tool, or throughout the individual chapters of this thesis. Chapter 4 offers an in-depth analysis of features from two product categories (e.g., social networks, streaming platforms). Chapter 5 expands this scope by presenting inspiring design cases across a broader range of platforms and product categories.
- **Starting with the activity (stage 3 → stage 1):** Designers can select a positive activity to foster and identify suitable technologies or features that can effectively support it. To determine which aspects of the activity can be shaped through design, they can consult the 'knowledge base' of the design tool, which provides information on (a) activity details, (b) strategies for optimal practice, and (c) related digital activities, such as LinkedIn 'endorsements' as a way to practice gratitude. In addition, the taxonomy of fourteen positive activities (Table 3.1, page 67) offers a concise overview for reference.

Step 2: Identifying driver(s) of behavior: When starting from the technology side (stage 1 → stage 2), insights from user research can help designers identify barriers to engagement, such as the need for users to be prompted or motivated to perform the activity. When starting from the activity side (stage 3 → stage 2), drivers of behavior can be determined based on theorical insights. For example, expressing gratitude is a relatively straightforward activity that often only needs a reminder (i.e., opportunity) to be performed. In contrast, developing strategies for coping may require building specific skills (i.e., capability).

Step 3: Choosing mechanism(s) to apply: The selection of mechanisms to support a positive activity within a specific technological environment can be guided by: (a) mechanisms used in similar technologies (e.g., other social networks) or feature types (e.g., commenting functions), accessible via the design tool or database; (b) recommendations for optimal practice (Section 7.3);

(c) the identified driver of behavior; or (d) the chosen integration strategy. For further support, designers can also refer to the taxonomy or the codebook as quick reference tools.

Step 4: Implementing the mechanism(s): For inspiration on how to implement a mechanism, designers can refer to interaction patterns outlined for each mechanism or use the design tool to filter technology examples by the mechanisms they employ.

Taxonomies and real-world examples. For each of the stages 1-3, the framework includes detailed taxonomies and real-world examples to facilitate its practical application. Designers participating in the case study found these resources valuable to support the design process, indicating their utility for industry design practice.

Distinct pathways. Insights from this PhD project revealed distinct pathways composed of specific mechanisms and drivers of behavior that lead to each positive activity. These pathways were empirically examined and mapped through the laddering study (Chapter 2), the expert analysis (Chapter 4), and the case study (Chapter 5). In addition, detailed connections between framework elements were established, including (a) interaction patterns and mechanisms, (b) mechanisms and drivers of behavior, and (c) mechanisms and positive activities (Chapter 4). The tool further recommends promising design mechanisms to support each positive activity, guided by evidence-based strategies for their optimal practice (see also 7.3). Together, these insights can provide inspiration and guidance for designers to build connections between framework elements in their own projects.

Focus on impact. Two key aspects of the Vision in Product Design method (Van Dijk & Hekkert, 2011), which informed the case study in Chapter 5, were found to advance designing for positive activities: (a) focusing on the intended impact of the design and (b) considering how specific interaction qualities can foster engagement in the activity. Ideally, the design decision-making process outlined above would therefore begin with the activity (stage 3) and work backward to inform specific decisions at the interface level. However, designers may not always have this flexibility due to constraints imposed by corporate interests and business goals.

Design tool. These insights were finally translated into a digital design tool intended to help designers navigate the framework stages and pathway connections through various entry points, accommodating their personal preferences, level of expertise, and the specific requirements of their current design project.

7.2 Recommendations

Building on the findings of this dissertation and insights from the broader literature, this section presents a list of recommendations for designing features of consumer technologies that support wellbeing, further advancing the concept of Active Design as defined by Calvo and Peters (2014). These recommendations serve two main purposes: (a) ensure technology designers have the 'right' mindset and objectives, and (b) safeguard against potential pitfalls and misuse of the approach.

7.2.1 Make wellbeing an actionable design goal

The first recommendation is to make the concept of wellbeing more accessible to designers by helping them pinpoint the specific aspect(s) of wellbeing that a technology, feature, or design project could address. As a design goal, wellbeing can feel abstract and intangible, often leading to initial skepticism. Indeed, imagining how a news platform or social networking site might enhance life satisfaction or foster a sense of purpose can seem far-fetched, leaving designers unsure where to start. To address this, wellbeing should be broken down into concrete aspects or determinants, which can be more intuitively linked to specific life domains and technology contexts. For example, social networks can foster meaningful connections, while business platforms can help users achieve personal goals. Clearly defining the targeted aspects of wellbeing at a more granular level provides designers with actionable starting points. Although theoretical wellbeing design frameworks identify specific determinants that can be targeted through design, they often lack practical guidance for translating these determinants into concrete design interventions for consumer technology. Positive activities, as evidence-based interventions for promoting wellbeing, offer a promising starting point. This thesis can further support design efforts by outlining clear pathways that link positive activities to design mechanisms and interaction patterns, offering practical guidance for implementing them at the interface level.

7.2.2 Design for wellbeing at the feature level

A similarly detailed understanding is required to predict and evaluate the varied effects of consumer technology on user wellbeing. Following the principles of Active Design (Calvo & Peters, 2014), the second recommendation is, therefore, to deconstruct consumer technologies into specific components that (may) impact user wellbeing differently and to approach wellbeing design at the level of individual features or user scenarios (see also Calvo & Peters, 2014; Cho et al., 2021). Much like wellbeing itself, consumer technologies are complex systems that serve multiple purposes, incorporate a wide range of features, and support

diverse uses, resulting in nuanced wellbeing effects across different user groups (Cho et al., 2021; Lukoff et al., 2018). Moreover, users interact with these features for diverse motivations, gaining different rewards and gratifications from these interactions (Lee et al., 2015; Lukoff et al., 2018). For example, social networking platforms include features like personalized newsfeeds, which can encourage compulsive or excessive use through various design mechanisms (Cho et al., 2021; Monge Roffarello et al., 2023). At the same time, these networks also offer features that users associate with positive wellbeing outcomes, such as direct messaging or creating posts (Cho et al., 2021). Similarly, on YouTube, features like video autoplay or recommendations have been shown to undermine users' sense of agency, often leading to longer-than-intended usage sessions, while features like specific searches and playlists help users maintain control over their technology use (Lukoff et al., 2021).

To create effective wellbeing interventions within consumer technology, designers must develop a nuanced understanding of which features may harm users, and which may benefit them. This insight is crucial for crafting targeted wellbeing interventions that address harmful behaviors through protective features while promoting positive behaviors through proactive features. Achieving this requires sophisticated methods to analyze individual features and usage patterns within a given technology. This PhD project used expert analysis to examine existing features of consumer technology regarding their intended support of positive activities. Research on digital wellbeing interventions has employed other methods, such as feature logs, event-sampling, and retrospective interviews, to investigate how specific features in social media and video streaming platforms contribute to regretful technology use (Cho et al., 2021) and diminished sense of agency (Lukoff et al., 2021). Product teams focusing on particular aspects of a technology, such as recommendation algorithms, or user flows like the online checkout on a shopping platform, could also benefit from applying more conventional user research methods, including observations and user interviews.

7.2.3 Contextualize wellbeing

Building on the first two recommendations, the third is to clearly determine which specific wellbeing factors are most relevant for the design of individual features or user scenarios. This process of 'contextualizing wellbeing' (van der Maden & Hekkert, 2023) involves establishing clear connections between distinct user interface elements and wellbeing components. As discussed above, this mapping is a critical first step in a series of design decisions required to effectively promote sustained wellbeing through consumer technology. The mapping can start from either (a) the technology, or (b) the targeted wellbeing factor, depending on the scope and objective of the design project.

Linking specific wellbeing factors to individual features also enables the development of targeted measurement strategies to assess the nuanced impact of different parts of a technology on user wellbeing. This fine-grained approach addresses common challenges in evaluating the wellbeing effects of consumer technology, which is often approached broadly by applying global wellbeing (e.g., happiness, life satisfaction) or illbeing measures (e.g., depression) to overall technology use (e.g., time spent). Such broad assessments, asking questions like "Do social networks undermine people's wellbeing?", often yield inconsistent results due to the heterogeneous nature of consumer technology (e.g., Valkenburg, 2022). In contrast, evaluating technology with context-specific wellbeing measures (e.g., social connectedness) at a feature level (e.g., interactions through comments or direct messaging), could produce more reliable and actionable insights (see Cho et al., 2021).

The framework, combined with the real-world feature examples illustrated in this thesis, can guide such targeted measurement strategies. For any given feature, designers can evaluate whether a specific implementation (e.g., notification wording) of a feature element (e.g., a prompt encouraging gratitude) effectively fosters the intended driver of behavior (e.g., motivation) and, ultimately, the targeted positive activity (e.g., practicing gratitude). To facilitate this process, the final design tool will direct designers to established measurement scales for evaluating individual drivers of behavior and positive activities. This level of specificity provides designers with clear, actionable insights on where and how to intervene along this chain.

7.2.4 Combine harm prevention and wellbeing promotion

This nuanced approach to designing consumer technology for wellbeing naturally leads to the next recommendation: combining protective and proactive strategies to promote wellbeing. In today's attention economy, consumer technologies are often designed to maximize engagement and time spent, making the sole prioritization of user wellbeing not (yet) entirely realistic. The resulting challenge for wellbeing designers, therefore, is to balance fostering positive outcomes with minimizing (potential) harms. To achieve this, they can draw inspiration from existing protective and proactive features, adopt different integration strategies, and incorporate evidence-based insights on positive activities or other wellbeing determinants. However, it is important to note that good intentions do not guarantee good outcomes. The same feature can be used in many different ways – both positive and negative. For example, this research found that Instagram users employ hashtags to subscribe to inspiring content, boosting their motivation to pursue meaningful life goals. Hashtags like '#blessed' can also promote expressions of gratitude (Bennett, 2014) and drive social activism (Malik, 2022). At the same time, these mechanisms can be

misused to promote harmful behaviors, such as self-injury (Moreno et al., 2016) or cyberbullying (Chan et al., 2021). This duality highlights a critical challenge for designers and tech companies: ensuring that features built to enhance wellbeing (like any other feature) are safeguarded against misuse. This requires anticipating unintended uses, building safeguards to avoid exploitation, and continuously monitoring real-world impacts.

7.2.5 Avoid overstimulating wellbeing

Promoting wellbeing through consumer technology holds significant potential but requires moderation to avoid unintended negative effects. Therefore, another recommendation is to avoid overstimulating wellbeing for several important reasons: First, research suggests that an excessive focus on maximizing happiness can paradoxically diminish overall wellbeing (Ford & Mauss, 2014; Mauss et al., 2011). Moreover, designing for positive outcomes should not come at the expense of recognizing the value of negative emotions. In 'The Upside to Your Dark Side', Todd Kashdan & Robert Biswas-Diener (2014) argue that optimal psychological functioning requires experiencing the full spectrum of emotions – both positive and negative – a perspective echoed by Fokkinga & Desmet (2012) in their approach to designing for emotionally rich experiences. Second, as Calvo and Peters (2014) caution, wellbeing can be "overconsumed" (p. 269), leading to unintended negative consequences: excessive positive emotions may foster addiction, constant self-reflection could spiral into rumination, and frequent triggers for empathy may result in emotional fatigue. This risk is exacerbated when embedding wellbeing interventions into consumer technologies with high usage rates. Overloading users with wellbeing prompts or interventions in every interaction could overwhelm users and diminish the intended positive impact. Third, again drawing on Calvo and Peters (2014), not every opportunity to enhance wellbeing needs to be mediated by technology. Offline experiences are vital for fostering wellbeing, offering unique opportunities for connection, personal growth, and mastery, that technology cannot replicate. Thus, the focus should be on areas where technology can create a meaningful and distinctive impact, serving to complement rather than replace offline experiences.

7.2.6 Balance short- and long-term engagement

The next recommendation stresses the need to balance short- and long-term strategies when designing consumer technology (for wellbeing). Lasting improvements in wellbeing require deliberate effort and cannot be achieved 'in passing'. While prioritizing short-term engagement metrics may bring quick profits for businesses, prioritizing them in the development of wellbeing-supportive features may undermine their effectiveness, ultimately rendering them mean-

ingless for users. Effective engagement in positive activities often demands a slower pace and deeper reflection – interaction qualities that are largely absent in current features, which are instead designed to encourage fast and frequent interactions, like Comments or Reactions. Although these features may successfully prompt positive activities, they often fail to support their proper execution. To address this, strategies for driving initial engagement with a wellbeing-supportive feature, should be paired with approaches that foster more reflective and meaningful user experiences.

Moreover, wellbeing design goals are sometimes viewed as being at odds with business interests. However, prioritizing short-term revenue streams over user wellbeing risks eroding long-term customer loyalty and increasing user churn. Users are becoming more aware of the negative impacts consumer technology can have on their wellbeing and are actively seeking to reduce time spent on online activities they find meaningless or unproductive (e.g., Lukoff et al., 2018), ultimately reducing long-term engagement. This shift in user expectations is already influencing the product roadmaps of major tech corporations. For example, in January 2018, CEO Mark Zuckerberg announced a significant change in Facebook's newsfeed algorithm to prioritize "meaningful social interactions" over passive content consumption. While acknowledging that this decision might decrease short-term engagement metrics, Zuckerberg argued it was necessary to increase the platform's long-term value for its users (Zuckerberg, 2018). This example illustrates how wellbeing-focused design and sustainable business success can align, paving the way for solutions that benefit both users and businesses.

7.2.7 Establish new metrics

Another recommendation is to establish (new) robust and scalable metrics to evaluate the wellbeing impact of individual features. Currently, there is a clear imbalance: short-term engagement metrics like clicks, views, and likes are easy to measure and optimize, while meaningful long-term metrics remain difficult to define and track. However, "what users do", i.e., what they view or click on, does not always reflect "what they need" or "what is good for them", making existing behavior-based metrics insufficient for assessing wellbeing impact. For example, AI-based recommendation algorithms typically optimize for engagement using behavioral signals such as views, clicks, likes, comments, and shares (e.g., Goodrow, 2021; Meta Transparency Centre, n.d.). These signals are interpreted as reflecting value for the user. As Cristos Goodrow, VP of Engineering at YouTube, puts it: "Clicking on a video provides a strong indication that you will also find it satisfying. After all, you wouldn't click on something you don't want to watch." (Goodrow, 2021). Indeed, feeds ranked by predicted engagement result in users spending more time on the site compared to feeds

ranked chronologically (Cunningham et al., 2024). However, while engagement metrics may indicate some level of "interest" in the content, they may not accurately reflect what users "value" or find "meaningful" (Hutchinson, 2021). On the contrary, users often consume or share problematic content, such as misinformation or polarizing material, underscoring the need for metrics that go beyond engagement to better capture what is truly in the users' best interest.

To address these shortcomings, platforms have begun incorporating explicit user feedback, such as surveys and response queries (Sato, 2021), and indicators for high-quality content (Cunningham et al., 2024; Goodrow, 2021) into their recommendation systems. For example, Facebook asks their users to indicate whether they want to see "more or less" of certain content types or to rate whether a post was "worth their time". These explicit metrics are then fed back into the recommender system. Similarly, YouTube's algorithm uses signals like "valued watched time", which measures the time spent watching videos that users perceive as meaningful. The perceived value of a video is assessed through 5-star ratings, along with follow-up questions to understand the reasons behind these ratings. Only videos that received 4-5-star-ratings are considered "valuable" and factored into algorithmic recommendations. For news and information, YouTube aims to provide "responsible recommendations" that prioritize high-quality information, demote "sensationalistic content", and optimize for fairness, as determined by classifiers and human raters. LinkedIn seeks to consider who responds to a post (e.g., experts on the topic) and how users respond, prioritizing "meaningful comments" over superficial remarks like "great" or "awesome". These efforts signal a growing interest within the tech industry to move beyond simplistic engagement metrics and incorporate richer, more meaningful metrics based on explicit user feedback into recommendation systems. Complementing these advancements, this thesis proposes measuring short-term predictors, such as engagement in positive activities, as a way to better assess and promote long-term wellbeing outcomes.

7.2.8 Embrace interdisciplinary collaboration

This recommendation highlights an essential – and perhaps obvious – point: designing consumer technology that genuinely supports people's wellbeing requires interdisciplinary collaboration among psychologists, designers, behavioral scientists, policymakers, and legal teams. Each discipline brings unique expertise, working together to develop solutions that are effective, practical, and scalable, ultimately fostering a technology landscape that benefits individuals and society. Equally important is collaboration between industry and academia, as these partnerships ensure that digital wellbeing interventions are grounded in evidence-based principles while remaining realistic and feasible for tech companies to implement. Open dialogue and mutual understanding

between researchers and industry representatives are essential to identify and advance such opportunities. This thesis contributes to this effort by showcasing ways to integrate positive activities into consumer technology through feature-based interventions that align with existing user flows and behaviors, offering a practical path toward meaningful improvements in user wellbeing.

7.3 Towards "bright patterns"

Previous chapters have briefly touched on possibilities for developing targeted design strategies for specific positive activities but did not explore these possibilities in depth. This section elaborates more concretely on how evidence-based strategies for optimally practicing positive activities (Lyubomirsky, 2007; see also Table 1.1, page 10) can serve as a foundation for targeted design approaches. Tailored to each activity and rigorously tested, these strategies have been shown to enhance the effectiveness of positive activities, potentially leading to greater improvements in wellbeing. Within the logic of the framework, these strategies can guide designers in selecting promising mechanisms to support each positive activity, serving as a blueprint for developing activity-specific design interventions. Below, I will illustrate this mapping process for two positive activities as examples (Table 7.1): Practicing Gratitude and Avoiding Overthinking. In addition, I will (a) demonstrate how the proposed mechanisms can be implemented at the interface level and (b) discuss how existing features align with this optimal practice, highlighting gaps and opportunities for future improvements. By doing so, I outline potential steps toward developing concrete interaction patterns to support (specific) positive activities (more effectively) within consumer technology, grounded in evidence-based principles for their optimal practice. Drawing an analogy to the 'dark patterns' identified by digital wellbeing researchers (Monge Roffarello et al., 2023), which are associated with negative wellbeing outcomes, I refer to these as 'bright patterns', guiding positive design interventions in consumer technology that proactively enhance user wellbeing. Some of these 'bright patterns' overlap with and draw inspiration from wellbeing-supportive design strategies proposed by Peters (2023). While I plan to expand on these 'bright patterns' in future work, this dissertation provides a high-level overview of potential interaction patterns linked to mechanisms, as summarized in Table A.2 in the Appendix and within the design tool's 'knowledge base' (Figure 6.3, page 152).

Practice Gratitude. An effective gratitude practice starts with (1) setting aside dedicated time and attention to fully focus on the activity (*Focus Attention*), see Table 7.1. Gratitude-supportive features can promote focus through (a) a *minimalist interface* that limits functionality (e.g., focus view) and overwhelming visual design elements (e.g., bright colors), and (b) *minimizing distractions* (e.g.,

Table 7.1: A mapping of promising design mechanisms and interaction patterns for supporting two positive activities, based on strategies for their optimal practice. (Lyubomirksy, 2007).

Positive Activity	Strategies for Optimal Practice	Mechanisms	Interaction Patterns
Practice Gratitude	Set aside time, focus on the activity	Focus attention	Minimalist interface
			Minimize distractions
		Action planning	Support daily integration
			Support flexible access
	Reflect what one is grateful for	Self-reflection	Mindful technology use
	Express gratitude directly to others	Self-expression	Public vs. private posts
			Fast vs. slow interactions
			Directed vs. broadcasting
		Modelling	Demonstrate desired behavior
	Provide specific reasons	Training	Provide specific instructions
	Express gratitude in various ways	Variation	Different formats, occasions
Avoid Overthinking	Identify and manage triggers	Prompts	Trigger interest, nudges
	Take action to solve problems	Self-Monitoring	Manage user behavior
	Restrict or time box		
	Distract from negative thoughts	Prompts	Nudges

by silencing notifications or enabling full-screen mode; see also Peters, 2023). To help users schedule time for the activity, the technology can further support action planning by enabling (a) daily integration (e.g., prompting gratitude practices at convenient times, such as before bedtime), and (b) flexible access (e.g., allowing users to practice the activity anytime, anywhere). Purpose-built features designed to support practicing gratitude currently lack support for these interaction qualities.

Practicing gratitude also benefits from (2) thoughtful reflection on what exactly one is grateful for and why (*Self-Reflection*), which often requires a *slower* pace of interaction. As reported by Instagram users in Chapter 4, reflective gratitude practices were frequently embedded into creative activities, such as creating birthday tribute Stories for friends, revisiting past posts on one's Wall, or engaging with meaningful content shared by others, all encouraging more *mindful technology use*. In contrast, purpose-built features like LinkedIn's Skill Endorsements, Quick Reactions, or Smart Suggestions focus on expressing gratitude (*Self-Expression*) and are designed for *fast* low-effort user interactions, which may limit opportunities for deeper reflection. However, a smaller subset of

features, such as Recommendations or Kudos (also on LinkedIn), which involve full text input, could encourage more nuanced and meaningful reflection (see also Calvo & Peters, 2014).

Another strategy is to (3) express gratitude directly to others (*Self-Expression*). The analysis in Chapter 4 found that both purpose-built app features and users' self-reported gratitude practices on Instagram often involve sharing gratitude *publicly* with a larger audience through wall posts, reactions, or Stories, rather than private messages. Public expressions of gratitude can foster positive feelings and behaviors by stimulating social learning and positive emotional contagion (*Modelling*; Sciara et al., 2021), strengthening social connections (Ho et al., 2023), and enhancing social support. Conversely, *private* messages may encourage more specific and personal expressions of gratitude, enabling deeper emotional connections. To accommodate diverse user preferences, gratitude-supportive features could offer options for both public broadcasting and private, directed communication (Burke & Kraut, 2016).

Also tied to self-expression, articulating (4) specific reasons for being grateful not only enhances the wellbeing in the person expressing it but also benefits the recipient. While selecting an emoji, a reaction or a predefined Kudo category like "Team Player" or "Amazing Mentor", as seen in existing features, may encourage some level of nuanced reflection, its potential is likely constrained by the brevity of the interaction and the lack of more personalized expression. Providing explicit instructions (*Training*) or reflective prompts (*Prompts*) stimulating more detailed input could guide users toward deeper reflection.

Lastly, to cultivate a habit of practicing gratitude, it is beneficial to (5) express gratitude in different ways (*Variation*), using various formats like text, photos, or videos, and on different occasions. Existing features already promote variation to some extent.

Avoid Overthinking. Science-based recommendations for avoiding overthinking include (1) identifying and managing triggers. Existing purpose-built features support this by (a) labeling content with warnings (*Prompts*, e.g., Content Warning), (b) nudging users to reliable information sources (*Prompts*, e.g., Fact Check Panel), and (c) offering controls to adjust their newsfeed preferences (*Self-Monitoring*, e.g., Show More/Less). Once users recognize their triggers, they can (2) take action to manage or avoid them by using features to (a) filter or adjust content (*Self-Monitoring,* e.g., Not Interested*)* or (b) regulate their behavior (*Self-Monitoring*), e.g., by (3) restricting or time-boxing specific interactions (e.g., Reduce, Hide Content). Another recommendation is to temporarily (4) distract oneself from negative thoughts to regain control over the situation. This can be achieved by interrupting potentially harmful user behavior (*Prompts,*

e.g., You're All Caught Up) and/or using nudges to redirect users toward positive actions (*Prompts*, e.g., Health Information Panels).

7.4 Limitations

One limitation of this research is the lack of empirical testing and exploration with users and industry representatives. Specifically, the effectiveness of the technology examples examined in Chapter 4 and the design interventions proposed in Chapter 5 have not been tested with users, making it unclear whether and to what extent they enhance user wellbeing. Furthermore, the design concepts from Chapter 5 have not been assessed by industry stakeholders to evaluate their appeal and feasibility. As such, the research focuses on 'scoping the field' and 'identifying opportunities' for integrating positive activities into consumer technology, rather than establishing 'best practices' or prescribing specific solutions. Nevertheless, insights from this research demonstrate in a concrete way (a) that such integration is possible, (b) how designers can approach it, and (c) where to begin within the current technology ecosystem. Similarly, the design tool introduced in Chapter 6 has not yet been evaluated with designers in industry practice, leaving it uncertain how they might utilize it and whether it will enable them to develop effective design solutions. As the tool introduces rather novel strategies for knowledge dissemination and design decision-making not typically addressed by established wellbeing design tools, further evaluation is crucial to assess its practical value. Lastly, while this research draws on and is informed by my professional industry experience, it did not explicitly include tech representatives, presenting a clear opportunity for future work. Another limitation lies in the methodological rigor of the research, including the type of research conducted and the range of technologies examined. The research relied primarily on qualitative research methods with small participant and technology samples. To address this limitation, empirical insights were consecutively matched with theoretical insights in a bottom-up-top-down approach. However, broader and more rigorous studies are needed to strengthen the findings and generalize conclusions.

7.5 Conclusion

This dissertation has explored the potential of consumer technology to foster sustained wellbeing. The research demonstrates that consumer technology can serve as a supplementary channel for delivering wellbeing interventions to a broad audience, complementing dedicated wellbeing solutions. Positive activities are empirically identified and validated as promising design targets for integrating wellbeing interventions into consumer technology. These activities span various life domains and are readily available in intervention format, and

thus ensure both broad applicability and practical actionability. Furthermore, they serve as reliable short-term predictors of long-term wellbeing, making them a feasible focus within fast-paced product development cycles in industry settings. The analysis of existing consumer technology revealed that positive activities are already supported through a variety of features and user scenarios, which further reinforces their relevance to the tech industry. This research also shows that designers can intentionally target positive activities in the design process. The proposed design tool supports this effort by helping designers navigate various starting points and resources for integrating positive activities into everyday technology. This work has the potential to influence industry practice by providing designers with actionable strategies and practical tools to embed wellbeing into their products, paving the way for technology that meaningfully and sustainably enhances people's lives.

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Summary

This dissertation explores how consumer technology can foster lasting improvements in wellbeing. Consumer technologies - social networking sites, communication tools, and streaming platforms - have become omnipresent, fundamentally shaping how we live, work, and connect. They kickstart our mornings, keep our schedules on track, and curate the soundtrack to our days. They capture cherished memories, help us plan global adventures, and guide us to new experiences. Far beyond mere utilities, they have become integral companions in our daily routines, holding immense potential to enhance wellbeing when designed with care and intention. Yet despite this potential, consumer technology is the focus of intense debate. Concerns have mounted around its overuse, its detrimental effects on teenage mental health, its role in fueling distraction and societal polarization, and its contribution to spreading misinformation.

These valid concerns about technology's negative impact are pressing and warrant urgent action. At the same time, focusing solely on reducing harm risks overlooking an important opportunity: designing consumer technology to actively enhance wellbeing. Unlike dedicated wellbeing technologies, such as meditation or gratitude apps, most consumer technologies focus on primary goals like shopping, communication, or productivity. However, they often include features with significant potential to enhance wellbeing: pinning aspirations on a digital vision board, rediscovering cherished memories through past social media posts, or curating playlists to energize your day. By rethinking these everyday digital experiences, technology can go beyond facilitating tasks to actively supporting personal goals, meaningful moments, and emotional wellbeing.

The deliberate integration of such wellbeing-supportive features, termed *Active Design*, forms the central focus of this dissertation. The research provides designers with the knowledge and tools to develop consumer technologies that create a lasting positive impact on people's wellbeing. Key questions that guide this work are: How can consumer technology promote sustained wellbeing? Which specific determinants of sustained wellbeing can it influence? How can these determinants be shaped at the interface level? And how can we intentionally design consumer technology for lasting positive impact?

EXPLORATORY STUDY AND THEORETICAL FRAMEWORK

In Chapter 2, an exploratory study with twelve participants used the laddering technique - an interview-based method - to examine whether and how physical and digital products can improve people's wellbeing over time. The results showed that when products enable or encourage positive activities, such as savoring or nurturing relationships, their benefits go beyond momentary pleasure. Participants reported that products helped them build meaningful habits, learn new skills, form deeper connections, stay present, and pursue personal goals, leading to lasting increases in their wellbeing. While positive activities have been extensively studied in psychology and inspired the development of dedicated wellbeing apps, their integration into everyday consumer technology has been less explored. Building on these findings, Chapter 3 introduces a theoretical framework that explains how technology can promote positive activities and, ultimately, sustained wellbeing. To improve accessibility for designers, the framework includes a list of fourteen positive activities that technology can support, along with eighteen design mechanisms to help integrate these activities into products.

APPLYING THE FRAMEWORK TO CONSUMER TECHNOLOGY

In Chapter 4, the focus shifts to consumer technology. Two studies were conducted to examine how purpose-built features and real-world uses of social media and streaming platforms support positive activities. The first study, an expert analysis of six popular apps, identified over 160 features intentionally designed to support many activities in the framework through various design mechanisms. The second study, an online survey of 117 frequent Instagram users, confirmed that everyday digital technologies can enable people to engage in positive activities, even through features not originally designed for that purpose. Together, these findings demonstrate that positive activities are a relevant and valuable design target for designers in the tech industry.

CASE STUDY AND DESIGN TOOL

Finally, the last research stage examined how designers can apply the theoretical knowledge from previous chapters in practice. Chapter 5 explores this through a case study conducted during a 10-week design course with fourteen Interaction Design Master's students at TU Delft. In the course, students were guided to integrate positive activities into existing consumer technologies of their choice, focusing on redesigning or adding features that support these activities. The analysis of the final design concepts identified multiple integration strategies for weaving positive activities into real-world technology, ranging from small tweaks to more significant changes in existing user flows. Observations during the course showed that students developed a strong understanding of the

theory behind positive activities. However, they had difficulty identifying a suitable technology context for their design vision, indicating that this step requires clearer guidance. Building on these insights and on existing literature, Chapter 6 introduces a concept – and an early prototype – of a digital design tool aimed at helping designers integrate positive activities into consumer technology. Specifically, the tool is intended to assist designers in exploring the framework through various entry points and information sources, ranging from evidence-based knowledge on positive activities to real-world examples.

KEY CONTRIBUTIONS AND RECOMMENDATIONS

Overall, this dissertation provides (1) a theoretical framework explaining how technology can promote sustained wellbeing through positive activities; (2) refined taxonomies for positive activities and design mechanisms relevant to consumer technology; (3) a curated database of feature examples illustrating how existing applications already support positive activities; and (4) an early-stage design tool to make this knowledge accessible and actionable.

Building on insights from this research and existing literature, the final chapter presents a set of recommendations for designers aiming to integrate wellbeing principles into consumer technology through Active Design:

1. **Make wellbeing an actionable design goal:** Break down wellbeing into tangible aspects that align with specific life domains (like social relationships) and technology contexts (such as team collaboration tools) makes it easier to address in design.

2. **Design for wellbeing at the feature level:** Acknowledge that different features of a technology can affect wellbeing in distinct ways. These effects should be evaluated and addressed using design strategies tailored to each feature's (anticipated) impact.

3. **Contextualize wellbeing:** Combine recommendations one and two to identify the wellbeing components most relevant to individual features. This ensures that each feature aligns meaningfully with specific aspects of wellbeing, considering the context in which it is used.

4. **Combine harm prevention and wellbeing promotion:** Consumer technologies, embedded in the 'attention economy', are often optimized for user engagement, sometimes at the expense of user wellbeing. These technologies are not 'neutral environments'; they present both risks and opportunities. Distributing wellbeing interventions through consumer technology requires balancing protective strategies to prevent harm with proactive strategies to promote wellbeing. This ensures both work together to achieve positive outcomes while minimizing potential harm.

5. **Avoid overstimulating wellbeing:** Technology should not aim to promote wellbeing in every interaction or replace the essential contributions of offline experiences. However, when used in moderation, consumer technology can effectively foster and sustain positive behaviors, thoughts, and feelings that extend into or occur entirely within the offline world.

6. **Balance short- and long-term engagement:** While consumer technology often prioritizes brief, frequent interactions, such as comments and reactions, lasting wellbeing improvements require time for reflection and authentic self-expression. Wellbeing cannot be achieved 'in passing' or through superficial interactions driven by extrinsic rewards. Focusing on short-term engagement in wellbeing-supportive features risks compromising their effectiveness and diminishing their value to users. On the other hand, designing for meaningful wellbeing enhancements - ones that users can recognize and experience - may challenge short-term metrics and revenue models but can strengthen user loyalty, drive sustained engagement, and ultimately benefit both users and businesses.

7. **Establish new metrics:** Developing robust, scalable metrics to evaluate the wellbeing impact of individual features is essential for creating effective design interventions. Traditional engagement metrics (e.g., clicks, views, shares), often fail to capture what users truly value or need. Incorporating explicit user feedback – such as surveys, content ratings, or signals for high-quality content – can provide deeper insights, enabling tech companies to optimize interactions for meaningful engagement while mitigating harm.

8. **Embrace interdisciplinary collaboration:** Designing consumer technology that truly supports user wellbeing requires collaboration across academic disciplines, as well as between academia and industry, to ensure solutions are evidence-based, practical, and scalable.

CONCLUSION

Consumer technology has the potential to both harm and promote wellbeing. While harms must be addressed, this dissertation illustrates how features of everyday technologies can be intentionally designed to cultivate meaningful relationships, support personal goals, and boost emotional resilience. It demonstrates that positive activities offer a tangible, evidence-based target for designing such features and provides actionable insights and tools for design practitioners and researchers. By integrating wellbeing principles into everyday technologies, positive interventions can reach a wide audience, improving our interactions with technology and creating lasting positive impacts in our lives beyond the screen.

Samenvatting

Dit proefschrift onderzoekt hoe consumententechnologie blijvende verbeteringen in welzijn kan bevorderen. Consumententechnologieën - sociale netwerksites, communicatietools en streamingplatforms - zijn alomtegenwoordig geworden en bepalen fundamenteel hoe we leven, werken en contacten leggen. Ze geven onze ochtenden een kickstart, houden onze agenda's op schema en creëren de soundtrack van onze dagen. Ze leggen dierbare herinneringen vast, helpen ons bij het plannen van wereldwijde avonturen en leiden ons naar nieuwe ervaringen. Ze zijn niet langer alleen maar gebruiksvoorwerpen; ze zijn onmisbare hulpmiddelen in onze dagelijkse routines geworden. Als ze met zorg en aandacht worden ontworpen, kunnen ze ons welzijn aanzienlijk verbeteren. Ondanks dit potentieel is consumententechnologie het onderwerp van hevige discussies. Er is bezorgdheid ontstaan over overmatig gebruik, de schadelijke effecten op de geestelijke gezondheid van tieners, de rol die technologie speelt bij het aanwakkeren van afleiding en maatschappelijke polarisatie, en de bijdrage aan de verspreiding van verkeerde informatie. Deze terechte zorgen over de negatieve impact van technologie zijn urgent en vereisen dan ook dat er dringend actie wordt ondernomen. Tegelijkertijd bestaat het risico dat als we ons alleen richten op het beperken van schade, we een belangrijke kans over het hoofd zien, namelijk het ontwerpen van consumententechnologie om het welzijn actief te verbeteren. In tegenstelling tot specifieke welzijnstechnologieën, zoals meditatie- of dankbaarheidsapps, richten de meeste consumententechnologieën zich op primaire doelen zoals winkelen, communicatie of productiviteit. Ze bevatten echter vaak functies met een significant potentieel om het welzijn te verbeteren zoals het vastleggen van ambities op een digitaal visiebord, het herontdekken van dierbare herinneringen via oude posts op sociale media of het samenstellen van afspeellijsten om je dag nieuwe energie te geven. Door opnieuw na te denken over deze dagelijkse digitale ervaringen, kan technologie verder gaan dan het faciliteren van taken en actief persoonlijke doelen, betekenisvolle momenten en emotioneel welzijn ondersteunen. De doelbewuste integratie van zulke welzijnsondersteunende eigenschappen, Active Design genoemd, vormt de centrale focus van dit proefschrift. Het onderzoek voorziet ontwerpers van kennis en instrumenten om consumententechnologieën te ontwikkelen die een blijvende positieve impact hebben op het welzijn van mensen. Belangrijke vragen die hierbij een rol spelen, zijn: Hoe kan consumententechnologie duurzaam welzijn bevorderen? Welke specifieke determinanten van

duurzaam welzijn kan het beïnvloeden? Hoe kunnen deze determinanten op interfaceniveau worden vormgegeven? En hoe kunnen we consumententechnologie doelbewust ontwerpen voor een blijvende positieve impact?

VERKENNEND ONDERZOEK EN THEORETISCH KADER

In hoofdstuk 2 is in een verkennend onderzoek met twaalf deelnemers de laddering-techniek – een interviewgebaseerde methode – gebruikt om te onderzoeken of en hoe fysieke en digitale producten het welzijn van mensen in de loop der tijd kunnen verbeteren. De resultaten toonden aan dat wanneer producten positieve activiteiten, zoals het genieten of onderhouden van relaties, mogelijk maken of aanmoedigen, de voordelen ervan verder gaan dan kortstondig plezier. Deelnemers gaven aan dat producten hen hielpen om zinvolle gewoonten op te bouwen, nieuwe vaardigheden te leren, diepere connecties te vormen, aanwezig te blijven en persoonlijke doelen na te streven, wat leidde tot een blijvende verbetering van hun welzijn. Hoewel positieve activiteiten uitgebreid in de psychologie zijn bestudeerd en de ontwikkeling van speciale welzijnsapps hebben geïnspireerd, is de integratie ervan in alledaagse consumententechnologie minder onderzocht. Voortbouwend op deze bevindingen introduceert hoofdstuk 3 een theoretisch kader dat uitlegt hoe technologie positieve activiteiten en uiteindelijk duurzaam welzijn kan bevorderen. Om de toegankelijkheid voor ontwerpers te verbeteren, bevat het kader een lijst met veertien positieve activiteiten die technologie kan ondersteunen en achttien ontwerpstrategieën die helpen deze activiteiten in producten te integreren.

TOEPASSING VAN HET KADER OP CONSUMENTENTECHNOLOGIE

In hoofdstuk 4 verschuift de focus naar consumententechnologie. Er werden twee studies uitgevoerd om te onderzoeken hoe speciaal ontwikkelde functies en het gebruik van sociale media en streamingplatforms in de praktijk positieve activiteiten ondersteunen. De eerste studie, een expertanalyse van zes populaire apps, identificeerde meer dan 160 functies die speciaal zijn ontworpen om vele activiteiten binnen het kader via verschillende ontwerpmechanismen te ondersteunen. De tweede studie, een online enquête onder 117 frequente Instagramgebruikers, bevestigde dat alledaagse digitale technologieën mensen in staat kunnen stellen om positieve activiteiten te ondernemen, zelfs via functies die oorspronkelijk niet voor dat doel waren ontworpen. Samen tonen deze bevindingen aan dat positieve activiteiten een relevant en waardevol ontwerpdoel zijn voor ontwerpers in de tech-industrie.

CASESTUDY EN ONTWERPTOOL

Tot slot is in de laatste onderzoeksfase gekeken hoe ontwerpers de theoretische kennis uit de voorgaande hoofdstukken in de praktijk kunnen toepassen.

Hoofdstuk 5 onderzoekt dit aan de hand van een casestudy die werd uitgevoerd tijdens een tienweekse ontwerpcursus met veertien masterstudenten Interaction Design aan de TU Delft. Tijdens de cursus kregen de studenten de opdracht om positieve activiteiten in bestaande consumententechnologieën van hun keuze te integreren, waarbij de nadruk lag op het herontwerpen of toevoegen van functies die deze activiteiten ondersteunen. Uit de analyse van de uiteindelijke ontwerpconcepten kwamen meerdere integratiestrategieën naar voren om positieve activiteiten in real-world technologie te verweven, variërend van kleine aanpassingen tot meer significante veranderingen in bestaande gebruikersstromen. Observaties tijdens de cursus toonden aan dat studenten een sterk begrip van de theorie achter positieve activiteiten ontwikkelden. Ze hadden echter moeite met het vinden van een geschikte technologische context voor hun ontwerpvisie, wat aangeeft dat deze stap duidelijkere begeleiding vereist. Voortbouwend op deze inzichten en bestaande literatuur introduceert hoofdstuk 6 een concept en een vroeg prototype van een digitale ontwerptool die ontwerpers moet helpen om positieve activiteiten in consumententechnologie te integreren. De tool is specifiek bedoeld om ontwerpers bij het verkennen van het kader te helpen via verschillende invalshoeken en informatiebronnen, variërend van op feiten gebaseerde kennis over positieve activiteiten tot voorbeelden uit de praktijk.

BELANGRIJKSTE BIJDRAGEN EN AANBEVELINGEN

Samengevat biedt dit proefschrift (1) een theoretisch kader dat uitlegt hoe technologie duurzaam welzijn kan bevorderen door middel van positieve activiteiten; (2) verfijnde taxonomieën voor positieve activiteiten en ontwerpmechanismen die relevant zijn voor consumententechnologie; (3) een gecureerde database met voorbeelden van functies die illustreren hoe bestaande toepassingen positieve activiteiten reeds ondersteunen; en (4) een beginnende ontwerptool om deze kennis toegankelijk en inzetbaar te maken.

Voortbouwend op inzichten uit dit onderzoek en de literatuur, biedt het laatste hoofdstuk een aantal aanbevelingen voor ontwerpers die welzijnsprincipes in consumententechnologie door middel van Active Design willen integreren:

1. **Maak welzijn een uitvoerbaar ontwerpdoel:** Door welzijn op te splitsen in tastbare aspecten die aansluiten bij specifieke levensdomeinen (zoals sociale relaties) en technologiecontexten (zoals tools voor teamsamenwerking) wordt het gemakkelijker om dit in het ontwerp te verwerken.

2. **Ontwerp voor welzijn functionaliteitniveau:** Erken dat verschillende kenmerken van een technologie welzijn op verschillende manieren kunnen beïnvloeden. Deze effecten moeten worden beoordeeld en aangepakt met on-

twerpstrategieën die zijn afgestemd op de (verwachte) impact van elk kenmerk.

3. **Contextualiseer welzijn:** Combineer aanbeveling één en twee om de welzijnscomponenten te identificeren die het meest relevant zijn voor individuele kenmerken. Dit zorgt ervoor dat elke feature zinvol aansluit bij specifieke aspecten van welzijn, rekening houdend met de context waarin deze wordt gebruikt.

4. **Combineer schadepreventie en welzijnsbevordering:** Consumententechnologieën, ingebed in de aandachtseconomie, zijn vaak geoptimaliseerd voor gebruikersbetrokkenheid, soms ten koste van het welzijn van de gebruikers. Deze technologieën zijn geen neutrale omgevingen; ze brengen zowel risico's als kansen met zich mee. Het verspreiden van welzijnsinterventies via consumententechnologie vereist een evenwicht tussen beschermende strategieën om schade te voorkomen en proactieve strategieën om welzijn te bevorderen. Dit zorgt ervoor dat beide samenwerken om positieve resultaten te behalen terwijl potentiële schade tot een minimum wordt beperkt.

5. **Vermijd het overmatig stimuleren van welzijn:** Technologie moet er niet naar streven om welzijn bij elke interactie te bevorderen of de essentiële bijdragen van offline ervaringen te vervangen. Desalniettemin kan consumententechnologie, mits met mate gebruikt, op effectieve wijze positieve gedragingen, gedachten en gevoelens stimuleren en ondersteunen die zich uitstrekken naar of volledig plaatsvinden in de offline wereld.

6. **Zorg voor een balans tussen korte- en langetermijnbetrokkenheid:** Terwijl consumententechnologie vaak de voorkeur geeft aan korte, frequente interacties, zoals opmerkingen en reacties, is er voor blijvende welzijnsverbeteringen tijd nodig voor reflectie en authentieke zelfexpressie. Welzijn kan niet terloops worden bereikt of door oppervlakkige interacties die worden gemotiveerd door extrinsieke beloningen. Als we ons dus richten op kortetermijnbetrokkenheid bij welzijnsondersteunende features, riskeren we de effectiviteit ervan aan te tasten en hun waarde voor gebruikers te verminderen. Aan de andere kant kan het ontwerpen van betekenisvolle welzijnsverbeteringen - verbeteringen die gebruikers kunnen herkennen en ervaren - een uitdaging vormen voor kortetermijncijfers en verdienmodellen, maar kan het de loyaliteit van gebruikers versterken, duurzame betrokkenheid stimuleren en uiteindelijk zowel gebruikers als bedrijven ten goede komen.

7. **Ontwikkel nieuwe meetmethoden:** Het ontwikkelen van robuuste, schaalbare meetgegevens om de impact van individuele functies op het welzijn te evalueren is essentieel voor het creëren van effectieve ontwerpinterventies. Traditionele meetgegevens over betrokkenheid (bijv. klikken, weergaven, delen) geven vaak niet weer wat gebruikers echt waarderen of

nodig hebben. Het integreren van expliciete gebruikersfeedback, zoals enquêtes, inhoudsbeoordelingen of signalen voor content van hoge kwaliteit, kan diepere inzichten opleveren, waardoor techbedrijven interacties kunnen optimaliseren voor zinvolle betrokkenheid en tegelijkertijd de schade kunnen beperken.

8. **Omarm interdisciplinaire samenwerking:** Het ontwerpen van consumententechnologie die het welzijn van de gebruiker daadwerkelijk ondersteunt, vereist samenwerking tussen academische disciplines en tussen de academische wereld en het bedrijfsleven. Dit zorgt ervoor dat oplossingen op bewijs gebaseerd, praktisch en schaalbaar zijn.

CONCLUSIE

Consumententechnologie kan het welzijn zowel schaden als bevorderen. Hoewel de schadelijke effecten moeten worden aangepakt, illustreert dit proefschrift hoe features van alledaagse technologieën doelbewust ontworpen kunnen worden om betekenisvolle relaties te cultiveren, persoonlijke doelen te bereiken en emotionele veerkracht te versterken. Het toont aan dat positieve activiteiten een tastbaar, op bewijs gebaseerd doel voor het ontwerpen van dergelijke functies bieden en verschaft bruikbare inzichten en tools waarmee ontwerpers en onderzoekers aan de slag kunnen. Door welzijnsprincipes in alledaagse technologieën te integreren, kunnen positieve interventies een breed publiek bereiken, onze interacties met technologie verbeteren en blijvende positieve effecten in ons leven creëren die verder gaan dan het scherm.

Appendix

Table A.1: User behaviors per positive activity.

Activity & Behavior	Type	Description
PRACTICE GRATITUDE		
Gratefully reflect	Proactive	Reflecting on or writing down what one is grateful for
Express gratitude	Proactive	Express gratitude directly to others
AVOID OVERTHINKING		
Reduce doom-scrolling	Protective	Reducing excessively seeking out negative content
AVOID SOCIAL COMPARISON		
Reduce negative comparison	Protective	Alleviating body dissatisfaction and fear of missing out
Authentic self-presentation	Proactive	Aligning self-presentation with one's true identity and values
Diverse beauty standards	Proactive	Representing a broad diversity of appearances
PRACTICE ACTS OF KINDNESS		
Prosocial behavior	Proactive	Engaging in actions intended to benefit others
Support others	Proactive	Offering emotional, informational, or practical support
Respectful interactions	Proactive	Engaging with others in a polite and considerate manner
Reduce toxic interactions	Protective	Minimizing cyberbullying and hate speech
NURTURE SOCIAL RELATIONSHIPS		
Direct exchange	Proactive	Directly interacting with other people
Connect with others	Proactive	Keeping in touch with others, finding like-minded people
Stay up to date	Proactive	Getting updates from family and friends
Collaborative use	Proactive	Engaging in shared activities with others through technology
Self-disclosure	Proactive	Expressing one's thoughts and feelings, confiding in others
DEVELOP STRATEGIES FOR COPING		

Distract from problems	Proactive	Directing attention away from stressful situations
Emotion regulation	Proactive	Using technology to (up)regulate positive emotions
SAVORING		
Reflect on experiences	Proactive	Sharing positive experiences for personal or social reflection
Reminisce past experiences	Proactive	Recording and reflecting on past experiences
COMMIT TO GOALS		
Set personal goals	Proactive	Defining meaningful goals to work toward
Focus on personal goals	Proactive	Directing attention and effort toward achieving goals
TAKE CARE OF MIND		
Promote mental health	Proactive	Adopt positive mental health behaviors
Reduce mental health threats	Protective	Mitigating direct risks to mental health, e.g., self-harm
Reduce harmful content	Protective	Reducing exposure to harmful content
Reduce excessive use	Protective	Reducing time spent on a platform

Table A.2: Interaction patterns to implement specific design mechanisms. Definitions are partly adapted from Peters (2023), Ploderer et al., (2014), and (Burke & Kraut, 2016).

Design Mechanism	Subcodes	Examples
Focus Attention	Minimize distraction Promote intentional focus	Quiet Mode Inclusive Beauty Searches
Education	Showcase impact of actions Provide relevant knowledge	Comment Warnings Wellbeing Guides
Training	Provide specific instructions	Show Your Support
Goal Setting	Define meaningful goals Redirect user behavior	Collections Nighttime Nudges
Action Planning	Support daily integration Support flexible access	Hashtags, Subscriptions Save for Later, Personal Playlists
Social Support	Opportunities for connection Foster emotional support Support collaboration	Groups Reactions Collaborative Collections
Prompts	Trigger interest Set reminders	Memories Job Alerts

	Nudge positive behavior	Nighttime Nudges
	Show social prompts	Add Yours
Feedback	Reflective feedback	You're All Caught Up
	Feedback on goal progress	Milestones
Self-Monitoring	Visualize user behavior	Memories, Wrapped
	Manage user behavior	Unfollow, Mute, Hide Reaction Count
Personal Relevance	Personalization, algorithmic curation (performed by system)	Explore
	Choice over content (performed by user)	Browse by Mood
Modelling	Demonstrate 'good' behavior	Pinned Comments
Variation	Support diverse practice	Kudo Types
Joy of Use	Make interaction aesthetically pleasing	Stickers
	Make the activity enjoyable	Wrapped
Self-Reflection	Create self-awareness	You're All Caught Up
	Support mindful use	Recommendations
Self-Expression	Public vs. private	Posts vs. DMs
	Fast vs. slow	Reactions vs. Recommendations
	Directed vs. Broadcasting	DMs vs. Stories

Table A.3: Drivers of behavior mapped to design mechanisms and interaction patterns based on the COM-B model of behavior change (Michie et al., 2011, 2013). Note that some mechanisms can foster multiple drivers of behavior. The mappings below represent the primary connections identified in this research.

Driver of Behavior	Definition	Design Mechanisms	Interaction Patterns (exp.)
Capability *"facilitate"*	Features that strengthen a person's psychological and/or physical ability to perform the activity, including having relevant knowledge, attention capacity, and behavior regulation ability.	Focus Attention Education Training Self-Monitoring	Minimize distractions, promote intentional focus; showcase impact of one's actions; provide specific instructions, help users understand and manage usage patterns

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Driver of Behavior	Definition	Design Mechanisms	Interaction Patterns (exp.)
Opportunity *"trigger"*	Features that create a supportive environment for practicing positive activities by providing sufficient time, social support, and reminders to encourage engagement	Action Planning Social Support Prompts	Support daily integration, provide flexible access to relevant content and functionality; provide opportunities to connect and/or collaborate with others, offer emotional support; trigger, remind, and/or nudge users to engage in the activity
Motivation *"stimulate"*	Features that support reflective motivation, i.e., deliberate, conscious decision-making based on reasoned thought and explicit intentions	Goal Setting Feedback Personal Relevance Modelling Self-Reflection Self-Expression	Define meaningful goals, (re)direct user behavior toward desired actions; provide feedback for reflection and on goal progress; highlight positive behavior by other users; foster self-awareness, promote mindful technology use; allow users to express thoughts and feelings publicly and privately
	Features that support automatic motivation driven by habitual behaviors, emotional reactions, or learned associations	Personal Relevance Variation Joy of Use	Provide relevant content through personalization and/or explicit choice by the user; foster varied ways of practicing the activity; make the activity itself enjoyable

Glossary

Active Design Design approach that integrates wellbeing-supportive features into existing technologies that serve a different primary purpose (Calvo & Peters, 2014).

Attention Economy Economic model in which user attention is the primary commodity, driving business practices that prioritize maximizing engagement and time spent on platforms (Davenport & Beck, 2001).

Automatic Motivation Behavior driven by habits, emotional reactions, and learned associations (Michie et al., 2011).

Behavioral Intervention Technologies (BITs) Digital technologies designed to change specific behaviors in order to improve people's physical or mental health, wellbeing, or quality of life (Mohr et al., 2013).

Capability A person's psychological and/or physical ability to perform a specific behavior, including knowledge, skills, and attention capacity (Michie et al., 2011).

COM-B Model Behavior change model positing that behavior occurs through the interplay of capability, opportunity, and motivation (Michie et al., 2011).

Consumer Technology Any digital or interactive technology designed for everyday use by the general public, as opposed to applications intended for business or government purposes.

Dedicated Design Technologies specifically designed to promote wellbeing as their main purpose, such as meditation apps or health trackers (Calvo & Peters, 2014).

Design Mechanisms Specific methods, processes or techniques used to activate psychological or contextual factors that drive behavior, such as reminders, rewards, or feedback (Wiese et al., 2020).

Digital Wellbeing Interventions Tools and features designed to help users manage their technology use and encourage healthy digital habits (Monge Roffarello & De Russis, 2023).

Drivers of Behavior Psychological and contextual factors that determine whether a behavior is performed, including capability, opportunity, and motivation (Michie et al., 2011).

Eudaimonic Wellbeing An aspect of psychological wellbeing focused on self-actualization and optimal functioning, comprising aspects such as positive relationships with others, a sense of purpose, and self-acceptance (Ryff & Singer, 2008).

Experience Qualities How users subjectively perceive and experience product attributes during the product interaction (Hassenzahl, 2003).

Flourishing A combined state of hedonic and eudaimonic wellbeing, representing optimal mental health (Keyes, 2002).

Hedonic Adaptation Psychological process where people return to their baseline level of happiness after experiencing positive or negative life events (Frederick & Loewenstein, 1999).

Hedonic Wellbeing An aspect of subjective wellbeing focused on pleasure and positive emotions, characterized by frequent positive affect, infrequent negative affect, and overall life satisfaction (Diener, 1984).

Interaction Patterns Specific implementations of design mechanisms at the interface level through concrete product properties and user experience qualities (Wiese et al., 2020).

Laddering An interview technique that systematically explores the connections between product attributes, their motivational consequences, and personal values (Reynolds & Gutman, 1988).

Means-End Chains (MEC) Hierarchical sequences showing how product attributes lead to motivational consequences and ultimately connect to personal values (Gutman, 1982).

Opportunity External or contextual factors that enable or prompt behavior, such as having sufficient time, access, and social support (Michie et al., 2011).

Person-Activity-Fit The degree of alignment between a positive activity and an individual's interests, values, and lifestyle, which affects the activity's effectiveness (Lyubomirsky & Layous, 2013).

Positive Activities Simple strategies aimed at cultivating positive behaviors, feelings, or thoughts (Sin & Lyubomirsky, 2009), such as expressing gratitude or practicing acts of kindness. When practiced regularly, they can enhance wellbeing in a sustained way (Lyubomirsky & Layous, 2013).

Positive Psychology Interventions (PPIs) Specific interventions based on positive activities, such as "Writing a Gratitude Letter" or noting "Three Good Things" that happened during the day, as targeted practices for fostering gratitude.

Preventative Design Design approach aimed at reducing or mitigating negative effects stemming from current technology design (Calvo & Peters, 2014).

Proactive Design Features that actively encourage and promote positive activities; a specific variant of Active Design (Wiese et al., 2024c).

Product Properties Observable or tangible aspects of a product or technology such as colors, visuals, and interactive elements (Wiese et al., 2020).

Protective Design Features that help users avoid or reduce certain behaviors that can undermine wellbeing; a specific variant of Active Design (Wiese et al., 2024); closely related to Preventative Design.

Reflective Motivation Deliberate, conscious decision-making based on thoughtful consideration and clear intentions (Michie et al., 2011).

Sustained Wellbeing Lasting improvements in wellbeing that persist over time.

Wellbeing Design Frameworks Theoretical approaches that outline how design can foster wellbeing, such as Positive Design, Positive Computing, and Positive Technologies (Desmet & Pohlmeyer, 2013).

Acknowledgements

Finally, here it is: the ultimate occasion to practice gratitude. Along this journey I've been incredibly fortunate to be supported, challenged, and inspired by many. This section is for you.

To my supervisors, **Paul and Anna,** thank you for sticking with me through the ride. This PhD came with its fair share of twists and turns, yet you continued to believe in me even when things were uncertain. Your support meant more than I can say. I'm deeply grateful for your guidance, patience, and encouragement.

Paul, my promotor for the first 95%: it's fair to say that we approach ideas from different ends of the spectrum: your thinking zooms out to see the bigger picture, mine is drawn to details and patterns. Together, that brought clarity and nuance to my research. You challenged me often, stretching my thoughts in all the right ways. I've learned a lot from your insight into what matters, both in science and in life, and this is something I'll carry with me far beyond this project. Let's just say: I now enjoy seeing the trees *and* the forest — though I still like to examine the bark.

Anna, my copromotor and first point of contact at TU Delft: without your personal commitment, this project might never have come to life. Thank you for your generous investment of time and care, from helping with our complex legal setup to offering a listening ear when I needed to talk things through. Not to mention Berlin's most thesis-boosting ice cream, which arrived at my doorstep just in time. Beyond that, your research in Positive Design has been a constant source of inspiration — not just for this dissertation, but for how I see the role of design in the world.

Pieter, thank you for being an advisor, and for taking on the role of promotor during the final stretch. You listened closely, asked the right questions, and offered thoughtful guidance. Your calm presence and clear thinking brought a sense of direction and reassurance exactly when it was needed most.

To the **DIOPD team**, Siyuan, Willem, Derek, Michelle, Steffen, Alev, Pelin, Haian, Steven, Anna, and Pieter, it was a real pleasure to be part of your orbit during this season of life. I was inspired by our conversations, and the depth of your work on Positive Design. I always felt I could reach out when questions came up, and that sense of openness and support meant a lot. **Willem**, I am really

glad we connected when we did. You were always quick to help, generous with your insights, and persuasive enough to sneak us into the digital wellbeing lunch at CHI - which ended up having a big impact on my work. **Alev**, thank you for fielding my thesis-submission questions, even while you were busy preparing for your own PhD defence. **Siyuan**, from our very first meeting, there was an instant connection. Thank you for listening, for the emotional support, for the personal conversations — and of course, for those gloriously non-sweet Chinese treats you shared with me.

To the people at **StudioLab**: thank you for welcoming me into your world of ideas and possibility. Although my stay in Delft was brief, I immediately felt at home. Stepping into the lab each morning gave me a real sense of belonging, like I was exactly where I needed to be. That feeling extended beyond StudioLab, to everyone walking the halls of IDE: professors, researchers, designers, students — thank you for helping me reconnect with what drew me to design in the first place: its power to ask big questions, and imagine better futures. Special thanks to **Susanne** and **Berit** for the thoughtful conversations. Coming back to academia from industry, it meant a lot to share the experience with others who understood both the challenges and the excitement of that shift.

To the many individuals at the **IDE Graduate School**: thank you for the behind-the-scenes support and steady guidance that kept everything on track. **Sylvia**, thank you for trusting both the timeline of my PhD project and my commitment to following through. And **Jeff**, thank you for approaching my questions about data privacy with such patience, clarity, and insight.

To the graduate students who contributed to my research, I am immensely grateful. **Michael**, it was a privilege to be part of your Master's project. Your drive to use design for positive change was inspiring. I've appreciated your thoughtfulness, openness, and the depth of your reflections. Your challenge was to design for two of the trickier positive activities in my thesis, and you approached it with creativity and heart. To the **Interaction Design Master's students**: thank you for your imaginative ideas and original design concepts. They built the foundation for one of the key papers in my thesis.

This PhD would not have been possible without the financial and personal support of my former employer, brands4friends, and the great people I had the chance to work with. **Seppo**, I still remember the moment I first mentioned the idea of starting a PhD. Without hesitation, you told me to go for it, and continued to have my back every step of the way, even though it meant seeing less of me on team projects. Your support was never just professional; it came from a place of genuine care. I can't thank you enough. That said, your greatest legacy is probably the word *globalgalaktisch* — which, to this day, earns me a surprising level of street cred wherever I bring it. **Robert,** you stood by me

throughout this PhD with a kind of grounded positivity that, I know for a fact, isn't fueled by industrialized sugar. Thank you for your curiosity, optimism, and genuine interest — not just in the research, but also in the person behind it. **Krischan**, thank you for the absurd number of hours you spent sorting out the collaboration agreement, and easing my relationship with the law. You never lost your patience. I appreciated not just your sharp legal mind, but also your dry wit and light-hearted spirit — they made our many lunches and park walks genuinely fun. **Johanna**, thank you for your creative input on the design of several figures and the layout of the design tool. **Alexander**, thanks for helping make this thesis look good. I know you gave it your all, because you understood how much it meant to me. Thank you for letting me in, and knowing me so well.

To my **friends** — thank you for hearing me out, lifting me up, and making me laugh, always. Sabrina, Elze, Jule, Nina, Sigrid, Sonja: you are the most amazing crew. We *are* better together. The world needs more women like you. **Sabrina**, you are always there for me. Thank you for grounding me, holding space for deep reflection, and bringing refreshingly different perspectives. **Pablo**, thanks for your enthusiasm and belief in me.

To my parents — thank you for everything that came long before this thesis. I dedicate this work to you, because without your support and belief in me, none of this would have ever happened. You gave me roots and wings — down-to-earthness and freedom, in just the right amounts. Thank you for letting me roam the forests, for never trying to shape me into anything I wasn't, and for always trusting my choices. **Mama**, you are the kindest, warmest, and strongest person I know. I started this PhD because of you. You encouraged me to start over — because you sensed I needed something else in my life, long before I could see it myself. Thank you for reminding me to listen to my inner voice, and for being the perfect prototype of a good human being. **Papa**, thank you for gifting me your quirky sense of humor, your uncivilized heart, and your unique way of seeing the world. You taught me to think for myself and to follow my own path. Thank you for your unconventional ways, your stubborn idealism, and your refusal to settle for anything dull or hollow. You two are, without question, the coolest people I've ever met. I carry you with me, always. I love you forever.

Eva, my twinny and honorary supervisor of my heart. We tackled this PhD the way we tackle everything in life: together. You helped refine my thinking, sharpen my writing, and slice through complexity with laser-like precision. A true master of PhD memes, you kept me grounded with the perfect mix of honesty and humor. Your uncanny ability to get straight to the heart of my half-formed thoughts can only be explained by twin telepathy, fine-tuned over a lifetime. Without a doubt, you are one of the intellectual and emotional co-authors of

this work. Your intelligence, wit, and no-nonsense clarity have been invaluable to this thesis, just as they are in my life.

To my Canadian in-law family, thank you for your genuine interest in both my work and my wellbeing. **Judy** and **Dennis**, you made these last two writing summers feel less like academic confinement and more like a retreat. You painted the office, brought amazing lunches, scheduled spa days, and made sure I was well-fed with generously North-American sized ice cream when the writing got stuck. Most of all, thank you for caring for our daughter with so much love — from backyard science missions to wild garden adventures. You gave her a world to explore and me the peace of mind to write. Thank you for being the kind of second family that makes everything lighter and full of joy.

To **Matt**, my partner in life and personal ICT support. Some call you the "coding monk" - and they're not wrong. You are my calm in the chaos, always debugging both my technical questions and life in general. We met just after I started this PhD, and the timing couldn't have been better. Your creative mind, insightful thinking, and technical mastery came in very handy — and undeniably shaped this project at its core. From designing a sensitizing booklet, to programming a custom laddering analysis software, to developing a design tool, plus all the LaTeX wizardry — you were involved at every stage. Without a doubt, this thesis carries your intellectual and creative imprint. And thank you — for building more than tools with me: a life I love and deeply cherish.

To **my daughter**, you arrived in the midst of my PhD, and turned my world upside down in the most beautiful way. You remind me every day of what truly matters. I hope that by the time you reach for whatever digital technology the future holds, it'll be designed with your wellbeing at heart.

To **Amber**, thank you for being such a kind and joyful presence in our daughter's life. You stepped in during the busiest moments, making sure she was cared for, giggling, and blissfully unaware of the PhD stress swirling in the background.

To **myself** — you did it. Breathe. Don't rush. Savor. Let this experience leave its mark on you, like you hoped it would.

About the Author

Lisa Wiese received her Master's degree in Psychology from the Otto-Friedrich-University in Bamberg in 2008, with a focus on Multivariate Statistics, Cognitive Systems, and Human-Computer Interaction. For her graduation project, she conducted research at the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig, using neuroscientific methods to study social-cognitive development in infants.

In 2018, Lisa began her PhD in Human-Computer Interaction (part-time) at the Delft Institute of Positive Design. Partially funded by brands4friends, an eBay subsidiary, her research explored how everyday technology can support lasting wellbeing by encouraging positive activities. She presented her work at major conferences such as Designing Interactive Systems (DIS) and the Design Research Society (DRS). Her DRS talk was later featured in a SIGWELL seminar on design for wellbeing. Her work has been published in peer-reviewed journals, including *Multimodal Technologies and Interaction (MTI)*.

Alongside her academic path, Lisa has built more than 17 years of industry experience in UX research and design. She has held senior roles at brands4friends, eBay (as a contractor), and a Berlin-based UX research consultancy. In these roles, she has translated insights from her PhD into practical methods for measuring digital wellbeing and meaningful attention in real-world projects. She regularly shares her work at industry events, on technology blogs, and in professional webinars. Her goal is to bridge wellbeing theory and design practice — enabling healthier, more meaningful interactions between people and technology.

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