Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Architecture and Design
Department of Design

Vemund Holmeset

Addictive UI: The art of keeping the users attention

An investigation into time-distortion and the flow-state with TikTok

Master's thesis in Master in Interaction Design
Supervisor: Eleftherios Papachristos
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Abstract

We live in an attention-based economy online. Which means that the main source of revenue for many companies is not your money, but your attention. To keep the users attention, addictive strategies have been created. When using these strategies, it can provoke the user to enter a flow-state. In this state-of-mind, the user is absorbed in a hyper-focus of productivity where they can experience time-distortion. Many wellbeing-applications have been developed to counter mobile addiction. But none of them contain a feature to help the users when they are absorbed in a flow-state. One of the main ways to quantitatively measure the flow-state is perception of time. And the best way to counter time-distortion is interruptions. Thus, this experiment created an interruption event for the participants while using TikTok. Results show the interruption event significantly increased the participants' perception of time. The thesis presents a concept prototype with a function that allows the user to set up their own interruption event. With the goal of having the existing wellbeing-applications using the concept as inspiration, to adopt a similar feature.

Background

On the Internet, there are many companies with different goals and motivations. Most of these companies operate in an open market, where their main function is to provide services to the users. Most of these services are designed with the goal of providing something of value which makes the users want to use them more. Of the five biggest websites in the world (excluding pornography) Google, YouTube, Facebook, Twitter and Wikipedia, (Bianchi, 2023) four have revenue as a major goal of their service and are for-profit companies (excluding Wikipedia). And they rely on advertisements to reach this goal. This trend follows in phone applications, with TikTok and Instagram being the most downloaded applications globally in 2022 (Ceci, 2023). Advertisers pay these services to display their ads. Thus, the more people use them or how much longer each individual spends on the service. The more revenue the company earns. Xu et al. (2012) argues that the users' playtime is associated with the service's revenue, so it would be advantageous for developers to design systems that keep users attention (Xu, Turel & Yuan, 2012).

What can be described as the most valuable asset on the Internet? It is not our money, considering that the most popular and profitable services such as Google and Facebook provide their main services for free. But our attention and time. The internet can be described as an "attention-based economy", where there are eyes-there is money to be made. Therefore, the main challenge for these companies is to capture the user's attention and keep them using. According to research, users spend more or less the same amount of time online each week, as we do not change our use patterns when discovering new sites (Boik, Greenstein & Prince, 2016). Thus, the battleground commences around who can make the user spend the most time on their service. Plenty of methods and strategies have been developed to keep users' attention.

This inherently is not a bad thing, as people have complete freedom on the internet to choose for themselves where to spend their time. The companies that provide the

best user experience and service should rightfully reap the rewards. But in the quest of keeping the users' attention, some worrying strategies have been employed, which involve unethical design choices. Some have been proven to try to trick, manipulate or coerce (dark patterns) users (Brignull, Miquel, Rosenberg & Offer, 2015). But even worse, some services use what we can categorize as “addictive” strategies to keep the user's attention. There are many forms of addictive design patterns, which are present in video games, online gambling and mobile games. But this thesis will focus on user interface (UI) elements on social media. We are more connected than ever, and we care a lot about how we are perceived and viewed by other people on social media. Thus, it is the one of the platforms that hold the most ethical responsibilities for their users' mental health.

Introduction

There are many ways of categorizing or describing the behavior we associate with the term “internet addiction” and how UI patterns can invoke it. One way which is popularized in research is when applications abuse what is otherwise viewed as positive state-of-mind in psychology: “the-flow-state” (Lyons, Kiyak, Cetinkaya, Hodge & McAlaney, 2022) In this state, users may forget about time and be absorbed in hyper focus, which is advantageous for efficiency and concentration (Csikszentmihalyi, 1990). This state-of-mind can be abused to make users use beyond what they would rationally decide is necessary. The best way of measuring if a user is in a flow-state is looking at their perception of time (Hancock, Kaplan, Cruit, Hancock, MacArthur & Szalma, 2019).

One of the most fast-growing and popular applications in the world is TikTok (Ceci, 2023). The application is better at screen-time retention (attention) compared to its competitors (Turner, 2021). To achieve this, TikTok uses design strategies which may be described as unethical as they can invoke addictive tendencies. As countermeasure to applications like TikTok, there have been many wellbeing-applications developed (e.g. Android OS *Digital Wellbeing* or Apple iOS 12

ScreenTime). These applications focus mainly on informing and analyzing the user data. Giving the users options to block certain applications. But they have no functions that help users who are in a flow-state. This is the research focus of this thesis. With the aim to explore whether users lose their perception of time on TikTok and to provide design recommendations for wellbeing-applications to implement. The thesis will focus on TikTok because of its growing popularity and ability to keep the users attention.

RQ1: To what extent does a TikTok session invoke a flow-state by measuring the users perception of time?
RQ2: Is it possible to develop a strategy which can help users break the flow-state while using TikTok.

Goal: Prototype a design concept which can be used by existing wellbeing-applications now or in the future, aimed at providing users with a way of breaking the flow-state**.**

Ethics on the subject

Internet Addiction

Addiction is usually associated with gambling and drugs, and can be defined as a: recurrent failure to control behavior. experiencing powerlessness and continuation of the behavior despite negative consequences, essentially unmanageability. (Goodman, 1990). With the rise of the Internet in the late 80s, a new disorder started being labeled as *Internet addiction* (Habib, 2019). In 1996, a study reviewed over 600 cases where users showed clinical signs of addiction (Young, 1998). Diagnosing internet addiction has been proven difficult, as it is not negatively chemical or substance dependent. As these technologies have had many benefits and advancement for our society and not something to easily be criticized as addictive (Montag & Reuter, 2017). With the ever-changing landscape of the internet, it is difficult to provide definitions, but the best method to clinically detect internet

addiction is to compare it to other established addictions (Montag & Reuter, 2017). The firsts screening measure developed to diagnose the disorder was to ask questions such as: do you feel preoccupied, a need to achieve satisfaction, hard to control, restless when trying to stop, jeopardized relationships or job, lied about it and used it as a way to escape problems (Young, 1998). Internet addiction is not currently listed as a psychological disorder (Cherry, 2022).

Internet addiction is not something that should be labeled falsely or lightly. This paper will focus on "Addictive UI" which is defined for the purpose of the thesis as: strategies on interfaces that may invoke or provoke addictive tendencies. These strategies should not be misunderstood as claims of direct cause-and-effect evidence of addiction inducing for all users. Unlike more traditional drugs, describing what is addictive is much harder in this environment and requires vital nuance. This thesis will not provide evidence or claim what is internet addiction, physiological effects or diagnose any of the participants, or draw assumptions upon their results. But rather present existing research around addictive UI. And develop a strategy that can help users break what can be described as an addictive tendency, for a undefined user group.

Persuasive design and addictive UI

Persuasive design is about influencing or "nudging" users to certain behaviors (Castmo & Persson, 2018). Based upon psychological and social theories. Nudging users into certain decisions can be both negative and positive, as it will always depend on the motivation and the goals of the designer. To call persuasive design inherently bad is wrong, as there are many scenarios in which it can be used for good. Instead, there is a constant ethical discussion within academia and among design practitioners about when persuasion becomes manipulation (Gray, Kou, Battles, Hoggatt & Toombs, 2018), (Nystrom & Stibe, 2020) and (Shamsudhin & Jotterand, 2022). Chen argues that persuasive design is connected to addiction because it increases screen-time and contributes to the addictive behavior (Chen,

2021). Contrary to persuasive design, Addictive UI is generally agreed upon as unethical. The main issue is rather what can we identify as an addictive UI.

Who has Internet addiction? When is the persuasive design manipulative? When is the UI design addictive? What these questions have in common is the “gray-line” in which they exist. This “gray-line” exists because many of these “bad” design patterns can be used for good. Thus, there is an important ongoing discussion around ethics, law and consumer rights. It is very difficult to identify when a design “has gone too far” or “crossed the line”. Without any “red-line” today, design practitioners have to decide for themselves when the design has “crossed-a-line”. Which means their ethical beliefs play a vital role. This thesis will not try to answer these questions. Or identify where the line is, or should be. But finding one might restrict what we value the most on the internet, the freedom of information.

Theory

How to make Addictive UI

Steve Jobs explained with enthusiasm why the iPad was the best way to browse applications. He believed everyone should own an iPad. He was asked: “Your kids must love the iPad?” He said: “Actually, we don’t allow the iPad in the home. We think it’s too dangerous for them” (Alter, 2017).

Greg Hocmouth, one of the founding engineers of Instagram, observed that he was building an application for addiction “There’s always another hashtag to click on, people can become obsessive”. Instagram is bottomless, Facebook has an endless feed, Tinder encourages users to keep swiping. According to Tristan Harris, the problem is not our willpower but the designers who break down our self-regulations (Alter, 2017). We can categorize the design elements that are used to keep users' attention. To better understand and find strategies to counter them.

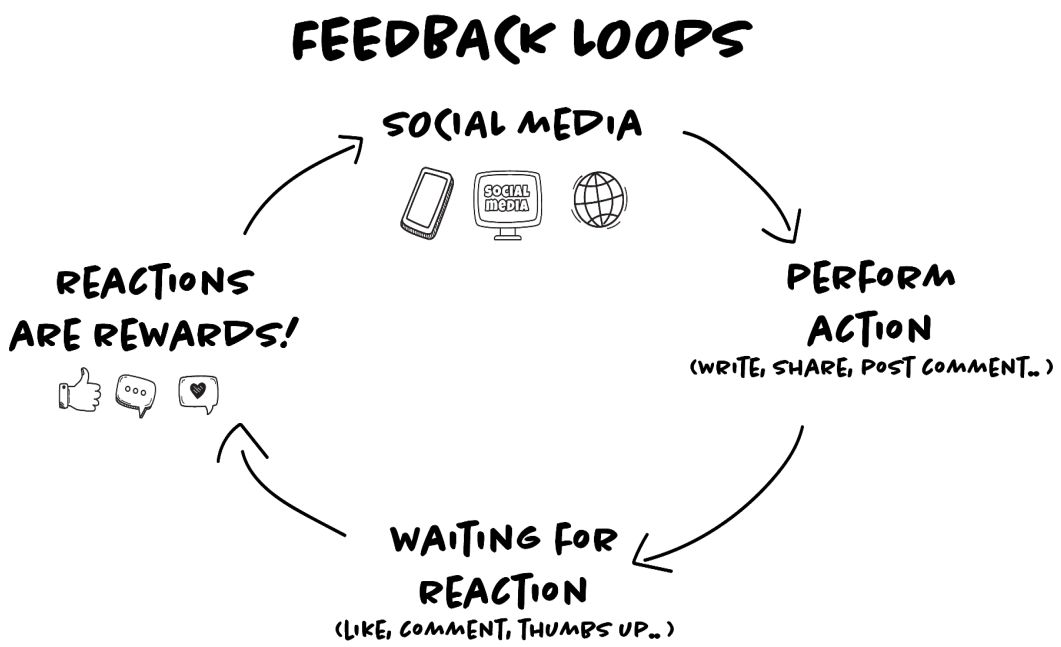

Figure 1. *Social media, perform action, waiting for reaction to receive a reward. Based on (Kumar, 2018) diagram of feedback loops.*

The dopamine is a neuro-chemical which is critical for all kinds of brain functions, in short it is responsible for pleasure feeling. When a person eats, drinks or performs a pleasurable action, dopamine is stimulated, encouraging the person to repeat that action (Macït, Macït & Güngör 2018). Robert Sapolsky, who did foundational research on this at Stanford, calls it the "magical maybe". When the user looks at their phone, there might be a text there or a notification. A large dopamine increase if an indication is seen, and disappears quickly after viewing it (fig 1). Some users get a 400% spike in dopamine when receiving a notification, which is roughly the same as cocaine (Kotler, 2017).

Former Facebook president Sean Parker in 2017 expressed fear over what the social network is "doing to our children's brains". He explained how it is developed to be addictive. Facebook is a "social-validation feedback loop" which exploits the human psyche (Macït, Macït & Güngör 2018). Another Facebook employee Chamat Palihaptyata who worked there between 2007 and 2011 said, "It is a point in time

where people need a hard break from some of these tools and the things that you rely on. The short-term, dopamine-driven feedback loops that we have created are destroying how society works“ (Macït, Macït & Güngör 2018).

On 1 April 2015, Reddit admins unleashed a prank on its thirty-five million users, which demonstrates the concept of feedback UI loops.

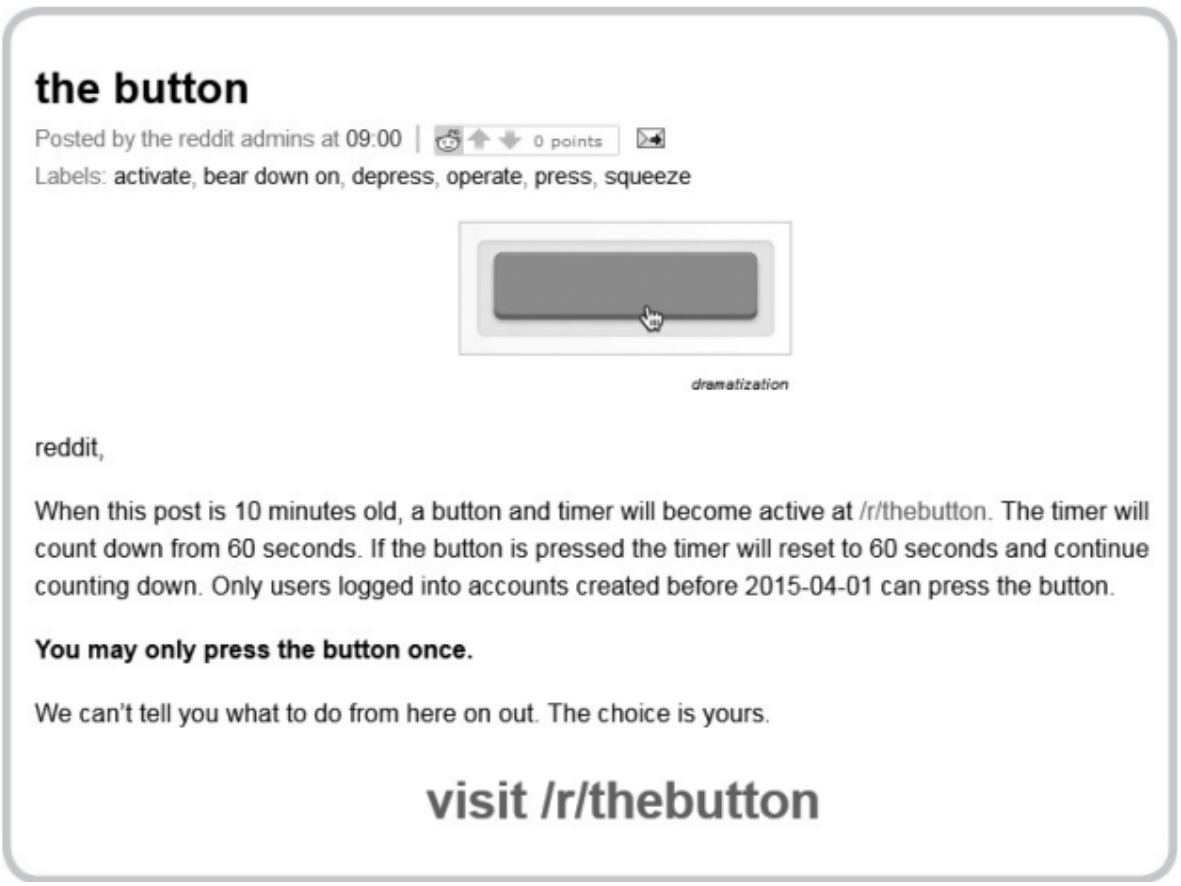

Figure 2. *60 seconds - click the button before the timer reaches zero, every user can only click it once (Alter, 2017).*

The button was a simple concept where a countdown timer would go from sixty to zero. When a random user clicked the button, the counter reset to sixty, and each user could only click it once. How long could the community keep the counter running? (Alter, 2017). Most users clicked the button instantly, while the smart users would stay up all night waiting to press the button on a lower number, to receive a more rare badge to boast their achievement. April 2 (24h later), the timer went below

fifty for the first time. On the forty-eight day, user BigGoron pressed the button the last time (on 0.5 second left), Reddit user hailed him the Pressiah (press-iah) (Alter, 2017).

A very well-known feedback loop is the Facebook *like* button. Users could now receive real time feedback with a simple click, It was interactive and valuable. A post with no likes was a representation of failure (Alter, 2017). The action of liking is so popular that the Merriam-Webster now lists "like" as an alternate definition as "To electronically register one's approval of something" (Petrillo, 2021). In UI design, we can make interfaces that reward the dopamine system. By allowing the users to track their status and have other users interact with it. Facilitating users to grow and foster their reputations. Whether it is a like button, notification, ranking structure, reward system or a competition.

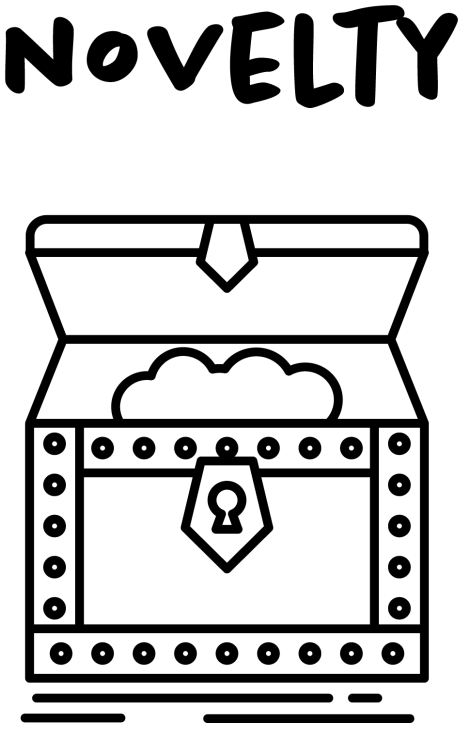

Figure 3. *Novelty, the excitement and fear of the unknown. Illustrated with the infamous famous loot boxes.*

Novelty seeking can be defined as the receptiveness of an individual towards new ideas (Hirschman, 1980). When talking about substance drugs, Novelty seeking stands out as key. Research finds from studies that human and animal novelty seeking models can predict the risk of compulsive use of addictive drugs (Wing, Nesil, Choi & Li, 2016). Novelty seeking is also considered a major risk factor for internet addiction (Li, Zhang, Xiao & Nie 2016). Novelty seeking is a mostly used term in pornographic addiction. But is also used in gamification and UI design. The main difference being, instead of searching for something new and better, taking the addiction one step further. Novelty is used here to keep users interested in known ideas by avoiding hedonic adaptation. Hedonic adaptation refers to when people become used to a positive or negative stimulus, the effects of that stimulus decrease over time (Lyubomirsky, 2011).

When designing to keep users attention, it is important to avoid hedonic adaptation. Users should not be able to predict what is coming. There should always be the possibility of surprise or change. Actions such as updating the UI frequently helps in this regard, but there is a fine balance between changing too much or too little. Providing unpredictable rewards like the infamous loot boxes is the easiest way of achieving novelty. For YouTube, Facebook or Twitter novelty is built into the design. There will always be new items on the timeline.

No one has mastered novelty as well as TikTok and YouTube Shorts. By moving away from the somewhat predictable *following* or *friends* content-oriented timelines. Where the user has an idea of what is coming next, based upon who they follow or know. To the new AI user-data *for you* pages. Where the user never knows what is waiting on the next slide. It might be something funny or something the user does not want to miss out on, so why not slide one more?

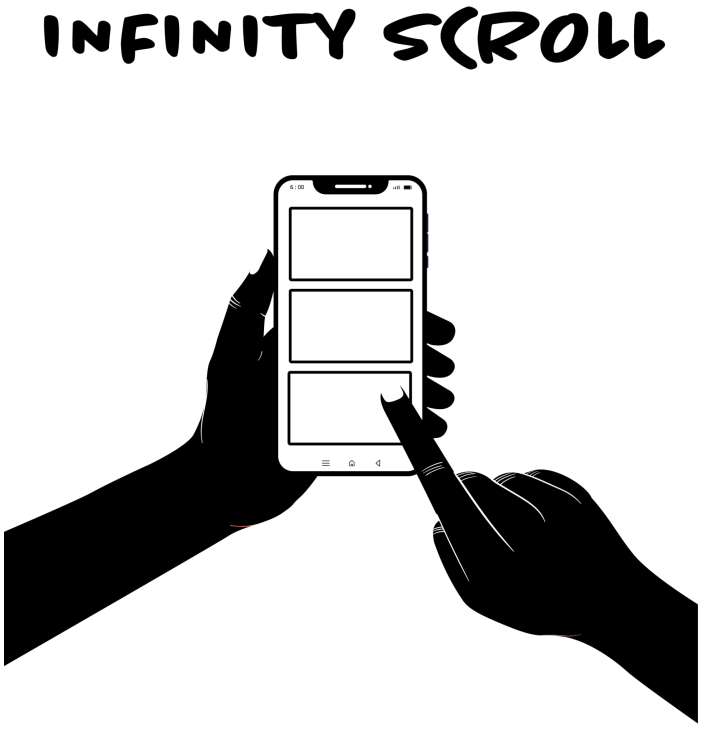

Figure 4. *Infinity-scroll, allows for fast, easy and never-ending interactions.*

Web development has moved continuously in a direction of reducing waiting time and a more fluid user experience. First we had the (SPA), a web application that could fit into a single-page. Now we have infinite-scroll, where users can scroll through large amounts of content, without clicking *next* or *view more*, browsing faster and easier (Karlsson & Larsson, 2016). Infinite-scroll is used to its full potential on social media. Making the user more vulnerable to consume more than they would without it. Resulting in them spending more time than intended (Neyman, 2017). It is possible to trick consumers to eat more soup by giving them a bottomless bowl, resulting in an increase of 73% consumption (Harris, 2016). In essence, infinite-scrolling is used to prolong usage, because it lacks any stopping cues (Noe, Turner, Linden & Allen, Winkens & Whitaker, 2019). Stopping cues allows users to think about what they are doing, which might distract, bore, or simply remind them that they have something else to do.

The addictiveness of infinite-scrolling lies in the experience of “forgetting time”. The flow of eternal content makes the consumption of endless novelty possible

(Paasonen, 2016). The rhythmical ease of scrolling and habitual movement makes it hard for users to make a conscious decision to stop. The aim is not to win, but to simply make users continue. The effortless rhythmical design of social media platforms blends into our everyday life, generating effortless dwelling (Jovicic, 2020). Infinity-scroll is an important component for making the user forget time and worries of everyday life. A perfect tool to escape and capture the user's mind without letting go.

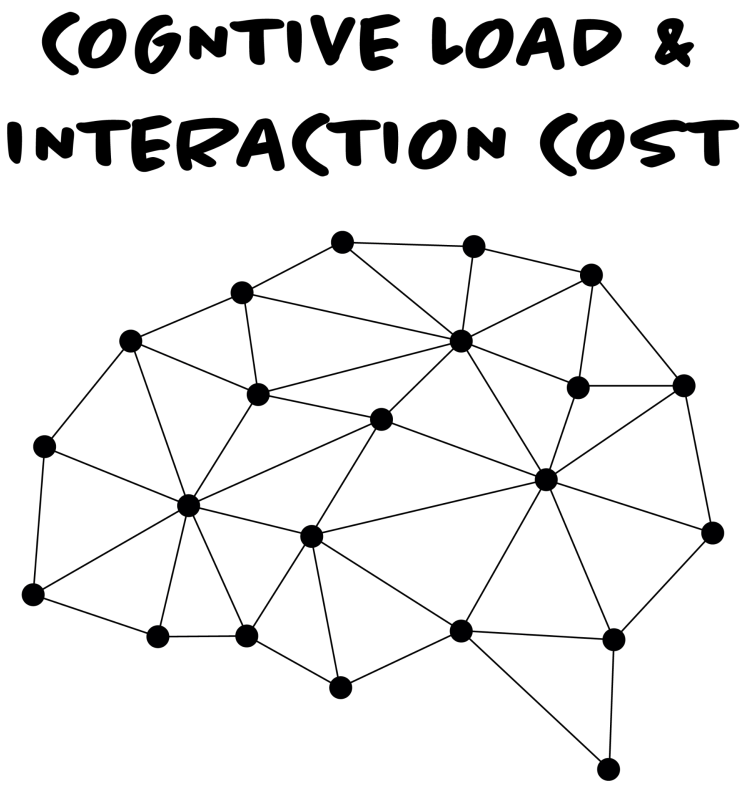

Figure 5. *Reducing cognitive load and interaction cost, makes it harder for the user to take breaks.*

To keep the user using, interactions have to be smooth and flow with ease. Both mechanically and psychologically, to accomplish this, the designers need to focus on reducing cognitive load and the interaction cost. When we receive information which triggers a call for action or a reaction, the brain must decide whether to use or not “digest” the information. The brain uses resources to process the information, the amount of resources depends on the cognitive load. Essentially, the brain can

only store a certain amount of data (Kadzhoshalieva, 2020), When our design requires too much data the user becomes fatigued and frustrated. It is well-known in UX-design, to reduce cognitive load to avoid poor decisions, productivity and stress. Thus, reducing the cognitive load is a natural step in creating additive UI, so users feel less inclined to take breaks (Note: these are fundamental positive principles of UX-design, which cannot be argued as addiction inducing alone. But rather an important component in creating the addictive UI).

Cognitive load is the mental aspect, while interaction cost is the mechanical by making sure the interactions flow with ease. By reducing the required desktop typing/clicking or phone swiping, which is necessary to complete a task. In general, minimizing the mechanical effort it takes to perform those interactions can provide a good user experience. But for addictive UI, this principle is pushed to its extreme. Often reducing the interaction cost to a single swipe or button press. Google introduced the YouTube Shorts function in July 2021 ("YouTube Shorts," 2023), which is a copy of the super successful TikTok UI model. Let's illustrate the difference using a basic user journey:

YouTube "**original**" → browse/search for videos → click video → adjust quality → adjust video size → adjust volume → click play → exist video → repeat (all interaction done by swiping/pressing the screen or moving/pressing the mouse multiple times).

YouTube shorts: click YouTube shorts → next video (one swipe - one keyboard button. Then repeat action forever with infinity-scroll).

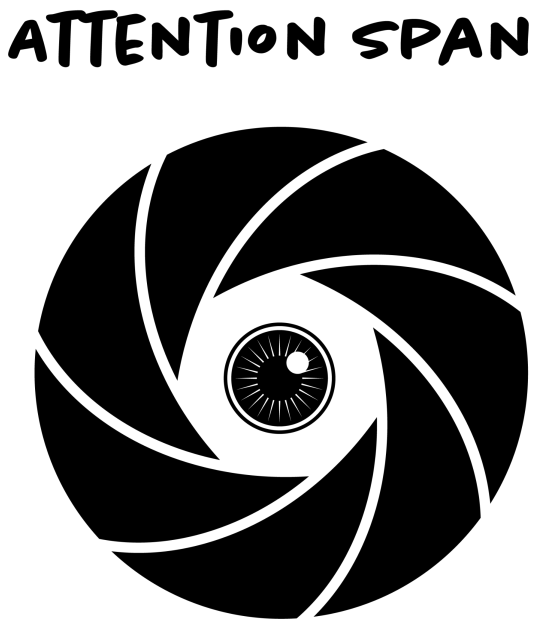

Figure 6. *To keep the users using, keep the content short and engaging.*

A person's attention span determines how long they perform a task or view content before becoming distracted. Hyper stimuli and quick to consume content increases the chance of users not becoming distracted and losing focus. Twitter allows only 280 characters, YouTube Shorts and TikTok primarily allows only 60-seconds long video clips. Some studies have shown that children have lower attention span, and that the children's attention span-persistence measured at young age can predict factors such as college completion (McClelland, Acock, Piccinin, Rhea & Stallings, 2013). A study on human attention span and modern technology, found that the average human attention span was now eight seconds (Bradbury, 2016). If our mobile internet culture is a direct factor in shorter attention span is disputed. Statistics posted in Time magazine, New York Times, Telegraph and more states that the average attention span is down from 12 seconds in 2000 to eight in 2018. But scientists that have studied human attention span say that it is not correct (Subramanian, 2018). Study shows that finding an average attention span is meaningless as our attention span is very much task dependent (Subramanian, 2018). Researching a complex single value like attention span, seems to be difficult and not something that can be done by comparing older to newer generations. Further studies have found that there is no connection between attention span lengths and

number of social media accounts and frequency of use (Kies, 2018). Meaning, the claim that social media platforms are decreasing the user's attention span is disputed. Attention span is about avoiding long form content. All Addictive UI strategies naturally become more effective if they are consumed at a faster rate. Addictive UI strategies serve much less of a purpose when watching, e.g. a movie or reading an article.

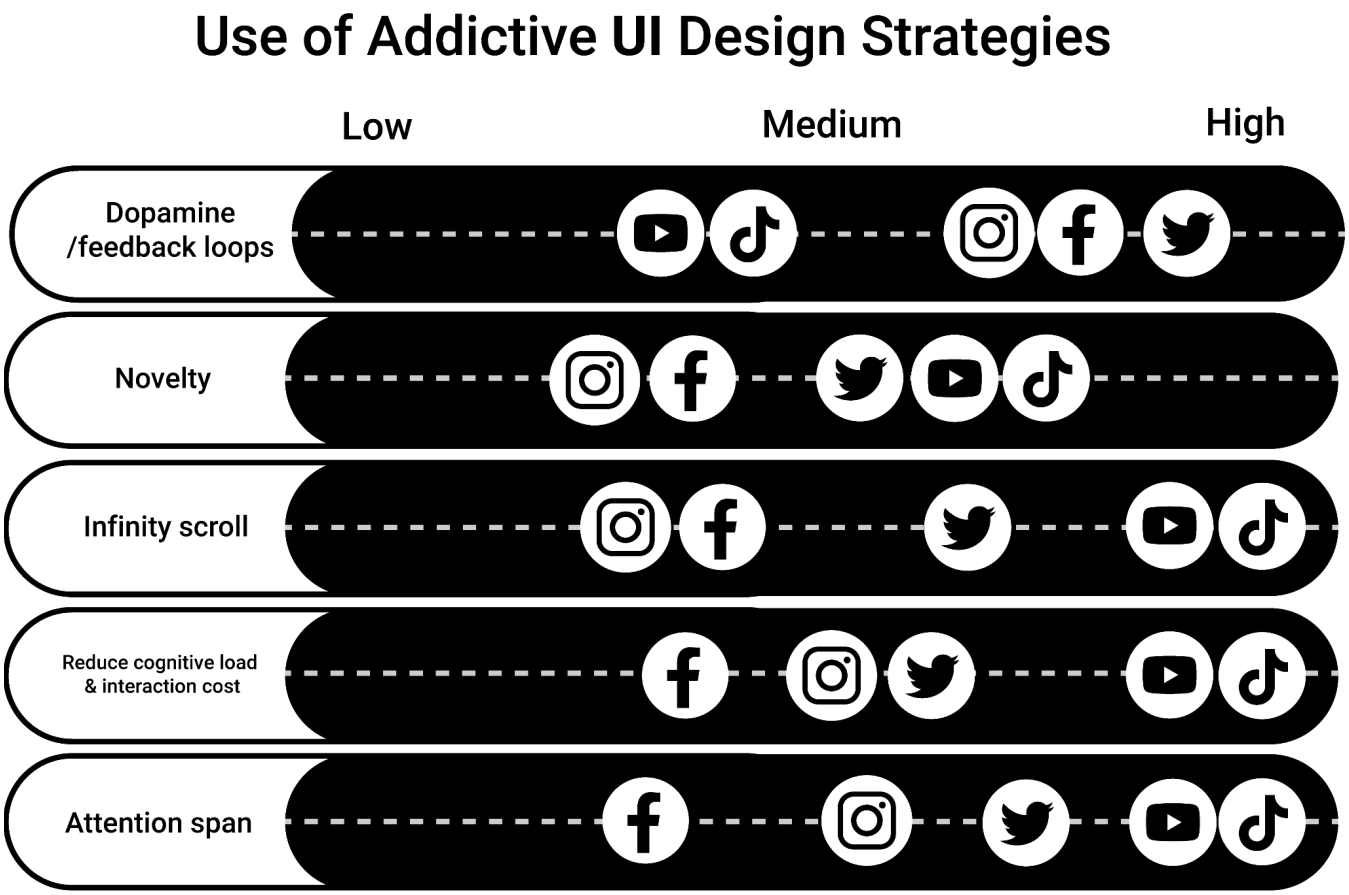

Figure 7. *This thesis analyzes of the severity of the different social media applications, with their usage of addictive strategies: Instagram, Facebook, Twitter, YouTube Shorts and TikTok as of March 2023.*

Fundamental principles of UX design is to make applications easy to use and learn. Many of these strategies can be viewed as positive aspects of UI design in different circumstances. (Montag & Reuter, 2017) argues that strategies such as these are important advancements in UX-design for creating easier and more effective

applications. This means it is counterproductive to condemn them as a whole. Stating, e.g.: “Infinite-scroll is an inherently addictive function and should be banned” is a pointless statement, as it is a function that has made browsing much easier and faster. Instead, we must view how the accumulation of the addictive UI strategies is used. While being aware of the motivations and ethics of the designers and the stakeholders who facilitate their inception. The designers of these systems are not blind to the physiological effects of how and why these strategies work (Courtwright, 2019). Although they might claim to not realize that they are considered “harmful”.

The flow-state

When these Addictive UI strategies are used together, they can provoke the user to enter a flow-state (Petrillo, 2021). “Flow refers to an optimal experience in which a person is fully immersed in an activity due to a feeling of energized focus” (Csikszentmihalyi, 1990). This state-of-mind can be important and positive for productivity. Therefore, any interruption from the flow-state can be viewed as a negative (Lyons, Kiyak, Cetinkaya, Hodge & McAlaney, 2022). Thus, the flow-state is rightfully seen as a positive frame-of-mind in psychology. However, this flow-state can be abused. Several studies have shown that the continental use of the flow-state during media consumption can provoke addictive tendencies (Chen, 2006). The characteristics of a flow-state can be viewed as a precursor for addiction (Khang, Kim & Kim, 2018). In society and design, the flow state is accepted to be a positive and rewarding experience, so it is natural that such experiences for users could lead to addictive behavior (Hull, Williams & Griffiths, 2013). When it is encouraged and fostered by many communities as a positive state-of-mind. While the negative side of the experience is mostly ignored.

TikTok

A 2023 report from “Common sense” which was reported in The Washington Post. Surveyed 1,300 adolescent girls from the United States. Found that nearly half (45%) of the girls answered that they feel addicted to TikTok. While 68% percent of the girls who had symptoms of depression said they felt addicted to the application (Common sense, 2023). Although, how the survey defined what it meant to be addicted to the application is not shown. If the participants themselves were asked to use their own interpretation of the word, the results might be unreliable.

Smith and Short (2022) studied 354 college students using the Bergen Facebook Addiction Scale. While switching the same six criterias from Facebook to TikTok. With a perceived more reliable criteria to base the term addicted on, they found that 68% had “no risk”, 25% “low risk” and 6.4% being classified as being “at-risk” of addictive tendencies (Smith & Short, 2022). With over 1 billion monthly users equals 64,000,000 people potentially being “at-risk” based upon the sampling of college students.

TikTok is available in over 150 countries, with over 1 billion active monthly users (For reference, Facebook has 2.9B, YouTube 2.2B and Instagram 1.4B). Users spend an average of 95 minutes per day on the application (Wallaroo, 2023). TikTok is much better at keeping the user's attention for longer sessions compared to its competitors (Turner, 2021).

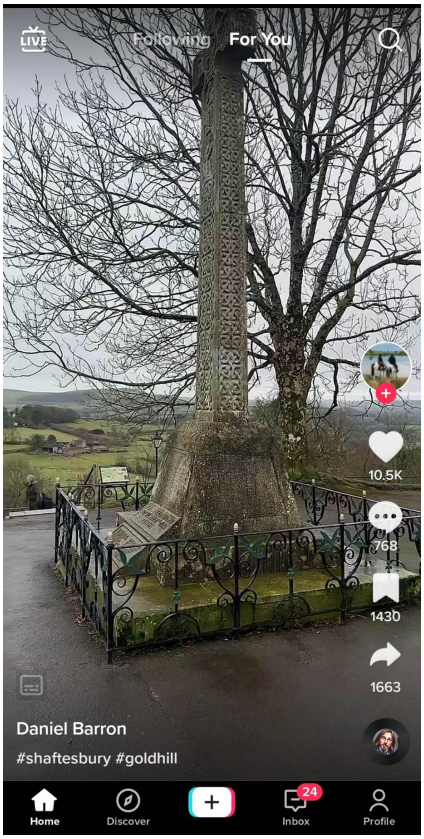

Figure 8. *The TikTok UI.*

TikTok is a massive social media short-format video-sharing application. With easy to consume content, often involve memes and music. The UI is hyperfocused on reducing cognitive and interaction cost. With a single action required to proceed, backed by a never ending infinity-scroll. TikTok's success is mainly attributed to its beyond-human-intelligent AI. Which is responsible for the revolutionary *for you* page (the AI is surrounded by controversies and privacy concerns which collects user-data to tailor content to every individual). This *for you* algorithm has a strong novelty effect, as the user can never predict what is coming next. Overall, the application is a good accumulation of the addictive strategies which are needed to absorb the users in a flow-state.

Pertillo (2021), describes the TikTok UI among these lines, The infinity-scroll and novelty, may induce a flow-like-state, which puts every user in a trance of focus and productivity. A person immersed in this state, may experience time-distortion. Plus

reducing interaction the cost further enables the entrance into this flow-state. All of these components together increase the application's addictiveness (Petrillo, 2021). The infinity-scroll functions like a slot machine. Rewarding the novelty and dopamine system. As the stimulus varies depending on the quality of the videos. Which keeps the user engaged, as the next video might be “the one” (Petrillo, 2021). Zhao & Zhuo (2021) argues that the addictiveness of TikTok is associated with an entertainment spiral where the users experience a flow-state. In this flow-state, users feel enjoyment, concentration and time distortion (Zhao & Zhuo, 2021). This flow-state is also relevant in other avenues, like gambling addictions (Park & Hwang, 2009).

Qin, Omar & Musetti (2022) researched TikTok addiction with the S-O-R model. They examined the flow-state, and found that concentration was the most important factor in the determining the addictive behavior. They then demonstrated the importance of the flow-state (enjoyment, concentration and time distortion). When determining the addictiveness (Qin, Omar & Musetti, 2022). And the obvious counter to concentration is interruption.

TikTok positions itself publicly as a company that wants to attract the user while contributing positively to society. Therefore, the company would not like the application to be exposed as addictive. Thus, the UI should be improved to provide an effective function to interrupt users who have been immersed on TikTok for too long (Qin, Omar & Musetti, 2022). As of 3rd March 2023, TikTok guidelines announced their update to limit daily screen time to 60 minutes for all people under 18 years old. These people will be forced to enter a passcode to continue watching. (Weatherbed, 2023). TikTok is well aware of the nature of their application and how it is being used.

Pertillo (2021) explains how flow-inducing IU and infinite-scroll capitalizes on reward-based learning processes, forming dopamine loops and fostering addictive use. This is concisely engineered by the developers, and therefore could just as easily be eliminated by the same people. But they would never admit that the success of

their application depends on the ability to manipulate their users. The design is conscious and deliberate (Petrillo, 2021). The ethical implications of this statement cannot be understated. If such environments exist where designers are deliberately using the psychological literature to "hook" the user. There has to be a societal discussion about company responsibilities and ethical conduct.

Countermeasures

Looking beyond psychological treatments such as therapy. Or law and regulations. Which are all important and relevant countermeasures. For the purpose of this thesis, it is more advantageous to look at practical solutions by researching the 3rd party wellbeing-applications developed.

Existing applications

Name	Downloads	Rating	Main features
Forest	**10M+**	**4.6** ⭐	- Uses gamification to reward users by growing a virtual forest. - Putting down your phone or finishing your to-do-list will grow the tree. - Set reminders, timer-mode or pomodoro to more effectively track or follow your progress.
StayFree	**5M+**	**4.6** ⭐	- It has many features to stop or limit usage: block, focus, sleep, pause and lock. - Allows the users to track their progress with history and statistics visualized with charts. - Contains information customization and inspiration quotes.
YourHonor	**1M+**	**4.5**⭐	- Focuses on personalized features to allow users to control their usage. - Customized dashboard, to set goals, timers and daily routines. - Receive daily reports, statistics and the possibility to export your data for further research.
Quitzilla	**1M+**	**4.4** ⭐	- A general “bad habit” tracker, which allows users to log and consciously be aware of their habits. - Uses gamification with rewards and achievements for quitting or following goals. - Allow users to write and see their motivations, showcasing useful statistics.
SPACE	**1M+**	**4.2** ⭐	- Categorizes and allows users to understand what “type” of user they are. - Set goals, exclude applications and notification blocking. - Share your progress with friends, families, colleagues and build habits together.
Digital Wellbeing (Android OS)	**1B+** (Android Operating feature)	**3.3** ⭐	- Focuses on improving wellbeing by visualizing and making disconnecting easier. - Get a daily view of your digital habits, use-time, notifications and how often the user checks or unlock their phone. - Set time-limits, Bedtime-mode and focus-mode.
BlockSite	**5M+**	**3.1** ⭐	- Allows users to gain more self-control by blocking apps or sites when they need to keep focus on another task. - Stay focused: remove all distractions, like blocking adult content. And schedule your work. - Can sync with the computer, so the app works cross-platform.

Table 1. *Overview of the most popular wellness-application on Google Play Store.*

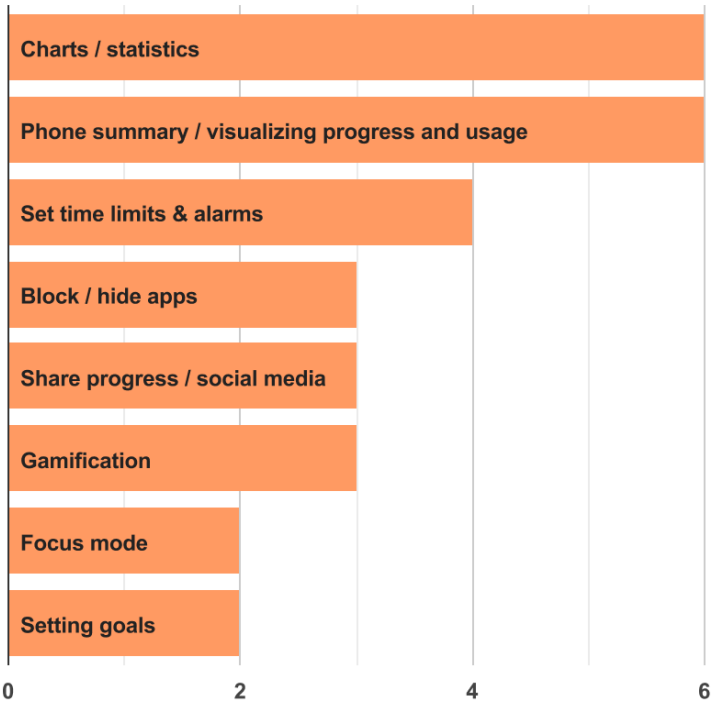

Figure 9. *Distribution of the features provided by the 7 wellbeing-applications on (table 1).*

Summarized, the wellbeing-application's primary functionality is to track the users. Allowing them to set goals and visualizing their progress with statistics. The users can: block, lock or hide certain features. The philosophy is to prevent bad behavior by rewarding good behavior, often with gamification. For a persona TikTok user, these applications would be good at preventing the user from opening the application. Or after using it, visualizing how much time they have "wasted" on it. But none of the current wellbeing-applications listed here would be effective at stopping users in a flow-state. Research shows that wellbeing-applications focus mostly on limiting screen time, with over 70% of the applications providing tracking of use, visualized with charts (Almoallim & Sas, 2022).

(Table 1). Contains many of the most downloaded apps on the Google Play Store for Android. The applications were found using keywords such as: "screen time", "addiction reducing", "wellbeing" and "phone tracker". The table excludes applications with less than 1 million downloads. The purpose of the table is to gain a

general overview of the most relevant wellbeing-applications being used today to counter addictive tendencies.

Monge & Russis (2019) performed a critical review of over 42 digital wellbeing apps and conducted an experiment with 38 participants. They found that the road to effectively helping the user in changing behavior with the wellbeing-applications is still long. The apps are useful in specific situations, but bad at making the user form new habits (Monge & Russia, 2019). (Walsers, Jong & Remus, 2022), findings contradict Monge & Russia (2022), stating that awareness and self-monitoring is important in mitigating smartphone addiction. While still acknowledging the weaknesses of features such as blocking (often viewed as too strict) and gamification (fun, but lacks evidence of stopping the addictive use).

Lyons et al. (2022) observed the same, with a clear lack of software applications that could meaningfully stop the flow-state and feedback loops. They proposed a prototype which was specially designed to combat this. The design was an "interruption event" that would break the user away from their feedback loop and timeliness state (Lyons, Kiyak, Cetinkaya, Hodge & McAlaney, 2022). The solution was a pop-up dialog that the user had to acknowledge before continuing. The prototype proved to be effective in bringing the user out of the flow-state (Lyons et al. 2022). The prototype would track how long each application had been used. Then provide a time-set interruption event when necessary (Lyons et al. 2022). The user could customize when the interruption event would occur. Lyons et al. (2022) implemented and ran experiments on the prototype with participants and received a majority of positive responses (Lyons et al. 2022).

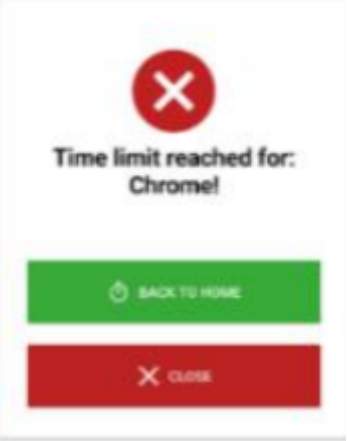

Figure 10. (Lyons et al. 2022) Interruption event.

Lyons et al. (2022) prototype did show promise in stopping the flow-state. The interruption event forces the user to make a decision, either by continuing or quitting the session. This may deter some users from trying the application as it may seem as an excessive action. The new application *one sec* has improved the interruption event model by providing a more user-friendly UI.

one sec	**50K+**	**no data**	**Pros** - one sec makes users take a deep breath whenever opening the application, creating a distraction, which often results in users deciding not to open the application. - Simple yet effective idea that requires not much intervention or commitment from the user. - Designed to make users think and reflect on their actions. - Aimed to change bad habits as applications appear less appealing to your brain. - Easy to use and learn with a relatively simplistic yet appealing UI. **Cons** - one sec only works when the user is opening the application (not during use), meaning it is not effective in stopping users in a flow-state. - One second might not be enough time, and should be customizable for the user.

Table 2. *Overview of the characteristics of the application, one sec.*

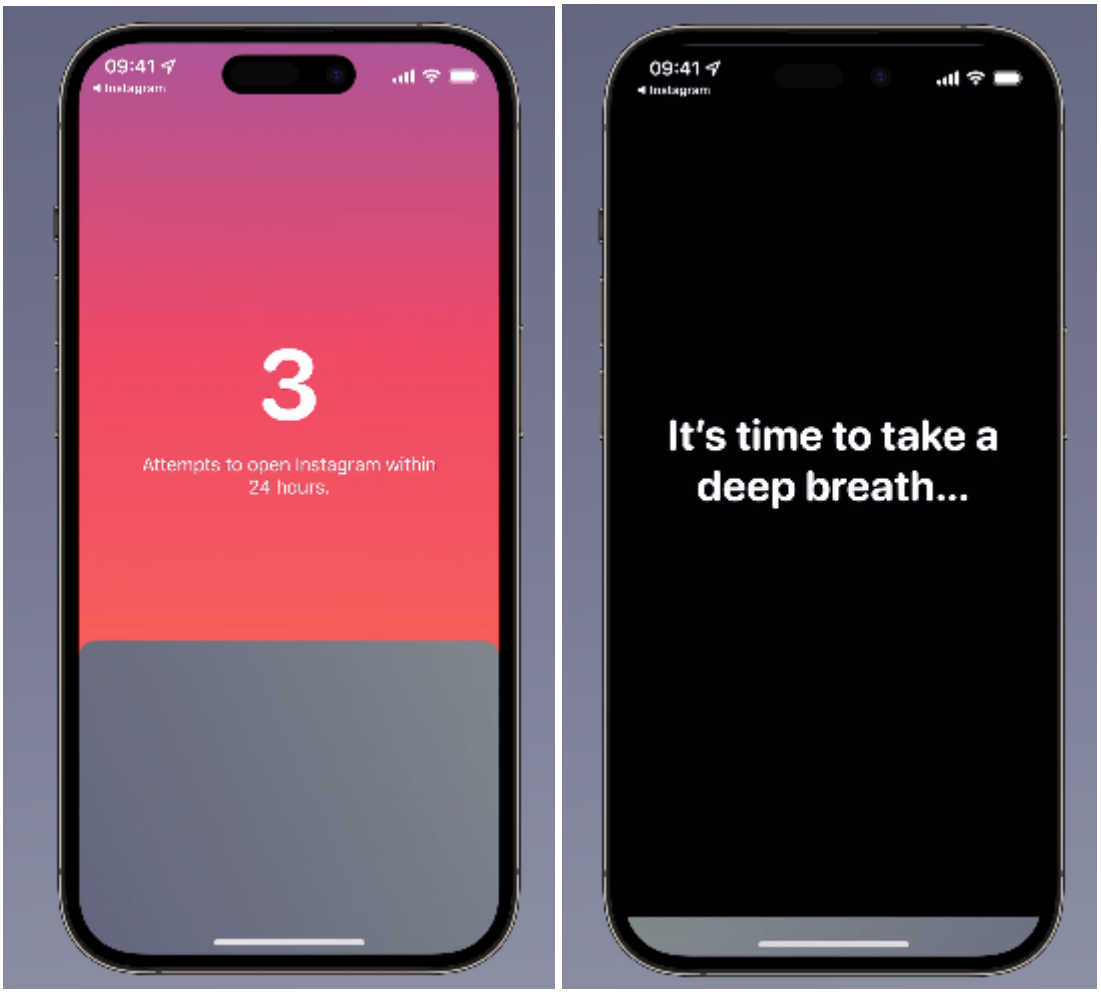

Figure 11. *one sec interruption event in action (one sec, 2022).*

In February 2023, Gruning et al. (2023) from the Heidelberg university tested the on sec application on 280 participants over 6 weeks. They found that the application reduced app usage in two ways: (1) on average or better just 36% of the participants, closed the application after they saw the one sec pop-up. (2) Over the six weeks, users attempted to open the target application 37% less often. In total, the application decreased the actual opening of the targeted application by 57% over six weeks. The study also showed an improvement of overall happiness during the six weeks (Gruning, Riedel & Lorenz Spreen 2023). Even though these results are promising, more studies showing consistent positive results are needed to make conclusions about the feasibility of this countermeasure. This design project will take inspiration from and combine the concepts of Loyns et al. (2022). Interruption event and the one sec application UI (one sec, 2022).

Breaking the flow-state

Many psychologists believe that during flow, users lose track of time and experience time-distortion (Rau, Peng & Yang 2006). It is accepted that a time-distortion is one of the additive symptoms of internet use (Greenfield, 1999). Research has shown that individuals with smartphone addiction perceive time moving faster. And the users' perception of time is a major marker which can be used to classify the severity of their addiction (Lin, Lin, Lee, Lin, Lin, Chang & Kuo 2015).

Hancock et al. (2019) performed a meta-analysis of 63 quantitative studies on the flow-state's relationship with the experience of time. They found that the only aspect of the flow-state that can be measured quantitatively to some degree is time-distortion (Hancock, Kaplan, Cruit, Hancock, MacArthur & Szalma, 2019). Of the nine dimensions of the flow-state, the sense-of-time is the only dimension which can be expressed externally. Which means it is the most valuable tool for identifying and evaluating the degree of the flow-state (Hancock, Kaplan, Cruit, Hancock, MacArthur & Szalma, 2019). Their findings show a strong empirical impetus for the role of time perception as a valid and reliable quantitative metric for flow-state assessment (Hancock, Kaplan, Cruit, Hancock, MacArthur & Szalma, 2019). Interruptions breaks the flow-state, which means we can use the participant's perception of time to determine the effectiveness of the interruption.

There is not as much research on stopping-cues for internet addiction, but there is similar research from other fields that uses the flow-state to “hook” players, such as online gambling. Harris & Griffith perform a critical review of the harm-minimisation tools and research done for electronic gambling (Harris & Griffiths, 2017). The review contains 20 studies, to name three findings at random:
(1) (Floyd, Wheelan & Meyers, 2006), evaluated if warning messages impacted gambling behavior. Participants exposed to warning messages had significantly more money remaining at the end of play.
(2) (Auer & Malisching & Griffiths, 2014), evaluated if pop-up messages would facilitate gambling session cessation. They found that there was a nine-fold increase

of gambling cessations at the 1000-spin mark when there was a pop-up message informing the number of plays.
(3) (Stewart & Wohl, 2013), Asses if a momentary pop-up would affect craving and dissociation. They found that the pop-up reminder would make participants more likely to adhere to monetary limits set by the user.

Lavoie & Main attempted to use interruption events to thwart the effect of the flow-state during gambling. Similarly to *one sec,* they provided warning messages before play about how much money they had lost. This measure failed to significantly reduce the flow-state during gambling (Lavoie & Main 2019). This suggests that taglines and advertisements that are used to warn people of the harms of gambling are likely more ineffective, because the flow-state takes over during gambling not before (Lavoie & Main 2019). (countering the findings of Gruning et al. (2023)). Overall, interruption events were shown to have success in stunting online gambling.

The literature findings summarized

Using addictive strategies can provoke the user to enter a flow-state. The user perceives time moving faster while experiencing hyperfocus in this state-of-mind. We can break the flow-state with interruption, while using the user's perception of time to measure the effectiveness of the interruption. To research the validity of these propositions. This experiment will create an interruption event when participants use TikTok. Then measure if this event breaks the flow-state.

Literature search

The thesis is primarily based on academic literature around addictive UI using search engines: Google Scholar and Oria library. With literature from journals such as: *psychology of addictive behaviors, Frontiers in Psychiatry* and *Journal of Gambling Issues.* And the CHI (Conference on Human Factors in Computing Systems) conference. The keywords used for the literature search were: addiction, Internet addiction, interruptions, and the flow-state. The primary source of inspiration for the subject was from Nathalie Nahai an expert in psychology, persuasive tech and human behavior. Writer of the international bestseller *Webs of Influence: The Psychology Of Online Persuasion* (Nahai, n.d.). Nahai held a presentation in the Qt World Summit in 2019, explaining how to create addictive UI by reducing interaction cost/cognitive load, dopamine loops and unpredictable rewards (novelty) (Qt Group, 2020). Her ideas were the foundation of the literature search and research topic. While concepts, such as abusing the flow-state, came during the literature review.

Method

Overview

The goal of the experiment was to answer RGQs 1 and 2 with empirical research. Using the application TikTok ver. 29.7.3 (TikTok n.d.). Testing to what extent a TikTok-session invokes the flow-state by measuring the participant's perception of time. Then having the same participants perform the session with interruption events to examine if it had an outcome on the variable.

There are three main methods commonly used to determine time estimation in experiments (Bindra & Waksberg, 1956). *Verbal estimation*, *production* and *reproduction*. This study will use reproduction, which means the participants will perform an action twice. Two intervals, and the participants must determine which is longer or shorter (Bindra & Waksberg, 1956). For this experiment, the intervals will be the same length, but the content will vary.

Target group & sampling

The target group was adults from the age of 20 to 60 years old. The goal was to collect data from a sample size that would be adequate considering the time limitation as a solo project. Therefore, a non-probability sampling method was used. The desired number of participants was obtained through the use of convenience and snowball sampling. An important consideration in the selection process was to ensure variation while avoiding testing an excessive number of participants from the same user group. To achieve this, the participants were individuals from different ages, occupations and genders. The procedure resulted in 30 participants (13 female, 17 males aged 22 - 62 mean age = 42).

The first participants were gathered by a personal means, such as friends and family, often through social media. After the participant had completed a test, they would be

asked to recommend or help find more people. Often resulting in their parents or friends. Thus, participants were first collected with convenience sampling, which turned into a snowball sampling.

Ethical considerations

When dealing with people, we have to take necessary steps to ensure their privacy, security and rights are upheld. For certain experiments, approval from institutions or written consent-forms should be deployed. To protect both the participants and the conductor, especially when dealing with children or personal information. For this experiment, the researcher did not require any personal information which could be used to identify or harm the participant. All that was collected was the person sex and age. Essentially what was required was having an adult view TikTok for 30 minutes and answering five questions related to what they saw. Thus, the experiment could be undertaken with verbal consent. The participants were assured beforehand that no recording was taking place and their information would only be written down on paper. Their data would be used for a master thesis, which would be public publication. They could leave or quit the experiment at any time, and their help was greatly appreciated. The experiments ran smoothly without any complications.

Work progress

Reaching the final procedure involved trial-and-error, therefore the methodology will be presented in a chronological order. The participants had to be TikTok users and familiar with the platform.

Control session First version: ask the participants to use TikTok normally without telling them for how long. Meanwhile, the observer would time the session in 10 minutes with a stopwatch. When the session was complete, they would be asked how much time they thought had passed. If the participants reported a time less than 10 minutes. We can then assume that the participants were absorbed in a flow-state.

The flow-state relationship with time-distortion as a determining factor has also been studied by (Varma, 2018) and the studies within (Hancock, Kaplan, Cruit, Hancock, MacArthur & Szalma, 2019) meta-analysis involving 63 articles.

Deducing the severity of the flow-state for each individual, or its legitimacy as a single variable, was not the goal of the experiment. Most humans perceive time differently, as there would be natural variation. The variable that was valuable and reliable was the difference between using TikTok with or without interruptions.

One aspect of the study design that was carefully considered was the testing environment. For the flow-state to be most effective, the environment had to be natural. This ruled out lab or physical study. Quantitative data was collected, thus it was not necessary to observe body language or facial expression for emotional queues. The best environment would be where they consume TikTok normally, in the comforts of their own homes.

It was vital that the participants did not know the experiment was about time perception. Knowing the exact purpose of the study could lead to deliberate or unconscious adaptations that could affect the results (e.g. the hawthorne effect (Wickstrom & Bendix 2000 or desirability bias (Fisher, 1993)). Therefore, the participants were told beforehand that the subject was on their *for you* page and the algorithm (AI).

The control session was piloted multiple times. The first time, the observer called participants over messenger and told them to open TikTok and start watching for an undefined timespan. It became apparent that the mere presence of the observer in the voice call caused distractions. The participants would often ask questions or explain what they saw. Thus, the next time, the observer explained before the procedure that the subject was about AI. And they should just ignore the observer and ask questions afterward. The final solution for the control session was that the observer called participants and explained the process like this: “I will hang up the call, you watch TikTok, I will call you back and ask you questions”. This way, the

participants could watch TikTok in peace, in the most natural situation possible. As the observer timed the session before calling back.

The next concern for the control session was how to ask, “how much time do you think have passed?” Without the participants becoming aware of the real subject. It would be easy to falsify the results when all phones have a clock, which they could use to time their session. Therefore, for the first pilot-test, the participants were asked to go into settings and hide their clocks. But that is not possible on an iPhone. It would also make them aware that the subject was most likely connected to time.

Thankfully, people are not aware or thinking about how much time is passing. So it was about hiding the real subject. The solution was furthering the algorithm plot by asking questions such as: “what kind of videos did you see?” or “Do you think the algorithm knows what you like?”. Then at a random point during the interview ask, “by the way, how long did you think you watched TikTok?”.

This often resulted in a short answer: “like eight to 10 minutes” or “like seven minutes”. Which is not an accurate answer per se. but rather a “feeling” or a “hunch”. Fortunately, this is exactly what was wanted. The “feeling” of flow and time-distortion is not something that can be pinpointed down to the quantitative margin, as that is not how people “feel” time. This is also why the session length was changed from 10 to 12:30 minutes, to avoid as many 10 minute answers as possible.

Effect session ran the same as the control session, except the observer was present and provided the **IE** (short for interruption event). The observer piloted and tried different methods of providing the IE. The first way was having the participants download the application “To Do Reminder With Alarm”. Here it was possible to set up intervals every 5th minute which would have to be turned off before continuing, similarly to Lyons et al. (2022) IE. But on the pilot tests, it turned out to be hard to explain how to turn the alarm off, and it caused too much confusion and frustration. Thus, it was easier for the observer to simply ask the participant to stop the video for three seconds and then replay it. The observer told the participants before session

two: “I will have to take some notes, could you stop the video when I ask you to, so I can write down something”. After 12:30 minutes, the observer asked: ”how much time do you think has passed?”. Then explained the actual subject and had a light discussion around it.

Procedure

The optimal way of answering RQ 1 and 2 was with empirical testing. To find the difference in time perception between the two conditions for each individual. First condition being the time the participants notes in the control session. And the second, the time participants “feel” in the effect session with the IE. And the variable which is wanted to study is the mean between the two conditions for each individual. Then taking this variable and comparing it to the other participants' variables under the same conditions. With 30 participants, 15 performed the control session first and the other half effect first. This way we can see if the variables change depending on which session was performed first.

The participants were called over messenger, and performed the experiment with voice chat, in their own homes. Providing geographical, sampling and time consumption advantages to the observer.

To answer RQ2, the observed wanted to research if the amount of IE had an impact on the variables. If there is an optimal time to provide the IE and if it scales. Therefore, the 30 participants were separated into three categories (10 in each): 2B, 3B and 4B (short for 2 breaks etc.).
2B had two IE at the: 4th and 8th minute.
3B IE: 3/6/9/ min.
4B IE: 3/6/9/11 min.

Inferential statistics analysis

The data was gathered on an Excel spreadsheet. Considering the nature of the data and sample size, the averages and standard deviation were calculated first and compared to perception of time within the conditions. Followed by statistical tests to assess the significance of the results. To calculate this dependent, paired sample T-tests were used to compare the means between the two sessions, collectively and separately. Within their categories (control and effect). With the goal of finding themes and a trend. The results were calculated using a T-test calculator online and the charts were made in Excel. ANOVA tests were used to compare the three IE categories (amount of breaks). Age, gender and session order (effect vs control performed first). This was done with the data analysis tool in Excel, where the charts were made.

This way the observer could infer four things and answer RQ1 and 2.
(1) To what extent does a TikTok session invoke time-distortion and the flow-state?
(2) Is it possible to break the flow-state with a IE and does the amount of IE impact the results?
(3) Did which session the participant perform first have an impact on the results?
(4) Did the participant's age or gender play a role in the outcome?

One important coding of the data was: since participants often gave vague answers, “like eight to 10 minutes”. In these instances, the number was valued in the median. Participants never gave numbers such as “8:30 or 8:45”, which is not a problem since what is being researched is a “feeling”.

Results

Experiment

The results from the control session show (M = 9.93, SD = 1.5) and effect (M = 13.77, SD = 2.1) for all participants. When participants performed the experiment with interruption events, it showed a statistical significant increase of perception of time, $t(29) = 8.4$, $p < .0001$.

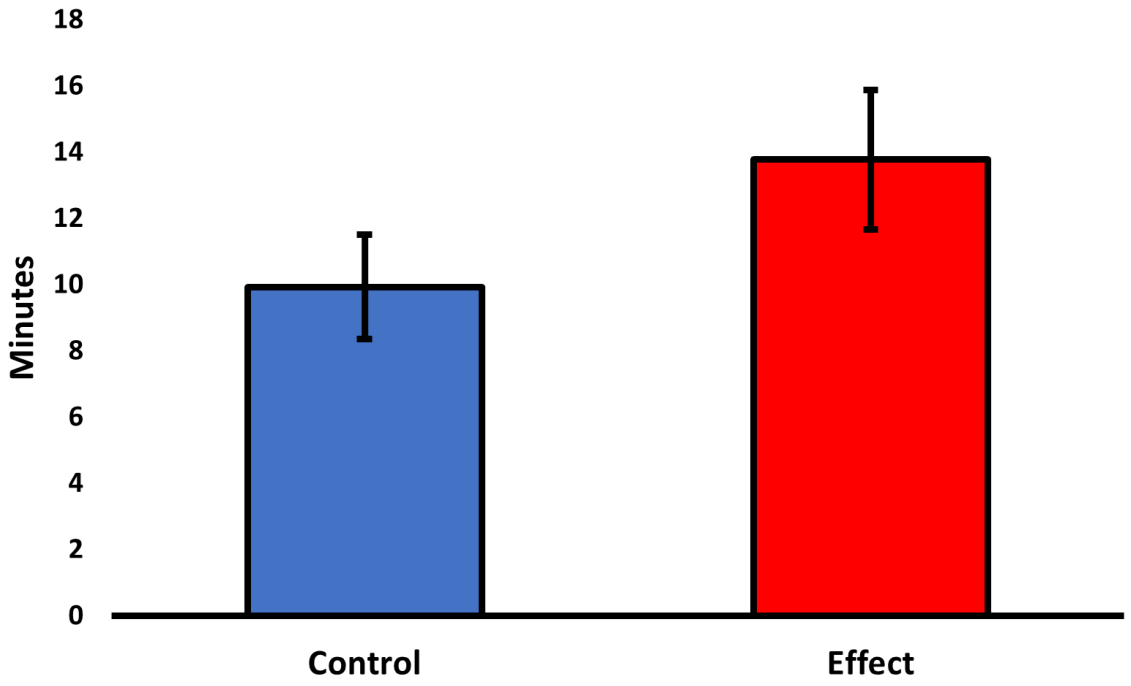

Figure 12. *The mean control (no interruptions) and effect (with IE) for all participants. The time perception is smaller without the IE. With standard deviation error bars.*

For control the session, the mean was 2.97 (9.93) minutes less than the actual session length of 12.30 min. The median answer was 10 min, which 18 participants reported. Highest number being 15 min and lowest 7 min. The effect session had a mean of 1.46 (13.77) min more than the session length. Median 15, 13 participants reporting, highest 17 min and lowest 10 min.

Separating the three categorize 2B, 3B and 4B. To find the difference between each individually. To find if the amount of breaks scales during the IE session.

2B: The results show control (M = 9.7, SD = 1.2) and effect (M = 12.2, SD = 2.08). With a mean difference of 2.5 min, t(9) = 3.3, p = .0087.
3B: The results show control (M = 10,1, SD = 2.02) and effect (M = 13.9, SD = 1.3). With a mean difference of 3.8 min, t(9) = 4.5, p = .0013.
4B: The results show control (M = 10, SD = 1.2) and effect (M = 15.2, SD = 1.6). With a mean difference of 5.2 min, t(9) = 9.06, p = .0001.

Presenting the difference between the means of three categories and sections collectively with a repeated measure one-way ANOVA.

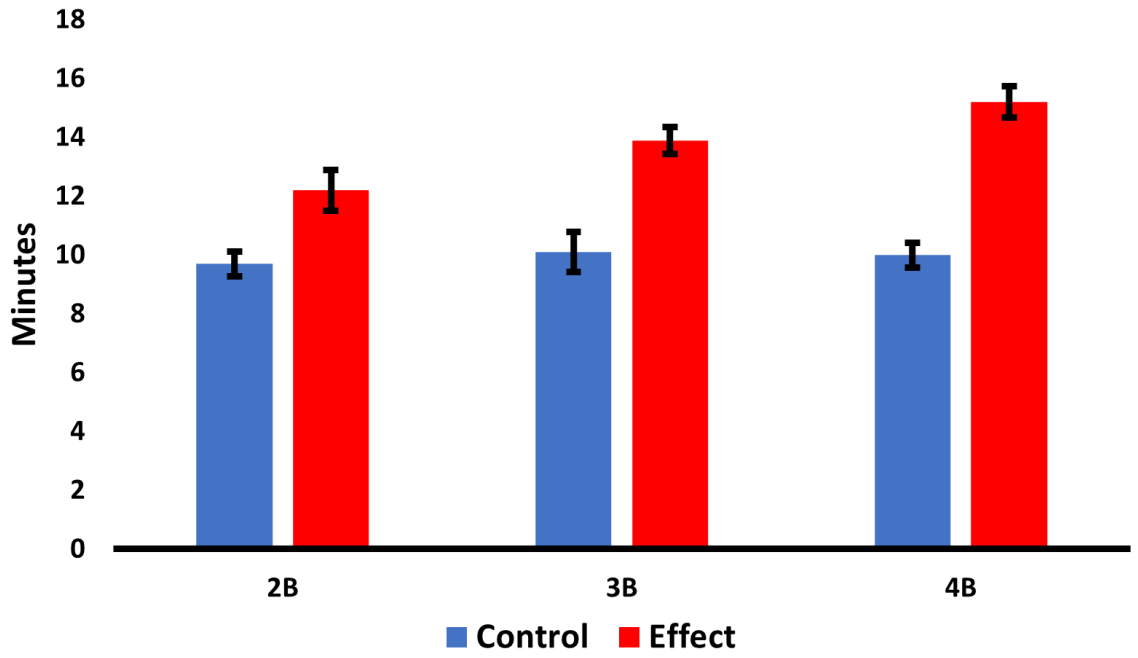

Figure 13. *The means between sections and categories separately and as a collective, including standard error bars.*

Results reveal a significant main effect on the number of IE on the participant's perception of time. And between the three, effect categorizes separately. (F(2,54) =

3.0558, p = 0.055). With perception of time rising from 12.2 min(2B), 13.9 min(3B) to 15.2 min(4B). Results also reveal that the three effect categorize did not influence the control session.

Using a Two-way independent sample ANOVA to analyze the total results when separating the 30 participants into two categories, 15 participants performed control first and the rest effect first.

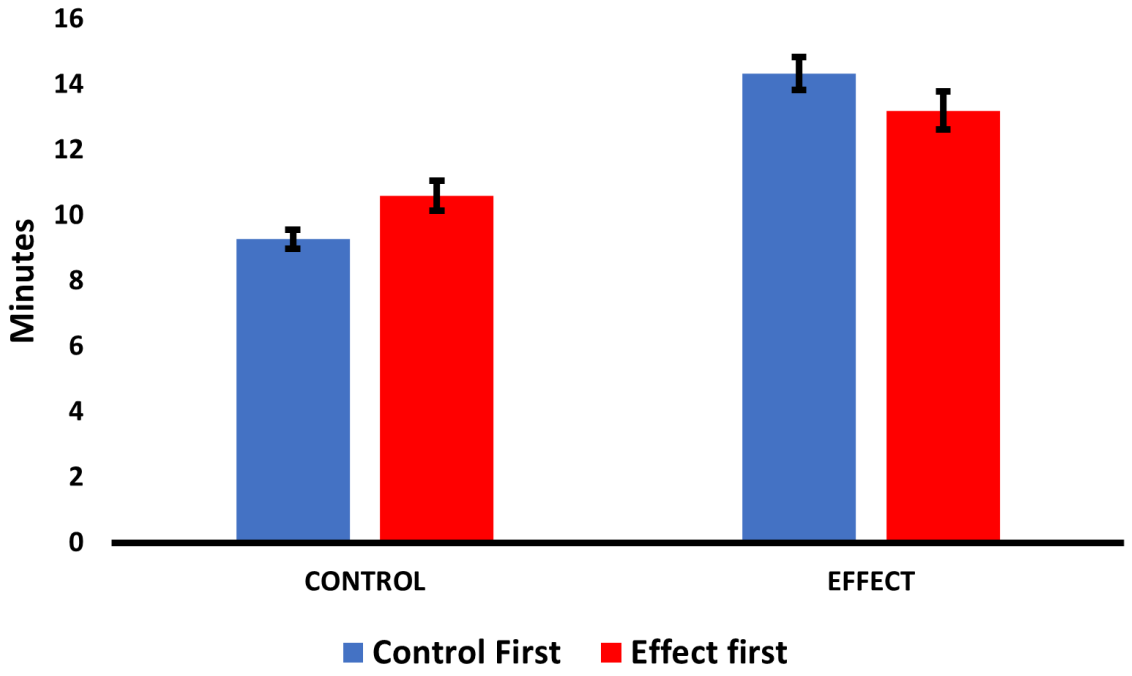

Figure 14. *Blue bars represent control being performed first, red bars result with effect first, with the standard error bars.*

The results reveal a significant main effect on session order on time perception (F(1, 56) = 6.934, p = 0.010). When the control session was performed first (9.2 min), the time on was pierced as shorter compared to when it was performed second (10.6 min, 1.4 min more). The same trend occurred when performing effect first (13.6 min), with effect being perceived as shorter. Then, when it was performed second (14.3 min, 1.1 min more). Thus, both the effectiveness of the IE and the flow-state is affected by the order of the study conditions.

Another one-way ANOVA was performed with age as the dependent and time perception as the independent variable. Separating the ages of the participants into two categories: 20 to 30 (17) and 30 to 60 (13) to calculate whether age was an influencing factor on time perception. The results show that there is no significant difference in the age categories, which impacts the variables in any meaningful sense. ($F(1, 56) = 0.04206$, $p = 0.838$). Finally, separating the results into their respective genders, F (13) M (17), the same results occurred with no significance difference to report ($F(1, 56) = 0.7950$, $p = 0.376$). Meaning, that a person's age or gender does not influence the effect of the IE on time-distortion and the flow-state.

Prototype

Competitive analysis

There are multiple methods in the design process to choose from, in this thesis the most important method for the outcome of the design will be presented. To prototype a concept that can be adopted by wellbeing-applications. It must be compatible with the current developer design philosophy and benchmark. They are more likely to adopt it if the design seems competent and easy to incorporate with their current models. To achieve this, a competitive analysis of the current benchmark for wellbeing-applications will be presented. Three applications were chosen: StayFree (StayFree n.d.), ActionDash *(ActionDash n.d.)* and onesec (one sec, 2022).

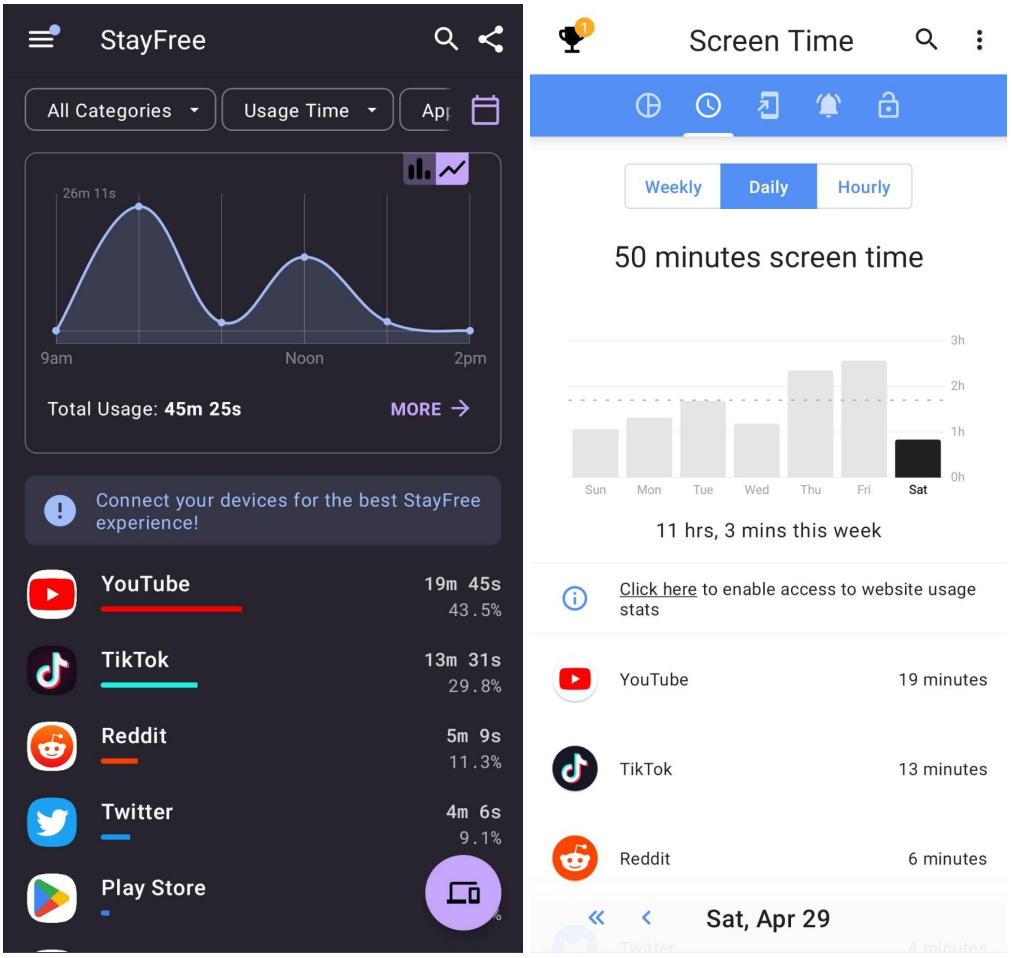

Figure 15. *Screenshot of StayFree (StayFree n.d.) and ActionDash (ActionDash n.d.). Home UI.*

The StayFree and ActionDash UI uses similar information architecture. There are many differences in the details, but the overall structure of the elements is the same. Highlighting the summarized statistics for the *day*. Then the individual use of each application. The information is sorted in a flat linear hieratical structure. Both applications use *search* and are focused on providing sufficient whitespace and proximity between elements. All in accordance with current benchmark. StayFree prefers to label with text, while Screen Time with icons. This makes Screen Time faster to use but decreases the accessibility for new users. Both UI's main focus is informing the user on their usage across time-spectrums.

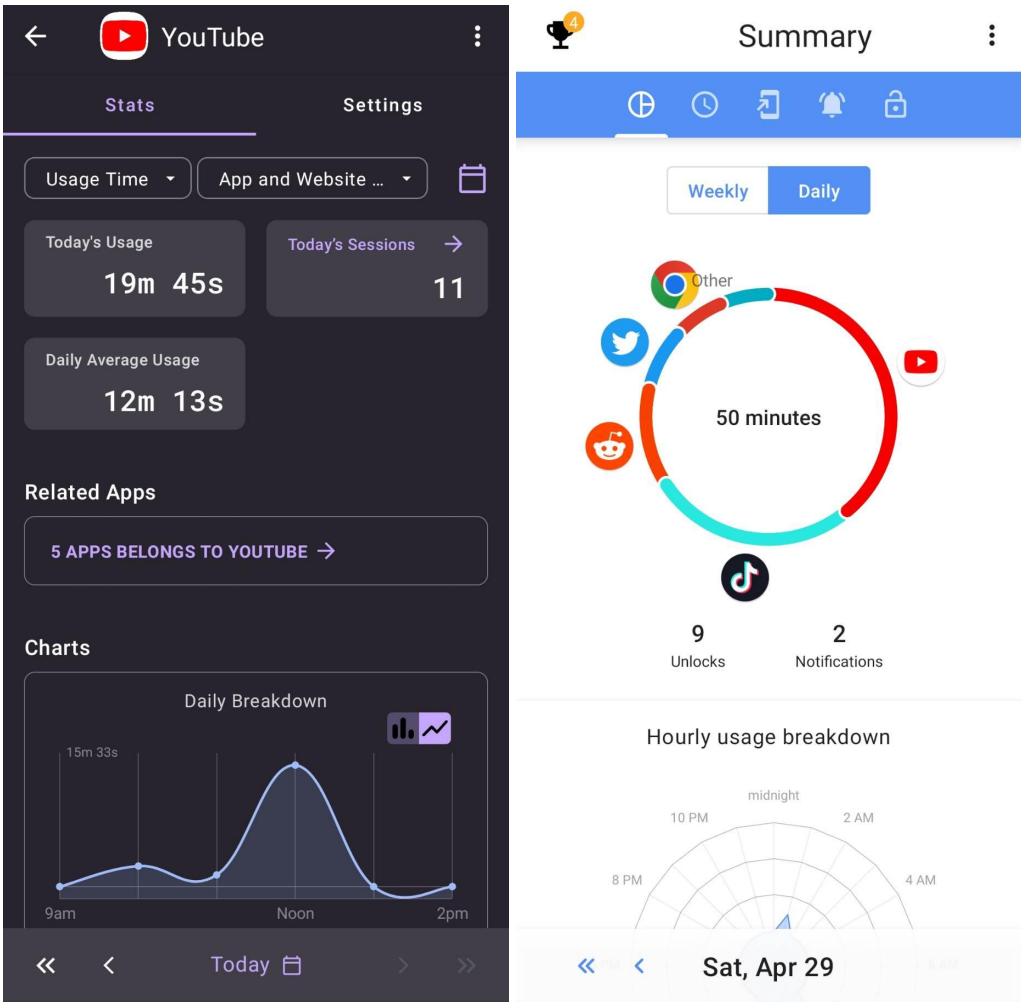

Figure 16. *Screenshot of StayFree (StayFree n.d.) and ActionDash (ActionDash n.d.). Statistics UI.*

The main difference between the two applications is their labeling and categorization methods. They essentially provide the same information in different ways. StayFree labels with numbers and text, while Action dash uses icons (look at the navigation bars on (fig 16).) and more charts. Both methods have pros and cons, numbers are faster to understand and allows for clearer understanding of the details. While charts take longer to read but give opportunities to identify themes and trends. The best solution comes down to the target groups. Stayfree is more accessible to learn for new users who are not familiar with universal icon languages

and charts such as scatter plots. While ActionDash is faster and easier for experienced users.

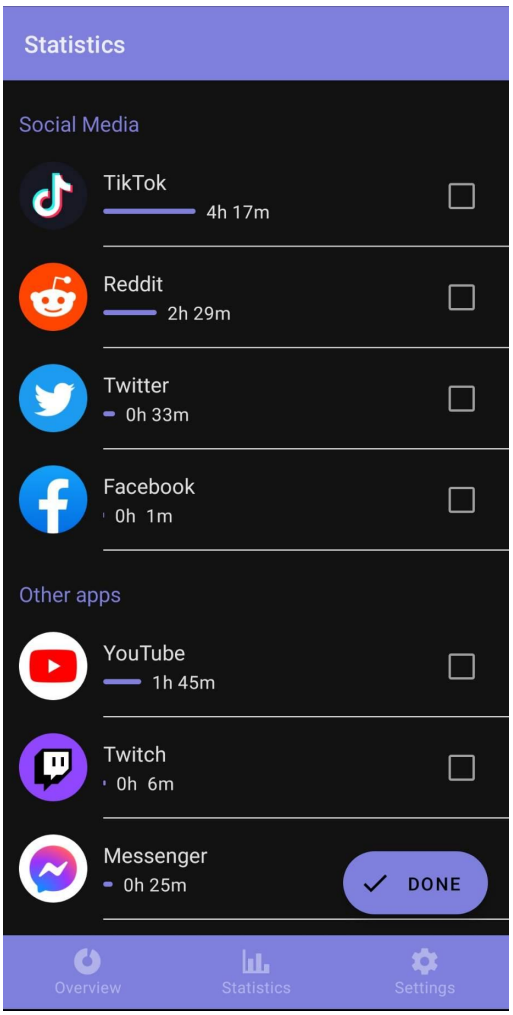

Figure 17. *Screenshot of the One sec app statistics UI (one sec, 2022).*

The *one sec* application generally was an outlier and seemed less developed compared to the other two. While trying to provide a similar layout to its competitors, the UI falls behind in terms of usability and information architecture. Lacking crucial functions available on the other applications like statistics and *search*. With disoriented white space and unnecessary large proximity between the elements. The text is too small, with the icons being too big.

Design process

The foundation to begin the development of the countermeasure was complete. Containing three main pillars. (1) TikTok's ability to invoke the flow-state and make the user experience time-distortion. (2) How an IE can stunt this flow-state. (3) Knowledge and understanding of the current benchmark for wellbeing-applications. Thus, wireframing followed by a prototype could be made in Figma.

The main principles and reasons for design choices:

- Current wellbeing-applications do not provide a feature which helps users stop using when they are in a flow-state. They provide statistics and options to block, hide or prevent opening of applications beforehand but never during usage.
- The design is not aimed towards the addictive user-base in itself. But rather developers of current wellbeing-applications now or in the future. With the goal of aligning with their philosophies and benchmark.
- The prototype will not be a complete design, rather a concept that can be used as inspiration and motivation for further development.
- The design will follow the current benchmark standards for wellbeing-applications.
- The design will be focused on user freedom, users should be able to change IE length. When it occurs and on which application it is active.
- The design will be aimed towards following standard UX guidelines like: easy to learn, use and universal design (accessibility and usability). Facilitate easier transition between screen sizes and further development by following conventions and current marked standards.
- Making it easier for new users to adapt to the application, when they are familiar with the UI model.

Concept

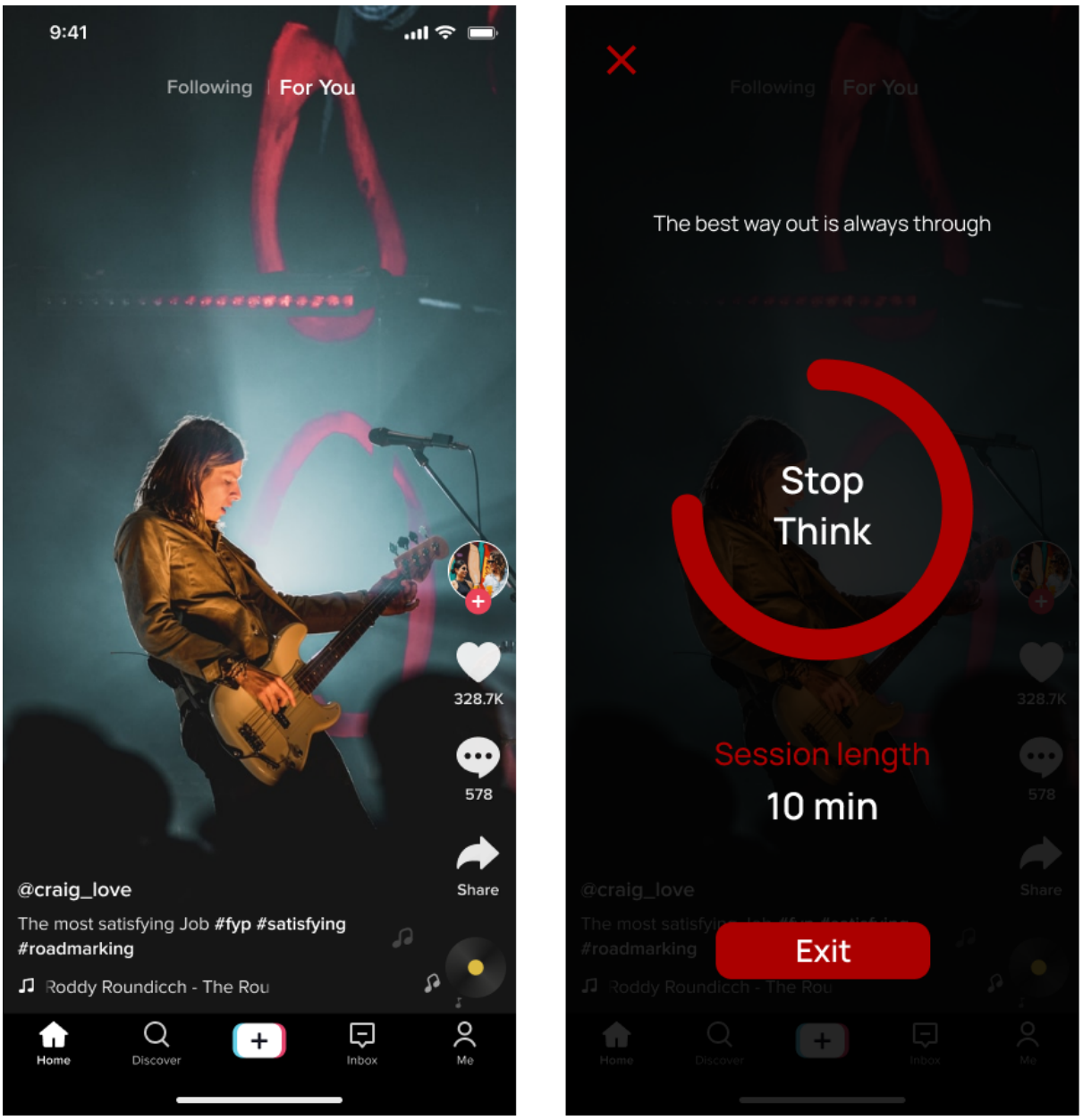

Figure 18. *Frames of the prototype, showing the IE concept in action. In this instance, it is shown how it would look on TikTok.*

On the application **Stop & Think**, users can set up their own interruption events. The IE's primary function is to allow the user to "Stop & Think". This function is specialized as a countermeasure to when the user is absorbed in a flow-state. During

the stopping cues, the user can reassess their situation and decide if they have something better to do. Stop & Think does not require a large user commitment, as it is easy and fast to use and learn. Instead of blocking or deleting the application, Stop & Think allows the user to enjoy what can be entertaining in reasonable amounts. While counteracting the addictive patterns. The feature can also be used for already addicted users to not stop "cold turkey", but rather pace themselves and slowly temper their usage. Quitting cold turkey has proven difficult in Internet addiction, as they often panic and experience withdrawal and rushes back to the same use pattern (Young, 1998).

Stop & Think is a countermeasure to addictive UI that preys on the psychological factors of the human mind. Today, many applications are intentionally made to keep the users using. Stop & Think is a step in the right direction in the overgrowing attention-based economy where your time is their money.

(Fig 18). Showcases the IE in action, presented as before and after. The user has three options for maximum user freedom. (1) They can wait for the IE to finish. (2) They can *exist* the application. (3) or they can end the IE prematurely. This option is a small *X* in the top left corner, which means the user has to move their hand all the way to the *X*. Many users will most likely decide to wait the 2–3 seconds unless they are impatient or something very important is going on (requires usability testing). But in all three scenarios, a stopping-cue will occur and the application's goal will be reached.

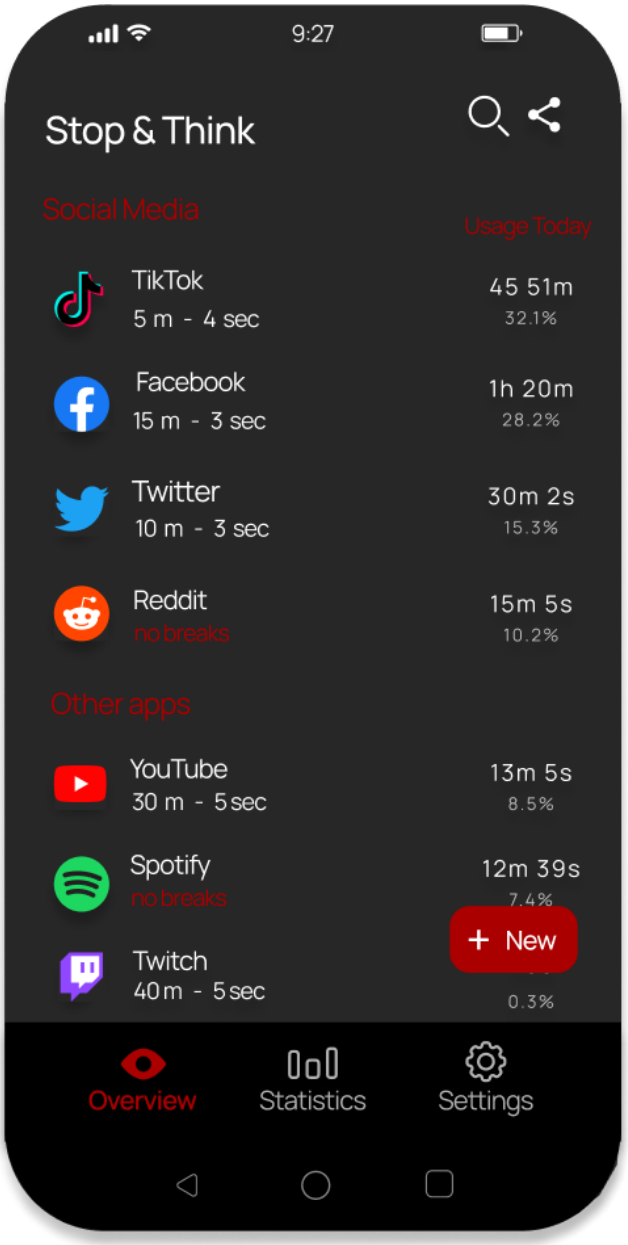

Figure 19. *Home page, showcasing statistics and current IE active.*

The *Home page* is designed in accordance with the benchmark (fig 15). The design is based on the same information architecture and UI, but with its own stylistic choices to fit the functionality that Stop & Think provides. In the current state-of-the-art for UI design, we have seen an emergence of the "dark mode". Using dark mode has many advantages: potential to lower energy consumption, providing longer battery life. It is more satisfying for the user as they feel less eye strain, especially suited for people that spend long hours. Decreasing the chances for ocular diseases (Eisfeld &

Kristallovich, 2020). Thus, in accordance with the themes of wellbeing, Stop & Think uses a black and red dark mode color scheme.

On the *home page*, the user has an overview of their most used applications daily and the current IE settings active. The information is organized hierarchically within two categories in a linear structure. *Social media* first, because the Stop & Think function is a specialized tool to counter addictive patterns which are common on certain social media platforms. There should be an option to change this in *settings* as it may serve a purpose in e.g. online gambling.

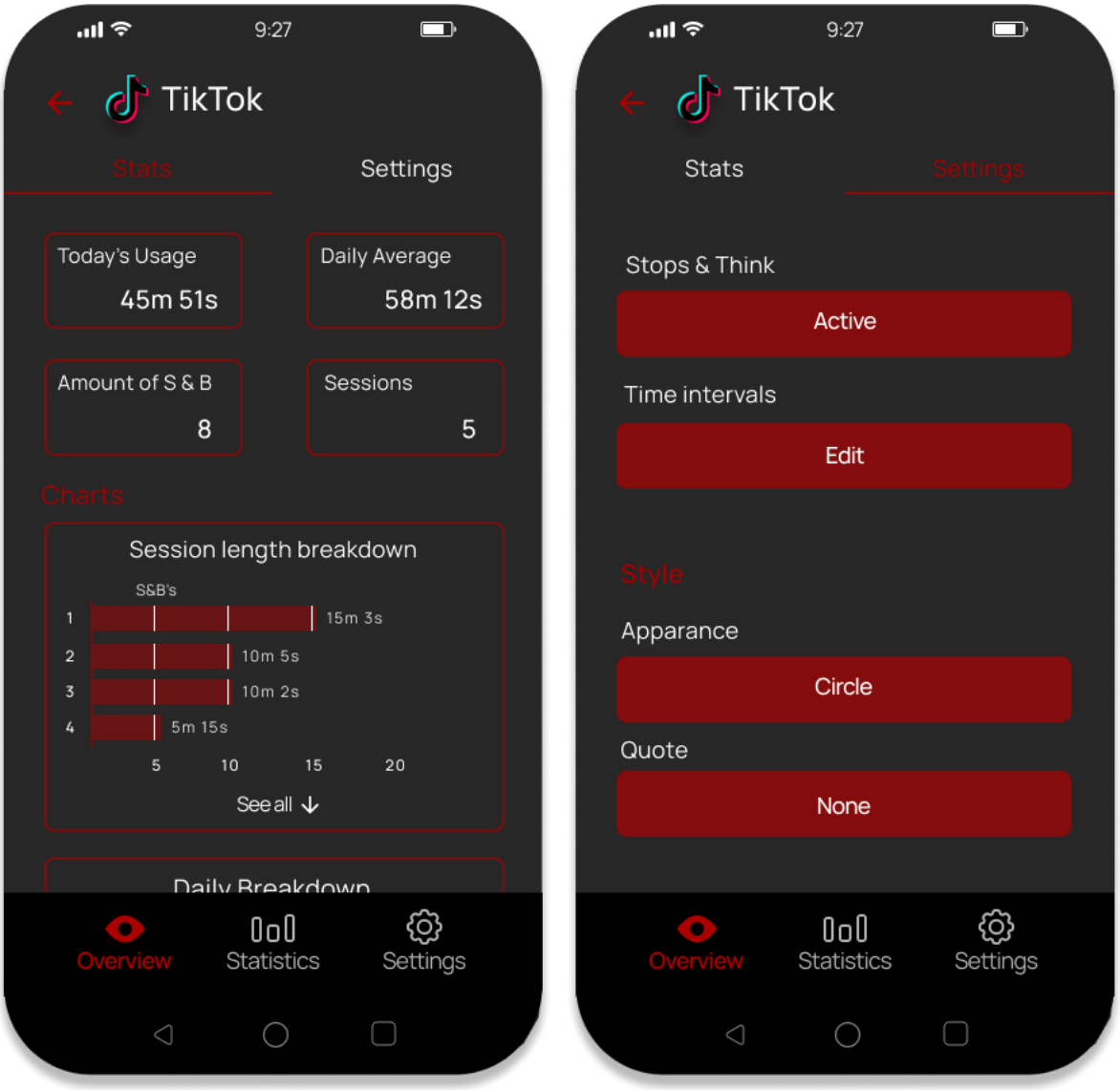

Figure 20. *Overview of the specific applications selected by the user*

(fig 20). The *overview* UI contains user information such as, *Today's usage* and *daily averages* so the user can compare today with yesterday. How many *sessions* and which point during that session the IE occurred. Indicated by the *white lines* in the *session length chart*. This way the user can analyze if the IE's has any effect on their use pattern, or if it needs any adjustments.

When dealing with many numbers, it is important to provide sufficient whitespace to not overload the user with information causing cognitive overload. Therefore, it is important to prioritize the information we choose to present. Which is why the design is limited to the five elements most relevant to the application, with sufficient proximity between them.

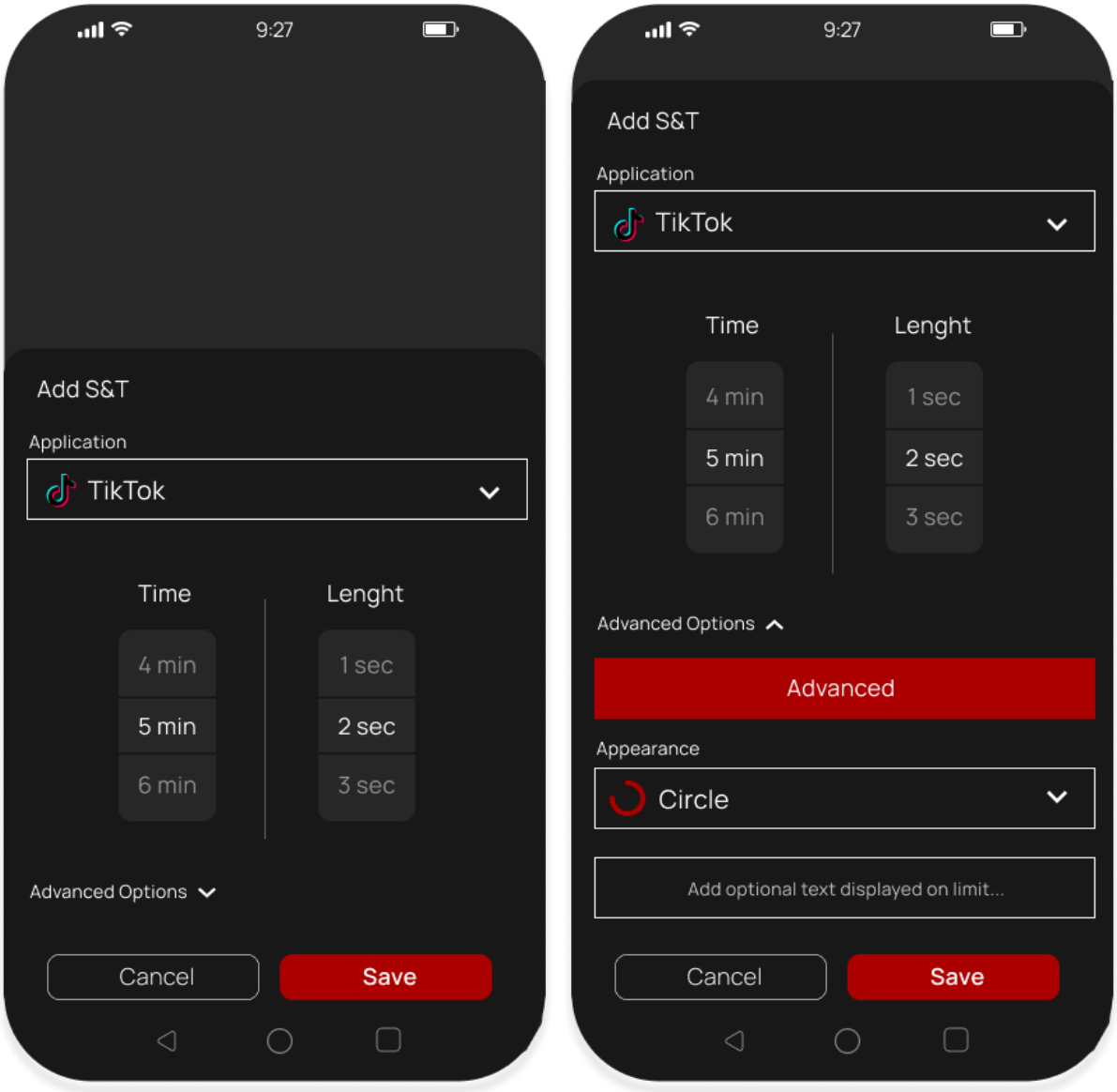

Figure 21. *Create a stop & Think intervals in the application.*

(Fig 21). Contains the most important feature, the ability to set time intervals and customize the IE. This design is focused on user freedom and usability. Choosing the *time* and *length* for the IE is in a "wheel design". Because when dealing with numbers between zero and 60, there is no need for typing. The users will always prefer swiping/pressing to typing numbers, as it is easier and can be done with one finger. Additionally, the design contains the option to change the *appearance* of the countdown timer (to e.g. *numbers* countdown instead of a *circle*) or add *motivational text*.

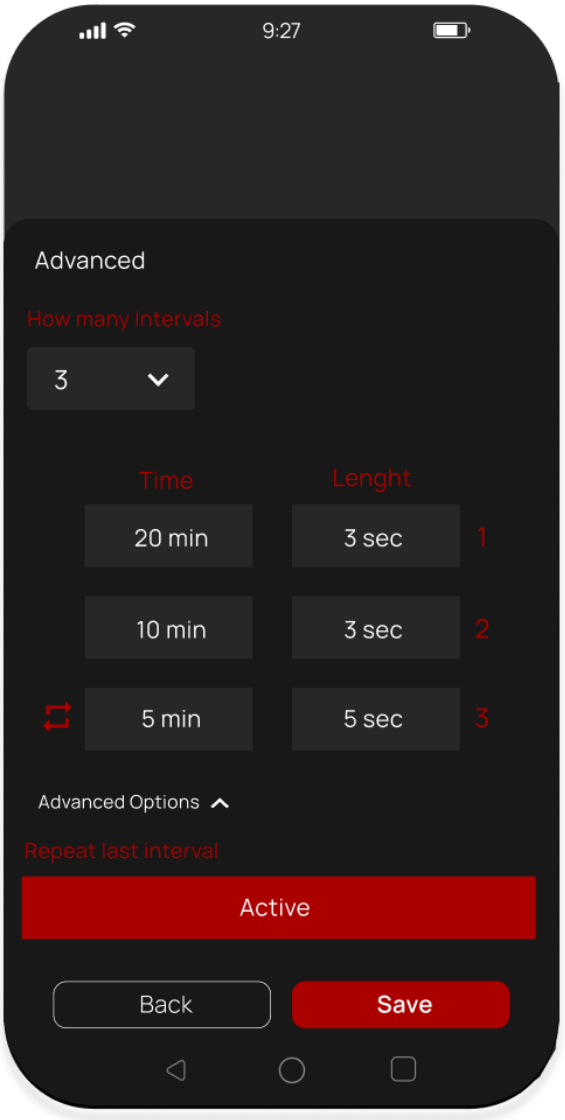

Figure 22. *Advanced Intervals options.*

To continue on the path of consistency in user freedom. Stop & Think will have the option for users to customize their IE intervals. A persona user might wish to use an application like TikTok uninterrupted for 15 minutes, then they want help to stop. For that user, the best option is setting *1st* interval for *15 min* - then the next, *5-min repeat*. Thus, it is important to give the user control to change the lengths between the intervals.

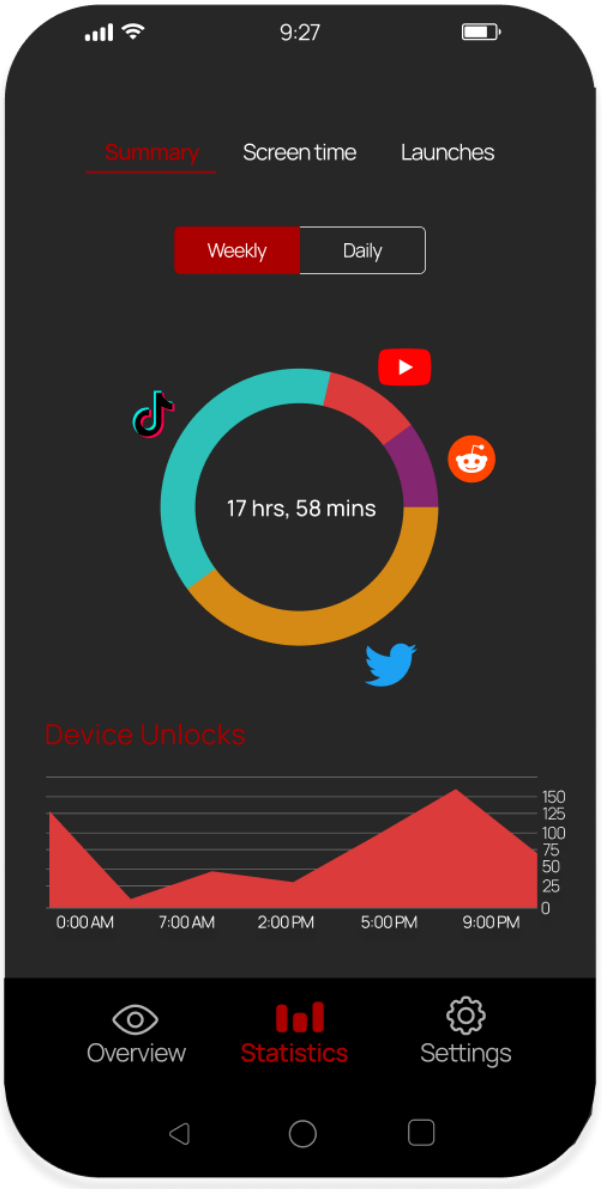

Figure 23. *Statistics summarized.*

Charts are a good way to visualize statistics and make the information easier to understand and remember. The user can select *weekly/daily* and gain an overview of the most used application with a Donut chart. They are advantageous and accessible as long as there are not too many data sets. Therefore, they have to be sorted into categories, such as 5 most used social media applications. Further, the user can view which points of the day they are most active, by looking at *Device unlocks* presented in an area chart.

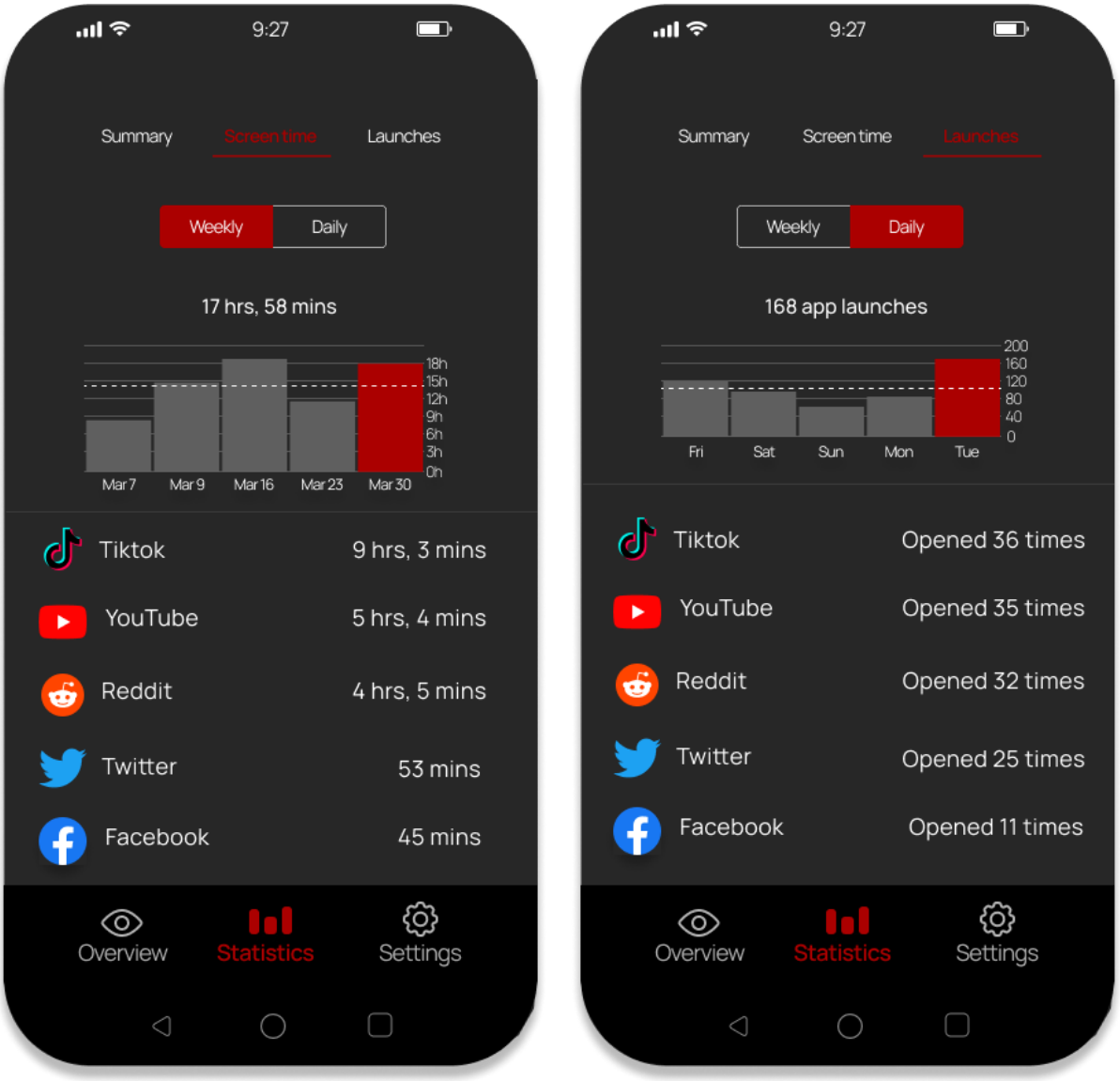

Figure 24. *Screen time and launch statistics presented in numbers and bar charts.*

(Fig 24). Has statistical data that other wellness applications provide, and therefore in accordance with their benchmark Stop & think will have similar options. The *white dotted line* across the bar chart represents the average usage, while the information architecture is presented in a hieratically linear structure.

Discussion

The flow-state and its relationship with our perception of time

The results show that interruption events are an effective countermeasure to the time-distortion experience on TikTok. Providing users with stopping cues of 3–4 seconds between two and four times during a 12-minute TikTok session, had a positive impact on their perception of time. Thus, the IE could act as a counter to the easy, fast, and never-ending nature of TikTok. By hindering the rhythmical ease of ever-flowing content otherwise known as infinity-scroll and feedback loops.

We value speed on the internet and hate waiting. The worth we place on efficiency in interaction design is immense. But in certain scenarios a break and an interruption might be just what we need. Taking 15 seconds of screen to reflect during a 15 minute session, proves to be of benefit to our digital wellbeing.

Everyone hates distractions when we are doing something that requires our attention. In general, we see distractions as a counter to focus and concentration. When creating an addiction-inducing application, removing distractions is key. The TikTok application is louder than other applications. On forums such as Reddit, users complain that the application is: "damn loud." They hypothesize it because “load=funny” or “to keep the teens' attention” (Reddit, 2020). The truth might be that the application is loud to reduce the possibility of distractions.

Stop & Think is a product of our environment, as it has been created specifically because of social media applications like TikTok. It serves a very specific purpose, to counter the current attention focused economy. Which means it is a specialized tool that is best suited being on wellbeing-applications among other features. Considering the general volatile nature of application design. TikTok is facing many issues on multiple fronts, including banning in the US and other countries (Maheshwari & Holpuch, 2023). There is no certainty it will be the same in a year.

Reflection on the study method and results

The results are derived from a TikTok simulation. They might vary upon the why or how. Hypothetically this can go in two directions:
(1) The time-distortion effect could be bigger when the user watches TikTok on their own free-will. As the knowledge of the ongoing procedure could hinder the entrance into a flow-state. Due to the test environment providing distractions.
(2) The IE effectiveness might be smaller in isolation. The mere presence of the observer in the call could be a distraction which influences the results. The Stop & Think simulation may be a bigger interruption than the IE would be in practice. Meaning, both variables have a chance of decreasing or increasing, when the study procedure is not interfering with what would be the natural outcome of the application.

The experiment results varied depending on the session order. The most likely reason for this outcome was due to fatigue. The observer noticed visible restlessness towards the end of the experiment. Some participants even asked how much time was left. The experiment required the participant to view TikTok for 25 minutes, while the average TikTok session is around 10 minutes (Ceci, 2022). It is possible that the second session results will always be inflated due to the study conditions. The user had always already spent 12:30 minutes watching TikTok at the start of session two. Meaning that the results which were found in the first session is the more realistic outcome for both control and effect, as they were less fatigued.

One of the goals of the study was to see if the amount of breaks scales with our perception of time. And if there was possible to identify the best time for the IE to occur. The difference between 2B, 3B and 4B scaled with 2.7 minutes, which is a significant amount. So what we can say is: “the more breaks, the better”. But to be able to identify a “sweet-spot” for when the IE should occur is not possible. To do so would require a more comprehensive sample and study size. Looking at user-data with different session lengths and amount of breaks across multiple platforms. Ideally, the prototype would come with a recommended time-frame for the IE, like:

“one three-second break every fifth minute”. But currently, the user would have to set up their own intervals and review their statistics to find the spectrums that suit them. This increases the user-freedom but makes the accessibility of the application harder. The best outcome would be to have the ability to provide both. Finally, in the very beginning of the implementation it may be advantageous to recommend e.g. a four-second break every fifth minute in principle, then expand from there when sufficient user data has been collected.

The mode for the control session was 10 minutes and effect 15 minutes. While the actual length was 12:30 minutes. It is important to remember the human factor to how people “feel” and “guess” time. It is not a coincidence that many people reported “like 10 minutes” or “A quarter”. If the actual session length was 10 or 15 minutes would the means be the same? Further research is required to answer such a question.

The additional dimensions to the prototype

The prototype is a concept made in Figma. To develop the application is plausible with a back-end developer with expertise in JavaScript. Using an already integrated class like AlarmMananger (AlarmManager, 2023), which can run over other applications. Then customize the code with CSS to gain the Stop & Think UI.

What this experiment did not test but is a possible outcome of the IE is that it makes the user quit the session. On (Fig 18). There is a big red button saying: *quit* during the IE. With the goal of nudging the user to close the application. This outcome could be studied with implementation.

Current wellbeing-applications base their philosophy around informing, which begs the question: does knowledge equals change? Labeling smoke packs with health warnings increases the chance of the customer being aware of the health risk (Hammond, Fong, McNeill, Borland & Cummings 2006). But does this decrease the chance of the customer buying them? Yes, for customers which are lower in nicotine

dependencies but to already addicted customers these labels have no effect (Shadel, Martino, Setodji, Dumbar, Scharf & Creswell 2019). Just making the user aware of how much they use, is not always enough.

Reflection on the thesis

Arguments and discussions about addictive UI usually boils down to the ethical principles guiding their designers. Which is why it is important to look at the ethical reasons for their creation. Internet addiction is widely discussed within popular literature. But there has been no development on the business ethic of creating addictive design (Bhargava & Velasquez, 2021). In the environments where addictive UI design is created, there are two main actors: the designer and the stakeholder. Today, a handful of young male engineers living mostly in California working at tech companies have a massive influence over two billion people's thoughts and choices (Bhargava & Velasquez, 2021). These young designers are faced with ethical problems as the stakeholders demand results and revenue. This is especially true in attention-based economies like social media, where the longer the user is on the application, the more money they earn (Bhargava & Velasquez, 2021). As the quote goes: “if you are not paying for the product, you are the product” (Shaikh, 2018). This business dynamic naturally creates an environment where the designer is incentivized to make an addictive UI.

In situations where a reluctant designer feels “forced” to create addictive patterns by stakeholders, Truong & Dalbard suggest grouping up with your colleagues and face stakeholders as a collective front (Truong & Dalbard, 2022), which is a high risk action that can cost their jobs. Currently, there are movements from governing bodies like CNL and EU with laws such as General Data Protection Regulation (GDPR), or the Federal Trade Commission (FTC) Act in the US. Which prohibits “unfair or deceptive” design. Perhaps laws and regulations should not only be aimed towards protecting the user. But also addictive UI designers, who feel they most create these patterns to succeed.

The concept of creating addictive patterns is nothing new as gambling machines before the internet were carefully created to alter human decision-making and behaviors (Yucel, Carter, Harrigan, Holst & Livingstone, 2018). And it was easy to adapt these design technologies and ideas into video games and internet design (Courtwright, 2019). Engineers are trained in university programs where such techniques are researched, developed and taught such as the *Persuasive technology lab of Stanford University* Where they are later hired by Silicon Valley companies to use the techniques they have learned (Cash, 2012). In the attention-based economy where stakeholders chase profit-margins and designers are educated on how to keep the user's attention. The inevitable rise of additive UI is unsurprising. Bhargava & Velsqaues claim to not argue that social media firms are intentionally and methodologically trying to make users addicted, but rather present the fact of the moral dimensions which results in addictive UI being created (Bhargava & Velasquez, 2021). The question remains if we can classify these social media companies as operating in bad faith. But the suspicion is undoubtedly there.

The American ethicist, computer scientist and businessman Tristan Harris. Was a design ethicist at Google, where he "studied how to ethically steer people's thoughts?" (Harris, 2017). Presented three radical changes needed to fix Internet addiction.
(1) We need to acknowledge that we are persuadable. Once we understand that our mind can be persuaded, we are more likely wanting to prevent it.
(2) We need new models and systems of accountability, the world will only become better at persuading people.
(3) We know we can steer and change the timeline of a billion people. To orchestrate the most empowering time-well-spent way for those timelines to happen we need a design renaissance (Harris, 2017).

Everyday people are becoming more connected through social media, the internet of things and the rise of AI. Society will only become more dependent on the internet. This issue will only increase and not go away. This thesis is on addictive UI, which is a small piece in a larger ethics discussion around all these dimensions we consider so

important to our lives. And when looking ahead, it is going to be an important discussion to have.

Finally, the Addictive UI strategies presented in this thesis are not secret techniques. The users are clearly aware of the nature of applications like TikTok. In a fresh 2023 US consumers report, users were asked what they use TikTok for (choose all that apply): the two biggest being: 43% *mindless entertainment* and 41% *comic relief* (The New Consumer, 2023). Addictive strategies are much more relevant in entertainment or social media. But no one uses them in places that matter to our health and safety. e.g. in a cockpit or a hospital. Their designers have not mastered some "dark art". It is a "cheap trick" playing on our minds. And many fall prey to it willingly, as after all it is just mindless entertainment to them. But for some it may interfere with their everyday lives to the point of provoking addictive tendencies.

Limitations & future work

There are a variety of factors that may limit the reliability of the results, as for example the choice of convenience sampling that has been employed in this thesis. Thus, it is important to take cultural and nationality biases into consideration when analyzing results. The participants were all Norwegians, with often multiple people from the same families being tested. To generalize the results for the whole population, a random sampling method would have been advantageous.

The total experiment contained 30 participants that were separated into three categories (2B, 3B and 4B). When comparing these, categorize the sample size as on the lower end of the scale, making the results less reliable as there is a bigger chance for variance. In retrospect, it would have been better to separate the 30 participants into two categories, not three (e.g. 2B and 4B). Making the test results more reliable and easier to analyze. This realization came to fruition when trying to find the most effective time interval for the IE to occur. It was too ambitious with the current parameters for the study.

Considering the IE had to be simulated by the observer, the results would be easier to replicate with a full implementation of the function. There was also unintended variation on the length of the breaks, as it was impossible to exactly time it for 3–4 seconds.

There are three optional paths forward, this thesis wishes to recommended:
(1) Perform a longitudinal study with full implementation, contact participants and ask them to use it for two weeks. Then analyze the use patterns before and after downloading the application. This would most likely yield more ecological valid results. Seeing if the function reduces the total usage and not only stopping the flow-state.
(2) Expand on the current study, with usability testing of the prototype. With a qualitative study, asking questions such as "How do you normally stop yourself when you are in a flow-state?" or "Do you think this application would be effective in helping you?". And contacting current wellbeing application developers to pitch or hear their feedback on the concept. Then using that user and developer feedback to improve the design.
(3) Finally, it is possible to find a middle ground between full implementation and a qualitative study using The Wizard of Oz technique, simulating the experience with a target group.

Conclusion

In an attention-based economy, where there are eyes, there is money to be made. Certain applications have developed addictive strategies to make the user use longer. These are strategies such as: Feedback loops, novelty, infinity-scroll, reducing cognitive/interaction cost and attention span. When used together, they can absorb the user in a flow-state. In this state, users may use more than they would consciously decide is necessary. Wellbeing-applications have been developed to counter the addictive nature of these strategies. But they contain no function that stops users in the flow-state. The most effective way to counter flow is interruptions and distractions. We can measure the flow-state by looking at the user's perception of time. This experiment tested the idea of an interruption event on TikTok users in a flow-state. The results show that the interruption event increased the user perception of time and therefore decreased the effectiveness of the addictive strategies. This thesis presented a concept prototype of an interpretation event feature. While making sure the design could slot in and work with current wellbeing-applications design models.

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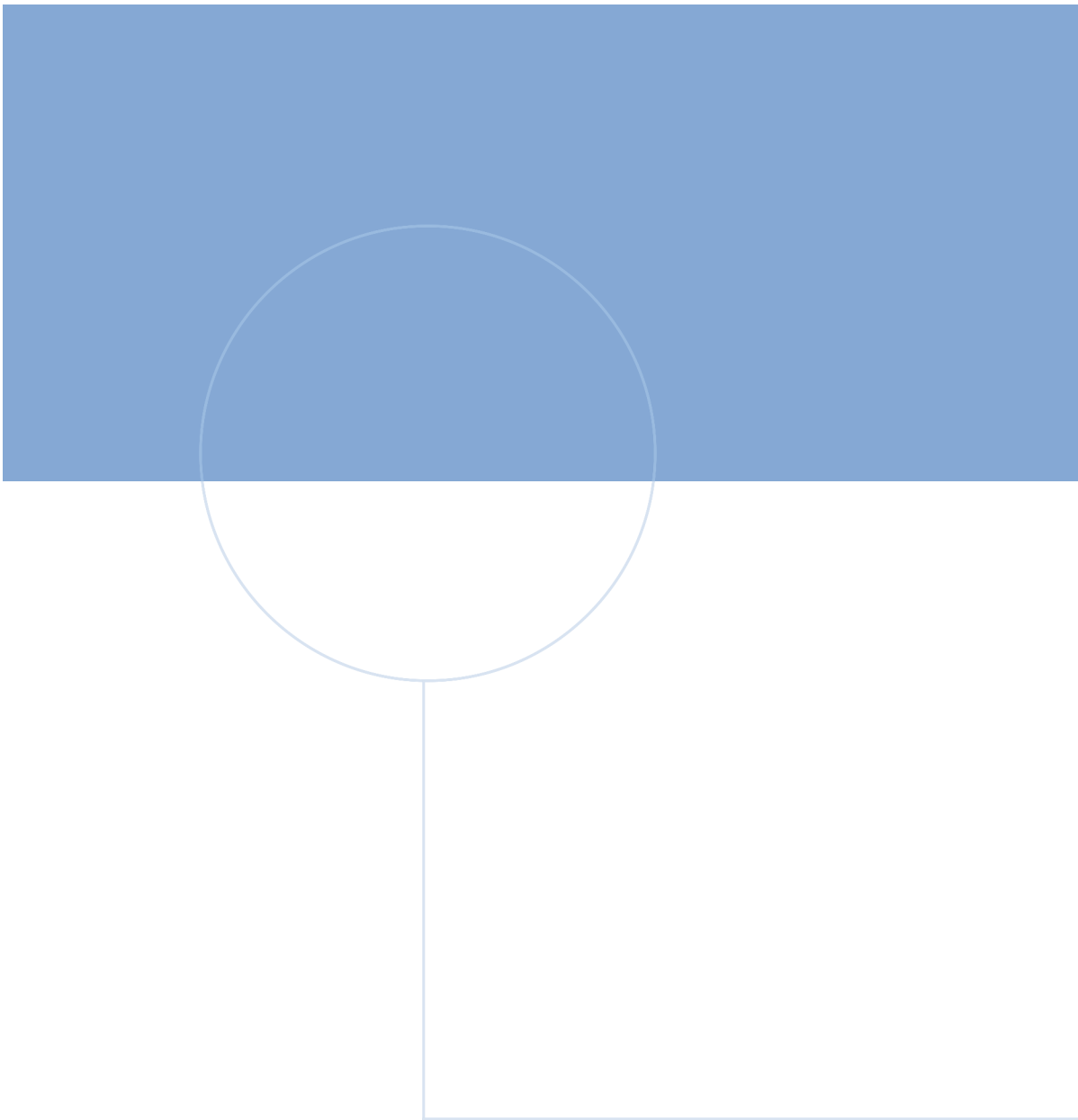

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