Cultivating Mindful Digital Habits

Manya Krishnaswamy | Carnegie Mellon University | 2018

Cultivating Mindful Digital Habits

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A thesis submitted to the School of Design, Carnegie Mellon University for the degree of Master of Design in Design for Interactions 2018

I would like to thank my parents for always supporting my dreams.

I would like to thank my friends, both near and far, for the laughter and inspiration.

Finally, I would like to thank Stacie for believing in my work (and me), supporting me every step of the way and helping me find clarity in times of doubt.

Contents

Abstract

The technologies that support almost every aspect of our daily lives are increasingly being crafted to attract our attention and keep us hooked. Design tactics, such as endless newsfeeds that keep us scrolling, notifications that intercept our attention, and the ease of weaving between digital activities, result in reduced control over how we channel our attention, an increase in stress levels and a widening gap between our actions and intentions.

Despite more people becoming increasingly aware of how their behavior is influenced by technology and wanting to take control back, few tools exist to support them in building better digital habits that bolster conscious consumption of technology in the long run. Current tools designed to help people combat distraction tend to focus on quick fixes that serve near term goals and lack customization to suit individuals' needs.

This research project takes a research through design approach to understand the challenges people face with digital distractions, develop a series of design interventions that take different approaches to addressing the challenges, and evaluating the interventions to develop a set of design principles for cultivating mindful digital habits. The principles can be applied to digital products and services to fight distraction, empower users with greater agency over their technology consumption, and create greater alignment between their actions and intentions.

Introduction

Background

We live in an age of distraction. The technologies that support almost every aspect of our daily lives are increasingly being crafted to attract our attention and keep us hooked. In such cases, the goal of design becomes increasing the number of eyeballs, amount of time spent, and number of clicks, likes, and other such revenue-generating metrics, rather than improving the quality of the experience or value added to people's lives (Krishna, 2015, p55). We see the manifestation of these goals in the endless news feeds that keep us scrolling, notifications that intercept our attention, and the ease with which we can seamlessly weave between digital activities

For the most part, products and services of the digital world provide us with tremendous value. However, they become increasingly concerning when what we pay attention to is driven by the technologies we use, rather than by our own intentions. These are the moments of friction we face with technology that widen the gap between our intentions (what we want to do) and actions (things we end up doing because they are the easiest, most convenient or best supported by technologies used). Think of the all times you sit down to work, but receive an email or message that ends up derailing your plans or when you pick up your phone to quickly reply to one urgent email but end up spending the next hour reading and replying to various other emails.

There are two approaches we can take to address the issues above. First, we can demand that the products and services we use are designed to be mindful of our goals; and prioritized over business goals. Second, we can develop our digital habits so that we are conscious about the ways we engage with technology products and services. The latter involves understanding that while the technologies we use provide us with value, they may not always align with our personal values and goals. It also requires us to proactively cultivate our habits; setting clear intentions every time we open an app, recognizing when the gap between our actions and intentions widen, and channeling our attention in a deliberate manner (Levy, 2016).

While both approaches can steer us towards a healthier relationship with technology, honing our digital habits can be especially powerful as they are independent of any particular product or service (and therefore the priorities of their makers) and can be tailored to our unique needs. In his book, Mindful Tech, David Levy frames the use of computers as a craft; a craft we need to hone over time with intention, care, and skill (Levy, 2016). By adopting this mindset, he argues that it can improve the quality of our engagement with technology.

Problem & Opportunity

Recently, we have seen a surge in awareness and a collective acknowledgement of the issues arising from technologies built in service of the attention economy. Apple's investors recently called for a rethink of the company's products to protect its youngest group of users (Chokshi, 2018, Rosenstein & Sheehan, 2018). The Time Well Spent movement spearheaded by Tristan Harris, former Design Ethicist at Google, is gaining traction amongst the masses as he exposes the profound influence software has on our attention (TimeWellSpent, 2017). Manoush Zomorodi's Bored and Brilliant Challenge brought together 20,000 people over a week to unplug, pause and observe the effects technology had on them (Katz, 2017).

However, despite more people becoming increasingly aware of how their behavior is influenced by technology and wanting to take control back, few tools exist to support them in building better digital habits that bolster conscious consumption of technology in the long run.

Current tools designed to help people combat distraction tend to focus on quick-fixes that serve near term goals and lack customization to suit individuals' needs.

> How can technologies be designed to cultivate mindful digital habits and empower users with greater control over their attention?

Scope

This research project took a ground-up approach to addressing the challenges perpetuated by the attention economy by focusing on designing tools that build better digital habits rather than redesigning existing products or services. In the short term, these tools can provide a more immediate remedy to combat technology-fueled distractions and provide the flexibility to ensure digital experiences suit the unique needs of individuals. In the long run, these tools can build habits and mindsets that are easily adapted to emerging technologies and can continue to safeguard users from distractions on newer platforms.

The project focused on established technology devices, such as smartphones and laptops. Well-established technologies are already deeply embedded in people's daily lives. Interventions that target these technologies, as a result, have the highest potential for impact. It was also important to address challenges regarding attention and agency with existing technologies as it laid the foundation for addressing similar challenges in future technologies.

While the design interventions that came out of this project were intended for a certain time frame (near-term implementation of 1-3 years) in terms of technical feasibility, the principles were crafted to remain relevant for years to come.

Significance

The loss of control in how our attention is channeled, due to digital distractions, takes a toll on different facets of our lives–social interactions, productivity and beyond.

According to Sherry Turkle, professor and researcher at MIT, conversations are “the most human thing we do” (Davis, 2015). However, many forms of digital communication are replacing intimate, face-to-face interactions with numerous digital alternatives that provide instant and bite-sized means of communication (Davis, 2015). In her book, Reclaiming Conversation: The Power of Talk in a Digital Age, Turkle dives deeper into this loss of quality social interactions as a result of excessive technology use (Turkle, 2015).

Furthermore, every time we check a notification on our smartphones in the another activity, we are multitasking. Gloria Mark’s research indicates that multitasking leads to increased stress levels and perceived workloads (Mark, 2008). When we switch tasks, we incur switch costs–the additional time needed to re-focus on the new task (“Multitasking: Switching costs”, 2006). Not only do switch costs increase the time taken to complete tasks, research suggests that they can even create mental blocks that “can cost as much as 40 percent of someone’s productive time” (“Multitasking: Switching costs”, 2006).

Finally, our smartphones make it easy for us to be constantly connected. As a result, we end up filling all the little pockets of time in our days with email, messaging, social media, entertainment, etc. In Bored And Brilliant, Manoush Zomorodi talks about what we lose when we prevent our minds from wandering and stop ourselves from being bored. When we allow our minds to wander, she writes, “we’re tapping into a vast trove of memories, imagining future possibilities, dissecting our interactions with other people, and reflecting on who we are” (Zomorodi, 2017). Mind-wandering is a vital cognitive activity that helps us develop a sense of self, make sense of ideas, and empathize with others (Zomorodi, 2017).

This research project is intended to provide insight into designing products and services that help users cope with information overload, empower users with agency over their technology consumption, and create greater alignment between users’ technology-use and their values.

Influential Projects

The following literature and artifacts provided great insight into the existing work related to distraction and the attention economy. Not only did they provide a foundation to build onto, but they also helped frame my work within a broader landscape.

Literature Reviews

The following literature helped me identify potential design approaches that proved to be crucial when transitioning from exploratory research to developing design interventions.

Digital Habits

Mindful Tech; David M. Levy

This book consists of a series of exercises designed to help users observe their existing digital practices (e.g. use of email), reflect on their findings, and think of ways to improve them. It is a consolidation of the content Levy teaches through various workshops and a class at University of Washington. The book also includes a number of anecdotes and short passages from his students journals, revealing their own observations and learnings from the exercises.

Levy writes about the idea of looking at our interactions with technology as a craft, which was particularly relevant to this study. While coming up with design concepts, I considered how the experience of using can instill the notion of technology-use as a craft through deliberate engagement, conscious improvement and care.

The Cost of Interrupted Work: More Speed and Stress; Mark et al.

This study was instrumental in understanding the impact of multitasking on users' stress levels and perceived workload.

"People in interrupted conditions experienced a higher workload, more stress, higher frustration, more time pressure, and effort."
–Mark et al.

When we multitask, our brain shifts its allocation of resources from one task to another; it does not process multiple things at once as the term “multitasking” might suggest. The paper frames digital interruptions and distractions as forms of multitasking that influence the allocation of cognitive resources in the same way.

The broader framing helped me identify opportunities to reduce distractions and increase focus while engaging in digital activities. This study was also crucial in contextualizing my work and making the case for the need to protect people’s attention.

Switch: Changing Things When Change Is Hard; Chip Heath and Dan Heath

While the book, in general, provided a great framework for changing behavior, the chapter on building habits was especially applicable to my research. The authors discuss the influence of environments on people’s behavior and the power of action triggers. Action triggers help people “pass control of their behavior to their environment... (and) protect goals from tempting distractions, bad habits, or competing goals.” (Heath & Heath, 2010, p210). The book shaped my thinking on the role of environments on people’s technology use and the triggers embedded in the environments that were at play. This book was also a critical resource when crafting action triggers in my design interventions.

Design Directions

Design Frictions for Mindful Interactions: The Case for Microboundaries; Cox et al.

The authors describe microboundaries as moments of friction that prompt users to shift from System 1 (automatic, default mode of thinking) to System 2 (deliberate, rational mode of thinking) as well as a means to create alignment between actions and values.

My project draws on Cecchinato et al’s work on microboundaries as a means of bridging the action-intention gap, particularly when applied as a way of disrupting mindless interactions with technology. This paper also served as inspiration in considering opportunities for microboundaries as a way of setting intention. Key considerations when applying microboundaries to my studies included timing (finding appropriate moments for intervention), level of friction (consciousness required before proceeding with the task), and the goal (communicating the goal of the microboundary to users).

Engagement Through Embodiment: A Case For Mindful Interaction; Vincent van Rheden & Bart Hengeveld

This study explored various embodied interactions aimed at creating high levels of engagement and mindfulness while interacting with a kitchen blender. Understanding the

qualities of tangible interactions that promote meaningful interactions, such as its embodied nature and level of abstraction, allowed me to seek opportunities to apply them during ideation and design development. The goal of embodied interactions in my research was to increase users' awareness and mindfulness of interactions with their devices.

Attelia: Reducing User's Cognitive Load due to Interruptive Notifications on Smart Phones; Okoshi et al.

The study described in this paper aimed to increase engagement with notifications by analyzing smartphone data and delivering notifications at opportune moments when users' were open to interruptions–they called it a state of interruptability.

While the goal of this study differed from mine, it pushed me to explore how context awareness can be used to enhance a system's understanding of users' mindset and goals. As a result, context aware computing became a key design direction in this project and shaped many early concepts involving contextual data, devices working together, and reactive systems that adapted to users needs in real-time.

The Coming of Age of Calm Technology; Mark Weiser & John Seely Brown

Weiser and Brown argue for the need for more technology to communicate through peripheral attention, rather than central attention, in order to reduce information overload. A piece of technology is calm when it lives in the background of its users' lives unless attention is required. The central concept of calm technology was useful to my study when I developed ideas for combatting information overload and while designing systems that provide users with real-time, peripheral feedback as they develop their digital habits.

Slow Technology–Designing for Reflection; Lars Hallnäs & Johan Redström

Hallnas and Redstrom put forth a design philosophy that invites reflection amongst people as they use technology; a contrast to the efficiency-driven approach that many technologies take. By inciting reflection on the inner workings of a piece of technology, users unfold multiple layers of meaning over time as they get deeper into its use; learning how it works, why it works that way and understanding the impact of using it.

Since reflection is a key component of mindfulness, this paper served as a starting point for weaving reflection into the core experience of my design interventions. It prompted me to consciously think about the moments or interactions that afford reflection as I developed the design interventions.

Artifact Reviews

The following section comprises existing products, services, and programs that intend to cultivate mindful digital habits and provide users with greater control over their attention. Surveying existing solutions allowed me to identify opportunity areas where current artifacts fall short, learn from their strengths and weaknesses and articulate the value of my approach.

Access

Freedom

Freedom is a browser plugin and mobile app that enables people to prohibit themselves from accessing specific websites during certain hours. It removes distractions by blocking frequently accessed and distracting websites, like Facebook or YouTube. Once access settings are set, the only way users can unblock websites is by emailing the company. This is intended to prevent desperate attempts at accessing websites.

Both the app and plugin are easy to install and use, removing barriers to adoption. This solution seeks to constrain behavior rather than cultivate better ones–I focused on the latter.

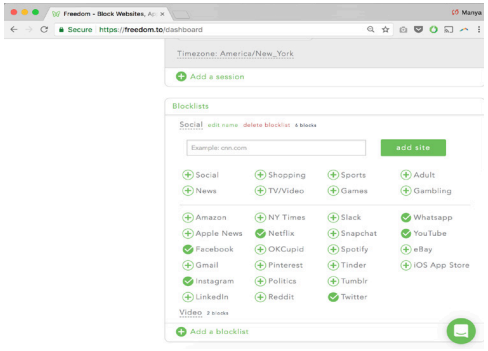


Figure 01. Freedom

DF YouTube

Distraction Free YouTube is a Chrome plugin that strategically eliminates video recommendations from the homepage and sidebar, as well as other major sources of distraction on the site that typically trigger continuous video consumption.

The settings options for DF YouTube make it incredibly easy for users to customize their YouTube experience by providing options to toggle eight key features, such as sidebar, trending, recommendations, related videos, comments, etc., on or off. Changes in settings are implemented immediately to help users quickly gauge whether the setting is desirable. As a result, I considered the ease of setup and clarity of communication in options during the ideation phase of my project.

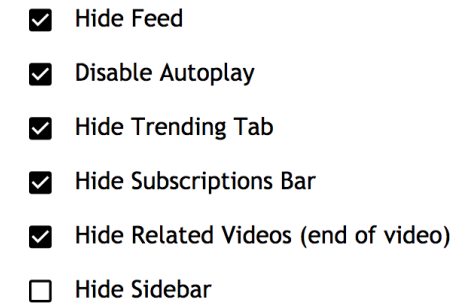


Figure 02. Distraction Free YouTube

Thrive

Thrive is a Android app by Samsung that strives to help people remove distractions on their smartphones. The app tracks users' smartphone activity and allows them to block apps, notifications, messages and calls. To give users piece of mind, the app enables them to create a "VIP list" of contacts whose calls and messages will always break through

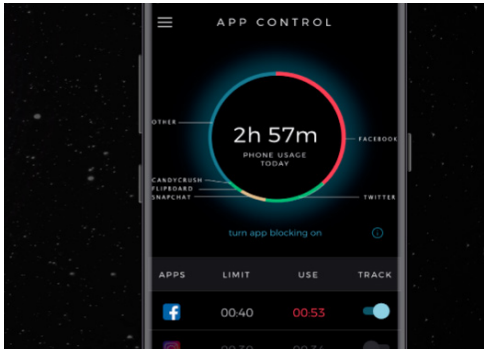


Figure 03. Thrive

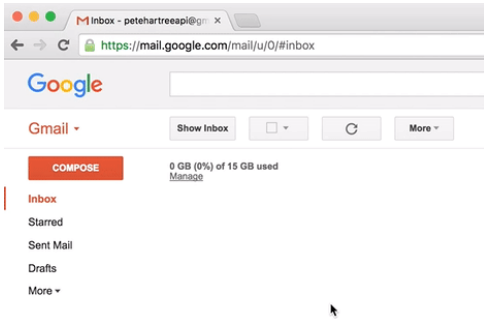


Figure 04. Inbox When Ready

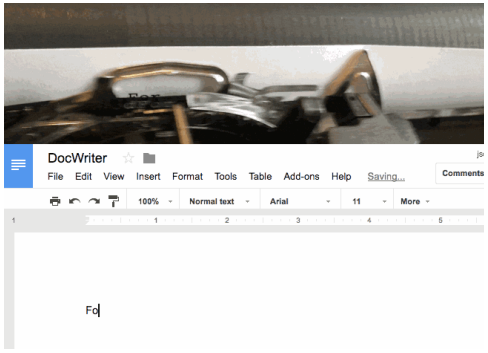


Figure 05. DocWriter

established blocks. Additionally, an auto-reply option can be set-up to notify people that the user is busy or in focus mode.

The fact that this app is endorsed by Samsung is acknowledgement from key technology players that digital distractions are a real issue that needs to be dealt with. It also serves as a starting point for establishing new social norms around responsiveness on messaging platforms.

Inbox When Ready

Inbox When Ready is a browser plugin for Gmail that refreshes users' inbox in specified time intervals (e.g. every 30 minutes). While the tool blocks out the entire inbox, it still allows people to search for specific emails if necessary. It is designed to reduce the overall time spent on email and frequency of checking for new emails; therefore reducing the chances of getting distracted by incoming mail. The overarching goal is to give people more time to dive deep into their work without being distracted by incoming emails.

Like many plugins, this tool is easy to adopt and enables some customization–primarily the setting for the time interval between inbox refreshes. It is a great example of an intervention that, not only reduces immediate triggers for distraction, but also strives to cultivate mindful email habits over time in a well-defined context.

Constrained Action

DocWriter

DocWriter is an interesting project by writer and programmer, James Sommers, that is designed to help writers stay focused and push through their drafts without distraction. It consists of a typewriter connected to Google Docs. The catch is that writers cannot delete anything when using the typewriter. They can, however, edit their files on Google Docs using a regular keyboard once they are done.

This project is a unique blend of old and new technology that limits functionality to help keep writers on task. The project's primary goal is to encourage writers to complete drafts, and channel attention. I drew on limiting the range of actions supported by tools and eliminating sources of distraction during the design development stage of my project.

Light Phone

The Light Phone is a simplified smartphone with limited functionality (an anti-smartphone, if you will) designed to help people disconnect from technology. While typical smartphones are designed to provide a range of apps and functionality, the Light Phone strives to

accomplish the opposite. The phone works with users' full-featured smartphones to deliver messages and calls–that's it. It is well-designed and intentionally crafted to feel minimal and induce a sense of calm.

The phone's intention of limiting functionality is powerful and is one that I have incorporated into concepts I developed through my project.

Time & Activity Management

Moment

Moment is a mobile app that tracks smartphone activity, such as number of pickups, amount of activated screen time, and time spent on apps. It is designed to bring people a greater awareness of their smartphone behavior and, as a result, find ways to improve it. It displays daily, weekly, and monthly trends in smartphone use. However, the app provides little support in making the shift from awareness to behavior change.

Tracking apps, like Moment, are a great way to create awareness of users' smartphone habits. However, insights from the app's data are not actionable and do not sufficiently support behavior change beyond awareness-creation–although it is an important first step. My project differs from moment in that it aims to create awareness, as well as identify concrete steps towards subsequent behavior changes. In addition to this, I focus on identifying ways to improve the quality of people's engagement with technology (rather than time spent) in order to align digital habits with users' intentions.

Intent

Intent is a browser plugin that tracks web activity, such as time spent on websites. Unlike plugins that block websites entirely, it goes a step further by allowing users to set goals on how much time they want to spend on certain apps and alerts them when they exceed daily goals. The plug-in is successful in giving users the ability to customize their goals for different websites, visualize the data, and introduce microboundaries when they attempt to access a site for which they have already exceeded their daily limit.

The solution is relevant as it helped me explore different ways to evolve engagement with potentially distracting sources. In this case, the plugin uses time spent and number of visits for a website as a means of limiting exposure to distractions.

Nomu

Nomu is part of a larger exhibition piece, called Unread Messages, designed to encourage people to think critically about the influence of technology in their lives. It helps people plan their internet activity using colored wooden blocks; each block representing a chunk of

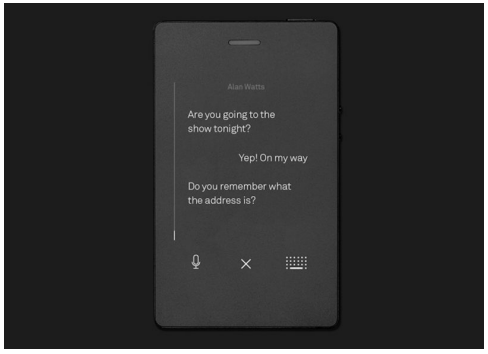


Figure 06. Light Phone

Figure 07. Moment

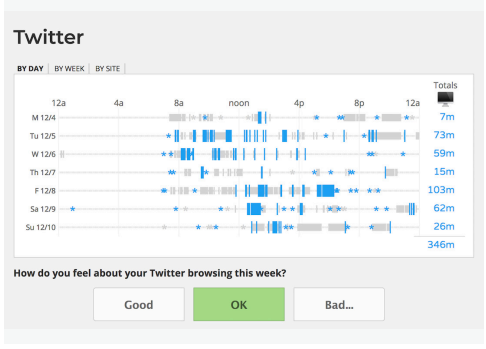


Figure 08. Intent

Figure 09. Nomu

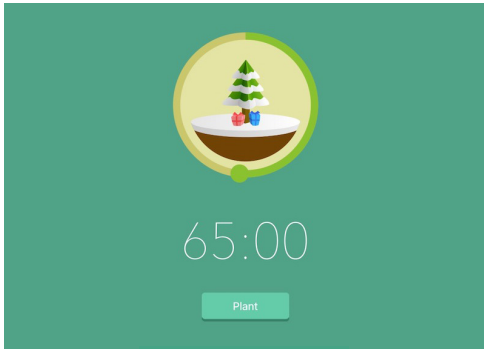


Figure 10. ForestApp

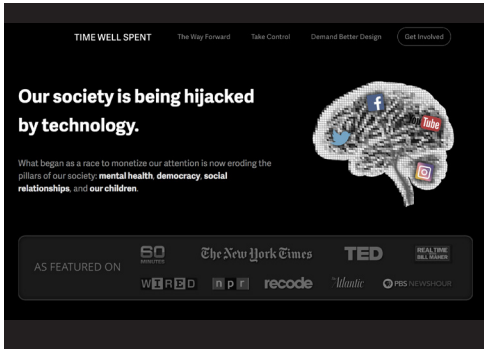


Figure 11. TimeWellSpent

time and each color representing a type of activity. For each type of activity, websites that are seen as potential distractions for the planned tasks are filtered out. The purpose is to give people a greater sense of agency over their internet browsing experience.

The piece served as impetus to explore tangible interactions during early stages of ideation in my project because of the deep engagement it encourages and its physical visualization of users' goals. There is something pleasing about the presence of a physical form, especially when the intention is to direct attention away from screens.

ForestApp

ForestApp is based on the pomodoro technique for productivity that asks people to break down their time into intervals of 25 minutes plus a 5 minute break. The app essentially serves as a timer and with use, keeps track of the user's "focus hours". Focus hours can be used to plant seeds in a forest within the app that grow as more focus hours are accumulated.

The app's ability to help people get into the mindset for focus was something that I wanted to mirror in my design interventions. Examining components of ForestApp, as well as the pomodoro technique, gave me a starting point for identifying factors affecting focus and how to prompt them. For example, by asking for 25-minute intervals, the app lowers the resistance to focus on the task at hand and put aside distractions temporarily.

Awareness

TimeWellSpent

It would not be possible to talk about how technology is affecting our habits without mentioning Tristan Harris, Co-Founder of the Time Well Spent initiative. His background as a former Design Ethicist at Google makes him well-poised to speak about how products are carefully crafted to take advantage of our cognitive susceptibilities (both visibly and invisibly).

He uses the Time Well Spent initiative to house a number of activities, such as TED talks on technology-fueled distraction, visions for alternative solutions, showcasing apps that help protect users from distraction and calls to action for members of the public to demand technologies that embody more human values.

Harris' work has been pivotal in exposing me to the challenges around technology and attention as well as the widespread impact it has on people's lives. His work has served as inspiration to undertake this project in the first place.

Mindfulness

Bored and Brilliant Challenge

The Bored and Brilliant Challenge is a component of the Note To Self podcast by WNYC. Over the course of six days, the podcast host, Manoush Zomorodi, challenged her listeners to observe, reflect and redefine their relationships with their smartphones. The challenges varied from keeping their phones in their backpacks instead of in their hands to deleting the app that drains most of their time. The podcasts are engaging and create a sense of community comprised of many other people facing similar challenges with their smartphone. The Note To Self team also collaborated with Moment (previously mentioned) to make the challenge available to app users.

The Bored and Brilliant Challenge aligns closely with the goals of my thesis. The challenge is a great start to building awareness of digital habits. With my thesis, I built onto this work by looking into how people can apply the reflective practices introduced in the podcasts in everyday life as people use their devices. It's also important to note, that while this challenge strives to create reflective practices that reduce screen time–which is extremely valuable–I am investigating ways of applying those practices to their use of the devices too.

Figure 12. Bored and Brilliant Challenge

Headspace

Headspace is a meditation app that offers a range of guided meditation sessions for people of all levels of experience. The app also offers special meditation sessions for dealing with stress and encouraging mindful technology use. Each session encourages the awareness of thoughts, a focus on breathing, and experiencing each moment. While all meditation sessions on the app provide similar prompts, the ones that focus on technology use are designed to provide users' with short mental breaks that refresh their minds and cultivate in-the-moment awareness of thoughts.

Headspace focuses on cultivating mindfulness and tends to promote mindfulness as a separate activity from technology use. However, my project proposes a fusion of mindfulness practices and technology use for more conscious consumption of technology. Over the course of my project, meditation sessions offered by Headspace have been useful to identify mindfulness techniques that can be translated to the digital realm, such as awareness of actions and setting intentions.

Figure 13. Headspace

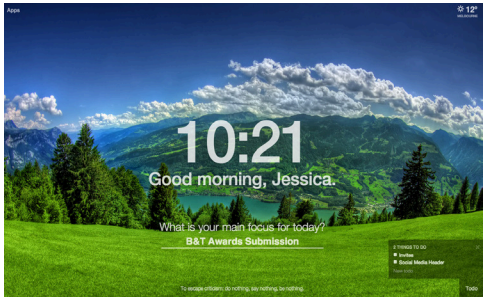


Figure 14. Momentum

Momentum

Every time users open a new tab, the Momentum browser plugin provides people with a captivating photograph as well as space for a micro to-do list. It is designed to remind people of their intention for the day as they browse the web as it takes the space usually dedicated to frequently visited pages and bookmarks. While it is a simple intervention, the photograph can help break or delay automatic reflexes that cause people to mindlessly browse. Seeing the success of Momentum–based on its widespread adoption–I used Momentum as a benchmark for a minimally intrusive intervention that fit easily into users natural workflow on the web.

Competitive Landscape

Key themes that emerged from literature reviews were intentionality, feedback, flexibility, control and social practices. The artifacts above were then analyzed through the lens of these themes to understand where existing efforts were focused and successful (shown on the matrix as clusters of interventions). In turn, this helped identify areas that were underserved and uncover compelling opportunities for further research and future interventions (empty spaces on the matrix).

In the upper left quadrant, artifacts tended to have narrow functionality and focused on developing specific habits. For example, DocWriter is a writing tool that constrains its functionality to provide a singular point of focus that, over time, shapes the way people write and think.

Artifacts in the bottom two quadrants, for the most part, provided varying levels of personalization and primarily fostered focus by blocking access to information. The artifacts here were mostly browser plugins that performed various functions, such as blocking access to websites or visualizing time spent on websites or apps.

Finally, the artifacts that provided a high level of customization and supported limited long term habit-building were typically observation and awareness exercises, such as those in Mindful Tech or the Bored and Brilliant Challenge. They were great starting points for someone looking to change their digital habits as they help users uncover opportunities for improvement. However, they provided limited support while making the behavior changes.

Through this exercise, I found that many existing artifacts focused on addressing immediate distractions and were limited in their flexibility to suit a variety of needs and contexts. There was an opportunity to explore tools for long term habit building that provided users greater flexibility and customization.

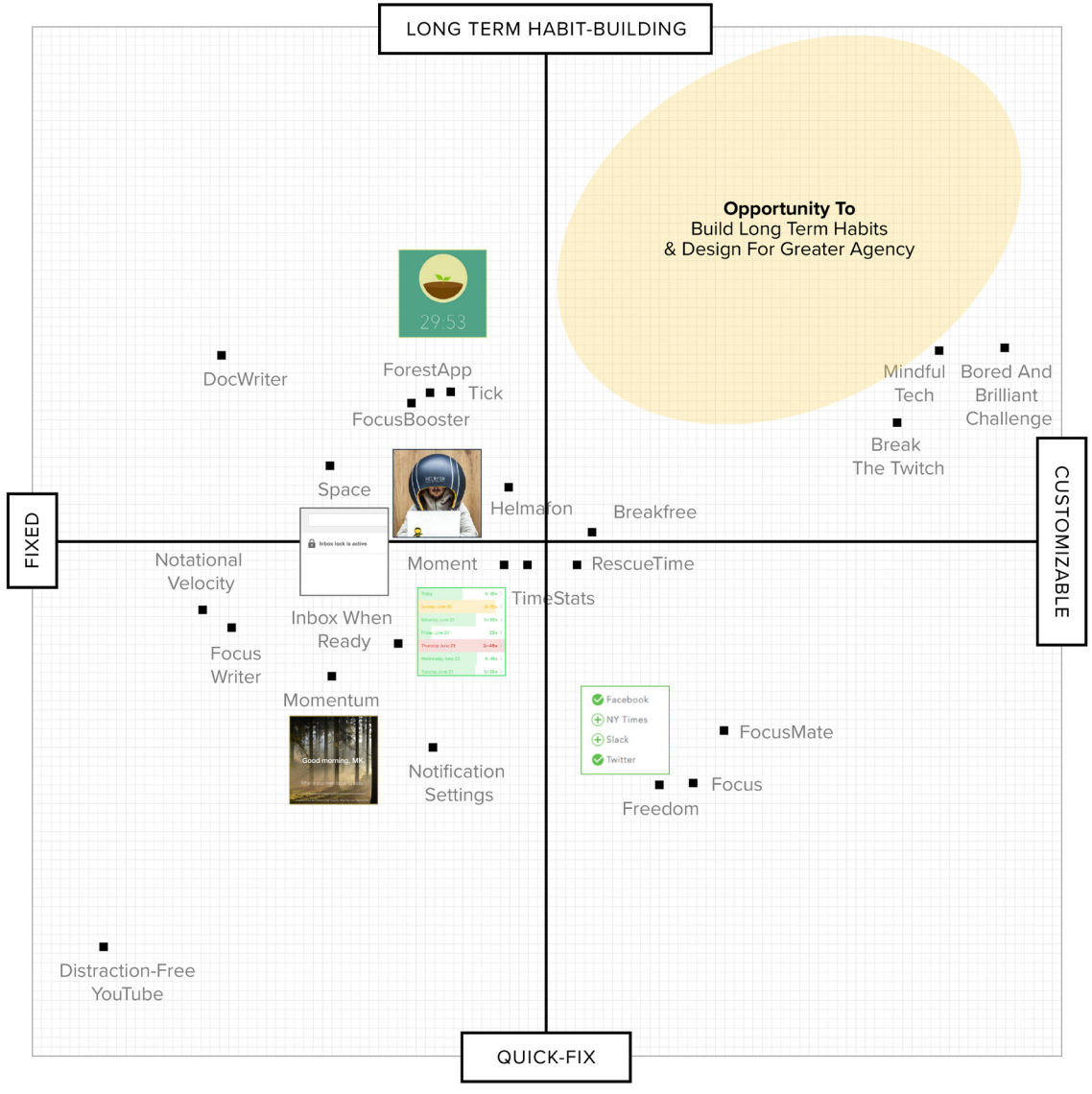


Figure 15. Competitive landscape matrix

Exploratory Research

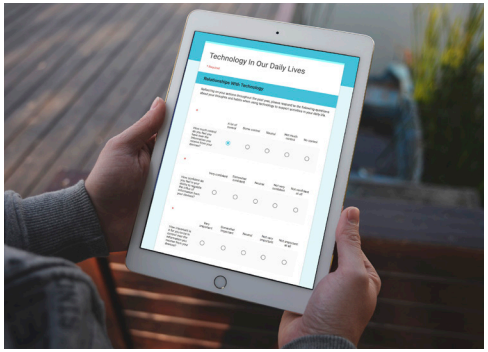


Figure 16. Survey

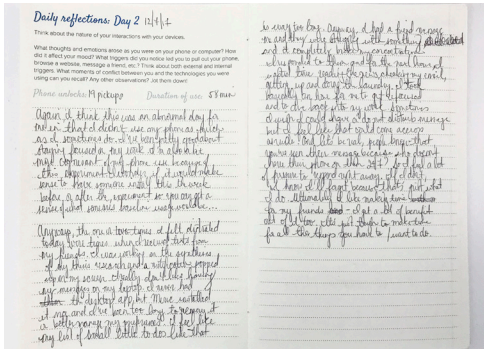


Figure 17. Diary

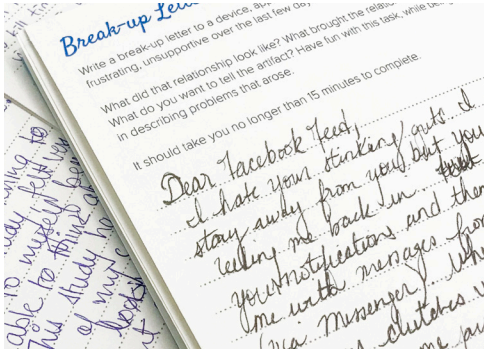


Figure 18. Break-up letter

The goal for exploratory research was to understand people's current digital habits and points of friction between users and their devices, especially mismatches between users' goals and the goals supported by technology. Discoveries from user research were used to hone in on strategic design opportunities for cultivating mindful digital habits.

Methodology

Research methods, such as surveys, diary studies and break-up letters were chosen to balance depth and breadth of data collection. The survey allowed for a broad audience and captured both qualitative and quantitative data, while the diary study and break-up letter captured in-depth information from a handful of participants. Together, the varied methods enabled me to triangulate data from different sources to uncover patterns and common themes that were subsequently used to support the ideation phase.

Survey

The survey received responses from 100 participants, reporting their perceived control over the influx of information from their devices, how technology contributed to their calm and stress, satisfaction with their current digital habits and share moments of friction or conflict they faced when using their devices.

Diary Study

The 3-day diary study probed four participants to observe their daily phone usage; making note of triggers that led to phone use, effects on mood and moments of friction or conflicting goals. At the end of the study, participants were asked to reflect on their observations. During the study, participants were also asked to install a mobile app that tracks phone unlocks and duration of use. As part of their daily reflections, they recorded data from the app.

Break-up Letter

Following the diary study, participants were asked to write a break-up letter to a device, app or feature that they found particularly stressful, frustrating or unsupportive. More specifically, they were asked to describe the relationship and its challenges and reasons for ending it.

Discoveries

Control Over Technology

Survey

Insights from the survey were used to compare participant responses to the importance of having control over, perceived control over and confidence in ability to control inflow of information on devices. The survey also helped uncover insights into the challenges that prevented people from feeling in control.

Importance & Perception

Almost all of the survey participants stated that it was ‘very’ or ‘somewhat’ important for them to be in control of the inflow of information to their devices. However, 35% stated they were either ‘neutral’ or were ‘not very’ confident. The most significant gap lies in the difference between the number of people that stated it was ‘very important’ for them to have control (54%) and the number of people that stated they have ‘a lot’ of control (14%).

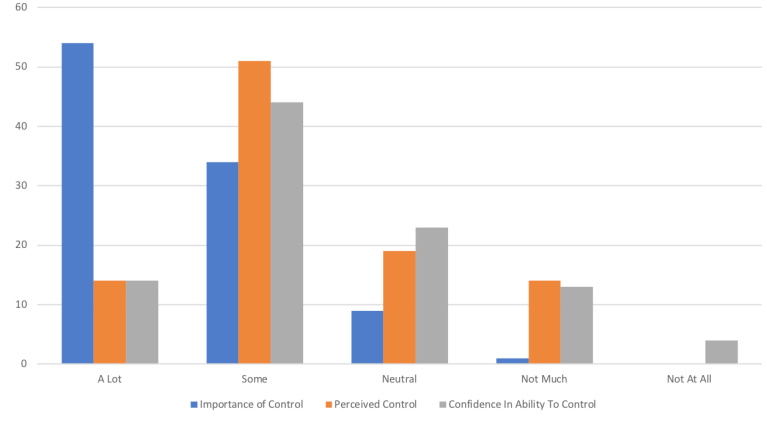


Figure 19. Importance and perception of control

Challenges

- Prioritizing Information: People wanted to be able to prioritize content so that they could get to the information they deemed important quickly, be it updates on social platforms, news, or search engine results. They felt that currently almost all information is given the same level of importance.

"Every e-mail and text is treated like an ANSWER-ME-NOW-EMERGENCY."

–Survey Participant

- Privacy: People wanted greater transparency on how their personal information is used and more power to select what personal information is shared than is currently available.
- Time Spent "Plugged-In": A handful of people wanted more control over their time spent on devices. They acknowledged a habit of checking their phones frequently and wished they were not as tethered to their devices.
- Notifications: Notifications were a key source of distraction that created a sense of unnecessary urgency. Many people stated they were easily distracted and wanted more control over how and when information was communicated to them.

Distractions


Diary Study


Break-up Letter

Across the studies, certain activities involving media devices caused participants to express dissatisfaction with their use of time and attention. The activities involved mismatched goals, loss of control or resulting negative emotions. Identifying sources of distraction and the context in which they occur paved the way for identifying opportunities for intervention during the ideation phase.

Triggers, Scenarios & Emotions

The following are the most frequently cited triggers of distraction:

- Social media news feeds that provide access to endless amount of new content. Participants shared the scenario of checking Instagram in bed soon after waking up as a result of updates received from the app. They noted that doing so affected their mood and made mornings less peaceful.

- Messages from communication tools that intercept users' attention from other activities. An example from the diary study talked about how incoming messages during social occasions diverted the participant's attention to their phone even though the information was not urgent or important. There was also a sense of guilt of not responding immediately because the other person might feel bad.
- YouTube, Netflix and other video streaming services that provide access to endless content and enable users to seamlessly transition from one video to the next in an attempt to captivate their attention for longer. One participant shared an instance where they received a cat video from a friend in the middle of work that led them to spending the next 30 minutes watching a number of other cat videos. The time spent watching videos left the participant feeling anxious about procrastinating on work.
- Clickbait headlines that are written to peak users' curiosity and drive click-throughs to articles. An example given in the diary study shared how the participant would often stay up late in the night as a result of reading articles simply because of the ease with which the articles grabbed the participant's attention.

Calm & Stress Contributors

The following are attributes or features of frequently used technologies that create calm or stress amongst their users.

Calming

- Ability to listen to music
- Not looking at a screen
- Tracking to-do items
- Communicating with friends and family
- Access to a vast source of information

Stressful Factors

- Lack Of Boundaries: The erosion of boundaries between work and personal life prevented people from disconnecting and taking refreshing breaks, and, as a result, added to their stress levels.
- Information Overload: The difficulty of trying to focus in the face of a constant stream of information left participants feeling overwhelmed.

- Social Expectations: The expectation of being responsive to messages and fear that they may need to be reached urgently caused participants to feel guilty and worry.

Digital Habits

Survey

The following information from participants helped understand the activities that are most frequently performed by users on their devices along with their level of consciousness and satisfaction with current digital habits.

Smartphone Activities

The types of activities most frequently performed:

- Communication–social media, IM, email, phone calls, etc.
- Entertainment–videos, movies, blogs, etc.
- Information query–searches, articles, etc.
- Transportation and Navigation–booking taxis, way-finding, etc.
- E-commerce–purchasing clothes, tickets, etc.

Cultivating Habits

On average, people were between ‘neutral’ and ‘somewhat’ satisfied with their digital habits with a sizable portion of participants (31%) being ‘somewhat’ or ‘very’ unsatisfied with their habits. Despite this, roughly 75% of participants only observed or made conscious effort to change to their digital habits occasionally. (Figure 20)

Desired Changes

Over 50% of responses indicated a desire to reduce time spent “plugged in” by getting better at regulating time spent on devices and social media apps, browsing the internet, and participating in mindless digital activities.

> “I don’t want to start and finish my day with scrolling down my Instagram and Facebook feed.”
>
> –Survey Participant

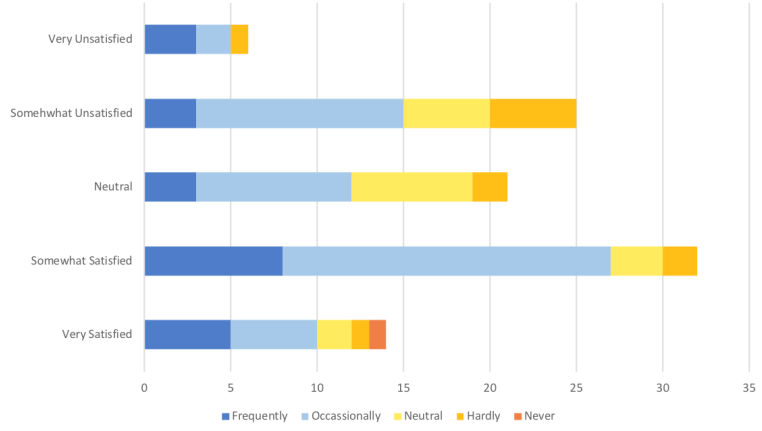


Figure 20. Satisfaction with digital habits

Summary Of Challenges

Survey

Diary Study

Break-up Letter

As a result of my initial inquiry, I defined the following key pain points that appeared to distract users and increase the gap between users' actions and intentions:

- Information Overload: The difficulty in distinguishing important and unimportant information given the amount of content people encounter.
- Ubiquity of Technology: The blurred boundaries between work and personal life due to being connected 24/7 and the ability to seamlessly shift from activity to activity.
- Social Expectations: The expectation of always being responsive and reachable, and practice of being constantly connected as a result.
- Mindless Interactions: The consumption of technology, often as a form of distraction or self-interruption, driven by habit rather than need.
- Overlooked Activities: The effect of screen time on the time spent on and quality of offline activities, such as face-to-face interactions, sleep, etc.

Figure 21. Built framework

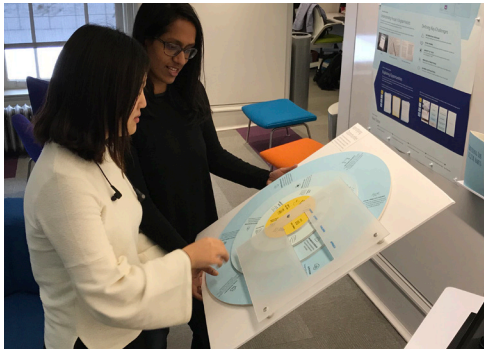


Figure 22. Framework in use

Framework For Ideation

The following framework was created to identify opportunities for design interventions for combating distractions in technology. It brings together activities and challenges that contribute to distraction, the contexts in which they occur, and potential design approaches that can be taken to address them. Options for contexts, activities and challenges were distilled from exploratory research while those for design approaches stemmed from insights gleaned through literature reviews of relevant work.

The framework was built as a tangible artifact for use as a generative conversational tool that enabled participants to configure the dials to describe challenging scenarios they commonly faced. The scenarios were then used as a basis for ideation in the following phase of the project.

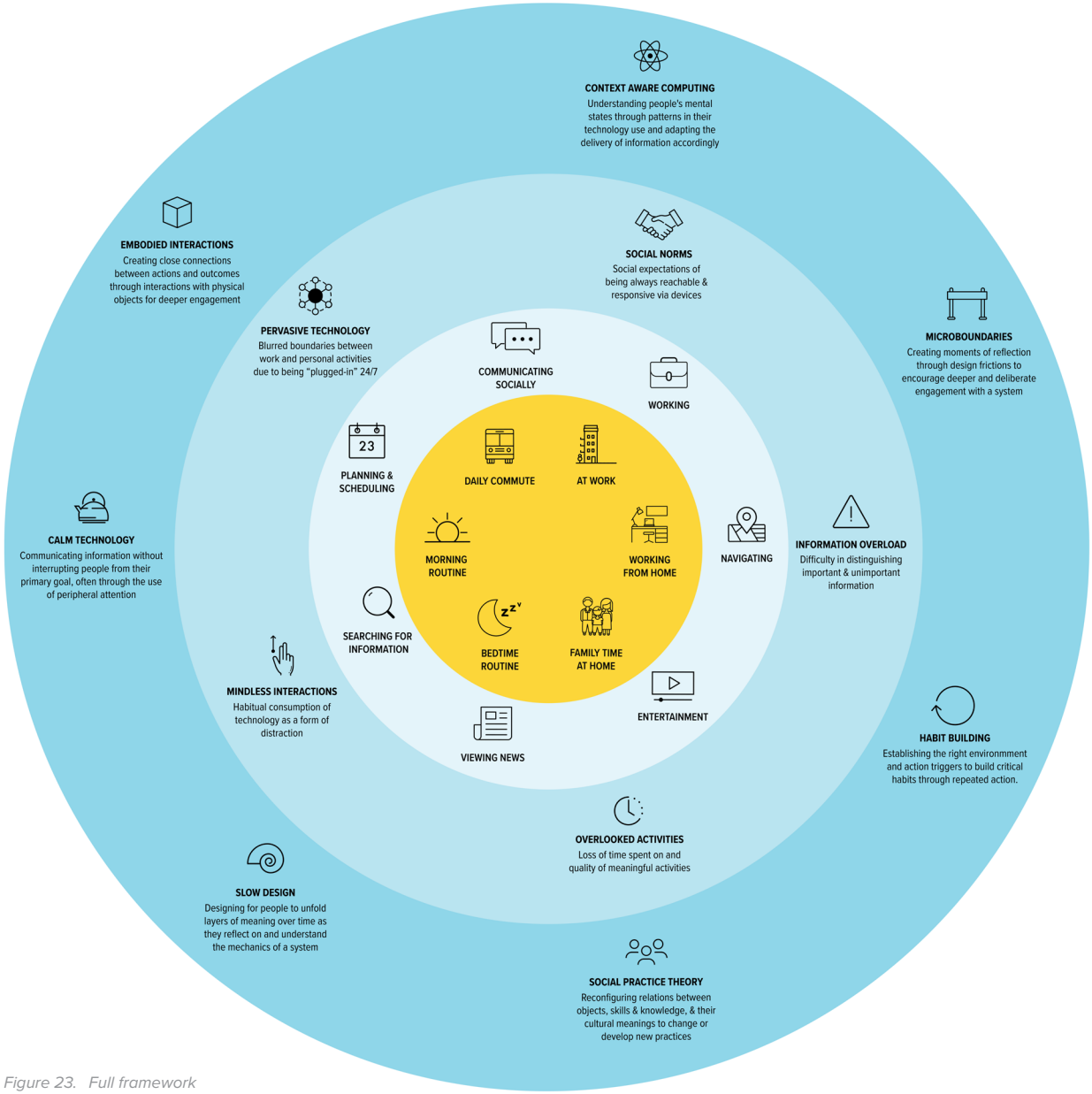


Figure 23. Full framework

Design Interventions

Scenarios developed through the use of the Design Opportunities Framework informed the ideation of various ways to foster mindful digital habits in the face of distraction. From a range of ideas explored, three were chosen for further development to explore different facets of distraction. Together, they explored the themes of intentionality, feedback, flexibility, control and social practices in technology consumption. Staying true to the research through design approach, concepts developed during this project were created with the purpose of testing with potential users to gain a deeper understanding of the challenges posed by digital distractions as well as potential ways to address them.

Storyboarding

Shortlisted concepts were developed into a series of storyboards to communicate pain points, proposed solutions, and desired outcomes for evaluative testing with potential users.

Each concept takes a different approach to cultivating mindful digital habits. Focal Spaces centers on giving users greater control over their digital spaces by helping them create digital environments that match their intentions. Daily Switch nudges users to take short mental breaks as a way of disrupting mindless smartphone interactions and resetting their intentions. Attention Coach provides users with realtime feedback when they start to stray away from their goals.

Proposed Concepts

Focal Spaces

Working From Home | Information Overload | Pervasive Technology | Context-Aware Computing

Focal Spaces proposes the adaptation of smartphones to user's goals by prioritizing information and tools necessary for the task at hand and hiding everything else. It is designed to foster alignment between the goals of users and the actions supported by their devices, as well as reduce the chances of distraction by removing sources of distraction.

For example, if someone is in "work mode", the smartphone home screen might suppress notifications from social communication and only show apps that are relevant to work.

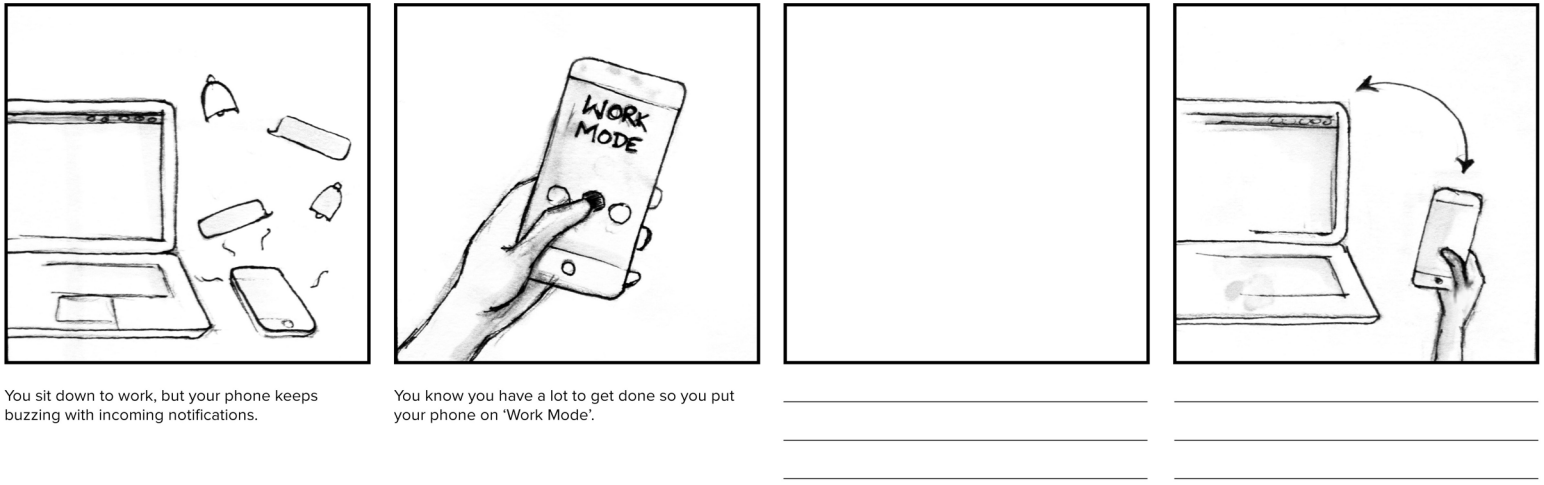


Figure 24. Focal Spaces storyboard

Daily Switch

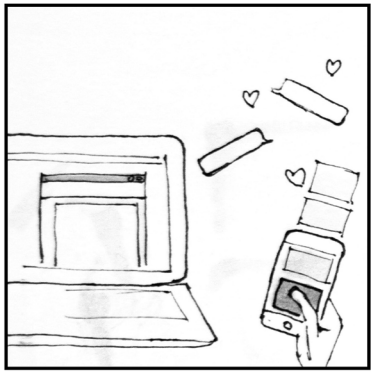

Morning Routine


Mindless Interactions

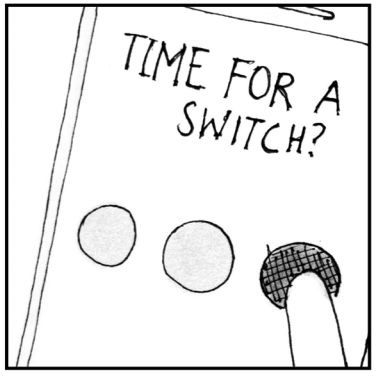

Microboundaries

Daily Switch detects mindless smartphone activity and encourages people to replace them with activities that they consider refreshing to help them refocus their minds.

For example, if the app detects repeated mindless scrolling through news feeds, it would prompt the user to take a break and provide them with a list of alternative activities to choose from, such as going for a walk or counting the number of people wearing primary colors.

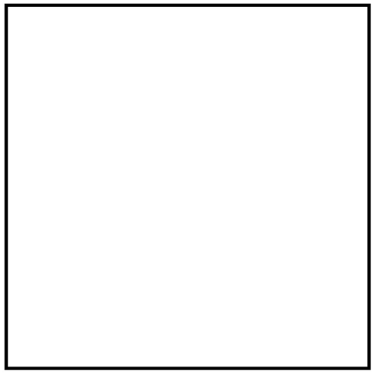


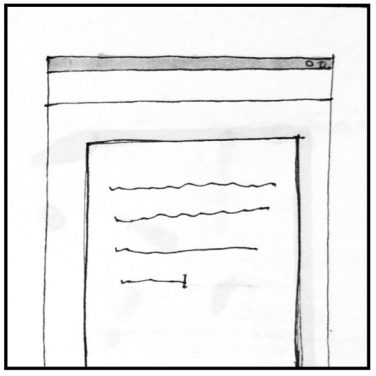
You're supposed to be working, but find yourself mindlessly scrolling through endless news feeds and storties.



Your phone notifies you of this and encourages you to make a switch that helps you get into the right headspace for deep work.

What activity would you like to switch to get into the headspace for focused work? What role does technology play in this, if any?





Now, you're re-energized, re-focused and motivated to tackle work.

Figure 25. Daily Switch storyboard

Attention Coach

At The Office | Information Overload | Embodied Interactions

Attention Coach is an ambient indicator that displays users' "level of distraction"which is calculated based on the reading of their digital behavior, such as number of application switches within a specified period of time, time spent on a single application, etc.

This intervention is designed to help people be deliberate in their decisions to multitask and engage with distractions–including those that may be relevant to their work.

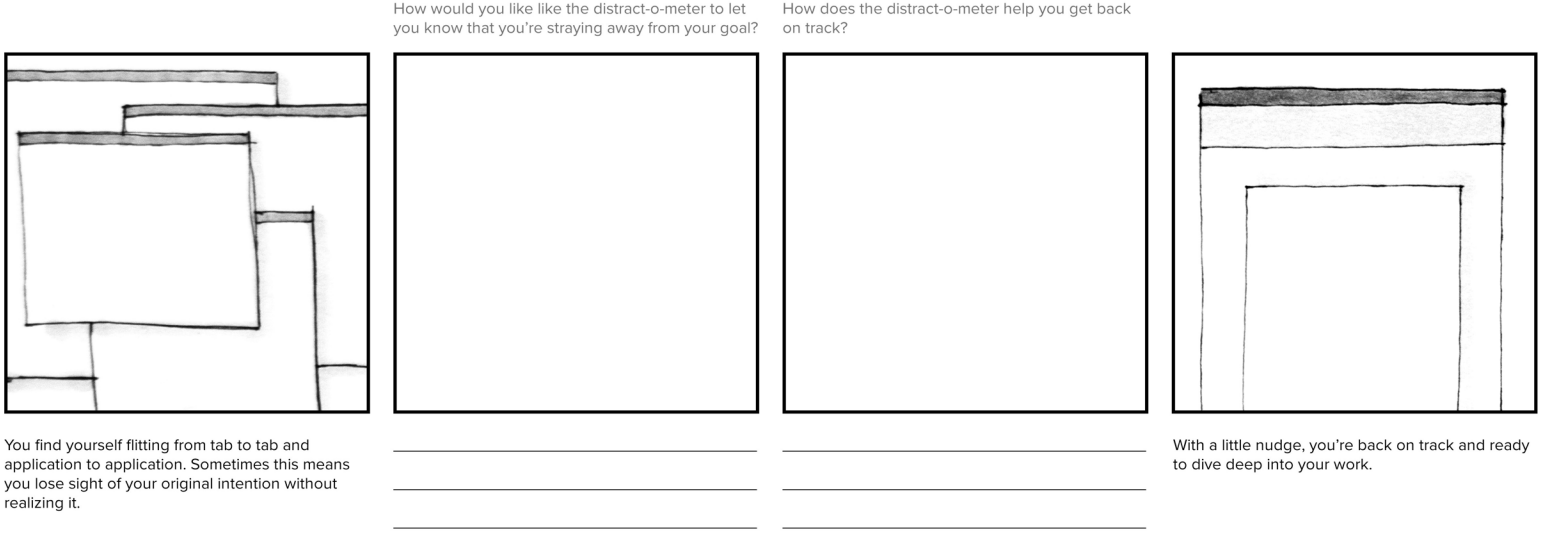


Figure 26. Attention Coach storyboard

Figure 27. Participant completing storyboard

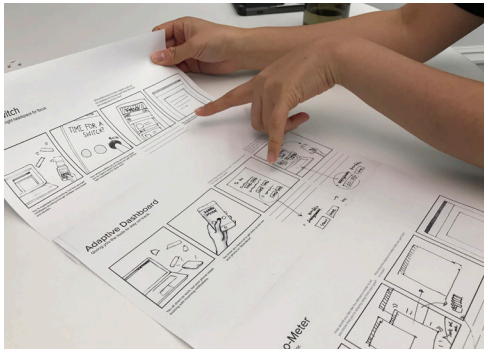


Figure 28. Participant completing storyboard

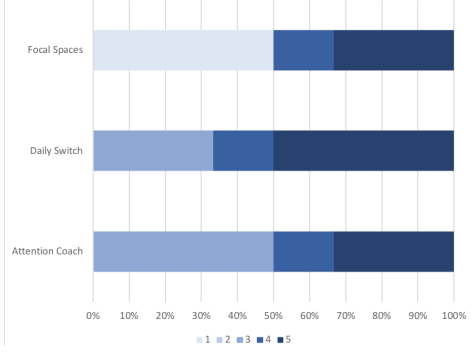


Figure 29. Participants' relatability to scenarios

"Fill-In-The-Blank" Storyboards

Method

In order to receive feedback and validation on early concepts, I tested them with six participants using "fill-in-the-blank" storyboards. Each participant was given a copy of the following storyboards that portrayed a scenario comprising a pain point, solution, and outcome. They were asked to complete the blank frame(s) in the storyboard by drawing and describing how the solution worked such that it would suit their needs.

After completing all three storyboards, participants were asked to rank the extent to which they related to the scenario presented in each scenario on a scale of 1 to 5 (1=not relatable).

Research Goals

The purpose of this research activity was to gain insight into:

- The extent to which people related to the pain points being addressed
- How potential users viewed and articulated the value of each solution
- Potential users' mental models of how these solutions would work

Insights

Relatability Of Scenarios

All participants 'highly related' to at least one scenario. And, all scenarios 'strongly resonated' with at least 50% of participants.

Feedback & Validation

The following points are key feedback and ideas extracted from storyboards and interviews with participants.

Digital Spaces

- The ability to filter notifications was suggested by almost all participants. They wanted to be able to select who can contact them even when they are in "work mode".

- Participants also stated the importance of notifying friends that they are working right now and that messages will only be sent when they are out of “work mode”.
- The idea of a universal “work mode” where various devices sync to create distraction-free conditions was welcomed by participants.
- Setting clear goals and having a timer to create a sense of urgency was also suggested.
- Multiple participants desired the ability to limit specific content, but wanted to do so only for short periods of time.

Daily Switch

- Feedback and suggestions from participants fell into two categories; ones that redirect their attention back to work by providing practical assistance to their workflow and ones that redirected their attention to activities that served as mental breaks.
- Some participants felt that features that assist their workflow would be useful to help keep them on track. Ideas ranged from pomodoro timers, to to-do lists, to questions that prompted users to reflect on the distraction they were engaging with.
- Other participants gravitated towards features that would motivate and inspire them to work, such as music, inspirational quotes and activities for taking mental breaks (e.g. taking a walk).

Attention Coach

- Many participants shared the usefulness of a visual indicator that provided reminders of the goal or original intention.
- All participants gravitated towards a screen-based intervention that could provide them with real-time feedback in the same medium where the challenge was experienced.
- Participants shared the challenge of staying on track when web browsers were an endless source of information as well as distractions. Features that helped deter use of browsers to access websites that were irrelevant to the primary task were seen as helpful.
- Ability to track and organize information, such as websites and notes, was cited as a useful feature.

Figure 30. Affinity mapping storyboard testing findings

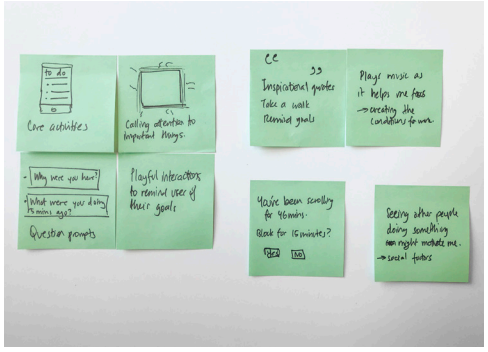


Figure 31. Affinity mapping storyboard testing findings

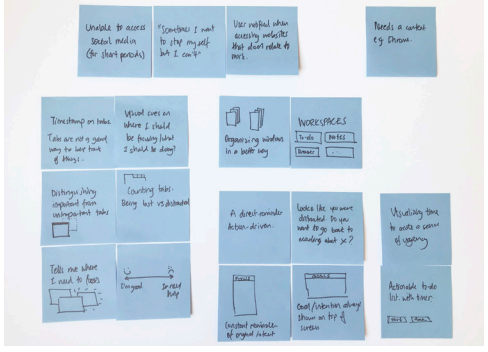


Figure 32. Affinity mapping storyboard testing findings

Final Concepts

Focal Spaces

Overview & Goals

Focal Spaces is an alternative desktop that users can activate to create conditions that serve their goal–be it engaging in deep work, or taking time off work. It is designed to empower its users to establish boundaries between digital activities, control incoming notifications, and set clear intentions for time spent on their personal media devices.

For example, a project-specific space may contain frequently used apps, links to relevant websites, access to pertinent files, to-do lists, and a priority inbox that filters only relevant communication from different platforms.

Available on both desktop and mobile devices, Focal Spaces is designed to de-clutter digital spaces and replace them with curated spaces that reflect users' state of mind and support their intentions across devices.

How It Works

Curated Spaces

Each space can contain multiple sections depending on the information and tools users want to be accessible. Sections and section content can be added or deleted as needed.

The goal is to give users easy access to relevant resources pertaining to their primary goal and hide everything else. The act of opening a space also serves as reinforcement of an intention.

Settings

The Priority Inbox filters incoming messages, only allowing messages from people in users' VIP list. Users also have the option of enabling auto reply to people whose messages will not be shown to the user until they exit the space.

In addition, users have the option of limiting access to specific apps or websites they want to avoid when a space is active.

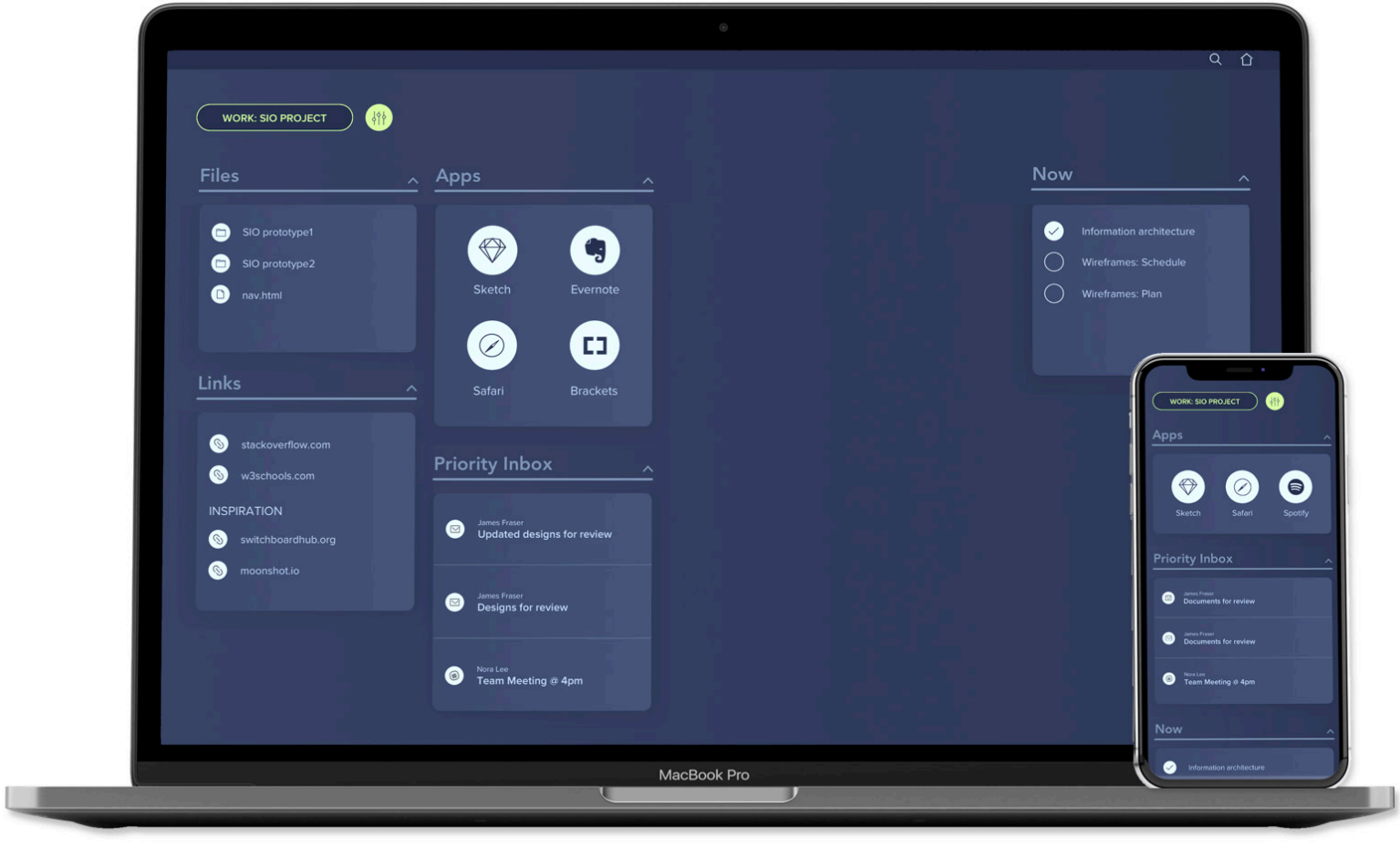


Figure 33. Project-specific Focal Space on desktop and mobile

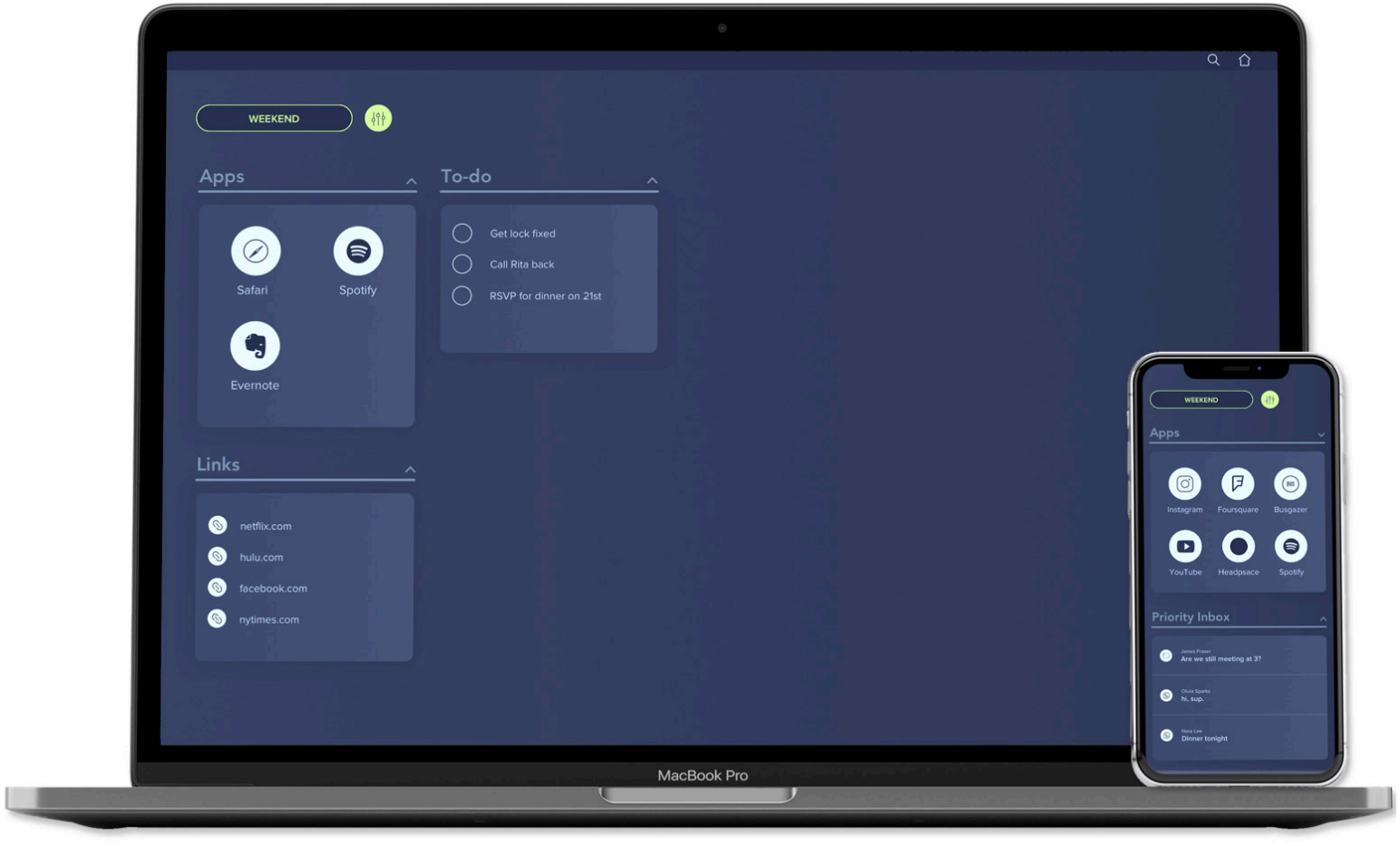


Figure 34. Weekend Focal Space on desktop and mobile

Creating A New Space

To make the process of creating a new space easy, Focal Spaces learns users' preferences by observing their behavior. Based on this observation, the system populates the space with what it has identified as necessary files, apps, communication channels, to-do lists, and links. Once a space is created, users can customize it further.

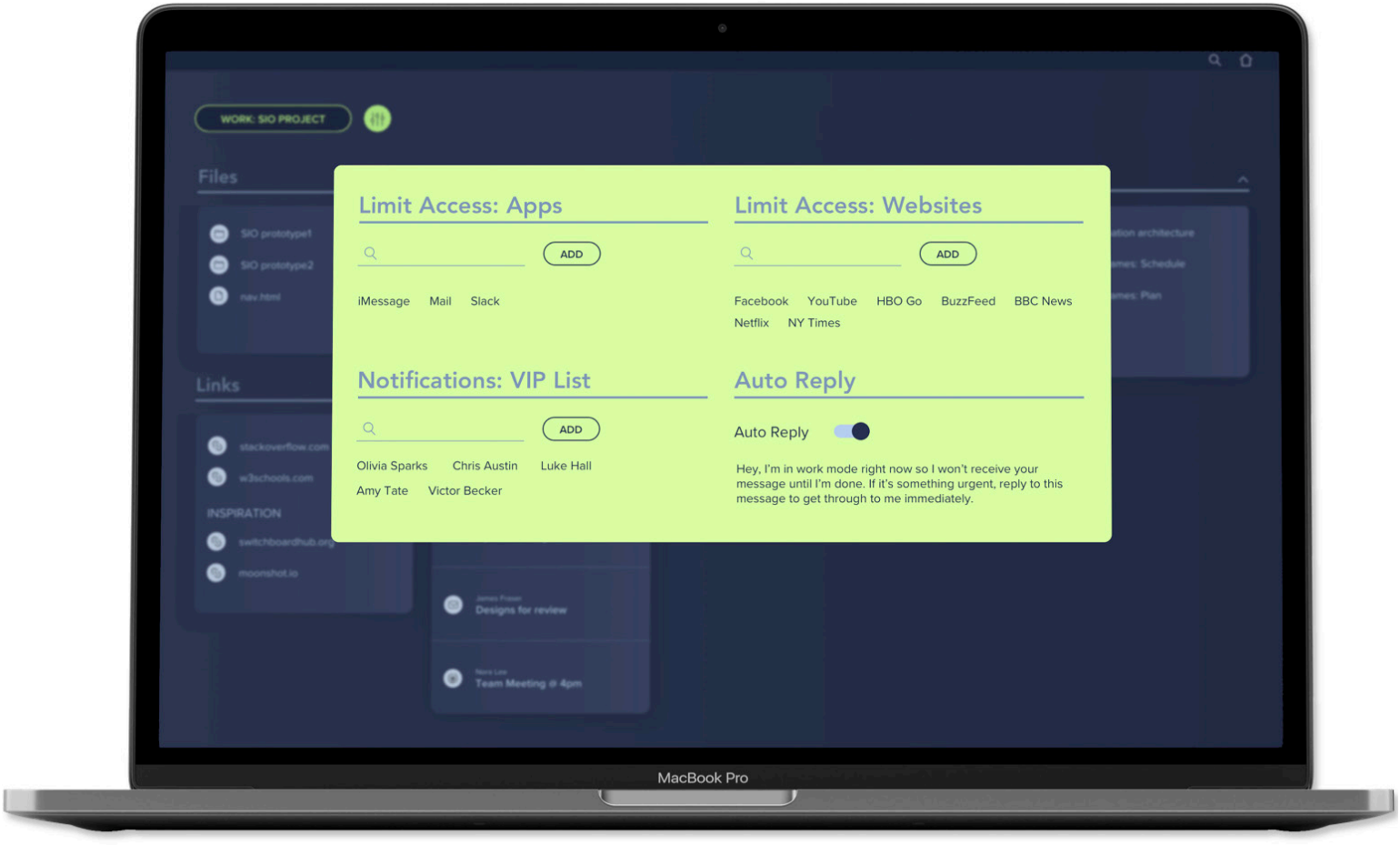


Figure 35. Settings options

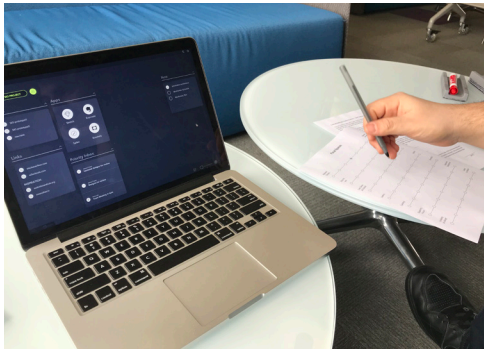


Figure 36. User testing with participants

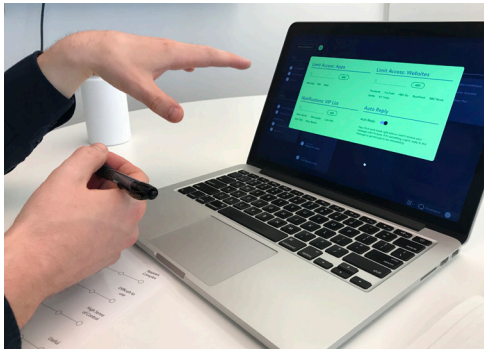


Figure 37. User testing with participants

Evaluative Research Discoveries

Whether or not participants found the intervention compelling depended on the level of structure in their existing work style. Those with somewhat structured work styles saw this intervention as a way to augment their approach. However, participants with a more organic work style found the intervention to be constraining.

Participants expressed that the intervention was intrinsically more conducive for work involving execution over ideation. The former, in their opinions, has a clear goal as well as a roadmap of how to get there, whereas the latter involved greater discovery, openness to new information, and freedom to quickly move between things.

Participants believed that reinforcing their goals before and during interactions with the system would likely help them stay on track. For example, simply activating a focal space reinforced the goals associated with it.

The system's ability to adapt to users' key workflows was important. Even if it did not work in every scenario, a few strong use-cases gave participants sufficient reason to consider adopting it.

The ease of tool setup appeared to be the critical factor that affected the likelihood of user adoption. While the system's auto-populate feature when creating new spaces would lower the up front effort required during setup, additional customization that require effort either deterred them from using the system or caused them to use it with default settings.

Daily Switch

Overview & Goals

Daily Switch is a mobile app that detects smartphone behaviors that users deem as an ineffective use of their time, and encourages alternative, off-screen activities that users want to spend more time doing.

Daily Switch aligns with research that indicates the value of breaks from work-related tasks in improving focus. Activities, such as meditation and exercise, are shown to be particularly effective. The goal of this app is to foster shifts in mindset that aid deep focus by encouraging off-screen activities that refresh and energize users.

How It Works

Setup

To help the system understand the tech habits users aim to cultivate, they are asked to choose their goals in the settings options., Next, users select their desired activities to help the system make smart suggestions for alternate activities that they want to engage in more often.

Certain activities, such as meditation, workouts, and listening to podcasts, allow the app to pull relevant content from third-party apps. For example, by connecting to a user's Headspace account, Daily Switch will automatically begin the next session in their Headspace playlist when they choose to switch to meditation.

Encouraging Switches

Based on the preferences indicated in the settings, the app detects smartphone behaviors that contradicts users' tech habit goals. Once a user is engaged in a problematic behavior for 10 minutes, the green shape appears at the bottom of the screen to indicate that it's time for a switch. After 15 minutes have passed, a full-screen indicator appears encouraging the user to switch to an activity that they deem more desirable. (10 and 15 minutes are default values that users can change.) Users can select an activity and the length of time they want to spend on it. The length of the break can be left at the default duration or adjusted using the slider.

While a switch is in progress, the screen displays minimal information–time indicator and the activity. In settings, users have the option of enabling a forced phone lockout while a switch is in progress.

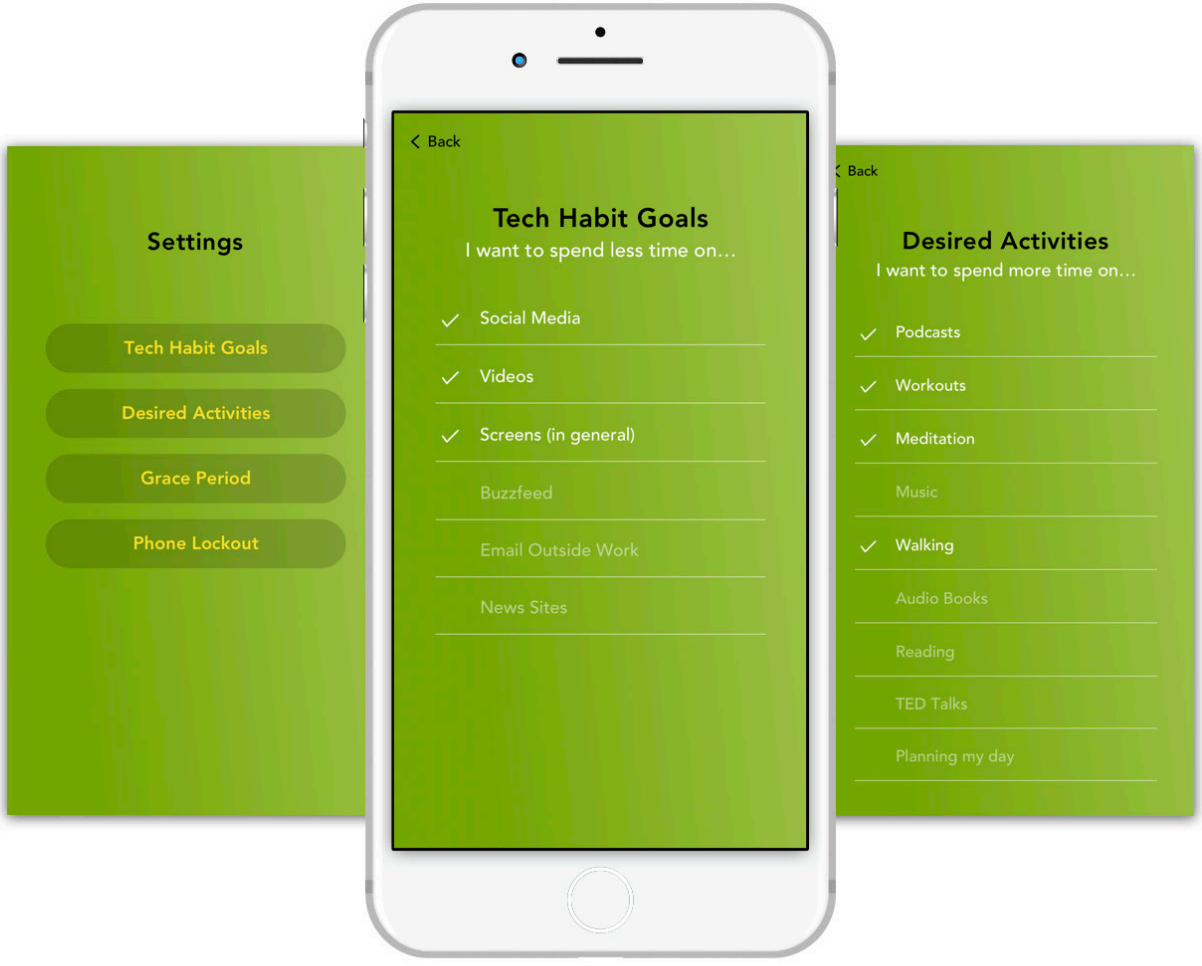


Figure 38. Participants' semantic differential responses

Figure 39. Switch screens

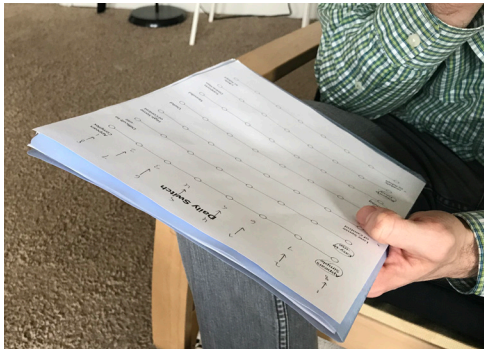


Figure 40. User testing with participants

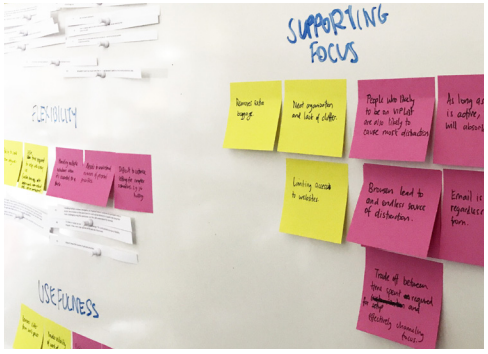


Figure 41. Synthesizing findings From testing

Evaluative Research Discoveries

While participants' long term goals remained consistent, their short-term goals often changed and were at-odds with long term goals. The system's ability to resolve conflicts between immediate- and long-term goals was a crucial factor in its success.

Participants preferred experiences where limiting access to tools or information felt natural, such as limiting the number of posts available on a news feed, or increasing the time taken for content to load. Generally, participants viewed the interventions as not disruptive and well-matched to the goal they were trying to achieve.

Tracking progress and providing feedback features were strong motivators for many participants, They appreciated being able to track the amount of time spent on a task or how many calories they were burning as a result of fitness related switches.

Successful switches greatly depended on the users' context and state-of-mind at the time.

Attention Coach

Overview & Goals

Attention Coach is a personal trainer for cultivating focus. Users choose between three coach personalities–supportive, strict, or playful–based on the kind of support they find most helpful, and when distractions arise, the coach is front and center to help them regain focus.

The goal of this system is to help people overcome the hurdles that prevent them from aligning their actions with their intentions. It is also intended to function as a probe that reveals the kinds of personalities and approaches that resonate with potential users.

How It Works

Setup

Users start by selecting one of the three coach personalities (supportive, strict, or playful) to set the tone of their experience. The coach personality affects when the coach intervenes, their tone, and the level of control users have over the use of their devices.

Scenarios

For evaluative testing, three scenarios were prototyped for each coach personality. The following work showcases examples of how the three coach personalities might nudge users towards focus through three scenarios that are based on multi-tasking.

Scenario 1: The coach notifies users that they are shifting attention between two documents that are open. While the two documents are related to the same task, frequent shifting of attention between the two documents may prevent users from diving deep into their work.

Scenario 2: The coach alters users' desktops to indicate that a lot of multitasking is prevalent. For example, a user may be distracted from their primary goal by new updates.

Scenario 3: The coach alerts users that they are attempting to access a website during a work session that they have identified as distracting them from their primary goal in the past.

Personality: Supportive

The Supportive Coach provides users with positive encouragement, and gentle nudges to users, but allows users to decide how they want to use their time and attention.

Scenario 1: This coach creates a subtle focal area by dimming the area surrounding the currently active window. In doing so, it reduces the prominence of extraneous information in users' peripheral vision, thereby reducing chances of external distractions.

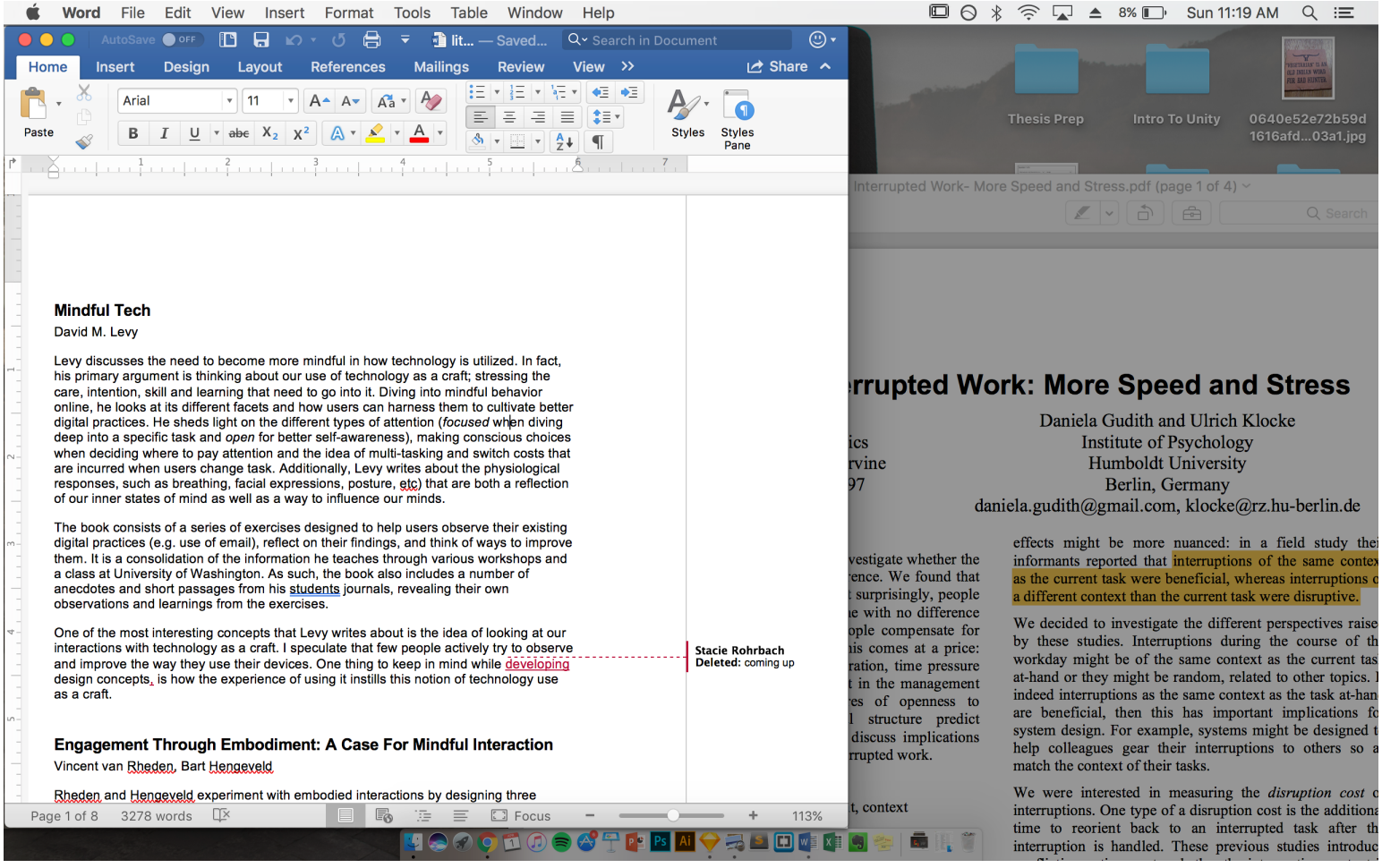


Figure 42. Multitasking scenario (1) with supportive coach

Scenario 2: Somewhat similar to the previous scenario, this coach aims to bring focus to applications pertaining to users' primary goals by adding a glow around the window. Marking a window with a star communicates to the system that it is important for the task at hand.

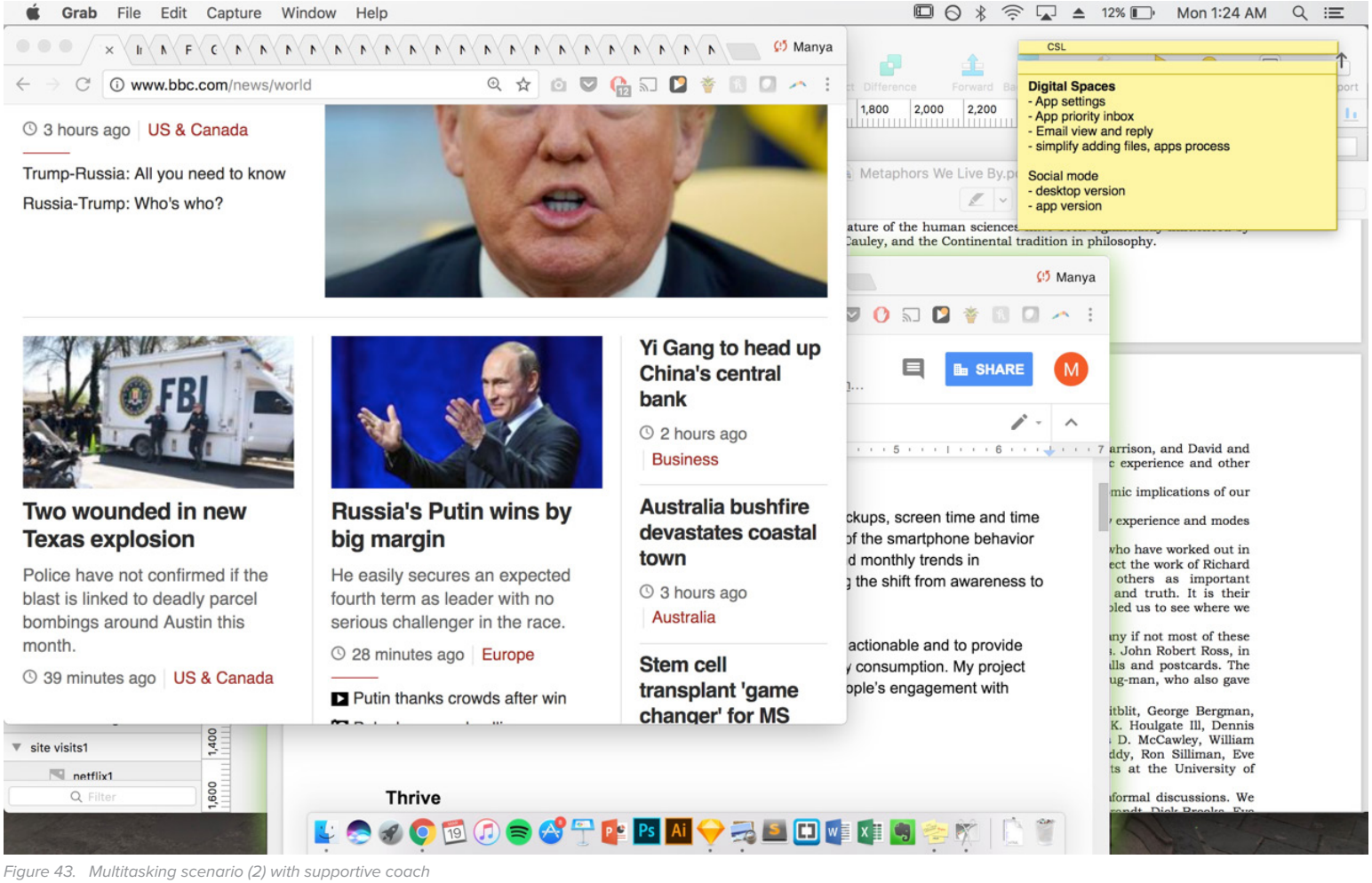


Figure 43. Multitasking scenario (2) with supportive coach

Scenario 3: In this scenario, the coach gives users a chance to pause as the page loads. While this takes place, the page displays an inspirational quote to evoke reflection along with a progress bar to visualize the time remaining before the page is fully loaded. Personality: Supportive The supportive coach provides support and encouragement to users, but ultimately enables them to decide how they want to use their time.

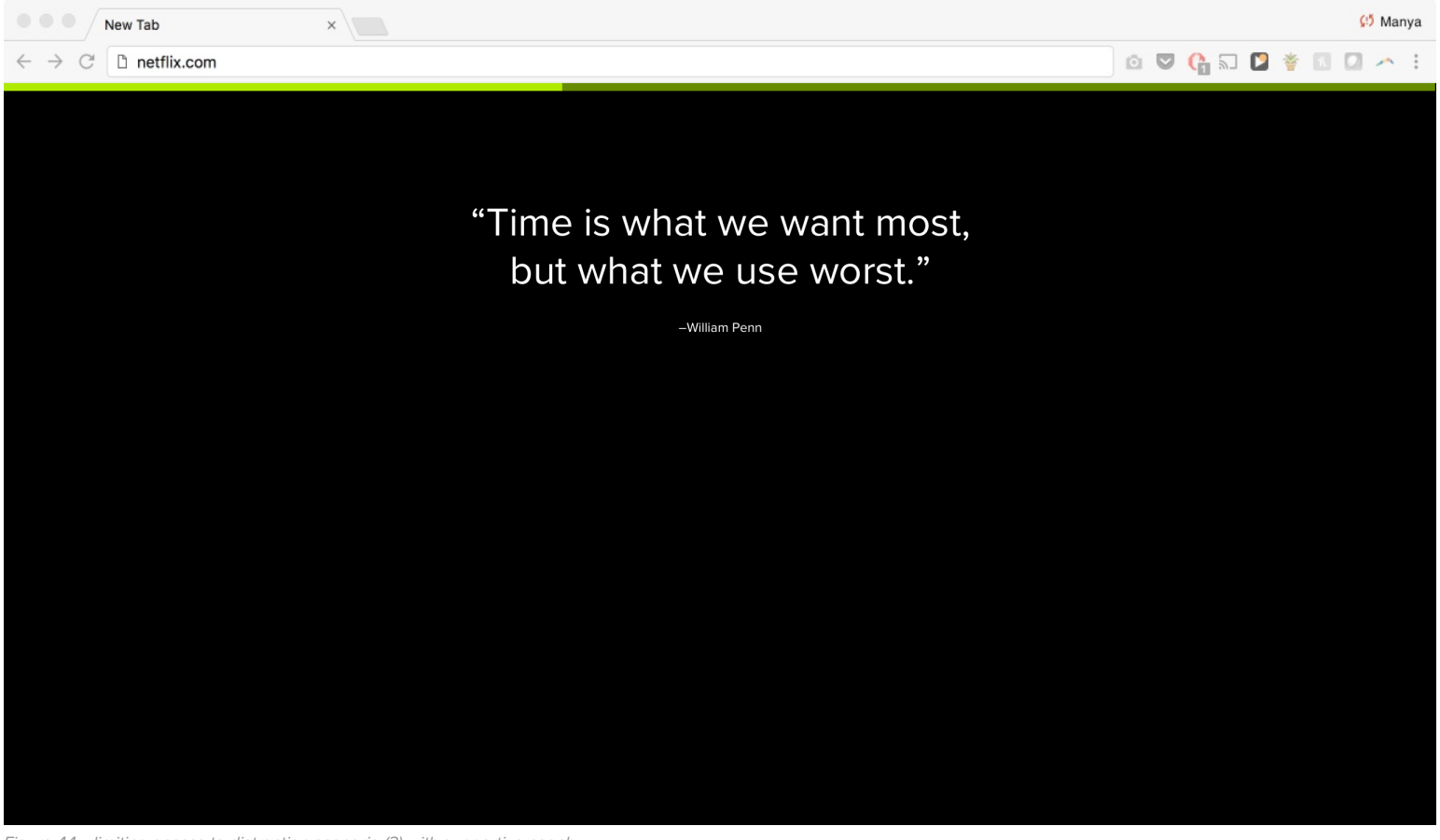


Figure 44. limiting access to distraction scenario (3) with supportive coach

Personality: Strict

The Strict Coach seeks to discipline users for poor behaviors. This coach ensures users adhere to their stated goals and is not afraid to put its foot down when required.

Scenario 1: When the coach sees frequent multitasking, it slowly increases the time taken to switch from one application or window to another. It introduces a microboundary to slow multitasking and gives users time to reflect on whether they really want to switch tasks.

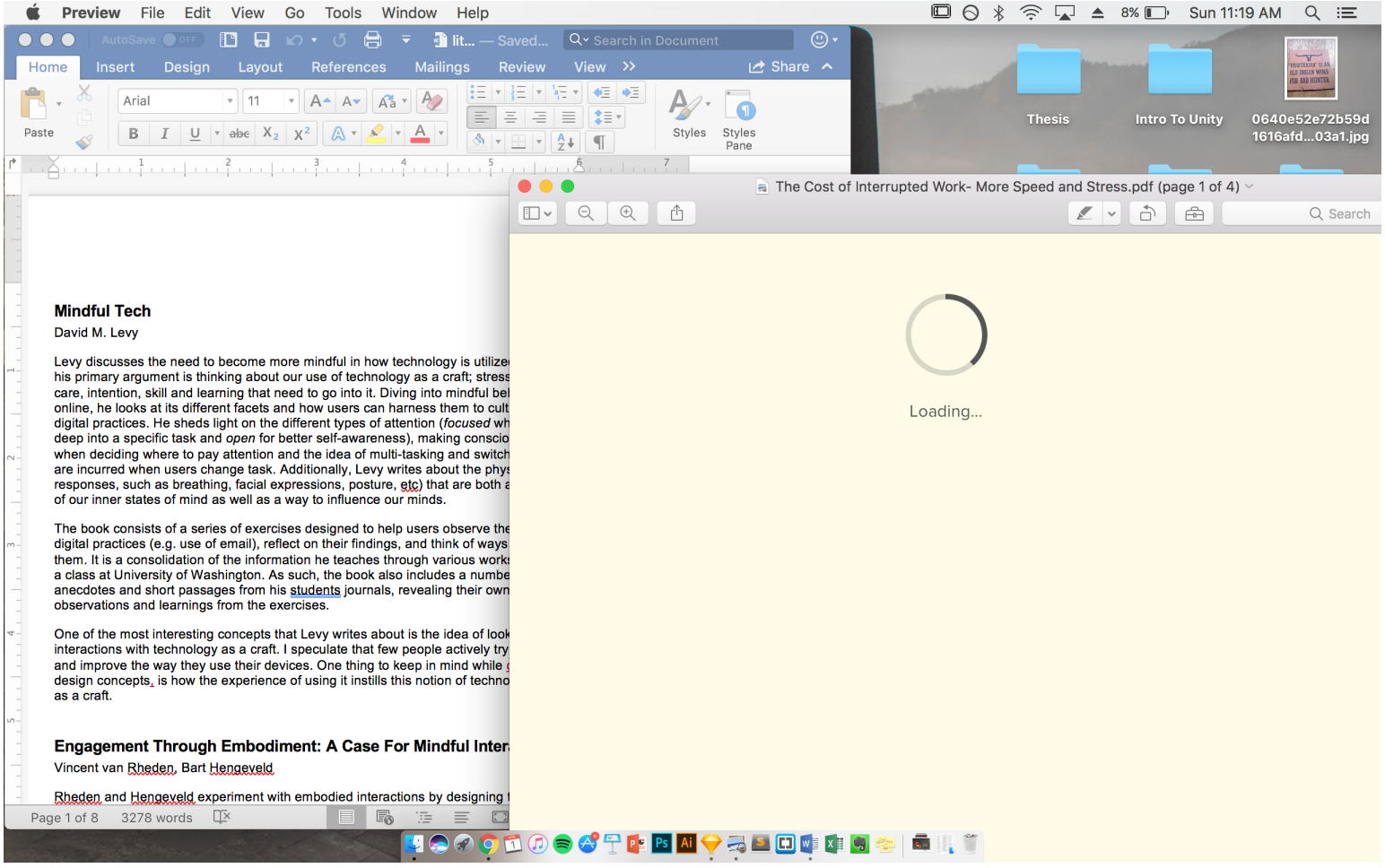


Figure 45. Multitasking scenario (1) with strict coach

Scenario 2: When users start to stray from their primary goal, the Strict Coach takes it locks the primary window in full screen mode and disables features, such as creating new tabs and switching to other applications. This lock lasts for 25 minutes, after which users can continue to do what they want. In doing so, the coach hopes to nudge users to stay on track and push past the distractions.

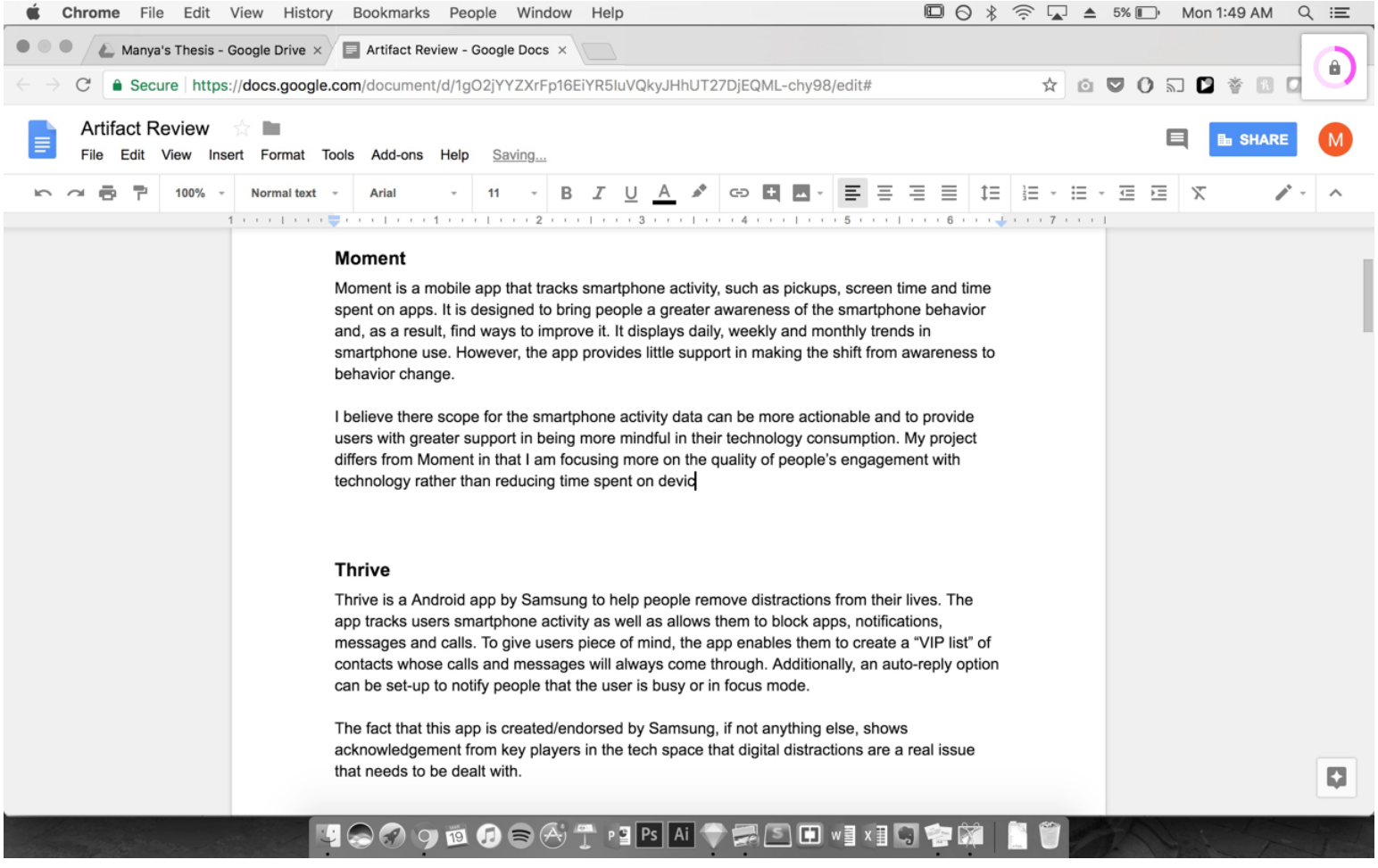


Figure 46. Multitasking scenario (2) with strict coach

Scenario 3: When users stray from their primary goal or exceed daily usage limits for websites marked as distractions, the Strict Coach blocks them from accessing websites, such as Netflix. Unlike the Supportive Coach that offers users more freedom to make decisions, the Strict Coach is not afraid of putting its foot down and being firm with users.

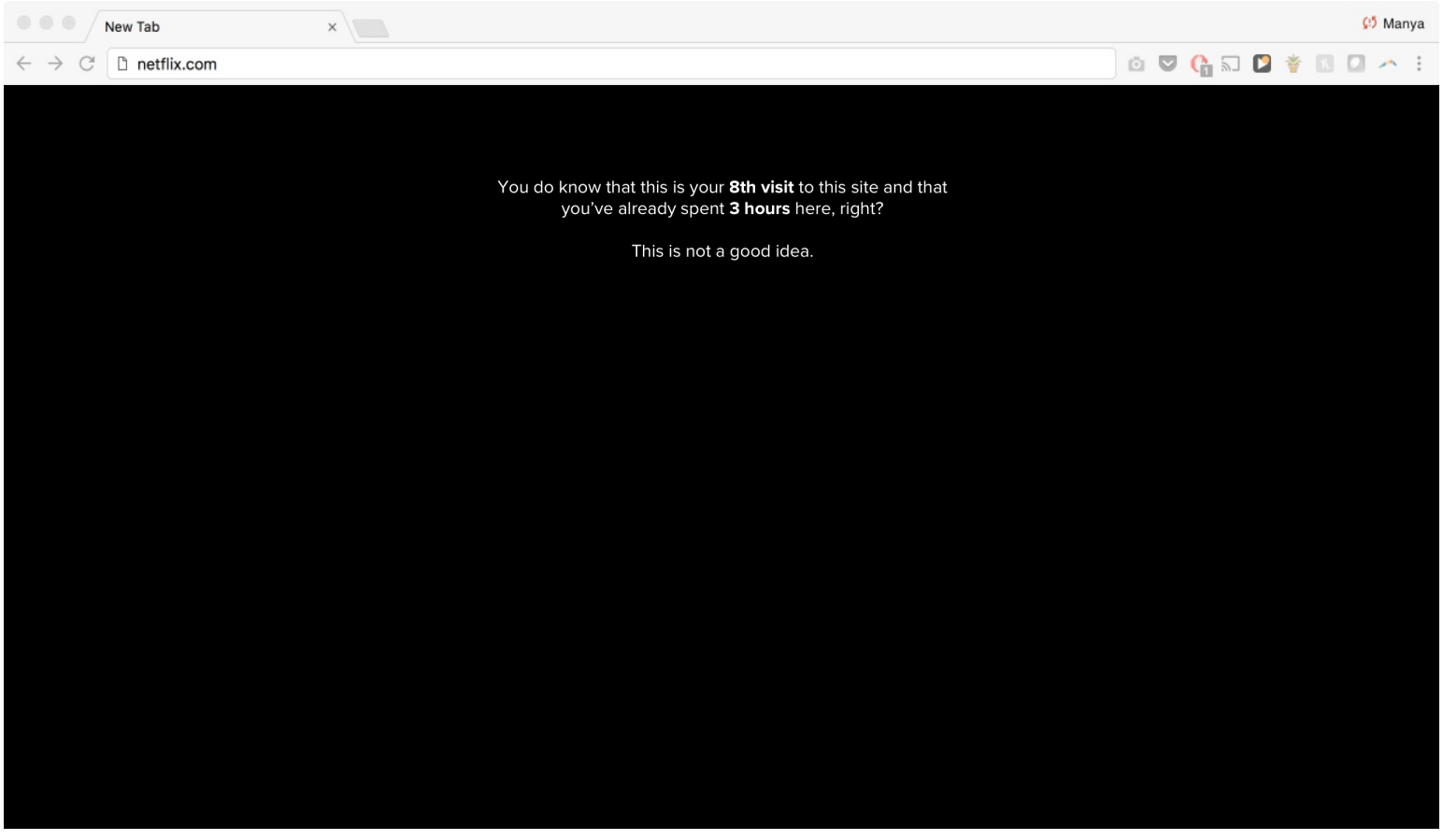


Figure 47. Restricting access to distraction with strict coach.

Personality: Playful

The Playful Coach takes an indirect approach to helping users keep their attention on their goals. While the previous two coaches gave users high and low levels of autonomy respectively, this coach lies somewhere in the middle by allowing users to make decisions for themselves but making it harder for them.

Scenario 1: In this scenario, the Playful Coach presents users with a screen that prevents them from conducting what they've deemed as bad behaviors. It intervenes by introducing adopts a screen that requires them to read and click to remove. However, the coach takes a "moving target" approach to makes it difficult for users to click the yes button. It functions on the premise hopes that the user will eventually give up and go back to what they were doing before.

Scenario 2: When this coach sees users distracted by the news, it gradually alters the darkness of the window to indicate to them that it's time to shift back to work. If they don't switch back, they will eventually find themselves with a news window that is now totally black.

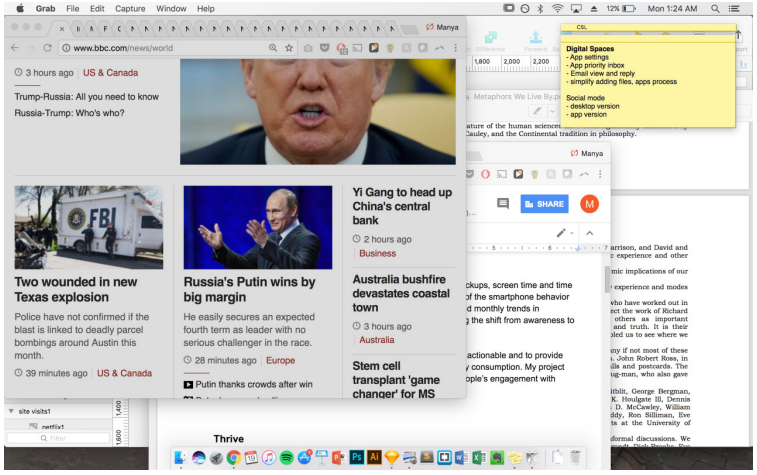


Figure 48. Multitasking scenario (1) with playful coach; progressive dimming of window

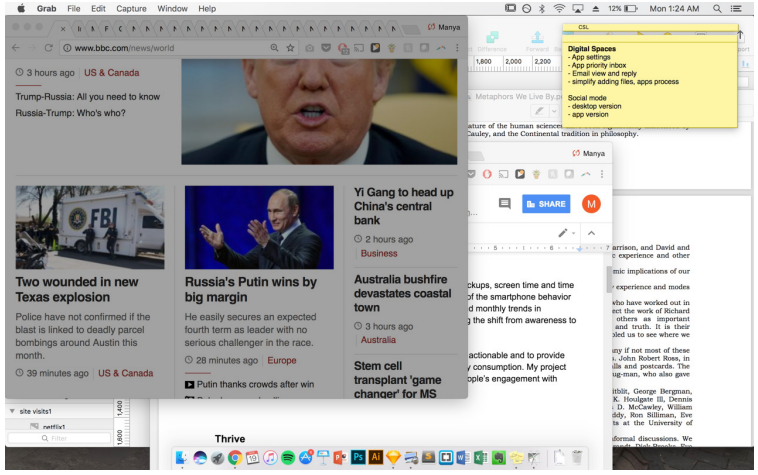


Figure 49. Multitasking scenario (1) with playful coach; progressive dimming of window

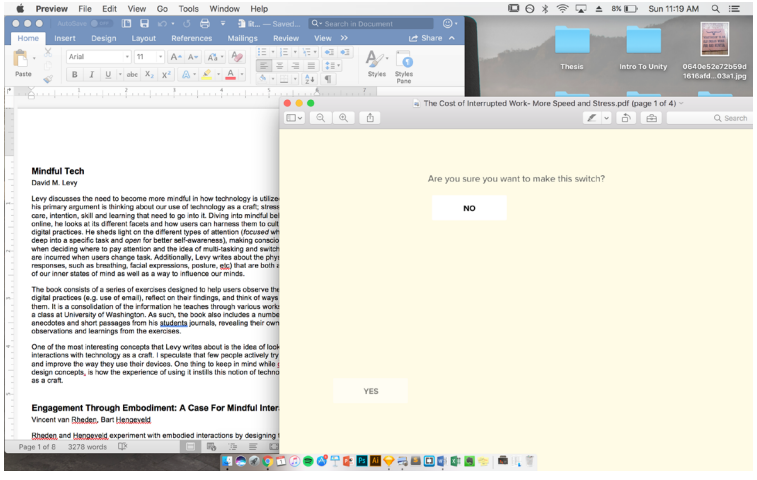


Figure 50. Multitasking scenario (2) with playful coach; moving button target

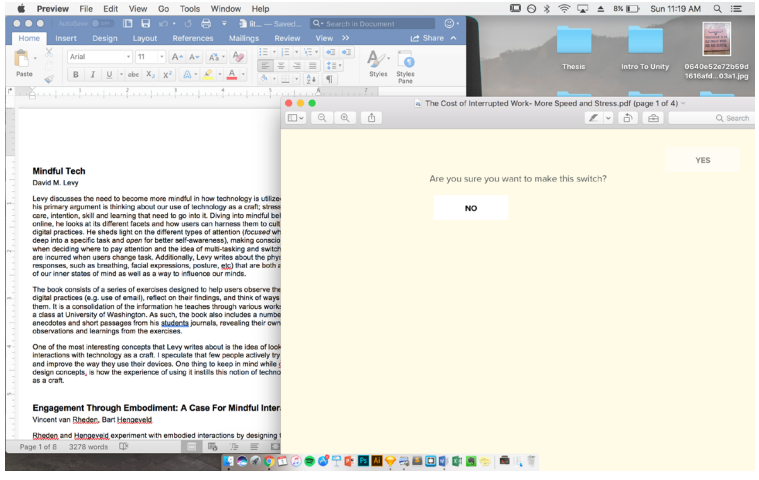


Figure 51. Multitasking scenario (2) with playful coach; moving button target

Scenario 3: Finally, this coach makes users work for their Netflix time by burying the access button. If they want it, they need to scroll for it. It is important to note that the size, shape, and color of access buttons continually change to prevent users from gaming the system. And, they never know what size, shape or color to look for.

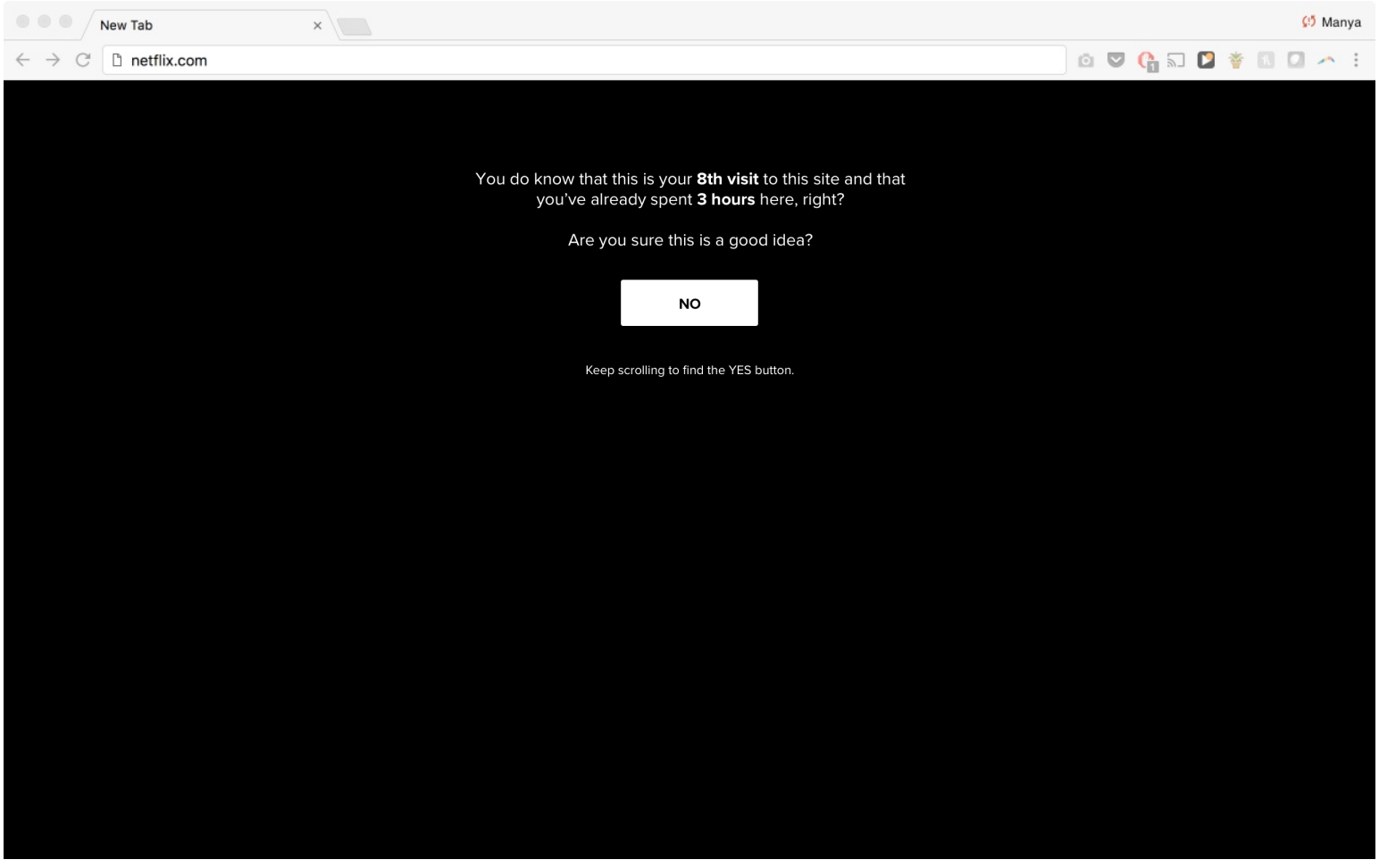


Figure 52. Limiting access to distraction scenario (3) with playful coach; scroll to locate the button to continue

Evaluative Research Discoveries

Participants saw two forms of control embodied in the intervention that impacted its success—control in setup and customization, and control while using the intervention. In some cases, their desired level of control differed for each type of control. Regardless, participants wanted the ability to shape the level of control they had during an experience.

Real-time feedback was well-received by participants, especially when presented as subtle indicators that played with factors, such as time and color. Subtle indicators communicated the message without disrupting their behavior.

Prolonged negative emotions towards a system will ultimately outweighed its perceived value over time. Although some participants selected the strict coach as the one they were most likely to adopt, they also strongly felt that they were highly likely to get annoyed with the limited control and leave the system after a short time while.

Participants responded positively when they felt like the system was reacting to their actions, as opposed to adhering to a “one size fits all” rule.

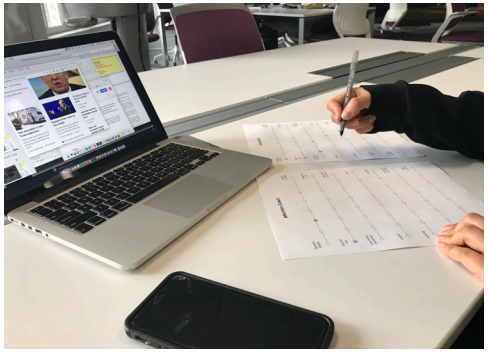


Figure 53. User testing with participants

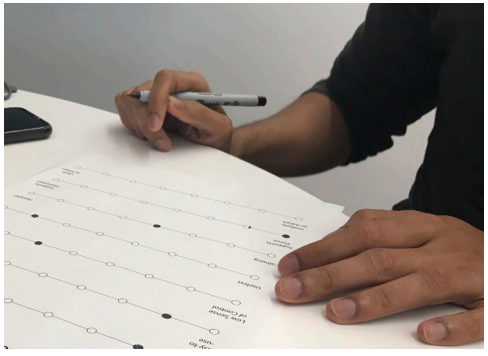


Figure 54. User testing with participants

Conclusions & Reflections

The following design principles for cultivating mindful habits are derived from generalizable insights gleaned during evaluative testing; and comprise the final step in addressing the underlying research question, “How can technologies be designed to cultivate mindful digital habits and empower users with a greater sense of control over their attention?” The origins of each design principle can be traced back to the challenges uncovered during exploratory research, design approaches identified from literature reviews, design interventions developed, and insights from evaluative research of interventions.

Design Principles for Mindful Digital Habits

The origins of each design principle can be traced back to the challenges uncovered during exploratory research, design approaches identified from literature reviews, design interventions developed, and insights from evaluative research of interventions.

Each principle embodies a key facet of mindful digital habits; describing its importance, how technology can support its cultivation, and actionable steps for designing tools that supporting conscious technology consumption.

1. Set Intentions

Encourage users to set intentions before interacting with a system. Introducing microboundaries are a great way to encourage reflection and surface underlying intentions. While in use, the system should create opportunities for continual reflection and reaffirmation of intentions as well as provide subtle feedback, where relevant, to users that describe how they are doing.

Approaching actions or tasks with clear intentions can help users connect actions to their overarching goals as well as recognize when they lose sight of their goals or engage in mindless activity. It is also likely to create a heightened awareness of distractions and enable users to become conscious of how they channel their attention.

> "I like that the loading bar makes you reflect without being obvious about it."
>
> – Participant responding to loading bar microboundary in Attention

2. Instil Boundaries

Create boundaries between different types of digital activities by dividing tools and information into goal-based segments. Make activities within a segment easy to do and those that lie outside the segment more difficult. Activity segments should match users' mental models of how they organize their activities and goals.

Grouping the plethora of tools and information available on devices reduces the amount of information available at any point in time, therefore reducing sources of distraction and cognitive burden that result from information overload. When done well, it also minimizes the effort needed to work towards a goal.

> "I've got all this stuff going on but the system pushes it out of my desktop... and my mind."
>
> – Participant on curated spaces in Focal Spaces

3. Be Flexible


Pervasive Technology


Context-aware Computing


Daily Switch


Attention Coach

Use soft rules to support long-term digital habit goals while adapting to immediate needs, when necessary. To do this, the system should understand the nature of work being performed and associated workflows, users' openness to nudges from the system, and instances where the system deters users from achieving their goals.

People's priorities change and, at times, long-term and immediate-goals can be conflicting. Carefully selecting moments for intervention increases chances of successfully building effective digital habits and improves the likelihood of adoption.

"My goals change, and the system needs to keep up."

"Not sure if I'll listen to the nudge. If I'm in bed scrolling through Facebook, I probably won't go for a walk because the system told me to."

– Participants on curated spaces in Focal Spaces

4. Encourage Analog Activities


Overlooked Activities


Habit-Building


Daily Switch

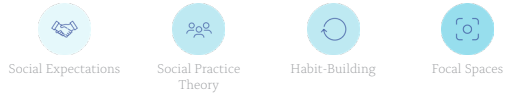
"I want to spend less time on screens, and more time thinking, sleeping and on face-to-face interactions."

– Participant on digital habit goals

Where appropriate, redirect on-screen engagement to analog activities. Like the "Be Flexible" principle, it is important to identify appropriate moments to redirect users to analog activities. For example, helping users recognize screen time that lacks a clear intention and encouraging offline mental breaks instead.

The vast majority of participants felt they were spending too much time on screens and had a desire to spend more time on analog activities. Redirecting attention to the physical world can help users spend more time on the analog activities that might be overlooked. Through repeated action, users can make this switch more easily and incorporate it into their digital habits in the long run.

5. Create Peace-Of-Mind



Establish entry points for users at various stages of their journey towards conscious technology consumption. Create a feeling of comfort by providing users with the ability to customize their experience and make gradual changes to their habits.

The thought of changing their digital habits can be intimidating and uncomfortable for users. Establishing different entry points and control is essential for users to feel comfortable and confident with evolving their habits. After all, changes in users' digital habits also have implications on the expectations of the people that surround them.

> "Removing chance encounters would make me feel like I'm missing out on something."
>
> – Participant on the discomfort of limiting information

Future Work

Next steps for further research and development falls into two broad areas–the design principles for cultivating mindful digital habits and the design interventions developed through the project.

Develop & Evaluate Principles

While the design principles are a result of an iterative design process that incorporated user feedback every step of the way, the principles themselves have not been evaluated. Further research is required to gauge the effectiveness of these guidelines in aiding the creation of new products and enhancement of existing ones that support mindful engagement with technology. It is also important to ensure the principles provide designers, product managers, and other stakeholders involved in the product development process a clear and actionable roadmap for supporting mindful technology consumption. Through further testing and iteration, a more robust set of principles can be developed.

Another point of consideration brought to light during user testing was that tools that enable mindful technology engagement may be more appropriate for certain types of work (execution of ideas over ideation, for example) or contexts (individual work over social work environments). Future studies that explore the applicability of the principles to a variety of work and contexts would be useful in either narrowing the use-cases for the principles or strengthening the case for its wide applicability.

Develop & Evaluate Design Interventions

The first step in further developing the three design interventions from this project would involve redesigns that incorporate the specific feedback received from participants during user testing sessions as well as application of the design principles to the interventions.

Embedded in each design intervention are a series of hypotheses on best ways to develop users' digital habits. To further evaluate the robustness of these hypotheses, more research is needed over longer periods of time with fully functional prototypes. Such studies can also shed light on how interventions need to evolve with users' habits over time.

Reflections

Target Users

One of the biggest differences amongst user testing participants was in their openness to evolving their digital habits. On one hand, there were people who were already conscious of the quality of time they spend in the digital world and actively made changes to their habits. On the other hand, there were people who felt a fear of missing out as a result of changing the influx of information or limiting access to sources of distraction.

Charles Harper

26 years

Software Engineer

Motivations

- Doing his best work while maintaining a work-life balance.
- Diving deep into work and any other activity he engages in.
- Seeing his progress.

Digital Habits

- Avid user of the Pomodoro technique to break work into intervals of 25 minutes with 5 minutes break.
- Early riser–his most productive hours are in the morning.
- Puts his phone away when working.
- Selectively enables notifications for important apps

Laura Patrick

25 years

Designer

Motivations

- Making time to hang out with friends and family.
- Likes to stay up-to-date with friends.
- Doing work that she is passionate about.

Digital Habits

- Almost always has her phone within reach
- Has notifications turned on across devices and apps.
- Her work style tends to involve a lot of multitasking.
- Prefers a less structured style of working that frees her to let her curiosity and interests drive her work.

Figure 55. Target user personas

The personas were created to reflect prominent mindsets, habits and values of the research participants. The personas represent two extremes of a spectrum of participants' openness to change, where all participants shared at least a few traits with one of the personas.

The personas are intended to serve as a starting point to facilitate important decisions regarding the target user group for a product, necessary features and customization options. Focusing on one end of the spectrum can enable products to provide more targeted customization options to users without over-burdening them with choices.

Platforms

To truly support mindful digital habits, the tools we create need to work across applications and devices; creating a cohesive view of users' digital habits and contexts, and intervening at the appropriate moments. For example, research findings from the Focal Spaces intervention suggest that more flexibility is required on operating system level for greater customization of digital experiences based on context and goals. In the case of Focal Spaces, this means being able to select the applications and information that are active and visible to users.

Mindfulness In All Products & Services

This project has focused on developing technology tools that are specifically designed to support more meaningful and mindful engagement with technology. As a result, the concepts and principles are developed to mediate people's interactions with technology. This, however, is one of many ways we can work towards the goal of mindful technology engagement. Having developed a set of principles for designing better tools, it would be interesting to explore how they can be incorporated into any digital product or service. What would an email client designed to encourage mindful email look like? What would a chat platform designed to encourage meaningful engagement look like?

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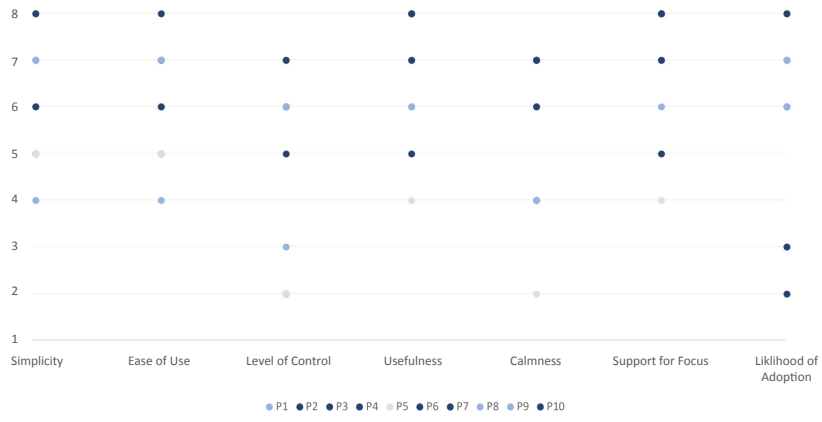
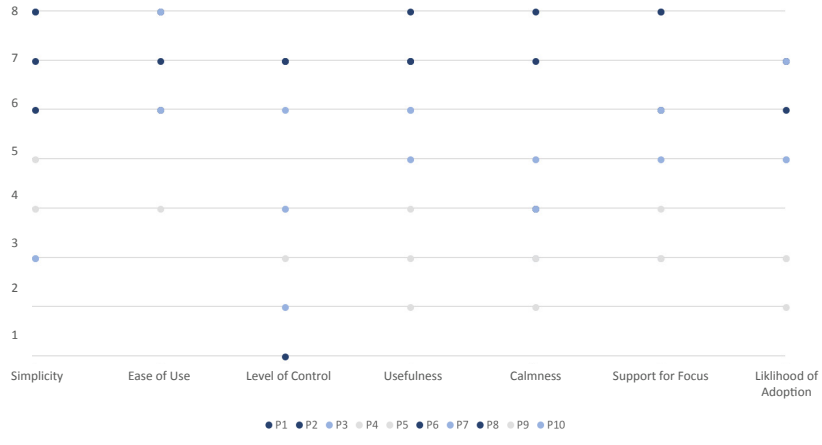
Appendix

Semtantic Differential Responses

Focal Spaces



Daily Switch



Attention Coach