Hooked on the Feed:

Investigating Addictive Social Media Design and Non-invasive Solutions

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ABSTRACT

Due to the increasing ubiquity of social media, compulsive social media use is an increasingly persistent issue that compels users toward irrational and excessive social media usage, which can lead to negative consequences like losing track of responsibilities. Though reasons for this behaviour are difficult to research, it is theorized that addictive social media design may contribute to compulsive social media use, which this current study aims to study and discover solutions for. Five addictive features have been identified and studied: the infinite scroll, notifications, the typing indicator, streaks and likes. To develop a better understanding and create solutions for these features, a survey study was conducted about how people use and perceive these features. This study resulted in an understanding of how all these features are experienced as addictive to a degree and how they may improve. This led to several proposed design alternatives for each feature that target the problem areas for each feature. To evaluate these designs, a second study, a set of interviews were conducted. The interviews generally indicated that different design alternatives to these addictive features can contribute to decreasing addictive social media use by increasing customization and altering the level of information presented through the feature, but that one size does not fit all for each solution. The results of this study contribute to understanding addictive design better and can contribute to the improvement of social media to make them less addictive.

Contents

1 INTRODUCTION

In the past few decades, reliance on digital platforms has increased and social media use has intensified significantly. Sharing, liking and commenting on social media has become a part of many people's daily routines, encompassing a large portion of people's social interactions and sources of information and entertainment [94]. Due to the rising use and ubiquity of social media platforms, the risk of excessive and problematic use has also risen accordingly. Average daily social media use is estimated to have increased by 13% to 43% in the past 10 years and is still rising [52][55]. On average, a person is involved daily with five different social media platforms [84]. Studies indicate that approximately 20% of adolescents spend at least 5 hours a day on social media [94]. These numbers correspond with the significant amount of self-reported social media addicts. A study by Cheng et al. [17] shows that an average of 25% of adults feel they are addicted to social media and are dissatisfied and concerned with their use, which ranges depending on location and age. Young adults and adolescents engage in compulsive use most often, as studies indicate around 47% of young adults and adolescents self-report addiction [6]. Compulsive social media use has been linked to negative consequences such as a decrease in productivity, lower quality of mental and physical health, worsening of relationships and overall, a decrease in control of one's screen time [3][51][84]. Undeniably, compulsive social media use has become an increasing issue for many people.

Despite the previous concerning statistics, compulsive social media use is not a well-understood or extensively researched phenomenon, even though a significant portion of social media users feel like they are addicted and suffer negative consequences because of it [27] [55]. According to different studies, personal reasons for using, and overusing, social media differ. Reasons are generally not easily identified [86][85]. For example, low self-esteem, depression and anxiety are often comorbid with excessive social media use and have been cited as both reasons and consequences, so a source is not easily identified [67] [86]. Often, the blame for social media addiction is fully put on the user by themselves [44]. However, it has been suggested that social media platforms play a role in fostering compulsive social media use due to their design. There is an economic incentive to maximize social media use [50]. These platforms rely on the continued interest of users for their revenue generation, in what has been coined 'the attention economy' in which human attention is treated as a limited resource that is sought after for economic gain [64]. As a result, it is theorized that the user experiences of social media platforms are purposefully designed to be highly persuasive to attract people's attention and maximize profits from advertisements [15][16]. If purposefully implementing addictive features, the creators of social media do not take into account the possible negative consequences of their designs. Social media companies should consider the potential consequences of their design choices and take the user's best interest at heart and prioritize the well-being of their users.

The rise in addictive social media design has not gone unnoticed; in recent years, attention to this topic has increased in the news and popular media. For example, in 2020, a documentary titled "The Social Dilemma" was released, aimed at researching and explaining the addictiveness of social media [58]. In the documentary, former employees of major social media platforms confirm the deliberately addictive designs of their former employers such as Facebook and Google. In turn, activism has also increased. For instance, a lawsuit against social media companies such as Meta, the owner of platforms such as Facebook, Instagram and WhatsApp, was started in 2023 [1]. A plaintiff has stated that lawyers working on the case have compared their work to the fight against tobacco and opioids, as addictive substances similar

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[1]https://www.axios.com/2023/01/11/social-media-addiction-lawsuits-case

to current social media design. The question currently remains whether the companies can be held liable for product designs that are charged with causing or contributing to harm. Despite recent media attention and activism, social media platforms have yet to acknowledge the issue transparently and little has been done to adjust addictive design features. As social platforms are not willing to take action, there is a need for outside solutions to the issues in these designs.

Research has been conducted on the topic of social media addiction, but rarely on the effects of addictive designs. Different solutions to social media addiction exist and have been proposed, such as nudges and screen time trackers that aid in directing user behaviour. These often do not take into account the highly persuasive nature of addictive social media designs. Thus, many solutions are disliked or ineffective in the long run. These existing interventions, such as notifications on screen time, are focused on alleviating the effects of addictive design elements while not removing or altering these features themselves. Ideally, addictive social media features should be treated at the source so that interventions such as nudges are not experienced as invasive. There is little research on neutralizing and transforming addictive design elements and the effects of doing so on social media usage. Positive non-invasive design alterations may prove useful for social media addicts and their compulsive social media use. Ideally, solutions should decrease the addictiveness of social media, but retain the quality of the user experience. This research aims to investigate the nature of addictive social media design and these non-invasive design transformations for social media user interfaces and their effects on social media usage.

2 LITERATURE REVIEW

This section discusses research related to the field of social media addiction and related concepts. An explanation will be provided on what makes a digital platform social media and what they are used for. Then, the condition of compulsive social media use, its consequences and possible reasons will be explained, in order to understand its nature before discussing the issue of addictive social media design. Several problematic design features will be identified and the reason for their addictiveness will be explained. Afterwards, a look can be taken at existing solutions. Behavioural solutions, screen time trackers and digital nudges will be presented, which target problematic social media usage. Subsequently, non-invasive design alternatives that can influence users toward conscious social media use can be designed, based on the literature research.

2.1 Social Media

Social media platforms are most often used for socialization, entertainment and information-seeking and sharing [5][60]. They are often aimed at providing the user with content on their user feed and also facilitate social interactions with other users in the form of private or public conversations. These conversations can be one-on-one, in private groups or in large-scale open or closed forums. Most social media platforms allow for multimedia communication, like seeking and sharing text, pictures and videos. Compulsive social media use is most commonly associated with social networking services, used to build social networks and interact with a large number of other users [86][32]. Facebook, Twitter and Instagram are the most popular examples of such social networking services [52], where users can link up with each other by reaching a 'friend' or 'following' status, e.g., based on real-life connections or shared interests [5][70]. Generally, social networking services have very similar abilities but differ in how information is shared and brought to the user. These platforms are often characterized and distinguished by the types of media that are focused on. For example, Instagram focuses on the sharing of videos and pictures, only allowing short descriptions, while Facebook focuses more on lengthier posts and allows for easier reading of large texts [60]. Context of media types differs as well, platforms such as Snapchat facilitate ephemeral image and video sharing while Instagram encourages permanent image and video sharing [36]. To summarize, social media includes different digital platforms that enable users to create, share and consume content and participate in digital social engagements [13][26].

2.2 Compulsive Social Media Use

Compulsive social media use is a condition that compels individuals toward irrational and excessive social media usage [32][27]. It is characterized by the compulsive need to use social media frequently and unceasingly, possibly at the cost of health, responsibilities and relationships [6][45]. Such people may experience feelings of anxiety or restlessness when unable to use social media, and a decreased ability to control the amount of time spent on social media, sometimes akin to an addiction. Though similar, compulsive social media usage cannot be attributed to a specific addiction disorder according to current diagnostic tools [21][84]. Compulsive social media use is, instead, a commonly used term to describe the growing reliance on social media and users' problematic use of it, as it may lead to behaviour and negative consequences much like behavioural addictions [79]. Compulsive social media use, however, does not necessarily have to occur at the same level as an addiction. Most people who engage in compulsive social media use do not experience consequences similar to an addiction and are rather just dissatisfied with their social media use and find it difficult to improve, without significantly life-altering consequences. Though different scientific resources refer to the condition as an addiction, compulsive social media use will be referred to in this text as a set of problematic behavioural patterns

that can have addiction-like qualities, in order to also target the social media user who is even slightly affected by social media. This thesis will focus on both the people who even slightly engage in compulsive social media use as well as the people who may experience it like an addiction.

In order to fully understand compulsive social media use, *"healthy"* social media use must also be understood. The line between healthy and problematic social media use is largely dependent on the person, their perception of their own use and the consequences they face [73]. An individual can spend an excessive amount of time on social media without it being compulsive when they can quit easily and do not significantly crave it when not using it [32]. When social media is used moderately according to a user and it does not, for example, influence their mental well-being or deter the user from attending to responsibilities, there is no compulsion [9][72][75]. Using social media does not need to be a negative experience during use either, Essentially, social media use will be healthy when a person is in complete control of how much, when and how they use social media. Taking care of these distinctions between compulsive and healthy social media use, the behaviour of compulsive social media use can be expanded on.

2.2.1 Behaviour.

Compulsive social media use culminates in a few characteristic types of behaviours. One of the most significant aspects of compulsive social media use is the state of flow it can induce for a user. Flow, a term coined by Csikszentmihalyi in 1990 [19], is a mental state of concentration that is so focused that people find themselves deeply absorbed in that activity [47][49][95]. The state of flow is achieved when task difficulty and user capability are rightly balanced, where a task is not boring or difficult, but attuned to the person's skill levels [49]. Kwak et al. [38] proposed six elements that characterize the flow experience on social media: focused attention (on social media), enjoyment (due to social media), curiosity (for other users and content on social media), telepresence (high immersion), time distortion (losing a sense of time) and self-disclosure (revelation of personal information). Flow is described as a positive state when applied to useful and productive tasks, such as those at school or work [82][95]. Using social media, however, is not a task that produces practical results, but is a task of entertainment. When a social media user experiences a high level of flow, they may fall into a state of "mindless scrolling" [8]. Mindless scrolling can be defined as a state of continually scrolling through social media without even thinking about it, where the user is in a flow state [71]. The difference between engaging with social media in a positive flow state and resorting to the negative state of mindless scrolling is moderation and self-awareness [34]. It is not inherently negative to enter a flow state for entertainment, as it provides benefits such as relaxation [82]. However, when a flow state is entered on social media, a loss of time and high telepresence can be a detriment to responsibilities, as these are then easily forgotten and neglected [38]. Moreover, the flow characteristic of self-disclosure can lead to regretful posting, as a user does not always think ahead in their actions [42][65]. If these behaviours persist, it is indicative of an addiction-like problem. Essentially, mindless scrolling is a flow state that has gone off the rails, which can significantly affect a user negatively.

Social networking services, social media such as Facebook and Instagram with a content feed, can most likely lead to problematic social media use and are most associated with social media compulsive social media use [86][32]. This is because these platforms highly encourage passive social media use, consuming other users' social media output without engagement [66][85], which is more likely to lead to mindlessly scrolling [71]. Active social media usage, engaging with other users, is less commonly associated with negative consequences [88]. This explains why research is mainly focused on social networking services, compared to social media focused on target one-on-one exchanges, such as

WhatsApp, where engagement with others is its sole purpose and where negative consequences are thus less apparent [93][85]. However, it has been shown that social media addiction can be applied to texting, if a person particularly seeks out socialization, rather than entertainment [41][87].

Mindlessly scrolling social networking services and texting incessantly is the most common behaviour of a social media addict, though this can present differently based on contextual factors. Namely, attentional states can fluctuate based on context (i.e., at home or at work), the time of day (i.e., morning or evening) and day of the week (i.e., workday or weekend day) [35]. People often mindlessly scroll when they are in a context that allows them to do so, such as at home alone [8][35]. When not, such as at school or work where productivity is expected, people addicted to social media may instead engage in attempts at multitasking, which will culminate in small bursts of use instead [92]. Multitasking between social media and work leads to superficial social media use and sub-optimal work [92]. A person who is addicted, however, may still feel the compulsive need to attend to social media in these small bursts of use, even if it is likely not satisfying [48].

To summarize, addictive behaviour can manifest in different behaviours and attentional states. One kind of way is the flow state, where a social media user is so immersed, they will mindlessly scroll and forget about everything around them. When seeking socialization, addicts may also incessantly text. Another state is multitasking, where important tasks are continuously interrupted in order to attend to social media when possible. Overall, social media addiction leads people to compulsively use their social media whenever they can, for different reasons. This leads to different consequences.

2.2.2 Consequences.

Using social media can lead to both positive and negative effects for users. Positives include that it may contribute to mood improvement, feelings of belonging, and experiencing social support [81][46]. Social media can be especially positive for users that are unable to seek these benefits out in their daily life, sometimes even serving as a form of escapism [56]. Studies on social media use during the COVID-19 pandemic reveal that social media served as a comfort for many who were unable to socialize in real life, especially adolescents [23][54]. According to the social skill model of problematic Internet use [12], the need for self-presentation is a fundamental human motivation to form and maintain positive impressions of the self on other people. Besides socialization, social media content can also serve as a source of entertainment and news and is the main source of media content for many users [59]. While social media use has benefits, the negative consequences of compulsive use undermine these effects. As described, negative consequences of social media addiction include a decrease in productivity, worsening of relationships and lower quality of mental and physical health [3] [84][51]. These three are negative consequences common with behavioural addictions [3].

Productivity is affected by the fact that compulsive social media users are absorbed by social media for a large portion of each day. This can manifest in frequent and long use, but also in people's minds being consumed by social media when not in use [1][61]. As described, this leads to attempts at multi-tasking and frequent short bursts of engaging with social media [92]. Then, responsibilities cannot be tended to optimally. This can induce personal consequences such as feelings of frustration, stress and guilt [24]. It can also lead to problems at school or work, due to poor and insufficient results or no results at all [61].

Relationships can be affected by multiple factors. When engaging in real life with another person, the relationship can suffer if the compulsive social media user cannot be fully present for the other [27][51]. Such a person may engage in multitasking and short bursts of engaging with social media while socializing, to the potential frustration of others [2]. Compulsive social media users may conform to maintaining relationships fully through social media. While socialization on social media can strengthen existing bonds, some social media site users may experience weakening friendships, online ostracism, and heightened loneliness if highly absorbed in social media [69]. Research has shown that online friendships can partially supplement a person's need for socialization and can be experienced as fulfilling, but leads to less satisfaction compared to real-life relationships[56]. Thus, when led to only engaging in online social interactions, this may still lead to feelings of loneliness [56].

Mental and physical health can also be affected by compulsive social media use, besides the previous factors such as loneliness. Compulsive social media users can experience emotional withdrawal symptoms, such as becoming increasingly irritable, depressed or anxious when unable to check their social media [86]. Even physical withdrawal symptoms have been documented, such as shakiness and increased perspiration [46] [81][25]. Excessive use of social media can also lead to decreased sleep quality, which can have long-term health consequences [80]. Additionally, the sedentary nature of social media use can lead to physical inactivity, in turn leading to higher risks for cardiovascular diseases [80].

It can be concluded that though social media use has potential benefits and drawbacks that differ for each individual, excessive and compulsive usage is assuredly negative for any social media user and causes different unpleasant consequences when social media use is not under control.

2.2.3 Measuring Addiction.

Different researchers have attempted to develop a scale that can be applied to compulsive social media use. The most commonly used way to research whether a person engages in compulsive social media use is the Social Media Addiction Scale [83]. Originally, it was invented in the form of the Facebook Addiction Scale, by Andreassen et al. in 2012 [4]. It was developed to assess six core symptoms of addiction, applied to problematic Facebook usage. Later research by Tutgun-Ünal and Deniz in 2015 [83] modernised the model to encompass all social media services as a broader topic, as the identified symptoms can be generalized to other social networking services. The following list describes the six core symptoms analyzed by the Social Media Addiction Scale:

(1) *Salience*: This dimension means that using social media becomes the most important activity in a person's life and dominates his or her thinking (preoccupation), feelings (cravings), and behaviour (excessive use). Increased salience can lead social media users to neglect responsibilities, as social media is their main interest.

(2) *Tolerance*: This refers to the process of someone starting to use social media more often, thereby gradually building up the amount of time spent using social media. It describes the increasing need to spend much more time social networking in order to feel satisfied.

(3) *Mood modification*: This dimension refers to the subjective experiences that people report as a result of engagement in using social media. It may include feelings related to escapism, such as happiness and relaxation or even the cessation of negative feelings such as boredom and loneliness. Users may feel the need to use social media in order to feel better.

(4) *Withdrawal*: This dimension refers to unpleasant emotions and/or physical efforts that occur when using social media is suddenly reduced or discontinued. Withdrawal consists of moodiness and irritability, but may also include physiological symptoms, such as shaking.

(5) *Relapse*: This dimension refers to the tendency to repeatedly revert to earlier patterns of social media addiction. Excessive social media use is resorted to after periods of abstinence or control.

(6) *Conflict*: This dimension refers to all interpersonal conflicts resulting from excessive social media use. Conflicts exist between the social media user and the people around them. These conflicts may include arguments, neglect, lies and even deception.

The previous core symptoms are similar to those of other behavioural addictions, such as gambling, though it must be said that compulsive social media users are generally not affected to such a degree. Overall, compulsive social media users may crave social media and use it often. They must gain positive feelings from using it and may rely on it to feel better. They may, on the other hand, suffer from withdrawal symptoms when not using it. Because of this, when aiming to quit, it may be difficult to keep away from social media. These factors lead to conflicting feelings about social media use [83]. It bears repeating that scoring high on this scale does not lead to a clinical diagnosis, but an indication of the behavioural patterns of a compulsive social media user.

2.2.4 Reasons.

Social media addiction can arise due to different reasons. Some theories attribute addictive social media use to dispositional differences, presuming that people with certain dispositions are more likely to develop compulsive use [40]. Some research states that people who suffer from psychological problems such as depression and anxiety are more prone to developing a reliance on social media. Meanwhile, other research states that social media addiction causes psychological problems instead [40][79]. Comorbid symptoms are not yet well understood [56]. This makes social media addiction a difficult condition to research.

Despite this, some possible psychological reasons for compulsive social media use can be drawn from the earlier described benefits and consequences. For example, social media use can contribute to feelings of belonging and social support [81][46]. Thus, it is a likely connection that people who experience loneliness are more drawn to social media than those who already experience plenty of socialization in their real life [2][27]. People with social skill deficits may perceive social media-based interaction as relatively more comfortable and safe compared to face-to-face interactions [40]. This can lead to people overly relying on social media and developing a tendency toward compulsive use. Another identified reason for overusing social media is that it is a source of entertainment. Consuming social media content can lead to a rush of dopamine [11]. Studies show this can lead to an addiction to the dopamine produced by using social media, similar to other behavioural addictions such as gambling [11] [43]. This then encourages the act of mindless scrolling, to keep the dopamine flowing [34]. These examples showcase that people are generally drawn to social media addiction due to the benefits it provides, culminating in negative consequences when people overuse and overly rely on social media. However, it is still unclear what makes the difference between beneficial healthy usage of social media, and engaging in problematic compulsive use, but these reasons may lead to an understanding of what psychologically motivates people to use social media in any type of way, with the possibility of compulsive use.

As explained in the introduction, research shows that deliberately addictive social media design may also contribute to the development of compulsive social media use [64][79]. The general consensus is that addictive social media design

does not cause compulsive use, but can worsen it significantly [64]. People who rely on social media, due to previous reasons such as socialisation and the dopamine it provides, are encouraged to do so by the platforms themselves [44][50]. As entertainment on social media can lead to an addiction to dopamine, the ease of access to consuming high amounts of bite-sized pieces of entertainment is enhanced by social media design. Nonetheless, the level of influence of

2.2.5 Summary.

The main takeaway about compulsive social media use is that it is not a well-understood phenomenon, though a set of possible behaviours and consequences have been identified. Compulsive social media use is characterized by the compulsive need to use social media frequently and unceasingly, leading to behaviours like mindless scrolling and attempts at multi-tasking, possibly at the cost of health, responsibilities and relationships. These factors, however, do not apply to every person, and compulsive social media use is difficult to study for different individuals. It will manifest differently, due to different possible reasons, such as seeking out socialization or entertainment for dopamine. Addictive social media design may also contribute to compulsive social media use, which the following section will elaborate on.

2.3 Addictive Social Media Design

Addictive social media design can be defined as user experience features that aim to persuade the user towards engaging with social media as often and as long as possible [50]. It is theorized that many social media platforms are purposefully designed to provide users with a constant stream of positive feedback, through likes, comments, and notifications. This creates a dopamine-driven feedback loop, where users, for example, feel a sense of reward and validation each time they receive a notification [34]. This makes it pleasurable and very easy to engage with social media. Over time, this may create a compulsive need to check the platform and engage with the content [86]. A total of five different addictive design features have been identified through literature and articles. The following sections will elaborate on what these features are, how they work and what their effects may be.

2.3.1 Infinite Scroll.

The first problematic design element is the infinite scroll feature, which is the most well-researched feature in relation to social media addiction. It is encountered inside social media feeds. The infinite scroll is a navigational feature where social media content is automatically loaded at the bottom of the feed on a single page, rather than letting users generate new pages of content themselves by clicking a button, as was common in earlier web designs [33]. Pagination is the style of loading content where buttons are pressed to navigate to a new page. The "load more" feature is a combination of both: content is loaded on the same page, but only after pressing a button. Graphical examples of these design features can be viewed in figure 1[2].

The implementation of the infinite scroll has been linked to a significant increase in social media usage, as well as an increase in mindless scrolling, as it decreases the input needed from the user, which may encourage passive use [55]. Addictive design elements in social media such as the infinite scroll have increased significantly over the past 10 years, used on popular social media platforms such as Facebook [3]. There is no known difference yet between the cognitive effects of pagination and the "load more" design features since they require the same effort from the user, of pressing a button and thus let a similar moment of pause occur for the user [55].
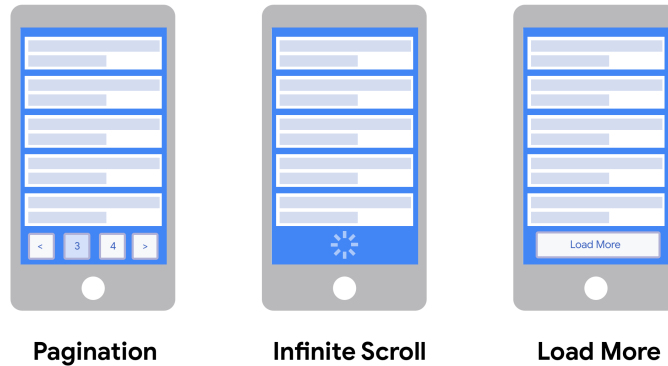
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[2]https://learnvue.co/tutorials/vue-infinite-scrolling

Fig. 1. Graphical examples of pagination, infinite scroll and "load more" design features

2.3.2 *Notifications.*

Another possibly problematic design feature is the notification. They serve to alert users to new activities that occur in their social media accounts [91]. For example, notifications may be used to alert users about new chat messages, that someone has liked their post or that they should view recommended a post. Notifications are different from other addictive design features by being present both inside and outside an app, serving as a significant cue to open up social media [7]. Notifications can cause phone screens to light up and make a noise if the user's settings allow it [68]. All smartphone devices allow for notifications to be customised by removing certain aspects like sound or can be removed entirely. While useful in concept, this feature is often designed in a way that heightens the likelihood that a user will open their social media [53], [91].

What may make notifications especially addictive is how the content and the reason for a notification are presented. An ideal notification will alert the user of the reason, so the user can decide whether it is worth it to open their social media or not [91]. For example, if a notification is deemed unimportant by the user, they can easily choose not to open their social media and even swipe it away. However, when hiding the intent by providing an ambiguous notification, the user cannot decide whether they should open their social media and is more likely to do so, in the case it is important and worth their immediate attention [76]. An example of hiding the intent of a notification can be seen in figure 2[3].
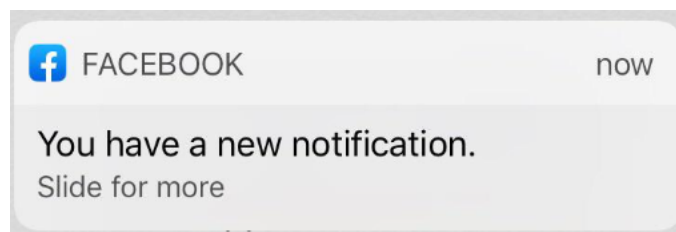

Fig. 2. An example of a Facebook notification hiding intent.

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[3]www.reddit.com/r/facebook/comments/g43dtf/anyone$_k$$no$$w_h$$o$$w_t$$o_c$$hange_t$$he_p$$ush_n$$otifications$

2.3.3 Typing Awareness Indicator.

A design feature common in chats on social media is the typing awareness indicator. These indicators aim to create curiosity and suspense as to what the other person in the chat might be typing [77]. They come in different forms. Some indicators feature as a *"X is typing..."* message, used in apps such as WhatsApp. Some others feature as what is commonly called *"the wavy dots of anticipation"*[4], three bouncing dots used in apps such as iMessage. This makes users unsure of the weight of the coming message as they don't know what it will contain, letting users pause to see the outcome of the message. This effect is similar to notifications hiding intent in the way of concealing a message's content but is different in the way that users will have to wait an unknown amount of time for the message to appear in their chat. Users may not feel like they can leave the social media chat as they are more likely to feel they must soon reply when seeing the wave dots of anticipation [77]. Little research has been conducted on the typing awareness indicator and its design. It is not yet known whether removing or altering the design of these indicators could contribute to social media users' addiction and well-being.

Fig. 3. An example of the typing awareness indicator in a chat on social media.

2.3.4 Streaks.

Some social media platforms incorporate *"streaks"* to encourage users to come back and engage with the app daily. Streaks are a type of gamification, wherein users can see the number of consecutive days in a row they have interacted with the app in a certain way [28]. The most popular social media platform that makes use of streaks is Snapchat. Here, the number of consecutive days a user has sent a picture to another user is tallied. An example can be viewed in figure 4[5]. Users have stated that streaks of a large number signify loyalty to friends on the platform and can invoke a sense of pride [29]. In turn, losing a streak can lead to feelings of disappointment and even irritation toward oneself [28][29]. Users have reported wanting to *"keep the streak alive"*, even feeling forced to send self-reported meaningless and unnecessary pictures on some days, just to continue the streak [22][30]. Evidently, streaks invoke a feeling of responsibility toward a social media platform. The addictive aspect here is that streaks make the user come back daily, even when the user does not have anything they would otherwise send. No known research has been conducted on whether removing or altering the presentation of streaks in social media has an impact on engagement and users' well-being.

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[4]https://medium.com/swlh/the-secret-design-tools-which-social-media-apps-are-using-to-create-addiction-e6a502ccb79f
[5]https://www.quora.com/What-is-a-Snapchat-streak-and-why-are-kids-so-obsessed-addicted-to-sending-them-on-a-daily-basis
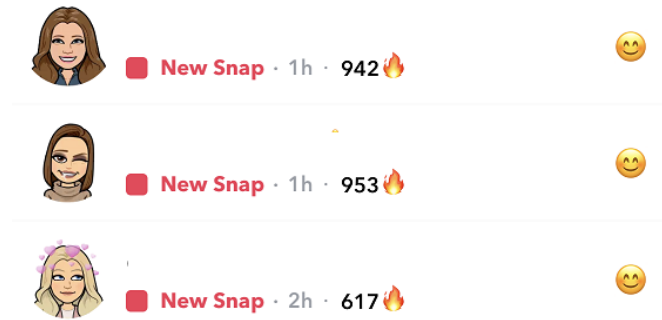
Fig. 4. An example of different streak counts with contacts in Snapchat.

2.3.5 Likes.

The like button provides social validation [18]. An example can be seen in figure 5[6]. A user can give likes to other users' posts, and can in turn receive them from others. Most social media platforms show the total number of likes attached to a post on their own posts. The number of likes can then be measured and compared allowing users to establish status by a quantifiable number. The number of likes or followers on social media is considered an important metric for many, as it indicates a person's or company's popularity, profitability, and, more generally, the post's effectiveness [89]. The positive feedback loop of getting likes and feeling of approval is theorized to keep users coming back. [18][78]. In an interview, professor of psychology Susan Krauss Whitbourne has stated: *"You get an emotional high when your posts hit a responsive chord with your audience, so you keep going after it, and you're never fulfilled because you'll always want more likes"*[7]. This, however, also means, a lack of likes can be experienced as disappointing and potentially as social ostracism [74]. Social media addicts may chase likes by pushing their self-disclosure [82], with potential regret afterwards [95].

Some social media platforms have taken measures against the user-reported pressure and insecurities induced by likes. In 2021, Instagram introduced the option to hide the like count [8], but this is not a widespread option yet [89]. No research has been published on the effects of removing or altering likes on users, though Instagram' states an internal study that has not been released to the public found that their experiment with hiding likes has not had an impact on users' psychological well-being.

Fig. 5. An example of a Facebook post's like count.
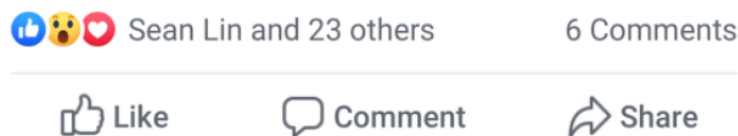
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[6]https://techcrunch.com/2019/09/26/facebook-hides-likes/
[7]https://www.cosmopolitan.com/lifestyle/a57384/why-your-likes-on-social-media-dont-mean-anything-addiction/
[8]https://www.bbc.com/news/technology-57254488

2.3.6 Analysis.

The previous addictive design methods touch on several similar patterns. All addictive design patterns aim to either lure users to social media and keep them there by engaging curiosity or provide content as easily and efficiently as possible. Notifications and streaks serve as reasons to enter the app, even when a user would not otherwise want to do so [53]. The infinite scroll is addictive because it is so convenient, allowing users to enter a mindless scrolling mode more easily [55]. The typing indicator and notifications engage the users' curiosity for more content. Likes and streaks provide feelings of social acceptance, which users may crave, causing them to possibly post more and more [18] [78]. While this may seem entirely problematic, on the other hand, you can present many such features as positive tools [64]. After all, notifications are appreciated by many users to some degree, as it makes users aware of their social media activity when not online. The typing awareness indicator similarly provides the user with information on content to expect. Moreover, the infinite scroll is convenient, ensuring users will not have to click anything to receive more content. Streaks and likes are appreciated as social validation and symbols for friendship [64]. Despite these positive aspects, it is still theorized that these features contribute to compulsive social media use. Users who are prone to addictive social media use are encouraged by these addictive designs in several ways. It does by promoting social media use as a habit [7].

As described, problematic social media use is often automatic and may feel out of a user's control, as they use it without thinking to alleviate feelings such as loneliness and boredom. This is similar to any regular habit. Research on countering social media addiction has been largely focused on how the habit of compulsively using social media is formed to develop countermeasures. Habits are implicit associations that people learn as they respond in ways that are rewarded [7]. These implicit associations become linked to internal or external cues that are processed in an increasingly automatic manner. Internal cues that stimulate social media use include negative feelings alleviated by social media such as loneliness and boredom [7]. The speed at which habits are formed depends on the frequency of cues and rewards. An example of how compulsive social media habits are corroborated by platform interfaces is the use of notifications. A notification, in the form of a sound or by simply lighting up a user's screen with a message, serves as an external cue for a user to engage with social media. Both internal and external cues are able to automate the response of conducting a habit, in this case, using social media. Another example of how social media enforces habit formation are likes, which serve as rewards for the behaviour of social media use. Social media use provides rewards by alleviating negative feelings. Addictive social media design plays into the association between cues and rewards, leading to starting up social media and using it often.

2.3.7 Summary.

A summarizing overview of the addictive design features and where these are found in the social media process can be viewed in figure 6. Here the social media experience is abstracted to a main feed to start with and two further options of selecting a post or a chat.

Addictive social media design is involved in all steps of social media use, even before starting it up, with the use of notifications. Notifications serve as cues for a social media app, to lure the user toward engagement. After opening social media, the user will be met with their main feed. Here, the user will get more information on their notification. On the main feed, they can scroll through content posted by other accounts. Logically, the infinite scroll is present here. Users will be able to see the number of likes for each post here. Alternatively, the main feed may also include social
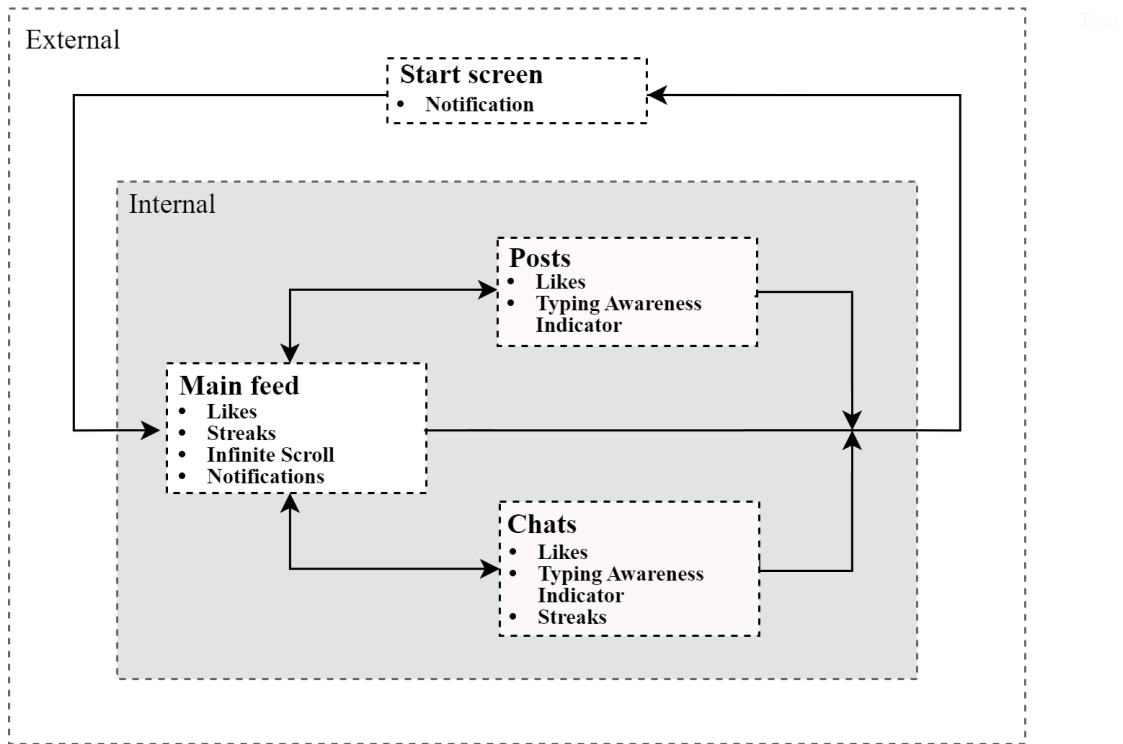
Fig. 6. An overview of social media pages and corresponding addictive design features.

contacts and engagement streaks can be viewed here. On the main feed, a user can choose to navigate to a detailed page for a post or a chat page. When clicking on a post, the user can again view likes. In the comments under a post, many social media platforms also include a typing awareness indicator, where the user will not know who is typing, such as on Facebook. When clicking on a chat, a user may again be reminded of their streaks and may also see typing awareness indicators. Users can also like each other's messages as social reinforcement. Users can navigate from posts and chats back to the main feed or they may close the app until there is an incentive to return again.

2.4 Interventions

There are different types of interventions for reducing the harmful effects of social media addiction. But first, in order to counteract social media addiction, a positive outcome as an endpoint must be decided. This is different for every user who self-reports being addicted [39]. In general, it tends to range from refraining from social media use entirely, to conforming to a certain limited manner of use. Healthy social media usage is generally characterized as conscious behaviour, where the user feels like they can stop at any time and are in control of their screen time. Several methods of reaching a state of healthy social media use exist. One method comes in the form of behavioural interventions, aimed at breaking the habit of compulsive social media use, outside of social media itself. One method is using apps such as screen trackers, to encourage self-reflection and limit use. Another method is to incorporate nudges into social media interfaces, influencing users during use. This section will describe solutions for both types of interventions.

2.4.1 Behavioural Interventions.

The most common method of counteracting social media addiction is simply quitting "cold turkey", entirely in one moment [39]. However, much like quitting behavioural addictions, this is often not a beneficiary method in the long term and users are reported to have come back to their former problematic habits when usually undertaking this method [68][57]. Furthermore, unlike most behavioural addictions, there is a general pressure to engage in social media for many people, to a certain degree. Thus, it is questionable whether the end goal of ending social media addiction. Realistically, people generally aim to decrease, not end, their social media usage, as it presents several benefits such as maintaining social relationships, as previously. Most likely, a user will only aim to reduce time spent on social media. Finding the right balance between healthy and problematic social media use can be challenging. People can improve their behaviour with the aid of several different options.

The most extreme behavioural interventions against social media addiction are supported by therapy. While social media addiction is not a recognised disorder, clinical programs for it have popped up in the last decade. For example, Brijder [9] is a Dutch clinic specializing in several addictions, alongside what is coined as internet addiction. Their program recommends and teaches several measures to reduce social media reliance: (1) let others know of your issue with social media, (2) decide how much time you will use social media before engaging, (3) set an alarm clock to limit yourself to your preferred time, (4) do not use the internet for several days to break the habit, (5) meet friends in real life, (6) undertake activities, play sports, and do hobbies unrelated to the internet and lastly, (7) reward yourself for following the previous tips. While this is an effective program inducing the necessary behaviour for healthy social media use, these programs are targeted at people who are extremely inhibited by their social media use. Most compulsive social media users would likely not apply to a clinic, despite their issues, since they likely also do not experience consequences to such an extreme degree. Even further, many people who are addicted to social media and realize it does not want to admit it openly.

Behavioural interventions are typically an effective tool to improve social media use for users who engage in compulsive social media use to a debilitating degree. Behaviours to increase conscious usage of social media is for example deciding beforehand how long you want to use social media and setting an alarm. However, the average compulsive social media user likely does not seek out such interventions meant for true addicts. To address the average compulsive social media user, a moderate solution is more applicable. An example of a more accessible method of reducing social media usage is tracking personal screen time by yourself.

2.4.2 Screen Time Tracking.

Screen time trackers aim to quantify a user's total screen time on a device, such as a smartphone. Users can see total screen time over different periods of time, such as hourly, daily and weekly usage. Not only overall time spent on a device can be viewed, but also individual apps. Smartphones often have such tracking tools built-in. Android smartphones, for example, have Digital Wellbeing[10], which is an opt-in feature for users. Various apps of this type exist, some with extended features such as the ability to lock certain apps after a set time spent on them or warn users after spending a certain time in an app. These apps aim to aid users in gaining information on their screen time, in order to understand and self-assess their device usage.

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[9]https://www.brijder.nl/probleem/internetverslaving/behandeling-internetverslaving
[10]https://www.android.com/intl/nl$_n l/digital-wellbeing/$

Rooksby et al. [68] developed ScreenLife, a multi-platform screen tracker. Their study showed that personally tracking screen time on digital devices helped to improve overall awareness. A study by Zimmerman et al. [96] about screen tracking similarly confirmed that people are generally interested in viewing their screen time. However, these studies also show that users can also have mixed feeling about tracking screen time. Users may initially feel positive about seeing their personal screen time data, finding it interesting and entertaining, as it improves digital self-awareness. The results provide some users with empowerment towards changing their habits, as they provide a method to perceive tangible results in the form of average time spent on a device. However, long-term studies indicate that while awareness of screen time increases, using a tracker does not reduce screen time [96]. However, despite certain benefits, users may also feel negative about seeing their personal screen time data, such as anger and guilt toward their personal usage, which may worsen compulsive social media use [10]. Studies on screen time trackers conclude that users often feel negatively towards them and tend to delete them or start to ignore them after a short time of usage [10][68]. Users of screen trackers have also felt frustrated at the fact that there is no discernment between self-proclaimed useful and useless apps, such as those aiding productivity versus social media for entertainment [68].

Outside of scientific research studies, there are multiple projects against compulsive social media use through tracking screen time with mixed results. One example is Goaro, a company centred around designing for digital well-being, that launched their product "Aro" in 2020[11]. The product is a Bluetooth-connected box to drop one's phone into when not in use, paired with an app that tracks the time a phone spends inside the box. This solution reverses the critique on the negativity of screen time data, as the amount of time spent away from one's phone. Users praise the gamified aspect of encouraging the user to put the phone down and increase the time spent without it. However, this product has also been perceived as unnecessary by some. One review states *"There's one huge downside to this, though, which is that there's a much cheaper and wholly subscription-free way to make sure that you get off your phone. That's a cardboard box."*[12]. Though providing the means to change behaviours, a problem identified with the regular screen time tracker, these types of products are still criticized for providing services that *"you can do yourself"*. Aro, while taking a different approach and providing the means for making healthy decisions, is still seen as an imperfect screen time tracker.

The main issue with screen time trackers is that while people may enjoy gaining insight into their screen time, they do not often alter their behaviour in the long run. While users are happy to look into their screen time information, they do not always know what the next steps are to change their behaviour and screen time trackers do not offer the means to do so. Screen time trackers who do attempt to provide the means are generally not accepted by users. For many, a more directly integrated intervention may be more useful, such as digital nudges.

2.4.3 Digital Nudges.

Since social media addiction has been a recognised issue, many researchers have aimed to design interventions against the addictive effects of social media inside the social media platforms themselves. Unlike behavioural interventions and screen time tracking apps, nudges interfere with social media platforms directly. Example studies will be highlighted in the following section.

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[11]https://www.goaro.com/
[12]https://www.wired.com/review/aro-home/

Purohit et al. [64] designed "Nudge", a browser extension for Facebook, aimed at reducing and removing triggers that invoke social media use. One of the methods included is the "hiding" nudge: upon entering the app, all notifications will be hidden. Another method is the "pause-reminder": a nudge explicitly aimed at the infinite scroll, occasionally popping up to remind the user of their mindless scrolling. After testing these nudges in an experiment, some participants reported that the nudges positively affected them, reducing Facebook use. Other participants, however, found the nudges to be overbearing. They wished for a middle ground, feeling restricted by the high level of involvement from the nudges [64]. A later study by Purohit and Holzer [63] on digital nudges found that nudges in social media raise concerns about ethics and privacy. One participant stated *"I felt as if I took a risk in relation to my FB-data giving over some control to [the digital detox app]."* Another study by Purohit et al. [62] aimed to co-design nudges against Instagram overuse with users. The results show that co-designing with potential users led to insights into the workings of a nudge, reducing issues with privacy and ethics. In turn, testing nudges with the potential users led to more positive results for users and their Instagram behaviour.

While shown to be effective in previous studies, research on the long-term incorporation of nudges in social media is lacking. Since especially long-term problematic social media use has negative consequences for users, the benefits of long-term incorporation of nudges are unclear. Furthermore, it is also uncertain whether users' feelings towards nudges may change over time. Research indicates that users may become immune to nudges over time, for example ignoring pop-ups that show users have reached their personal time limit [96]. Furthermore, not every user appreciates direct commands and "being told what to do", despite their interest in reducing social media addiction [64].

It can be said that nudges can be a useful tool for reducing social media addiction, but the effects of long-term implementation are uncertain, due to factors such as immunity over time. Nudges can be experienced as intrusive by some and are easily ignored. Though nudges have an edge over screen time trackers by directly intervening in a user's behaviour, this can be experiences as "being told what to do" by some users.

2.4.4 Summary. This section has discussed several interventions against social media addiction, all with their own benefits and drawbacks. Therapeutic programmes can aid social media addicts with regaining control over their screen time but are not intended for the average person who engages in compulsive social media use without extreme consequences. An ideal solution would invoke the same behaviour that is achieved in these programmes but is more accessible. Screen tracking apps can also aid people in gaining insight into their social media use but do not tend to inspire people to regain control of their screen time. To effectively direct user behaviour, the implementation of nudges has also been researched. However, these are not always experienced as effective and feel invasive to some. Ideally, a solution directs user behaviour subtly and does not invoke feelings of loss of privacy. It should be non-invasive and pleasant to use while making sure users do not feel the need to keep compulsively using social media. This study aims to design this ideal solution against addictive social media features.

3   RESEARCH QUESTIONS

The literature review has led to the following research question that will be studied in this thesis:

RQ: How can non-invasive interventions that effectively counter the effects of compulsive social media use be designed?

This study aims to devise effective solutions against social media addiction. The literature review has shown there is no perfect solution yet among existing interventions, which this study aims to design. No solution has treated the issue of addictive social media design yet at the source of it. Furthermore, existing research on addictive social media lack nuance by focusing only on the negative impact of addictive design, and do not take positive aspects of the addictive features into account, which this study will aim to discover and incorporate in potential solutions. Thus, the main research question expresses the goal of creating pleasant solutions that are effective in altering compulsive social media use but are experienced as non-invasive, which have not been researched or created yet.

In order to answer the main research question, several subquestions have also been created.

SQ1: How is compulsive social media use experienced and mediated?

The first step before designing a solution for social media addiction is to gain further insight into the problem. It must be understood how people use their social media and whether they do so compulsively. The literature review has shown that compulsive social media use is not yet well-understood and reasons will differ per person. After understanding why people may use social media in a problematic manner, particularly in relation to addictive design, more accurate solutions can be designed. Answering this subquestion will inform what behaviour must be targeted and how.

SQ2: What are the addictive features of social media design?

In order to design solutions for addictive social media design, it must first be researched what the problems about them are. Though social media has been pointed out to be addictive, little is known about which features are addictive and why. Thus, the possibly addictive features as discovered through the literature review will be researched to gather an overview of which aspects are addictive, or whether they may not be addictive at all.

SQ3: How do social media users perceive non-invasive solutions against addictive social media design?

Before the main question can be answered, the proposed solutions must be evaluated, in order to decide which non-invasive solutions are effective to decide whether they may be effective against compulsive social media use. Understanding how the solutions are perceived by potential users will provide an understanding of their potential success.

4 METHODOLOGY

This section will discuss the methodology for all parts of this research. As explained in the previous sections, this study aims to research the nature of compulsive social media use due to addictive social media design, as well as its mediation by studying existing solutions and designing new, integrated non-invasive solutions. The multidimensionality of this study has led to the design of two different phases, each using different research methods. First, an overall outline of the study and its steps will be described. Later sections will elaborate on how each phase of the study has been designed.

4.1 Study outline

The first study aims to answer the first two subquestions: *"How is compulsive social media use experienced and mediated?"* and *"What are the addictive features of social media design?"*. Finding out the answer to these questions serves as exploratory research towards understanding the issue of addictive social media design. Since little is known about how and why social media users are affected by addictive social media design, the first phase of the study aims to collect as much information and as many different perspectives on social media and addictive features as possible, to get a full picture. Thus, the choice was made to make to create a survey. In this survey, the participants were asked about their general social media use, such as which platforms they use and how, and they will be asked about how feel about and interact with social media. Participants were also asked about how they perceive their social media use and how they control it. Based on these answers, it has been made clear how addictive social media is perceived, which has made explicit how addictive social media design must be changed.

Based on the results of the survey, a set of design alternatives have been created. The results of the survey have been used to develop several design alternatives that may be effective in combatting the addictive nature of social media features. These proposals have been applied to mock prototype screens of popular social media platforms, to be familiar to participants during the evaluation, the next phase of the research. Designs featuring nudges will also be included, in order to evaluate existing interventions as well to support the necessity of integrated non-invasive solutions.

In the second phase of the study, evaluating the proposed designs will answer the third and final subquestion: *"How do social media users perceive non-invasive solutions against addictive social media design?"*. Since the proposed design solutions must be evaluated on their quality, the choice was made to conduct interviews with participants who are interested in altering their social media use. Then, in-depth discussions can be conducted on what potential users think of the features, and how the solutions compare against each other. Participants were encouraged to provide their own ideas as well, as there may be more ways to alter addictive social media features.

Based on the interview results, a final set of proposals will be provided. The proposals will be ranked based on quality and may be tweaked if necessary. The study will conclude with design alternatives to addictive features that are likely to be effective.

Before each study, participants have been informed about what the study will entail, what will be done with their information and what their rights are. All participants were given the opportunity to ask further questions before the start of each study and were able to give informed consent. All participant data has been anonymized for this thesis.

A summarizing overview of the experiment process and its phases can be seen in figure 7.
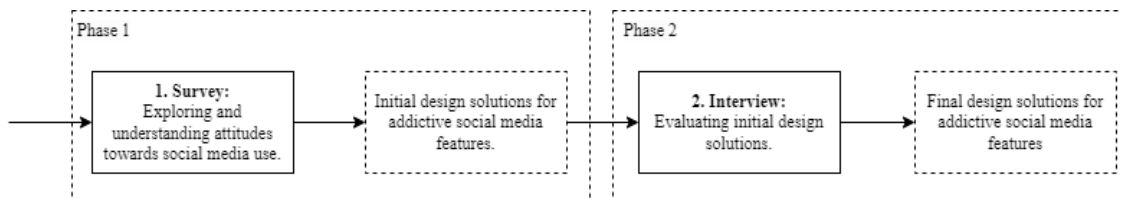

Fig. 7. Summarizing overview of the study phases.

4.2 Particpants

As this is an exploratory study on the issue of addictive social media design, the target group of the experiment is kept broad and includes every adult who uses social media. It is not yet entirely clear which demographic is perhaps more vulnerable to the effects of addictive social media design. This is, as described in the literature review, because it is unclear why certain characteristics are comorbid with compulsive social media use. Furthermore, in order to gain an understanding of the topic, it is useful to gather a large number of perspectives.

Participants of the survey who are interested in follow-up studies and admit they feel addicted to social media will be used for the interviews. Using the same set of participants throughout the study provides several benefits. Purohit et al. [62] found that co-creating interventions against compulsive social media use with potential users are beneficial to the product design and the testing of these solutions. Results of this study demonstrate that co-creation significantly increased users' sense of agency, sense of accomplishment and perceived sense of privacy while reducing users' privacy concerns. Furthermore, co-creation generally aids in designing more accurate digital interventions when involving the target demographic [62]. Thus, this study aims to take a similar approach. Participants who engage in compulsive social media use will be involved in every step of this study in order to create effective solutions for the target demographic.

4.3 Survey Design

The following section will describe the design of the first part of this study, the survey. As described, the overall goal of the survey is to gain an overview of how social media is used and what the sentiment on social media and the specific addictive design elements is. To let participants give their honest opinion on these features, the main purpose of the study will not be explicitly introduced. Rather than letting the participants know these features are addictive, the participants will be told that the survey is about general social media behaviour and certain features, and the questions will be designed around this idea. This ensures that participants are not directed towards answering more negatively than they actually feel about these features. Positive sentiments are equally welcome as negative sentiments, as the positive aspects must be also discovered. Positive sentiments will be used to keep the aspects of the designs that the users appreciate. After all, the goal is not to remove the feature's purposes but to improve them by reducing the addictiveness of them.

Since convenience and snowball sampling will be utilized to maximize participant recruitment, the study will be conducted in Dutch, as it is carried out in the Netherlands. While the survey is conducted in Dutch, the questions and

answers will be translated for this thesis and its discussion. This also decides that the target audience consists of adult Dutch-speaking social media users. The translation of all the questions and how they appeared to the participants can be viewed in appendix A. The following paragraphs describe the questions in the survey, in the order they appear to the participants.

4.3.1 Demographics.

The first few questions concern demographic information. But first of all, the survey opens with an information sheet, providing an explanation of what the survey will contain, and especially what will be done with the participants' input. Participants should tick *"I have read the information sheet and understood it"* at the bottom of the page to provide consent. On the next page, basic demographic information is asked from the user. Gender and age are asked to get an overview of the participant demographic and to analyse whether results can apply to the general public, or only a certain age group or gender. Participants will also have to answer *"Do you use social media?"*. As a participant's input would be redundant after answering no, this will end the survey. If answering yes, participants can move on to the next page and are allowed to answer further questions on social media use.

Users will then be asked about which social media platforms they use. The choice of pre-included social media platforms is based on a study about which social media platforms are used the most in the Netherlands [20] since Dutch social media users are the target of the investigation. Table 1 provides an overview of the prevalence of addictive social media features in popular social media platforms. Notifications and likes are utilized by all platforms, and the infinite scroll is used by all social networking services. Though this research focuses on social networking services, and not instant messaging services such as WhatsApp, the choice is made to include these still, since describing the differences between social media types can be confusing and time-consuming for participants. Furthermore, instant message services also contain addictive elements such as the typing indicator, as can be seen in table 1. Thus, answers about instant messaging services are deemed useful for this part of the study. Outside of the pre-selected options, participants can write down other platforms as well, to get a full overview of social media platforms in use.

Table 1. The utilization of addictive features by popular social media platforms.

	Infinite scroll	Notifications	Typing indicator	Streaks	Likes
WhatsApp		✓	✓		✓
Snapchat		✓	✓	✓	✓
Instagram	✓	✓			✓
Facebook	✓	✓	✓		✓
Twitter	✓	✓			✓
Linkedin	✓	✓	✓		✓
Pinterest	✓	✓			✓
Youtube	✓	✓			✓
TikTok	✓	✓			✓

4.3.2 Infinite scroll.

Afterwards, a few questions that pertain to the infinite scroll, or rather, the social media feed, will be presented. Since the infinite scroll is the most well-known addictive feature and is scientifically well-researched, the decision is made to

not specifically ask about the infinite scroll, as it may be known to some participants that its design is an issue. Then, this can dissuade participants from catching on to the purpose of the survey and can prevent them from answering more negatively than they otherwise would. Rather, other aspects of the social media feed are explored instead, to support the solutions against the infinite scroll. The following questions focus on content in the feed, and how participants interact with them.

A few questions on passive and active social media usage are presented to the user, with an explanation of the terms with examples included, as not all participants may be familiar with the term. The questions on this topic relate to the infinite scroll feature, as participants are asked about which social media platforms they use passively and which ones they use actively, and to which degree. As discovered in the literature review, passive engagement is most related to problematic social media use, as it leads to behaviours such as mindless scrolling. This question aims to find out which social media types may be most problematic. The pre-selected social media platforms from the previous questions are used again, and participants can tick off for each platform whether they only use it actively, mostly use it actively, use it actively and passively, mostly passively, only passively or whether they do not use it at all. The following questions go further in-depth on this topic by asking which types of media users actively engage with, and which types of media users passively engage with. The results of this question can lead to an understanding of which types of media are engaged with in what way.

4.3.3 Notifications.

Notifications are said to be addictive because they are specifically aimed at drawing users to their platforms. An aspect of notifications that can enhance this effect and is often deliberately implemented is a lack of information. For example, only showing only half of a message or simply stating that something has happened on the platform in general. Curiosity drives a social media user to enter the platform and see what the notification is about. The following questions on notifications aim to confirm these addictive aspects and whether there are any other details of a notification that affect the participants. The overall feeling towards notifications and ways of engagement with them will be explored.

Participants who use social media with notifications are asked some further questions on this topic. The first question, *"Do you react to social media notifications?"* is multiple choice, and can be answered by ticking off choices ranging from *"immediately"*, to *"never"*, with differing levels of reaction speed in between. With this question, the aim is to find out whether notifications are a priority to the participants, or very much not at all. This will make clear whether participants value notifications or if they may ignore them. The next two questions allow participants to explain their answers to this first question on notifications. The first question, *"To which types of social media notifications do you react?"*, aims to answer which notifications are valued, or whether there is no distinction between them at all. The literature review indicated that people are able to self-filter which notifications they would like to respond to or not, so there may be a difference. For example, a participant may only react to personal messages or may react to all of them. The second open question *"Which types of social media notifications do you find useful?"*, aims to provide a distinction between notifications that are interacted with, and which are actually found to be valuable. The outcome of the questions will reveal whether any notifications are deemed unwanted, and which types these may be. Afterwards, the question *"Do you spend more attention on notifications or scrolling through your feed?"*, is asked. This question touches on both the notifications and infinite scrolling features.

4.3.4   Typing indicator.

According to the literature review, the typing indicator is addictive due to the uncertainty of what a coming message will contain and interest in its content. The aim of this section is to confirm this addictive aspect and whether there are any other influencing factors. This will be explored through the following questions.

The first question asks the participants: *"Do you stay longer on social media when you see someone else is typing in a chat?"*. It is a closed question where participants can select *"never"*, *"sometimes"*, *"often"* or *"always"*. The answers to this question will confirm whether participants are affected by the typing indicator. In the following questions, participants can elaborate on their feelings about the typing indicator. The typing indicator is a two-sided feature, participants may stay longer when they see someone typing but participants may also be affected by others perceiving their own typing. Thus, participants are asked about their feelings on both situations through the following questions: *"What do you think of the ability to see that someone else is typing?"* and *"What do you think of how others can see that you are typing"*. The answers to these questions will contribute to understanding how the typing indicator is perceived and what can be improved about them.

4.3.5   Likes.

According to the literature review, likes are addictive because they can lead to social comparison. In turn, this can lead to a positive feeling related to social status, but can also lead to negative feelings of insecurity. Either way, both results can lead to compulsive social media use, as users may rely on likes for approval, may seek out further likes for social approval, and may generally be excessively preoccupied with other people's amount of likes. The following questions aim to find out whether participants are interested in likes and why.

Participants who confirmed they use social media with likes will be asked some further questions on this topic. The first question in this section, *"What do you think of social media likes?"*, is left open-ended. By leaving the question quite open, participants will be able to answer the question in multiple ways, so that different points of view can be expressed, such as on the feature's usefulness, what it is used for and the level of enjoyment or discomfort it may bring, alongside any other sentiments. The goal of the question is to get a feel for the range of sentiments that participants have on the likes system. The next question, *"Do you check how many likes your social media posts receive?"*, is a closed Likert scale question, with options ranging from *"never"* to *"always"*. The answers to this question reveal the overall interest in likes and will make clear how participants interact with likes on their own content. Afterwards, participants can elaborate on their answer with an open question: "*Why do you or do you not look at social media likes?*". Participants can then explain what they appreciate about the likes system, Lastly on the topic of likes, the question "*Have you ever changed the settings of likes? If yes, why?*" is asked. The answers can reveal the ways in which the default settings and design of the likes system are perceived and how it may be transformed to a different preferential design. An example is given for participants to understand what changing settings may entail. For clarity. an example is given of how likes can be turned off on Instagram so that likes are no longer visible.

4.3.6   Streaks.

According to the literature review, streaks are addictive because they are persuasive features that make use of the sunk-cost fallacy. Users who have a high streak with another user may feel highly involved in not breaking their streak and may even use social media solely for the streak. The following questions on streaks will ask the user about their opinion on streaks and their level of interest in it.

Participants are first asked about their overall opinion on it. This will reveal how much they care about it and whether they engage with it as the design intends i.e. paying close attention to maintaining a streak. Afterwards, the participants are specifically asked whether they ever open a social media platform solely to keep their streak going. This is a closed question with answers ranging from "*never*" to "*always*". Opening a social media platform only to keep a streak is indicative of compulsive social media use, as it would be a meaningless interaction, only intended to appease the feature. Lastly, as streaks may be addictive due to the consequences of breaking them, participants are also asked about their feelings in relation to breaking a streak. The answers to these questions will contribute to understanding how streaks are perceived and how they are engaged with.

4.3.7 Changing behaviour.

The last page of questions will ask the participants whether they are interested in changing their social media behaviour and are thus perhaps affected by addictive social media design. This will reveal the overall satisfaction of how participants perceive their own social media usage. Participants are first asked: *"How do you feel about the way you spend time on social media?"*. Then, they will be asked whether they are interested in changing this behaviour and whether they have ever made efforts to change it. Examples of decreasing screen time and seeking out more valuable content are given, to give the participants a frame of reference of what this may look like. The latter example, but other types of problematic social media use are also valuable, and users should also not be directed towards answering about compulsive social media use. The answers to this section will reveal the possible measures against compulsive and other types of problematic social media use.

4.4 Survey data analysis

For the analysis of the survey results, the data is translated to English in Qualtrics, which is then exported in an Excel sheet format. The results can be divided into quantitative and qualitative data. Quantitative data is informative content that is added to a table or graph, such as demographic data. The number of results for one answer is then counted, compared and discussed. As for the qualitative data, which includes the answers to all open-ended questions, the online platform ATLAS.ti[13] has been used, which is a tool for coding qualitative data. The platform allows for Word documents to be uploaded for coding. Thus, all answers to a single question were copied from Excel to Word, cleaned up to ensure all quotes are separated between individuals, and then uploaded to ATLAS.ti. Here, each statement is coded. Figure 8. provides a screenshot of one answer and its codings. It shows that one person's answer can contain multiple quotes, each with several labels.
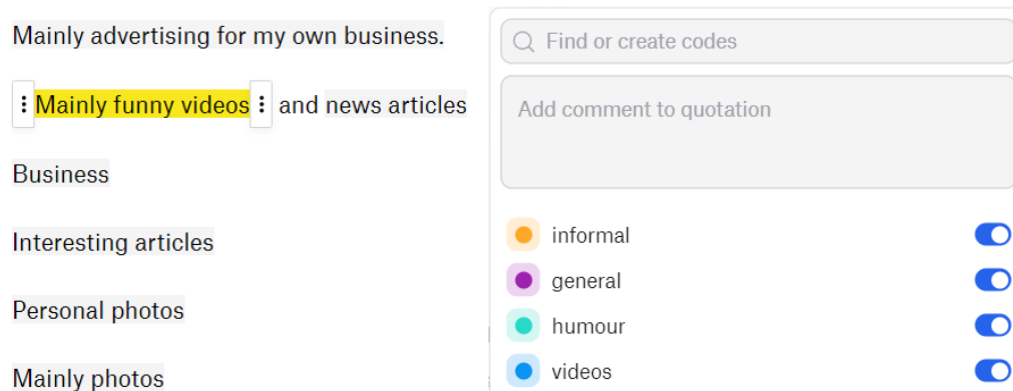
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[13]atlas.ti

Fig. 8. An example of coding a survey answer.

4.5 Interview design

The following section will describe the design of the second part of this study, the interviews. As described, the overall goal of the survey is to gather opinions and suggestions for the designed non-invasive solutions, to measure their potential effectiveness. While the survey was designed specifically not to mention terms such as compulsive social media use, participants who are interested in changing their social media behaviour will instead be informed specifically that these alternative design solutions are created for this purpose, and will evaluate them based on this addictive characteristic. They will evaluate the design solutions on their potential as interventions against compulsive social media use.

Several questions have been designed for an interview protocol. Appendix B provides the interview protocol used during the interviews. It is based on the results of the survey, which are discussed in the forthcoming results section (5.1). In this protocol, the questions that have been used are included with some notes on when to use them, if they are applicable to the participant. This ensures the interview is reproducible and interview results will be similar. The interview has been designed to be semi-structured. Thus, more questions have been asked than provided in the interview protocol, to get a good understanding of all a participant's thoughts. Participants are first asked about their wish for behaviour change. Though information on this topic has already been collected in the survey, these questions serve to ease the participants into the topic and to gain more expanded information on the context in which these participants evaluate the proposed solutions.

After establishing the level of compulsive use a participant engages in and how, they will be asked for each feature how they feel about it, but only if the participant engages with social media platforms with this feature and are familiar enough with it. They are shown visualised examples of the features, when applicable, as seen in appendix C. The questions for each addictive feature follow a similar format:

(1) Ask about the participant's overall opinion on and experience with the feature, and how they think they may be affected by it.

(2) Present design alternatives and ask about each design if the participant would think it would help them against compulsive social media and if they would like to use it.

(3) ask for further design suggestions.

After evaluating the features, participants are asked if they have any other suggestions and the interview is concluded.

The interviews are conducted in Dutch, since all participants are Dutch-speaking due to the same reasons described for the survey design, as participants from the survey are also used during the interviews. Conducting the interviews in the participant's native language is especially appropriate for the complexity of these long, nuanced interviews.

4.6 Interview data analysis

For the analysis of the interview results, notes will be taken for each question. Most importantly, the overall opinion on a design proposal will be noted, i.e. whether the participant approves, disapproves or is unsure. Notes are taken on their reasoning, whether they may have some suggestions to improve its implementation and any other relevant commentary. The interviews are recorded (when given permission by the participant), which will aid in the analysis and quotes will be gathered. When conducted in real life, a smartphone is used to record the interviews with Otter[14], an app that transcribes the words immediately. When conducted online, Microsoft Teams is used[15], which has an automatic transcription tool. Similar to the survey results, the results of the interviews are coded. Then, the coded results for each evaluation can be compared and concluded on. For this thesis, quotes takes from the results are translated to English.

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[14]Otter.ai
[15]Teams.Microsoft.com

5 RESULTS

This section provides the results of the conducted studies as described in the methodology section. First, the results of the survey will be shown and analyzed. Afterwards, the results of the interviews on the proposed designs will be discussed.

5.1 Survey results

The survey received an initial 84 responses. A total of 10 responses have been omitted from the data analysis due to incomplete or invalid results. 7 responses have been removed due to sending in surveys that had not fully been filled in. For example, several of these participants had only filled in their demographic data but skipped all further questions on social media. This makes these responses redundant and they were thus removed. 3 other responses, from participants who otherwise answered all questions, have been removed from the results as the statement *"I have read the information sheet and understood it"* on the first page had not been ticked off. As the aim of this statement is for participants to give consent, the necessary consent had thus not been given by these participants to be able to use their answers for analysis in this study. All omitted responses have been permanently deleted. This leaves a total of 74 responses that have been analysed.

As explained in the methodology, the survey has been conducted in the Dutch language with Dutch-speaking participants. The analysis of the results has been done with answers translated into English. Due to the scope of the results, answers to open questions have been machine translated through a translation service offered by Qualtrics, where the survey is hosted. The translations were then fully checked and edited for correctness, both for grammar mistakes that were not there in the original message and accuracy of the message content. Though thoroughly checked and researched, it should be noted that faulty translations may not have been prevented, though these likely consist of small differences in interpretation or grammar mistakes, that should not significantly affect the results.

The following sections will describe and analyze the results of the survey. Subchapters are divided by theme, in the order they appeared to the participants.

5.1.1 Demographics.

The participants were first asked about gender and age, to get a sense of the participant demographics. Table 2 provides an overview of the gender identities represented in the results. Every participant chose to disclose their gender. More women than men participated in the survey, and no non-binary person participated in the survey. It should be taken into account that this may affect the generalizability of the results, as research shows that men and women generally use social media with different intentions. For example, studies have shown that women are more often motivated by the ability to maintain close ties and gain social information (active), while men are more often motivated by the ability to gain general information (passive), though all genders show interest in both. Differences in intent are furthermore affected by other personal aspects such as personality [37].

Table 2. Gender demographics of the survey.

Gender	female	male	non-binary	prefer not to say
Answer distribution	50 (67.57%)	24 (52.43%)	0 (0.00%)	0 (0.00%)

Table 3 provides an overview of the age ranges represented in the results. Though these results skew on the younger side, this can be explained by the use of convenience sampling. A large portion of participants consists of university students, which explains why the majority of responses are by participants in the 18-25 and 26-35 age ranges. On the flip side, participants aged 65+ are lacking for similar reasons. However, a lower amount of results for this age range can also be attributed to the varying prevalence of social media usage among different age groups of Dutch citizens. According to a study by CBS in 2020, 96.8% aged 12 to 25, 96.0% aged 25 to 45, 91.9% aged 45 to 65, 76.0% aged 65 to 75 and only 39.8% aged over 75 use social media [14]. All in all, age factors must be taken into account when assessing the generalizability of the results.

Table 3. Age demographics of the survey.

Age range	18-25	26-35	36-45	46-55	56-65	65+
Answer distribution	22 (29.73%)	22 (29.73%)	11 (14.86%)	6 (8.11%)	9 (12.16%)	4 (5.41%)

5.1.2 Social media use.

This section will discuss the answers to the questions on general social media use, which further informs the demographic information on the participants. Moreover, differences in how specific social media platforms are used will be discussed.

Figure 9 provides a ranked table of how many participants use each social media platform, as well as the percentages of the total 74 participants that answered this question. The platforms that were provided by the survey are coloured a dark blue while the platforms that were added by participants are coloured a light blue, with the latter notably being the least represented options at the lower end of the ranking.
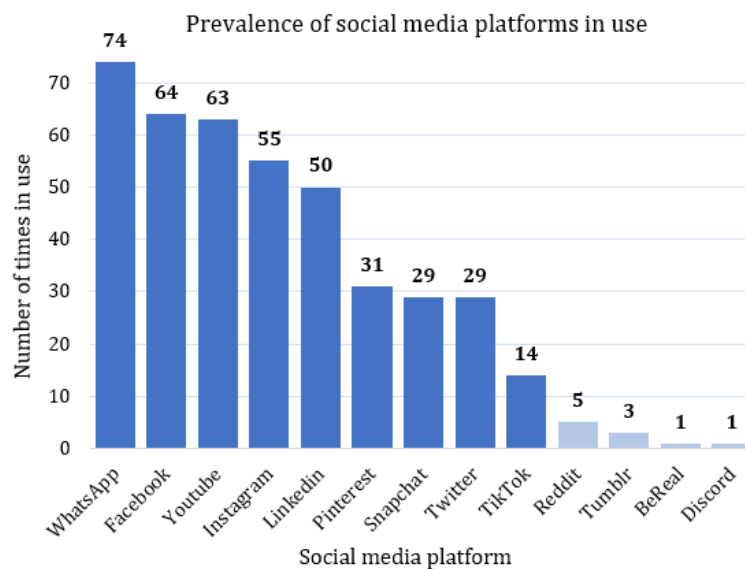

Fig. 9. Overview of social media platforms and the number of participants who use them.

For the open option to add your own platform that weren't listed, only 7 participants provided platforms that were not pre-included. Possibly, not every social media platform that each participant uses has been added in the open field, since it may not be clear to everyone what counts as a social media platform. Moreover, people may not feel like certain platforms were significant enough to add or simply did not think it necessary to add their own. Thus, while this data provides an interesting look into the range of existing social media platforms, it is likely that these platforms are used more often than reported and some may be missing. The results show that the most used platform is WhatsApp. This can be explained by the fact that the survey was spread among Dutch people and WhatsApp is by far the most popular social networking service for instant messaging in the Netherlands [20]. WhatsApp as an instant messaging service, with the aim of communication, is likely seen as the most necessary platform to use. Overall, the used platforms differ greatly in context and it cannot be said, outside of WhatsApp, that social media platforms with certain purposes are used more often than other types of platforms. For example, YouTube and TikTok as video-hosting platforms that encourage passive use are ranked very differently. The results showcase the general trend in social media popularity and this particular difference can, for example, be attributed to YouTube being an older and more well-known platform rather than any context or format-relevant distinction.

The previous figure and the number of platforms in use indicate that most participants use at least more than one platform. Across 74 participants, a total of 433 platforms were mentioned. The amount of social media platforms mentioned by each participant has been counted and the total number of social media platforms in use by singular participants can be seen in figure 10.
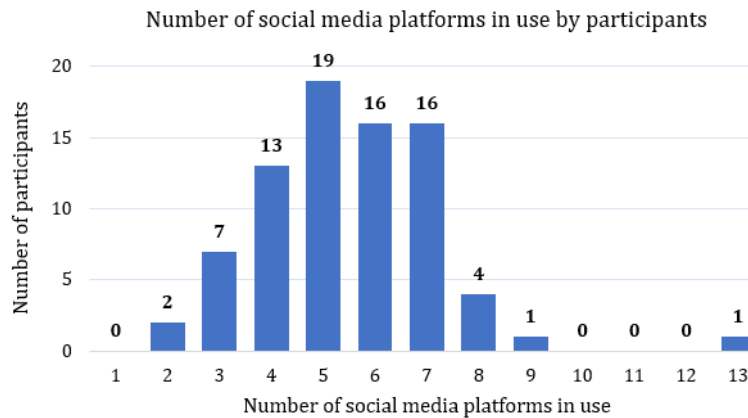

Fig. 10. Overview of social media platforms in use by participants.

The figure shows that the number of social media platforms a participant currently engages with ranges from 2 to 12 platforms currently in use, though the average amounts to approximately 5.66, or between 4 to 5 platforms according to the median. This shows that most social media users engage with at least more than one platform at a time. It is unknown to which degree these platforms are used compared to others. However, this data offers an understanding of how users engage with addictive features from different sources.

Participants were also asked to indicate how many hours per day they think they spend on social media in total. Table 4 provides an overview of the results.

Table 4. Table of the participants' self-reported total number of hours spent on social media per day.

Hours spent on social media per day	Less than 1 hour	1 to 3 hours	3 to 5 hours	5 to 7 hours	More than 7 hours
Answer frequency	6 (8.11%)	45 (60.81%)	17 (22.97%)	6 (8.11%)	0 (0.00%)

Overall, it can be said that most participants have significant experience using social media, with the vast majority using it for at least one hour or more a day. There is no extremely excessive use of 7 hours or more per day. This is in line with research on social media use concluding that the average estimates that they spend about 2 hours on social media in total per day [31]. However, the study also indicates that people estimate the time they spend on social media to be, on average, 2 hours lower per day than in actuality. Thus, the results of this question are likely not entirely accurate but do show how participants perceive their own use. It is unknown whether participants may have used a screen tracker to get accurate information on social media time.

Participants were also asked about how they use social media. Namely, whether they use certain platforms passively or actively. Figure 11 provides an overview of the results as they are in total, with the numbers of answers on social media not in use also included.
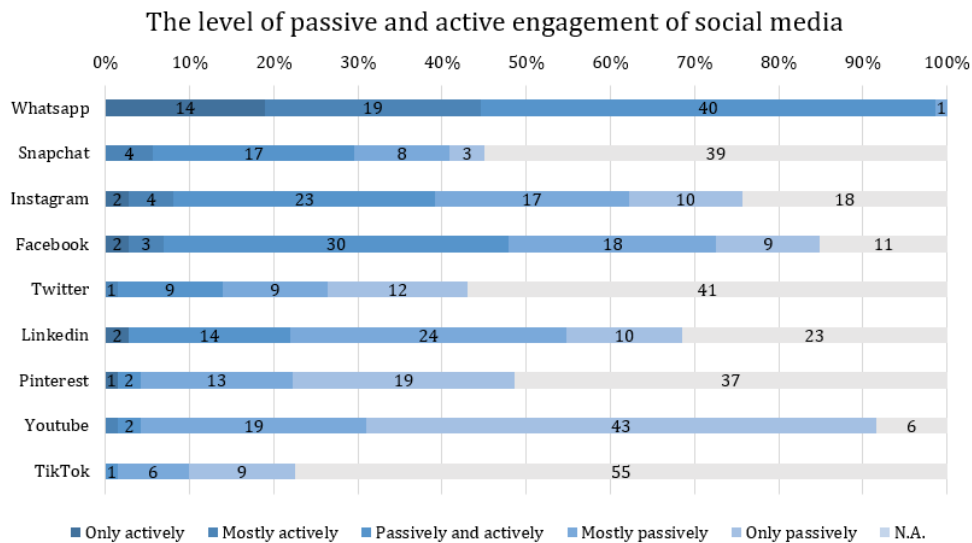

Fig. 11. Overview of social media and their levels of active and passive use.

Comparing the data of each platform offers mixed results. Some platforms have a more balanced ratio of active and passive users, while others show a higher proportion of passive engagement. As expected through the literature review, WhatsApp is a clear outlier as an instant messaging service, compared to the other platforms, which are all social networking services. As such a service, WhatsApp does not bring on passive scrolling, since a feed to scroll

through is not part of the app's features. Rather, active engagement is required to receive content to consume and no algorithm is used to provide content either. The platforms that are used passively most often are YouTube and TikTok. These platforms share the trait of mainly being video-sharing platforms. To summarize, the data suggests that user engagement patterns vary across different social media platforms. Since passive engagement with social media leads to addictive behaviour such as mindless scrolling, the design of a healthy social media platform should take inspiration from examples such as WhatsApp and a critical look should be taken at platforms that are used passively most often, such as YouTube, TikTok and Pinterest.

The questions *"In case you use social media actively, which type of content do you share?"* and *"In case you use social media passively, which type of content do you share?"* received answers from every participant, as everyone had at least one platform they do not solely use actively or passively. It must be stated that participants were given examples of personal photos, funny videos and links to news articles, which may have influenced participants toward certain themes.

Overall, participants provided more examples of how they passively use social media, compared to active content. A total of 126 examples for active content were coded, while 174 examples for passive content were coded. An example includes all separate mentions of a type of media that a participant actively or passively engages with. For example, the answer *"photos of friends"*, is one example labelled with several codes such as "photo" (format), "personal", "informal" (contexts) and "friends & family" (topic). The results of both passive and active quotations will be compared and discussed. Some examples were simply "photos", or were more elaborate, so the amount of codes per example differed. The different types of code that were discovered in this section will be explained and the results of these codes will be discussed and compared for both active and passive content. What is important to take away here is that content that is consumed significantly passively should be deterred, while content that is consumed significantly actively should be promoted, to encourage conscious and healthy social media use.

First of all, when looking at the answers, a distinction can be made between *"general"* (red) and *"personal"* (blue) social media activity, as has been done by several participants. Personal media can include photos of yourself with friends, photos of hobby products, and events you attend. On the other hand, general media would be news articles you are not involved in or music from an artist that you like. Figure 12 provides a Sankey-style diagram that shows the relative amount of general and personal examples that were given.

Fig. 12. Comparison of active and passive engagement and personal and general content

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The figure shows that general and passive content is engaged both actively and passively. Personal content is well-balanced between the two, with the content of oneself being engaged with actively more often, while the personal content of others is engaged with passively more often. As for general content, this is engaged with passively far more often. People may be less likely to engage with or share content that is not directly related to them. Thus, to deter passive engagement, the results here indicate that a user's feed should include fewer general posts.

Another distinction between different answers is the level of formality. For example, one participant answered: "*Personal posts, informative posts, advertising for my company*" to the question. So, the themes *"formal"* (teal) and *"informal"* (pink) have been included as distinguishing factors. Formal social media activity includes work-related social media activity while informal social media activity would be sharing memes. One participant stated *"A milestone or promotion"* and another participant stated *"mainly advertising for my own business"*, which is both formal personal content. Another participant's *"photos of my hobbies or "pictures of myself"* is informal. The results can be seen in figure 13.

Fig. 13. Comparison of active and passive engagement and formality.

The results show that informal content dominates the feed. Informal content that has been mentioned was, for example, *"mainly funny videos"*, as stated by one participant. The most shared informal content includes news links, while informal content that is engaged with passively ranges a lot in topic and format. Formal content is only ever engaged with actively. The participants of this study may not be interested in other people's career-related content, as they may for example be targeted towards companies. To deter passive engagement, social media platforms can encourage formal content or discourage informal content, though an amount of informal content is necessary for platforms that are made for enjoyment.

Any mention of a format type has also been coded. Thus, codes such as *"text"*, *"photos"* and *"videos"* have also been noted, when applicable (yellow). A comparison between the two types of content and formats can be viewed in figure 14.
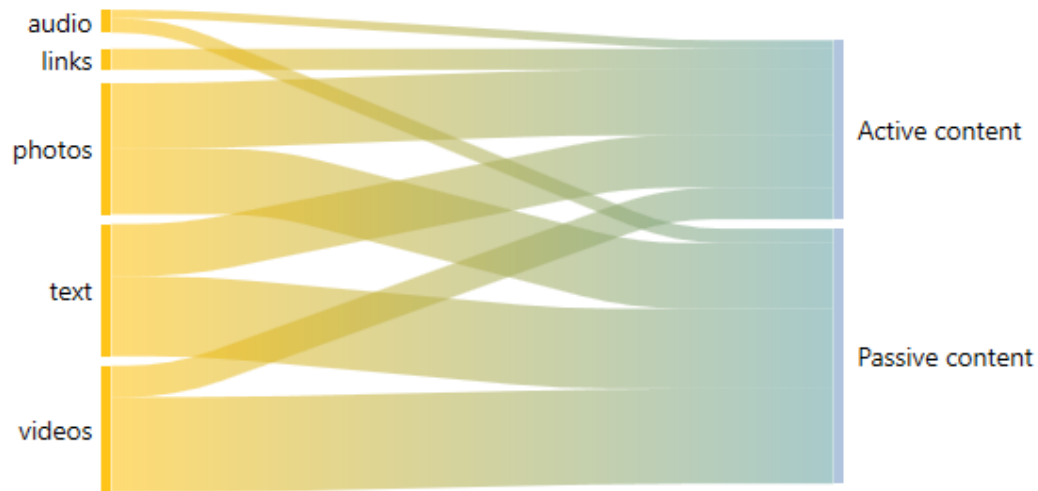

Fig. 14. Comparison of active and passive engagement and format.

There is no significant difference between format types. Only links are engaged purely actively, due to the nature of the format, as one is more likely to post their personal content directly onto social media. Videos are engaged with passively more often. This is in line with the results of which platforms are engaged actively and passively, being Youtube and TikTok, which are primarily video-hosting platforms.

As for topics, general content that was shared consisted primarily of news, food and hobby content. Personal content was specified less often and is dominated by mentions of work-related content. Nearly all photo content that is mentioned is of a personal nature. All links were general content, which is in line with the nature of the format, as links tend to be for sharing third-party content. Overall, the results showcase that participants of the survey share a large range of different types of content, and mostly share informal personal content with others. These different social media posts come in different topics. Thus, topics such as *"work"*, *"hobbies"* and *"pets"* are also coded (purple). An overview can be seen in figure 15.
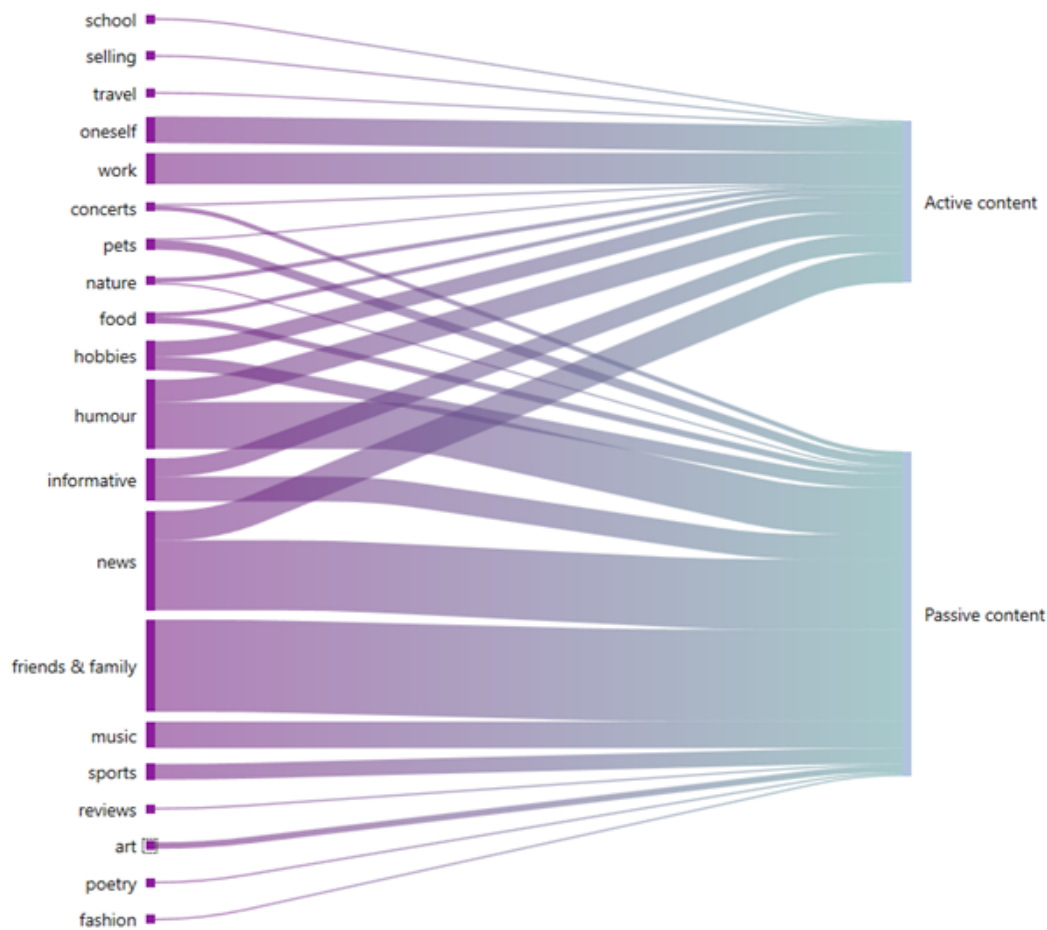
Fig. 15. Comparison of active and passive engagement and topic.

The results show that participants engage in a large variety of topics. Several of these topics, such as *"oneself"* and *"work"* are only engaged with actively. Likely since these pertain to your own life (personal). On the other hand, there are also topics that are only engaged with passively, such as friends and music (general). Topics that are engaged both passively and actively mostly consist of general content, as participants may actively participate in discussions or activities while also passively consuming information or content surrounding them. For example, one participant stated *"sharing news links"*, as active behaviour and *"reading news"*, as passive behaviour.

What should be concluded from the results is that certain factors, such as generalizability, formality, format and topic, are engaged with differently. Promoting content that is engaged with actively most often on the feed and discouraging content that is engaged with passively most often may have a positive effect in how consciously a person uses social media.

Participants were also asked the question *"When do you feel prompted to use social media?"*. Figure 16 provides an overview of the web of the range of results. The results were divided into four categories: *"location"*, *"cue"*, *"emotion"* and *"activity"*.
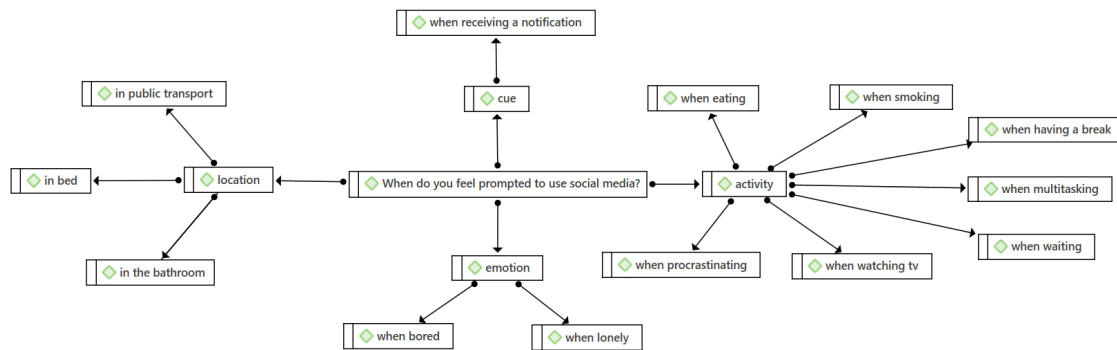

Fig. 16. A visualization of reasons to start using social media.

Generally, social media is used during activities a person's attention does not need to be entirely directed at, such as when eating or smoking. However, social media is also used when a person is supposed to fully direct their attention towards a task, such as with one participant who stated: *"I also often put videos on in the background when I should be doing something else."* As described in the literature review, this is an indication of compulsive social media use. The only mentions of emotions are boredom, due to a lack of engagement, and loneliness. One participant, for example, stated *"When I'm without something for a while that MUST get my attention, I want to grab my mobile already."*, while another one stated *"when I feel like I'm missing out".* Locations that are mentioned in the results are related to a lack of engagement. For example, as one participant stated: "When sitting in the train and I have nothing else to do". Some participants even admitted to feeling a compulsion to use social media. For example: *"It's crazy because actually I have no desire at all to stare at my screen all day but still it's kind of an addiction because you're afraid of missing something or you get pop-ups again as soon as you get a message or whatever".* This makes it clear that some participants already see an issue in their behaviour. Lastly, the addictive feature of notifications were mentioned as a cue to use social media. This is in line with its nature of grabbing a user's attention towards their phone, when not currently using it. Generally, social media is used when experiencing downtime, or when lacking engagement or pleasure. It is clear that social media provides a source of distraction in many different situations, even as a coping mechanism for negative feelings or when a person should tend to different responsibilities.

Participants were also asked the complementary question *"When do you feel prompted to stop using social media?"*. Figure 17 provides an overview of the web of the range of results.
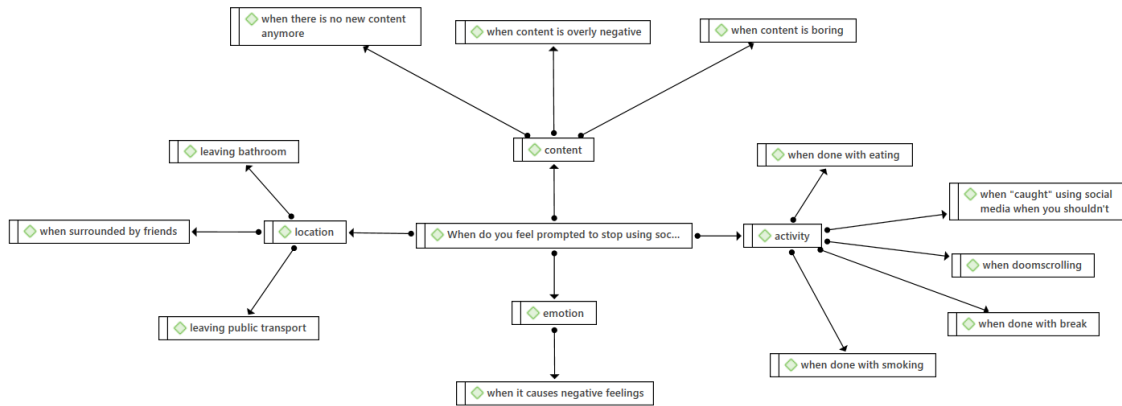
Fig. 17. A visualization of reasons to stop using social media.

The answers to this question largely complement participants' reasons for starting to use social media. For example, one participant's reason to start is *"when I'm on the train"* and their reason to quit is *"when I'm leaving the train"*. When contexts and being in a certain location end, participants tend to quit using social media, as their attention is directed elsewhere. Another example of this is *"when I'm with friends"*. A new dimension here is content. When it is no longer wishful to scroll through social media due to the content, a user may be prompted to stop. This can simply be *"when I reach the end of the feed and posts start repeating"* but it can also be *"when I feel like I'm doomscrolling"*. Doomscrolling is the act of spending an excessive amount of time-consuming large quantities of negative content when scrolling through the feed. This is related to the one emotion that is mentioned, in a general manner, as a "negative feeling" due to social media content. Overall, outside interruption and a negative feeling towards content are the main reasons to stop using social media.

Participants were additionally asked to share whether they use any social media with the following addictive features: notifications, seeing other people's type, streaks and likes. Table 5 provides an overview of the number of people using at least one social media platform with these features and the ratio of total participants that said yes.

Table 5. The amount of participants that use social media with certain addictive features.

Feature	Notifications	Typing indicators	Streaks	Likes
Answer distribution	45 (60.81%)	69 (93.24%)	24 (32.43%)	71 (95.94%)

Notably, there is a disconnect in the results of this table and figure 9. Since, for example, every participant uses WhatsApp, every participant should also engage with typing indicators. Nevertheless, it can be assumed that every participant who said "yes" to these questions has sufficiently engaged enough with these features to answer further questions on them. The results give an indication of the number of answers in the following sections, which will discuss the results of the questions on these particular addictive design elements. The first section is on notifications.

5.1.3 Notifications.

Participants were first asked how soon they react to notifications. Figure 6 provides an overview of the answers.

Table 6. A table showcasing notification reaction time.

Answer	Immediately	As soon as possible	At a later time	Whenever it suits me	Never
Answer frequency	1 (2.44%)	12 (29.27%)	4 (9.76%)	23 (56.09%)	1 (2.44%)

The results indicate that most participants do not seem to be burdened by notifications, as the majority answered: *"whenever it suits me"*. Only one participant is compelled to answer immediately. Furthermore, nearly all participants at least react to some types of notifications.

Participants were also asked about how they perceive notifications. A visualization of the answers can be seen in figure 18
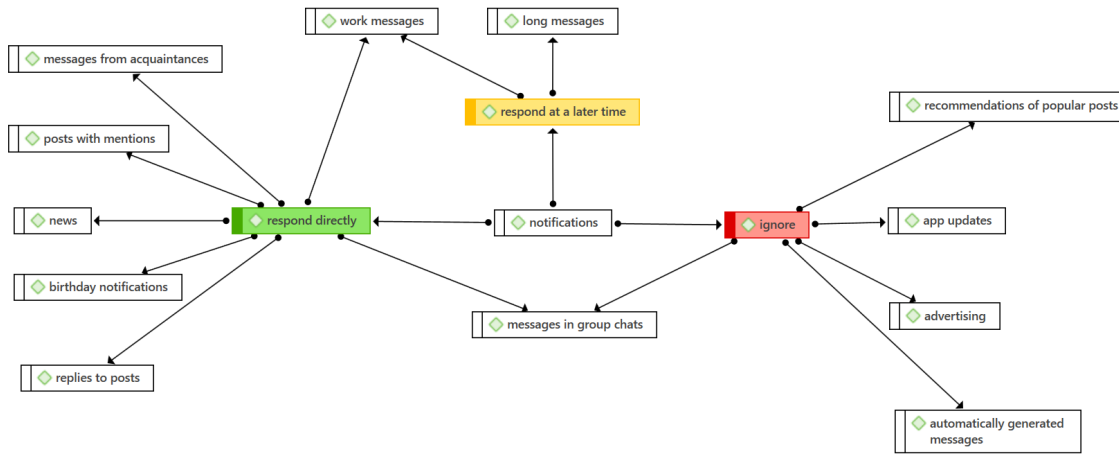

Fig. 18. A visualization of the sentiment on notifications.

Participants were able to elaborate on why they choose to respond to or ignore certain types of notifications. Participants mentioned that they value notifications of messages directed to them personally, rather than general messages. As one participant stated: *"I don't respond immediately in group chats. I do respond immediately in person. Or at least as soon as possible."*. They also value notifications on content that are perceived as useful or interesting to them, such as news and notifications that say it is a friend's birthday. Notifications that are not appreciated are those deemed to be impersonal and automatically generated. One participant, for example, stated: *"Basically, I respond to all notifications. Unless it is an automatically generated message or spam."* and another one stated: *"Standard notifications from the app itself I try to ignore"*.

Lastly, participants were asked whether they have ever adjusted the settings of notifications for any social media, and how. 32 participants (78.05%) said they have. Participants provided different reasons. One reason is the number of notifications certain apps give, such as one participant on WhatsApp: *"group app notifications where you immediately get*

29973 messages". The method here is turning notifications off completely. Some participants kept visual notifications but turned off the sound. One participant stated: *"I only use silent notifications for social media, so my phone does not vibrate when I get one in. That way, I still try to maintain something of control.".* Another reason is the perceived usefulness of notifications, as discussed earlier. One participant said *"I have my notifications for Instagram and Facebook turned off because I don't think these are relevant notifications"* and another participant said: *"On Facebook, I only get notifications when it concerns me directly. So not that friends have posted something, but when they respond to something of mine.* Lastly, notifications have also been adjusted according to context, such as turning off notifications when on holiday. To summarize, the context of the notification and the amount of notification matters when adjusting settings for it.

To summarize, participants feel differently about notifications dependent on context, and in turn, deal with them differently. Notifications on personal messages and mentions are appreciated most of all and notifications that are generic are appreciated far less. Most participants have adjusted settings for notifications, indicating a clear issue with the basic version of this feature.

5.1.4 Typing Indicator.

This section discusses the results of the question about typing indicators. Participants were first asked about whether they stay longer on a social media platform when they see someone typing. Table 7 provides an overview of the results.

Table 7. The amount of participants that stay longer in a social media app when seeing others type.

Answer	Never	Sometimes	Often	Always
Answer distribution	4 (6.25%)	40 (62.50%)	11 (17.19%)	9 (14.06%)

Overall, most participants have experienced staying longer inside a social media platform to a degree. This allowed for a variety of sentiments to be shared, as seen in figure 19.
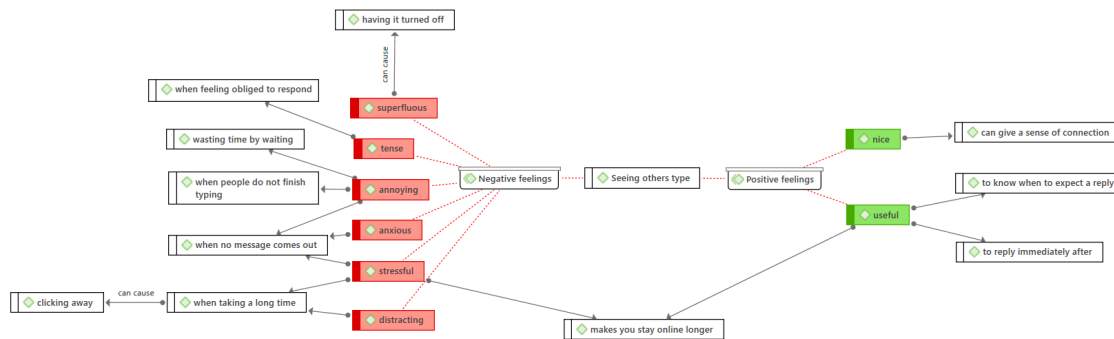
Fig. 19. A visualization of the sentiment on the typing indicator.

The opinion on the ability to see other people type, the typing indicator feature, is polarizing. Participants appreciate the feature when actively in a conversation, such as how it was stated by one participant: *"I find it convenient, then you know that someone is replying and sometimes you can wait and write something back immediately, instead of only reading it later and there being a lot of time between messages"*. It is seen as useful when wanting to keep the flow of

a conversation going. However, it can also lead to negative feelings, such as stress and annoyance, when the other person is taking a long time or does not end up sending their message. One participant said: *"Ever so slightly stressful. You feel obliged to respond quickly. On whatsapp, for example, I have it turned off"* and another one stated: *"find this very annoying because it sometimes gives me an adrenaline boost. Once people then take away their text, I'd like to know what they actually wanted to say"*. This may lead to participants closing an app out of frustration, but most end up feeling like they waste their time waiting for a response. Despite negative opinions, it is appreciated as a visualization of togetherness and non-verbal connection. One participant has stated: *"it can give a sense of connection at 'sociable' times"*.

Overall, the perception of the typing indicator is dependent on context. People appreciate them when active in a chat, but do not like seeing it outside of chats. Solutions will be designed around this difference and need for context to choose when to leave and when to stay for an incoming message.

5.1.5 Streaks.

This section discusses the results of the question about streaks. Participants were asked whether they ever open up social media in order to save a streak. Table 8 provides an overview of the results.

Table 8. The number of participants who open up social media to maintain a streak and to what degree.

Answer	Never	Sometimes	Often	Always
Answer distribution	10 (41.67%)	9 (37.50%)	5 (20.83%)	0 (0.00%)

The table makes it clear that part of the participants either naturally keep their streak, or do not bother with the feature at all. About half the participants have occasionally opened social media with the goal of keeping a streak but do not always do this, likely because at least sometimes, there is a reason other than to keep a streak to interact with a friend. All in all, this indicates addictive behaviour for some.

Participants were also asked how they feel about streaks. Figure 8 provides an overview of the results.

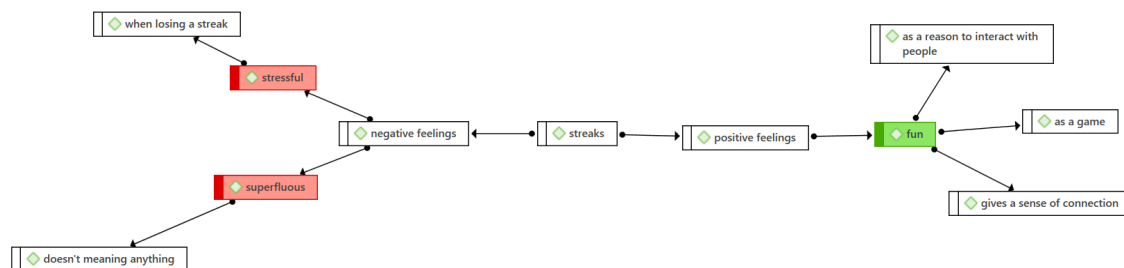Fig. 20. A visualization of the sentiment on streaks.

Sentiments are quite mixed. Those who do not engage with it view it as superfluous, while those who do tend to take it seriously to a degree. It serves as a reason to interact with others. One participant stated: *"I once lost a streak of over year old and I was actually disappointed but when you send a message to Snapchat they can fix it back for you"*.

Keeping up a streak for a long time gives a sense of connection and is even a source of pride: *"I don't know why but I am proud when it's a high number"*. Overall, those who engage with the feature tend to take it seriously, view it as a fun game and aim to keep it up, but it can lead to disappointment when losing a streak, which can be a reason for opening up social media to keep a streak, as about half of the responses have admitted to doing.

5.1.6 Likes.

This section discusses the results of the question about likes. Participants were asked about their sentiments on it. Figure 21 provides an overview of the results.
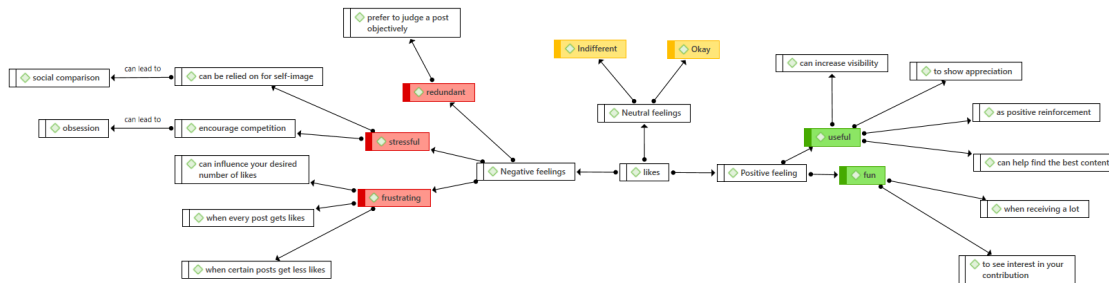

Fig. 21. A visualization of the sentiment on likes.

Participants generally have mixed feelings about the feature. They appreciate receiving likes:*"Get some satisfaction from getting lots of likes, to be honest"*. It is especially appreciated when receiving more likes than expected and they can serve as positive reinforcement. It can also increase the visibility of a person's content in the algorithm. They also view it as a tool to see good content they might enjoy: *"I usually do look at what my friends like because we often have somewhat similar interests"*. However, on the flip side, receiving fewer likes than expected can be disappointing: *"For example, when I post a new profile picture on Facebook, it feels painful when you get fewer likes than on the previous picture. It especially hurts when you get fewer likes on a photo of yourself/your own face versus, say, a landscape photo"*. The likes system, though appreciated, has led to social comparison, which can lead to negative feelings. It has also lost meaning to some: *"It doesn't matter when all your posts and everyone's posts get a lot of likes. It takes no effort"*. Overall, personal likes are appreciated but can lead to negative feelings when taken into perspective across a social media platform.

5.1.7 Changing behaviour.

The last questions pertain to how participants view their own social media use and ask them to have a critical look. Regarding the question of how they feel about the way they spend time on social media, participants reported mixed opinions. Table 9 provides an overview.

Table 9. A table showcasing participant satisfaction with their social media behaviour.

Answer	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very Satisfied
Answer frequency	3 (4.55%)	19 (28.79%)	30 (45.45%)	14 (21.21%)	0 (0.00%)

It shows that no participant is fully satisfied, though only a few are very unsatisfied. 37 (50.00%) participants admitted they are currently interested in using social media differently than they do now. 39 (52.70%) participants admitted

they have tried to change the way they use social media. The number of yes-answers to the latter question is slightly higher, implying at least some participants have been successful at purposefully changing their behaviour and are currently satisfied. The number of participants currently interested in changing their behaviour is significantly higher than known numbers on self-admitted social media addiction [6]. This can be explained by the fact that there is still a line between addiction and being interested in behaviour change.

Participants were also asked how they have changed their behaviour. Table 10 provides an overview of which types of action have been taken by participants and by how many, ranked by the amount of mentions.

Table 10. A table showcasing how participants have attempted to change their behaviour.

Behaviour change	Times mentioned
Deleting social media	14
Putting my phone elsewhere (when needing to be productive)	6
Unfollowing certain accounts	6
Being more critical of content	4
Setting a time limit	4
Turning notification off	4
Turning on "do not disturb" mode	1

The table shows that participants have taken a variety of actions. The most popular is to delete social media, which is in line with findings from the literature review, though it has also been studied to be a generally ineffective method. Some participants even mentioned mindless scrolling as their reason: "*Deleted Facebook off of my phone. Didn't delete account, but only the app. I found that at that moment I was scrolling mindlessly and that I got more dissatisfied about myself in a broad sense.*" though they continued: *"wasn't able to last long"*. Other methods included *"Unfollowing accounts I do no care for anymore"* and *"putting my phone far away"*. Four other participants mentioned using a time limit, though one admitted: *"unfortunately, they are easy to ignore"*. Notifications were also specifically mentioned by four participants. Overall, the results show that participants have taken a variety of approaches to improving their social media and should be supported in this behaviour.

5.1.8 Summary.
The results of the survey show that social media and addictive features are experienced very differently between the participants, though there is a clear indication that every feature is experienced as addictive to a degree by some. Thus, the decision is made that all features are evaluated in the second phase of the study. To summarize the most important takeaways from the results of the survey that are used in forthcoming discussions, it is important to understand what the most important addictive, negative aspects of the features are that should be changed and what the positive aspects are that must be kept.

For the infinite scroll, it has already been established that the feature is addictive and that the navigational style should be altered. Thus, the survey focused on the content that is presented in the feed with infinite scrolls. A difference can be made between active and passive consumption of content. The balance between active and passive consumption for each feature is generally balanced, but there are some exceptions. For example, general content and content of

others is engaged with more passively. Videos are also engaged with passively more often compared to other formats. People do not like to consume or engage with formal content of others and only share their own formal content. The next phase will aim to discover how active consumption can be further promoted in the feed based on different types of content, and will aim to discover alternatives to the infinite scroll.

Notifications can be appreciated for informing the user of certain events in social media, but can be experienced as annoying by some, depending on notification context and content. The results of the survey showed that notifications on personal messages are appreciated, while generic updates or recommendations for posts are not appreciated. Solutions should allow for more customizability for notifications and offer more information, to deter users from answering notifications they would otherwise not want to.

The typing indicator makes users stay longer in a chat, sometimes even if they do not want to. The typing indicator is only appreciated by the participants when shown in an active chat. It is not appreciated when it takes a long time for a message to be sent or when it is not sent at all. Solutions should take into account different contexts and should aim to inform the user so they can choose when it is worth it to stay longer, and when it is not.

Streaks are appreciated as a game and as a *"symbol of friendship"* by those invested in the feature. However, it can lead to empty, unnecessary interactions to keep the streak alive. Solutions should aim to keep the enjoyment of the streak game, but deter users from only entering social media to keep a streak alive.

Likes are appreciated as a form of social validation and as a way to provide feedback to the algorithm. However, it can lead to social comparison when the user, for example, receives fewer likes than expected. Solutions should aim to deter the user from engaging in social comparison.

About half of the participants were interested in behaviour change and have previously attempted to change their behaviour. Behaviour change included deleting social media, putting one's phone elsewhere and unfollowing certain accounts. Though a solution like deleting social media is quite radical, other behaviours like changing settings on notifications should be promoted.

The following section will take these results in order to design effective, non-invasive integrated solutions that aim to resolve the addictive aspects of the discussed addictive features.

5.2 Designing interventions

In this section, initial design proposals will be described for non-invasive solutions against addictive social media design. The design solutions will be designed based on the previously described literature review and results of the survey. The addictive aspects that were identified will be attempted to be mediated through non-invasive re-designs of the features. Positive aspects of features were also found, which will be aimed to be kept in these redesigns. Though most solutions will be non-invasive, solutions such as nudges, the screen time tracker and some boundary-pushing solutions will also be evaluated, in order to understand the scope an acceptable solution can be situated in. The following sections will describe the solutions for each feature.

5.2.1 Infinite scroll.

This section discusses the designed interventions for the infinite scroll. As described in the literature review, the infinite scroll is already well-researched as an addictive feature, with no established solution. Thus, different navigational methods will be evaluated. Two different navigational methods will be compared. First, a "load more" button is incorporated in an infinite scroll where users have to click a button to load more posts. Secondly, a pagination feature breaks the infinite scroll up into separate pages. These two features will be compared in the evaluation. Visualizations can be seen in figure 22.
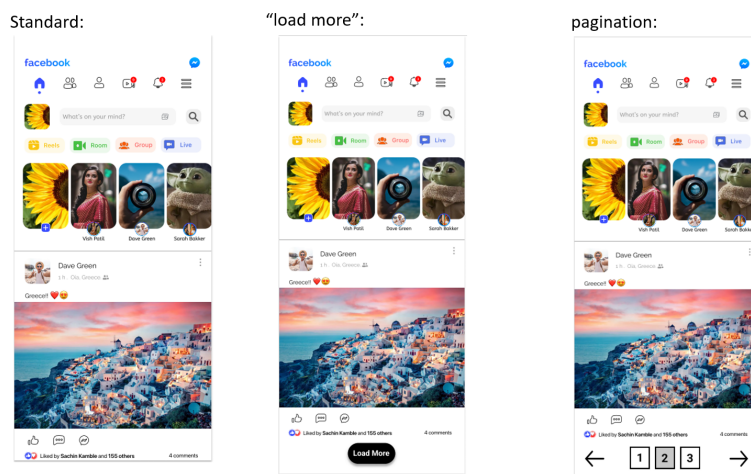

Fig. 22. Design alternatives for the infinite scroll.

The literature review has shown that scrolling through the feed can be made to be more active, rather than passive, so mindless scrolling is minimized or prevented. According to the results, people engage at different levels of activity and passivity with different kinds of content. E.g. videos are engaged with passively more often. A balance should be struck between content that is consumed passively and actively, where passive content is discouraged from overtaking the feed. Thus, a solution could be to intentionally incorporate content that could break the spell of mindless scrolling. Participants will be asked if they think any type of content could be effective in this goal.

Lastly, a commonly researched solution to mindless scrolling is to incorporate a nudge that tells the user how long they have been scrolling and to do something else. However, the literature review has shown that nudges like this have been

experienced as invasive, do not work for everyone and may become ineffective in the long run. To confirm whether nudges are indeed invasive solutions, or can maybe be useful if incorporated differently, the described nudge will also be evaluated. Figure 23 shows an example of what such a nudge can look like.
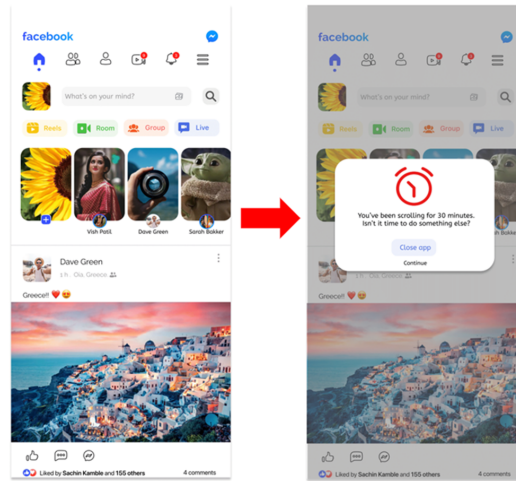

Fig. 23. An example of a nudge against mindless scrolling.

Table 11 provides an overview of the proposed design alternatives for the infinite scroll and its content.

Table 11. A table featuring the initial design solutions against the addictive effects of the infinite scroll.

Feature	Feature description
"Load more" button	Instead of an infinite scroll with no breaks, the "load more" button asks for occasional action from the user to load the next few posts on an infinite page.
Pagination	Instead of an infinite scroll, the feed is broken into different parts, much like a webpage. This will ask for occasional action from the user to load the next few pages.
Purposeful content variation	As different content may be related to mindless scrolling, a focus on incorporating content that is engaged actively and excluding content that is engaged passively may reduce mindless scrolling.
Scrolling-time pop-up	As mindlessly scrolling is related to losing a sense of time, incorporating occasional pop-ups about scrolling time can lead to more conscious use.

5.2.2 Notifications.

This section discusses the designed interventions for the notifications. According to the results of the survey, participants are generally unbothered by notifications but are sometimes annoyed by certain types of notifications, and are able to choose when and what to respond to by themselves. However, as notifications are often designed to hide their intent, users cannot always make an informed choice on which notifications are important and which ones are not. Then, they waste their time attending to a notification they would not have attended to otherwise. Thus, information in notifications should be altered or increased, or should be otherwise aided to filter certain notifications, which the following solutions will focus on.

One solution is that information can be increased to include the full message of a text. Since hiding information is an addictive aspect of the notification design, doing the opposite by incorporating full information may improve the feature to aid users in self-filtering which notifications they want to attend to. A total lack of information will also be tested. Visualisations of both ideas can be seen in figure 24.
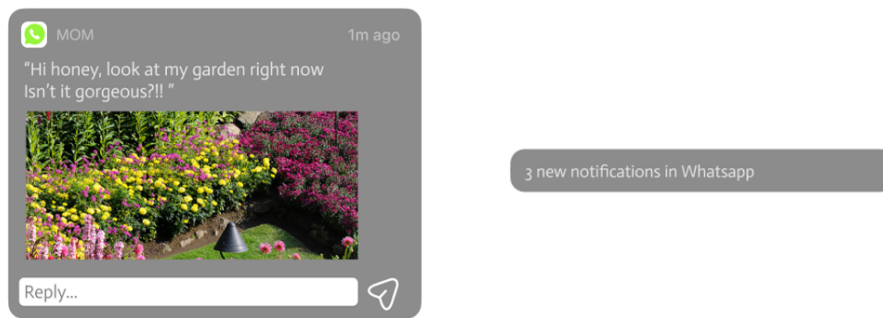
Fig. 24. A side-by-side example of showing full message content and no message content in a notification

In relation to the goal of aiding users to self-filter which notifications they want to attend to or not, it can be made easier for participants to decrease the compulsion to check their phones by allowing apps to filter different types of notifications for a user. Then, e.g., generic notifications could be removed, such as about app updates. These types of notifications are not appreciated by the participants while notifications such as on personal messages are appreciated, which can be given priority. An example of a notification with a high-priority label can be seen in figure 25.

Fig. 25. An example of how a high-priority notification will appear over low-priority notifications.

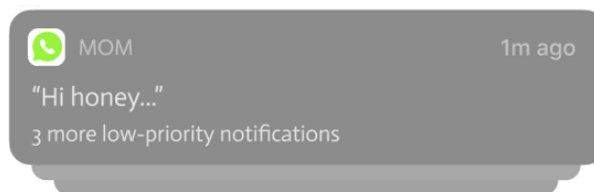Lastly, as notifications are a cue for inviting a user to social media, sometimes at times they should attend to other matters, the timing of the cue will be experimented with in the following solution. since the results showed that participants are already interested in customizing their notification view, the ability to delay notifications will also be tested. This solution gives the user the ability to set a timeframe in which they do not want to receive notifications, such as their working hours. Participants will also be asked if they would like other users to be able to override this delay. This solution could offer a way to further deter users from checking notifications when they should not. A visual example of the feature and its alternative option for the user to delay a message can be seen in figure 26.
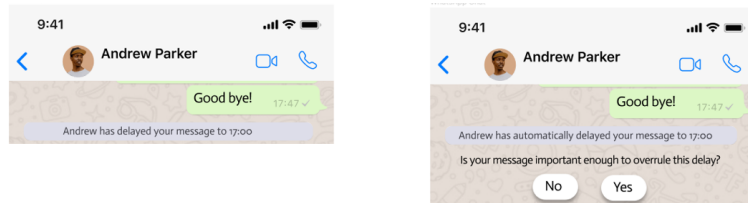

Fig. 26. An example of how a message can be delayed and how a user may override a delay.

Table 12 provides an overview of the established possible solutions.

Table 12. A table featuring the initial design solutions against the addictive effects of notifications.

Feature	Feature description
Filtering notifications	Provides the user the ability to filter out certain notficiations based on theme, such as filtering out recommendations from the algorithm.
Providing full notification content	Rather than showing a preview in the notification, the full message content would be shown.
Providing no notification content	Rather than showing a preview in the notification, it is only shown that there is a notification in the app.
Adding priority labels	Provides the user with the ability to add priority labels, so important notifications will appear at the top of the start screen and low priority notifications will appear at the bottom of the screen.
Delaying notifications	Provides the user with the ability to set a timeframe in which they do not want to receive notifications. Possibly, someone sending a message receives a notification of when their message will arrive and may get the ability to override it.

5.2.3 Typing indicator.

According to the results of the survey, most participants have previously been affected by the typing indicator to stay in a social media app longer than they necessarily would want to. The most 'annoying' typing indicator is for long messages where the indicator keeps burning and makes the user waste time, especially when the message doesn't end up being sent at all. The indicator is perceived as useful when a user is actively in a chat and would like to respond immediately. Thus, most potential solutions aim to inform the user better of what to expect from an incoming message, so the compulsion to wait for an incoming message can be deterred.

To make sure people do not stay unnecessarily long inside social media while keeping its usefulness for active chats, one solution is that the indicator should no longer appear on the main overview of chats, as this will bring attention to chats the user may not necessarily want to tend to right now. Then, it only appears in active conversations, where the typing indicator is generally appreciated.

As people find the typing indicator to be a waste of time for long or useless messages, a solution could be to increase the level of information in a typing indicator. Three different types of information will be evaluated. One solution is to show the. This might make users more conscious of the fact they are wasting their time waiting on a message. Another solution is to show the exact amount of words someone is typing, inside the indicator. The last solution is to show the exact. These solutions may provide users with the tools to decide which messages to stay around for and which they should not stay around for. Figure 27 shows examples of what these features may look like.

Fig. 27. An example of how a message can be delayed and how a user may override a delay.

Table 13 provides an overview of the established possible solutions.

Table 13. A table featuring the initial design solutions against the addictive effects of the typing indicator.

Feature	Feature description
Typing indicator only in chat	Removes the ability to see the typing indicator in the full chats overview and makes it only visible inside of a chat.
Add time indication	Change the typing indicator's text based on time, e.g. showing the other user has been typing for a long time.
See what the other is typing	Provides a user the ability to see what words another user is typing in a message to them.
See how much the other is typing	Provides a user the ability to see how many words another user is typing in a message to them.

5.2.4 Streaks.

Participants who use the streak feature enjoy it but may experience it as stressful and turn it into a high-stakes game for themselves. They might then enter social media only to keep a streak, as losing a streak can lead to negative feelings. To keep the enjoyment that people experience when maintaining a streak, yet also decrease the compulsion to send content to others only in order to keep a streak, the feature should be made to be more lenient. A few solutions were made up to make the streaks feature more lenient and healthy, but to keep the satisfaction and fun incorporated for the user.

First of all, the feature can be changed to not count consecutive days, but the total days a user has interacted with another user. Then, a streak-like counter is still incorporated and is still shown as a friendship symbol, but does not request the user to interact every day and unnecessary interactions can be kept at bay.

Similarly to the previous feature, streaks can also be made to be a weekly tracker rather than a daily one. Then, users do not count the consecutive days of interaction but consecutive weeks. Only one interaction with another user is requested per week to keep the streak alive. Again, communication is then less likely to be unnecessary or meaningless.

Lastly, the streak feature can also take inspiration from other non-social media platforms that incorporate a streak feature such as Duolingo and incorporate a *"streak freeze"*. This feature would provide the user with a tool to "freeze" their streak, meaning they can consciously implement the freeze to skip a day, for example for busy days or when they do not have anything interesting to share. This could decrease the stress associated with the feature. Figure 28 shows how such a streak freeze may look in the overview of Snapchat.

Fig. 28. An example of how a streak freeze can be equipped.

Table 14 provides an overview of the established possible solutions.

Table 14. A table featuring the initial design solutions against the addictive effects of streaks.

Feature	Feature description
Total streak counter	Changes the streak to not count consequetive days, but the total number of days. Streaks cannot be broken then, but will only go up.
Streaks for weeks	Changes the streak to not count each day, but instead each week of interaction. Then, only one interaction per week is required to keep the streak.
Streak freeze	Provides the user with a tool to "freeze" their streak. When they miss a day, the streak will remain.

5.2.5 Likes.

The survey results have shown that participants primarily find likes to be addictive due to social comparison. Seeing other people's likes leads to comparisons between your own and other people's likes for many. People do generally appreciate receiving likes as social validation. Participants also appreciate the like system when filtering for good general content to seek out, but have conflicting feelings when applied to their own posts or peers. It is a nice indication of who has seen and appreciated your post but can lead to disappointment when receiving fewer likes than others. Solutions should aim to reduce social comparison but keep the social validation they can provide.

The first proposed solution is to make likes visible only on a user's own posts without being able to see those of other people. This way, the user receives social validation but cannot succumb to social comparison, as they can see nothing to compare their likes to. This solution should remove the ability for social comparison completely. A visualisation of this can be seen in figure 29. There is an indication that a post has likes, but the user cannot see how many.

Fig. 29. An example of how limited likes may look like.

Furthermore, to see if the part of giving of likes is truly not part of the addictive issue, a solution regarding the spending of likes is also presented in the evaluation. The solution includes, for example, for users to only be able to spend 5 likes a day. Perhaps this solution would then inspire users to quit using a social media platform, which may relate back to the mindless scroll as well. An example of how this could be incorporated can be seen in figure 30.
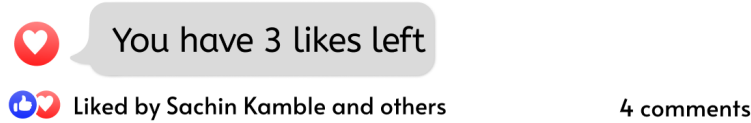

Fig. 30. An example of how limited likes may look like.

Table 15 provides an overview of the established possible solutions for the likes feature.

Table 15. A table featuring the initial design solutions against the addictive effects of likes.

Feature	Feature description
Making other people's likes invisible	This removes the ability to see other users' likes. This still gives the user the opportunity to give likes to other users, but only that user can see the amount of likes.
Limiting likes	Provides the user with only a few likes to spend in one day. For example, users can give only 5 likes in a day.

5.3 Interview results

In order to evaluate the previously described proposed designs, several interviews were conducted, as described in the methodology section. To reiterate, the main goal of these interviews is to discuss potential design solutions to minimize compulsive social media use. The interviews were conducted with participants who (1) agreed in the survey they are interested in participating in follow-up research and (2) agreed, in any type of way, they are interested in improving their social media use, such as reducing their screen time. Of the 30 total participants who were interested in partaking in follow-up research, 21 were interested in improving their social media use. For this interview, an e-mail invitation was sent to these 21 participants. A total of 14 participants responded and were also able to partake in the interview during the provided allotted times. 11 of these participants were women and 3 were men. 10 of these participants were in the *18-25* age range and 4 were in the *26-35* age range. The effects of skewed demographics discussed for the survey results are further enhanced here, so the limited demographics should be taken into account when discussing the generalizability of the results.

The majority of the interviews were conducted online through Microsoft Teams, due to convenience for the participants. 3 interviews were conducted face-to-face, while 11 were conducted online. In real life, the face-to-face interviewees were provided with a tablet to view the proposed designs on. During the online interviews, the pages were

screen-shared instead. This should likely not have an effect on the results. Again, the interview protocol can be viewed in Appendix B and the screens with visual examples as they were shown to the participant can be seen in Appendix C.

The following sections will provide the results of the interviews. The evaluations for each feature and corresponding design alternatives will be described and discussed. The options for each feature have been labelled with *"approved"*, *"unsure/mixed"* or *"disapproved"* based on the participants' evaluations. When approved, a participant explicitly agreed that the feature, as it is, would contribute to reducing compulsive social media use and they would use it like this. When unsure or mixed, the participant felt ambivalent or would alter the feature in some type of way, to make it effective. When disapproved, the participant would not like to see this feature implemented, and it may not work against compulsive social media use. The *"approved"* labels have been compared to create a ranked list of the features and all sides of the evaluation are discussed thereafter. In the end, a set of overall suggestions for each feature will be provided. Lastly, screen time trackers and how to improve them are also discussed.

5.3.1 Infinite scroll.

This section will discuss the results of the evaluations on the infinite scroll and design alternatives. Table 16 provides a ranked overview of how the different features were evaluated.

Table 16. A table featuring the evaluation of the initial design solutions for the infinite scroll.

rank	Feature	Feature description	Disapproved	Unsure/ Mixed	Approved
1.	Pagination	Instead of an infinite scroll, the feed is broken into different parts, much like a webpage. This will ask for occasional action from the user to load the next few pages.	0 (0.00%)	6 (42.86%)	8 (57.14%)
2.	"load more" button	Provides the user the ability to filter out certain notifications based on theme, such as filtering out recommendations from the algorithm.	0 (0.00%)	7 (50.00%)	7 (50.00%)
3.	Scrolling-time pop-up	As mindlessly scrolling is related to losing a sense of time, incorporating occasional pop-ups about scrolling time can lead to more conscious use.	3 (21.43%)	5 (35.71%)	6 (42.86%)
4.	Purposeful content variation	As different content may be related to mindless scrolling, a focus on incorporating content that is engaged actively and excluding content that is engaged passively may reduce mindless scrolling.	5 (35.71%)	8 (57.14%)	1 (7.14%)

Overall, participants completely agreed that the infinite scroll should be changed in some type of way due to how it encourages mindless scrolling, though opinions are divided between the "load more" and pagination options. In regards to pagination, one participant mentioned that it may be easier to plan how much you use social media with a pagination feature: *"maybe you can say for yourself, I'll scroll one page and then stop".* and another one mentioned: *"there's more of an end to your feed".* Another reason is that the "load more" feature may still keep you in the flow: *""load more" would be less effective, as it is still really accessible.",* commenting on how it then still takes little effort to reach more posts. Other

participants commented that they find the pagination alternative to probably be more effective, but question if it's beneficial to the overall user experience. Other participants explicitly preferred the "load more" button. One participant stated *"it might be a lot to go a new page every other post"*. An alternative option here would be for a user to be able to set a different amount of posts they want to see on one page, so navigating through pages is not overly intense. One participant also stated *"Sometimes, I want to be in the flow mode of the infinite scroll, and sometimes I don't on busy days"*. Perhaps, for a user like this, they can choose the navigational mode they engage in. Generally, pagination and "load more" were not disapproved, and were seen as viable solutions against the infinite scroll. They will have to be tested to see which types of navigation perform best regarding compulsive social media use.

Though nudges have been written off in the literature review due to being invasive, the responses to the scrolling-time pop-up were not completely negative at all. Some users would not appreciate pop-ups, while others see them as a beneficial tool when implemented differently. Different types of implementations were suggested all aim to make them less invasive, as is the main issue with nudges as identified in the literature review [64]. One participant suggested making it a pop-up in the corner of your screen notifying you of your scrolling time that fades away, to bring your attention to the time you spend on social media without being annoying. Another participant suggested that the message should be different: *"Tell the app what you want to be doing. Like go read a book, go to the gym, look out the window..."*. Thus, the message should be more customizable. In essence, the pop-up feature has potential but should be tweaked to be less intrusive and more user-friendly.

As for the inclusion or exclusion of certain types of content. Only the format of short videos was mentioned by four participants as being particularly addictive. One stated: "*I think what is especially addictive to me are YouTube reels because they are so short and easy to scroll through.* However, since they are enjoyable, most participants did not want to fully see them gone and saw no method of implementing them in any other way. One participant suggested creating a separate tab for this but admitted they would seek it out anyway. Only one participant fully approved by stating that it may be beneficial to put a long text post at the end of a paginated feed, so you are less inclined to navigate further. One participant suggested that it might be beneficial to include *"take a break" type of posts"* at the bottom of a page, similar to the pop-up, but incorporated more seamlessly. Generally, the majority of participants were unsure of how to include or exclude content like this and which types of content.

To summarize, the original infinite scroll was rejected, but it is still unclear whether pagination or the "load more" button would be most effective. Either way, these two alternatives are deemed to be better at deterring the user from mindlessly scrolling than the infinite scroll. The scrolling-time pop-up received mixed results but was accepted by some based on some alterations, like making it less intrusive and changing the text to be more directed at what the user should really be doing other than scrolling. Creating a variation in content was not well-accepted, as users generally saw no purpose for it and could not think of any way to implement it purposefully.

5.3.2   Notifications.
This section will discuss the results of the evaluations on the notification and its design alternatives. Table 17 provides a ranked overview of how the different features were evaluated.

Table 17. A table featuring the evaluation of the initial design solutions for notifications.

rank	Feature	Feature description	Disapproved	Unsure/ Mixed	Approved
1.	Providing full notification content	Rather than showing a preview in the notification, the full message content would be shown.	0 (0.00%)	0 (0.00%)	14 (100%)
2.	Filtering notifications	Provides the user the ability to filter out certain notifications based on theme, such as filtering out recommendations from the algorithm.	0 (0.00%)	2 (14.29%)	12 (85.71%)
3.	Adding priority labels	Provides the user the ability to add priority labels, so important notifications will appear at the top of the start screen and low priority notifications will appear at the bottom of the screen.	3 (21.43%)	5 (35.71%)	6 (42.86%)
4.	Delaying notifications	Provides the user the ability to set a timeframe in which they do not want to receive notifications. Possibly, someone sending a message receives a notification of when their message will arrive and may get the ability to override it.	3 (21.43%)	6 (42.86%)	5 (35.71%)
5.	Providing no notification content	Rather than showing a preview in the notification, it is only shown that there is a notification in the app.	14 100%)	0 (0.00%)	0 (0.00%)

The most well-evaluated feature was the ability to see the full message's content inside a notification. Participants agreed that it would deter them from entering social media and spending time on it, as they can tend to notifications outside of the app. Even for reasons unrelated to compulsive social media use, the feature was appreciated: *"Especially with WhatsApp it is nice to think about your answer before you open the message"*, referring to the *"marked as read"* indicator putting pressure on people to respond soon. One participant appreciated the feature for WhatsApp messages but questioned the technical implementation of, for example, a recommended video, but did state: *"TikTok on the start screen could be interesting"*. The feasibility of implementing this solution for all types of notifications is yet to be discovered, but it should be possible for notifications that already contain previews, such as from instant messaging services. All in all, this feature was very well-evaluated.

Participants generally appreciated the ability of higher customization for filtering notifications. Some participants already had notifications on and off for certain apps, so were especially interested in filtering notifications in different ways inside one app. For example: *"I think it would be great to filter notifications from group chats that send messages all the time."*, while wanting to keep notifications from personal messages. Another example a participant gave is that they have notifications on for one Twitter account, but would really only want to receive notifications on tweets about a particular topic from the account, so notifications could be filtered based on content. Participants who were unsure

were mostly ambivalent and did not see a personal reason for applying filters like this. Notably, these participants had already reduced their notifications a fair amount, such as one participant: *"I only have notifications on for WhatsApp"*. Overall, the feature was appreciated by the majority of participants.

The ability to add priority labels and receive a ranked notification overview received mixed evaluations. Participants who appreciated the ability to create a list of prioritized notifications appreciated it for making some sense of their large amount of notifications: *"It would be nice because I have a hard time setting priorities"*. Some participants felt unsure or disapproved about the ability to create a priority list: *"It wouldn't really matter because I like to clear all notifications."*, also describing that the shift in thinking about how the notifications are no longer viewed chronologically might be difficult. All in all, this feature received mixed evaluations and should be an opt-in feature for some. It seems like a lot of participants prefer to not receive notifications of low importance at all, and would like to filter it like with the previous solution.

Participants were intrigued by the ability to delay notifications but were critical of them. Participants who appreciated the feature said, e.g.: *"Better to open it all at once, rather than 40 times a day."*. Participants who were interested in the feature were unsure about allowing other users to override your delay: *"If it was really important, they would call"*, though one other participant worried about the possibility of emergencies where you may not be able to call. A compromise may be to make it explicitly clear to the other user that they should only override delays when it is very important. One participant was critical of the message the other person receives and said they would rather see it brought as *"*participant name* is at work until 5 PM"*. Thus, the way this information is brought to the other user should be worked on, perhaps by letting users fill in custom automated messages for other users to see. Some participants disapproved of the feature, such as a participant who stated: *"I would wait for 5 PM and then have an addictive reaction. It would make me anxious."*, meaning they would feel distracted by the idea of incoming notifications they do not yet know about. The same participant also stated they would rather see a temporary 'snooze' button to keep notifications away when needing to be productive since they do not have a set schedule to set such a timeframe as proposed. Generally, results were mixed, so this feature should be opt-in for the users who would benefit from it.

All participants disapproved of providing no notification content, confirming the notion that more information in a notification aids in self-filtering, as implied in one statement: *"Then I would check out all notifications which is frustrating."*. Thus, reducing the information in a notification should not be implemented, as no benefit against compulsive social media use could be found by participants.

Solutions that were provided by the participants themselves include making the user interface design of notifications more simple. The participant who came up with this solution provided the (non-social media) example of Duolingo, which uses bright cartoon illustrations in their notifications. They felt like this was effective for them to lure them to the app. Thus, notifications should ensure they are not too attractive in their design. This can be related to existing solutions like making the phone screen black and white, to make using it less enticing [58], so this is likely effective. Another participant noted: *"It already is very customisable but people don't always know what to do because there are already so many options in the settings they don't do anything"*. They recommended the ability to set notification settings upon account creation and to generally make it more accessible to users.

All in all, providing full notification content was the most well-appreciated feature for notifications, which may

benefit from full implementation. The ability to filter and the ability to add priority labels should be an opt-in feature, as some participants appreciated it and some didn't, because they did not see a reason for them to use it. The same counts for the ability to delay notifications. The general consensus is that delays should not be overridden, though concerns were raised for situations where this might be necessary. Lastly, the feature of no content in a notification at all was not appreciated, as expected. The evaluation showed that generally, a higher level of customisation and a higher level of information in notifications were appreciated by the participants and would be beneficial against compulsive social media use. Solutions from participants included making the UI of notifications less flashy and making customization more accessible.

5.3.3 Typing indicator.

This section will discuss the results of the evaluations on the typing indicator and design alternatives. Table 18 provides a ranked overview of how the different features were evaluated.

Table 18. A table featuring the evaluation of the initial design solutions for the typing indicator.

Rank	Feature	Feature description	Disapproved	Unsure/ Mixed	Approved
1.	Typing indicator only in chat	Removes the ability to see the typing indicator in the full chats overview and makes it only visible inside of a chat.	0 (0.00%)	0 (0.00%)	14 (100%)
2.	See how much the other is typing	Provides a user the ability to see how many words another user is typing in a message to them.	11 (78.57%)	2 (14.29%)	1 (7.14%)
3.	Add time indication	Change the typing indicator's text based on time, e.g. showing the other user has been typing for a long time.	8 (57.14%)	4 (28.57%)	0 (0.00%)
4.	See what the other is typing	Provides a user the ability to see what words another user is typing in a message to them.	14 (100%)	0 (0.00%)	0 (0.00%)

Overall, sentiments toward the typing indicator differed significantly between participants. For example, one participant said: *"It doesn't matter for individual conversations, as I don't wait around for them anyway"* while another participant stated: *"When I see the typing indicator, I immediately leave because I don't want them to expect a reply immediately when they see I'm online"*. Thus, contexts in which the typing indicator has been evaluated differ for each participant, though all confirmed at least occasionally staying online longer when seeing the indicator.

The most well-evaluated feature was removing the typing indicator from the full chat overview and letting the user only view it when the user is inside a particular chat. All participants agreed they would then be less likely to get distracted by a chat when they do not want to tend to a conversation. One participant stated: *"Especially for group chats this is handy for me because I often wait around outside the chat to watch other people go on when I don't even plan to take part"*. This is in line with previous results showing that typing indicators are only accepted as useful by users in active conversations when they feel like replying immediately as well. It was deemed to be a positive feature to implement against compulsive social media use. The other suggested solutions, however, were appraised far less positively.

The ability to see how much another user is typing was not well-evaluated. The majority disapproved, agreeing that it is intrusive. Though some participants first admitted some interest, they rejected the solution based on the idea that other users would then also be able to view how much they are typing as well. One participant stated, for example: "I hate this idea, especially for when you change up a message a lot before you send it and the other will start to think...", alluding to the fact that this would imply the user has maybe changed their mind about their message, revealing information the user would rather keep hidden. Participants who were unsure said they would maybe use it if implemented more subtly. One participant who was unsure about the feature thought that seeing the exact number would be intrusive but thought a redesign could work: *"You can make it look more like the iOS bouncing dots and put more dots as the message gets bigger"*. The one participant who approved of seeing how much the other is typing stated: *"It is easier to judge importance"*, relating that the length of a message can be inferred from the indicator, implying a longer message indicates importance. Only this participant saw no issue related to intrusion or privacy. Overall, this solution was not positively reviewed and should not be implemented.

Adding a time indication to the typing indicator was generally not well-evaluated. Participants who disagreed with this solution mentioned that it would only make them feel more antsy as to what the other person may be typing, especially if the timer will go up for a long time. Thus, this solution may lead to even more addictive behaviour, as users may start watching the timer go up until a message is sent. Participants who were unsure did not outright reject the solution but did not see what it would improve for addictive social media design and its effects. All in all, this solution should be rejected, as it may be experienced as addictive by some while being a useless addition for others.

The ability to see what another person is typing was evaluated very similarly to being able to see how much another person is typing. It was also deemed to be far too intrusive by all participants and would be experienced as an invasion of privacy when implemented. One participant for example stated: *"Sometimes you change your mind about what you're gonna say and there's a reason this isn't implemented anywhere"*. Clearly, this solution suffers from being experienced as too intrusive, and should not be implemented in any type of way.

Suggestions provided by the participants to further improve the typing indicator include altering the time in which the indicator appears: *"Put it in sight for a few seconds that someone has started typing"*. The same participant added *"Make it like a flashing light with a few seconds between flashing it"*, meaning that the indicator should appear for short bursts of time between set intervals. These solutions would still inform the user of an incoming message but in a less invasive way. Other suggestions included deleting the typing indicator completely, as mentioned by multiple participants. Many participants made clear that they do not see a point to the typing indicator and agree its view should be reduced in some type of way, in order to improve engagement with it.

All in all, only allowing the typing indicator to be seen in the chat was a well-evaluated feature, which could benefit from full implementation, as it is likely to deter users from being distracted by messages they do not always want to tend to at the moment The other suggestions received poor results, by being experienced as useless, invasive and as even more addictive. This shows that adding information to the typing indicator can lead to no change or even more compulsive social media use. The overall consensus is that less is more with the typing indicator and decreasing the view of the feature should lead to positive results in relation to compulsive social media use.

5.3.4 Streaks. This section will discuss the results of the evaluations on streaks and their design alternatives. Table 19 provides a ranked overview of how the different features were evaluated.

Table 19. A table featuring the evaluation of the initial design solutions for streaks.

Rank	Feature	Feature description	Disapproved	Unsure/ Mixed	Approved
1.	Total streak counter	Changes the streak to not count consequetive days, but the total number of days. Streaks cannot be broken then, but will only go up.	2 (22.22%)	1 (11.11%)	6 (66.67%)
2.	Streaks for weeks	Changes the streak to not count each day, but instead each week of interaction. Then, only one interaction per week is required to keep the streak.	3 (33.33%)	0 (0.00%)	6 (66.67%)
3.	Streak freeze	Provides the user with a tool to "freeze" their streak. When they miss a day, the streak will remain.	0 (0.00%)	4 (44.44%)	5 (55.56%)

A total of 9 participants were familiar enough with the streak feature for this evaluation. Thus, only these participants evaluated the solutions, meaning the evaluation for this streaks feature contains fewer results. However, the fewer amount of evaluations were still of great value.

The most well-evaluated feature was changing the streak feature to not show consecutive daily interactions, but to make it a counter that shows the total number of interactions, with no consecutive interactions needed. Participants suggested that this would keep the fun of the streak and would encourage users not to send content they would not otherwise send. *"You can still be prideful of your high number and show it off but you can also skip a day if you have nothing to say"*, as one participant stated. Critical participants stated that it may still emulate the problems of a streak, since it takes similar effort to create a streak counter with a high number. They were also unsure whether the feature should add one tally each day, or for every interaction. The latter though, may lead to spam interactions, which a solution should deter. As most participants agree this solution should be helpful, it is still worth it to implement, as it is likely to not lead to more compulsive behaviour.

Another decently well-evaluated feature is changing the streak count from consecutive days, to weeks. Only one interaction each week is requested from the user to keep their streak. Similarly to the previous feature, participants agree this can lead to fewer interactions that are made for the sake of keeping a streak alive. One participant stated: *"I would probably send less nonsense like a black screen that says "streak" on it"*. Critical participants, however, thought this might make the streak boring. *"I think a lot people will lose interest in the streak like this because it's so easy"*, as one participant stated. Though the solution should be tested for the aspect of entertainment and whether users would still be interested, it is likely to at least lead to less compulsive social media use.

The streak freeze feature was also well-evaluated by some, but not all. Participants who approved the feature thought it

to be useful for busy days or when they may not have anything to share with another user. Participants who were unsure about the streak freeze were interested, but could not see a way to incorporate the feature in a way that keeps the streak challenge balanced. For example: *"In Duolingo, you earn these freezes as a reward for finishing a level but Snapchat doesn't really have that. Maybe getting a reward like a streak freeze for sending so many pictures would be even more addictive"*. Clearly, this proposed solution has potential but requires more thought for its implementation. One solution suggested by a participant is to give a streak freeze at a set interval, to receive one each week for example. Only testing an implementation of this feature would lead to clear results on what could work and what users may use the streak freeze for. The overall consensus is that it may be effective, but the reward system should be given more thought.

No solutions were provided by the participants that did not come down to simply removing the feature. One participant stated: *"These solutions don't really capture the fun of the streaks. I guess if I don't have it like it is now, then I'd rather see it removed"*. Even thought the feature can be stressful, the thrill of keeping a long streak is difficult to keep when altering the mechanics behind the feature.

All things considered, creating a solution for the streak feature that is still entertaining and also less addictive is a challenging ordeal. Though the solutions were accepted by some participants, no solution is fully agreed on. It seems that reducing the high level of involvement in order to reduce the high stakes of retaining a streak is associated with a decrease in entertainment by some. Thus, it is difficult to find the balance of an entertaining solution that can reduce the level of compulsive social media use related to streaks. Some participants found the proposed solutions of creating a total streak counter, streaks for weeks, and the streak freeze to be effective, while some prefer to completely remove the feature instead. Overall, these features require more research to be conclusively good solutions, but are at least appreciated to improve compulsive social media use.

5.3.5 Likes.

This section will discuss the results of the evaluations on likes and their design alternatives. Table 19 provides a ranked overview of how the different features were evaluated.

Table 20. A table featuring the evaluation of the initial design solutions for likes.

Rank	Feature	Feature description	Disapproved	Mixed/ Unsure	Approved
1.	Making other people's likes invisible	This removes the ability to see other users' likes. This still gives the user the opportunity to give likes to other users, but only that user can see the amount of likes.	0 (0.00%)	0 (0.00%)	14 (100%)
2.	Limiting likes	Provides the user with only a few likes to spend in one day. For example, users can give only 5 likes in a day.	11 (78,57%)	3 (21,43%)	0 (0.00%)

Removing the ability to see other people's likes is the most well-evaluated solution. Participants agreed that it would prevent social comparison, as there is no frame of reference anymore. For example, one participant who admitted to social comparison stated: *"When I get less likes on a picture of myself than normal, I end up looking at other people's*

pictures for some reason... and then I feel even worse. Now I wouldn't even be able to". Thus, this solution is very likely to be beneficial against compulsive social media use, by removing the ability to socially compare.

The solution of allowing users only limited amounts of likes to give out was evaluated to be a confusing, unnecessary redesign. The solution might lead to even more social comparisons when likes can only be rarely spent. *"I only find this annoying, and this might even make likes more important to people when they're more rare"*, as one participant stated. As this targets the giving of likes rather than receiving, it does not target the main issue that was identified, which is social comparison. The results of the evaluation are in line with the notion that giving likes is not the addictive aspect, but the ability to see other people's likes is.

All suggested solutions from the participants included ways to limit the view of likes. One participant suggested: *"What if you could only see kind of a guess of how many likes a post has. Something like "more than 10" or "more than 100" and not the exact number"*. Changing the likes counter to be more of an approximation could aid in reducing the level of social comparison since you do not know exact numbers. Another participant similarly suggested it could be beneficial to not be able to see the total number of likes, but retain the ability to still see who liked a post, as social insight. This could also refrain users from social comparison. Though the same participant joked that a desperate person could still count all the individual likes, this is likely too large a barrier for many and could be a good solution.

Overall, participants could agree that likes lead to social comparison and an alteration to this feature should be made. Removing the view of other users' likes was appreciated most of all and was deemed to be beneficial for removing the toxic effects of likes. Suggestions provided by participants were variations on this notion, such as generalizing the amount of likes someone has or removing the total counter from the list of likes. The evaluation on limiting the ability of likes shows confirms this is not the issue, and liking posts is not an inherently addictive behaviour, while the social comparison is.

5.4   Screen Time Tracker

Lastly, participants were asked about their thoughts on the screen time tracker, a common solution against compulsive social media use in order to evaluate how this fits in the total overview of solutions and how it may be improved to contribute to reducing compulsive social media use.

Some participants had experience with a screen time tracker or similar tools but felt quite differently about them. Participants praised the tool for giving insight into their usage, especially if they did not expect some results. Sometimes, the results can even be experienced as shocking: *"I really didn't understand how much time I spend on YouTube, but I guess it's true..."*, adding that they did not return to the screen time tracker, choosing to ignore the usage they found to be worrying. Another limitation is that the screen time tracker provides the user with information, but the user does not always know what to do with it, confirming what has been found out in the literature review about this tool.

One solution to improve screen time trackers that was presented is the ability to get a deeper insight into how the user spends their time in a certain app. For example, though spending time on YouTube may be related to behaviour the user would rather not do, such as watching funny short videos for hours on end, this same time could have been spent watching. However, the screen time tracker makes no distinction between time well spent and time poorly spent.

"I wish I could see what accounts I watch so I can decide who to unfollow if I watch their stuff too much", as one participant states. Another suggestion to improve the feature was for the screen time tracker to analyze a user's behaviour in order to make specific improvement suggestions, such as *"you spend most time in Instagram, maybe you should aim to halve this time"*, as one participant stated. *"Maybe you can make a game with a rewards system around this too"*, added the same participant. There is a clear need for users to be able to gain an idea of what to do next and the tool should include more incentives to improve behaviour as well.

Overall, it can be said that the insights that screen time trackers provide are seen as interesting, but the level of detail in information can yet be enhanced and it would only be useful against compulsive social media design if the screen time tracker provided the tools for improvement by providing specific suggestions for goals the user can set.

5.4.1 Summary.
To briefly summarize the results, it was decided that alternative navigational methods can improve the effects of the infinite scroll, but it is unclear whether the "load more" button or pagination may be best. Pop-up nudges were found to be potentially useful when implemented more subtly. For notifications, providing the full content of a message was found to be highly beneficial, but adding priority labels and delaying notifications received mixed results. Adding more information to the typing indicator, however, was not well-received, and its view should be decreased, e.g. by removing it from the main chat overview. There was no clear, good solution to the streak feature, but it may still benefit from being made more lenient in different ways, at the cost of entertainment. Lastly, the ability to see other peoples' likes should definitely be removed, as decided by the participants of this interview. The screen time tracker as it is now, is not a useful solution and should be more insightful with its information and more assertive in aiding the user toward behaviour change.

6 CONCLUSION

This thesis aimed to explore addictive social media design and possible non-invasive solutions. Perspectives and experiences related to social media in general and addictive features were discovered and explored. Based on these discoveries, potential non-invasive solutions were designed, which were also evaluated on potential effectiveness. The following sections will answer the subquestions based on the previous results, in order to answer the main question.

6.1 SQ1: How is compulsive social media use experienced and mediated?

This subquestion was answered through the literature review and confirmed and elaborated on by the first phase of the study, the survey. The results showed a variety of behaviours associated with addictive social media use. People tend to enter social media when they do not need to tend to other responsibilities, but also often enter social media when they do, leading to attempts at multitasking. Behaviours like social comparison, useless interactions, and an overall regret with the way that time is spent, were mentioned by many participants. However, many participants were also interested in their behaviour in relation to social media and have attempted methods such as deleting social media, deliberately putting their phone elsewhere and altering notification settings, though with mixed results. Compulsive social media use is experienced and mediated very differently by different users and no user is affected the same.

6.2 SQ2: What are the addictive features of social media design?

This subquestion was answered through the literature review and confirmed and elaborated on through a survey study. Five addictive features were identified:

(1) **Infinite scroll**: Can contribute to passive engagement, promoting mindless scrolling due to the heightened ease of use.
(2) **Notifications**: Can contribute to engagements the user does not want in hindsight, due to notifications hiding intent, requesting users to tend to notifications they would otherwise not always want to.
(3) **Typing awareness indicator**: Can contribute to users staying in apps longer than they really want to, by being enticed to wait for incoming messages, that to the frustration of the user can make them waste their time.
(4) **Streaks**: Can lead to unnecessary interactions in order to keep the streak alive.
(5) **Likes**: Can contribute to social comparison, when users compare their own likes to those of others.

6.3 SQ3: How do social media users perceive non-invasive solutions against addictive social media design?

This subquestion was answered through the interview, aimed at evaluating the designed solutions that were based on the results of the survey. Overall, most non-invasive solutions were evaluated more positively compared to existing invasive or non-integrated solutions like nudges and screen time trackers. Overall, the suggestions did receive mixed results, though this is expected, as some suggestions were deliberately boundary-pushing to understand the full scope of what a solution should look like. Clear conclusions and suggestions can be made for what a solution for each feature should be like. and how effective non-invasive solutions may be designed This leads to answering the main question.

6.4   RQ: How can non-invasive interventions that effectively counter the effects of compulsive social media use be designed?

To answer this question, a set of suggestions for each feature can be made against the effects of compulsive social media use:

(1) **Infinite scroll**: Altering the infinite scroll to require more input from the user is the main solution to promote conscious scrolling. Add an opt-in subtle nudge as an option for users who need even more awareness of their mindless scrolling.

(2) **Notifications**: Aiding in self-filtering is key. Include the full message in a notification so a user can choose what to respond to and allow users to customize the feature to make distinctions between different types of notifications.

(3) **Typing awareness indicator**: Less is more. Reduce the view and prevalence of the typing indicator to only include it inside particular chats, when users want to engage in active chats.

(4) **Streaks**: To truly be effective, the streak should be made to be less entertaining or should be fully removed, as the difficulty of retaining a streak is most entertaining, and in turn leads to the most addictive behaviours.

(5) **Likes**: Social comparison should be deterred by removing or reducing the ability to see other users' likes, though likes as social validation should be kept.

To conclude, solutions differ for each feature. As there is no one-size-fits-all solution, a focus should be put on high levels of customization, the ability to choose how certain features are implemented, and finding the right balance between the positive and negative aspects of a feature.

7 DISCUSSION

The following sections will first discuss the key takeaways and opportunities that the current study presents, showing how this study has contributed to the overall body of work on the topic of addictive social media design and solutions. Limitations of the study and opportunities for future work on the topics presented in this thesis are discussed thereafter.

7.1 Key Insights

The current thesis study can contribute novel insights and further evidence to the current body of scientific work on (1) compulsive social media use, (2) addictive social media design and (3) the design of solutions against these problems. In this section, a small overview will be provided as to how the results of this research reflect on the literature review.

The topic of compulsive social media use has mostly been researched as a user's individual psychological issue, not taking into account that addictive social media design may contribute to compulsive social media use. The results of this thesis confirm some of the reasons for engaging in excessive social media use, such as social media as a source of quick entertainment. Similar consequences to the issue were also identified, such as frustration and disappointment due to social comparison. This thesis, however, takes it a step further by also indicating how these reasons and consequences can be linked to particular features. Though perhaps not on a debilitating level, studies on social media addiction should still take into account that the design of these platforms can influence behaviour significantly. For example, though likes are criticized to influence users toward social comparison, studies tend to only look only at the user, rather than social media for giving users the tools to engage in social comparison in the first place. This study thus expands on the compulsive social media behaviour cycle by including platform interactions in the process, which other research on this topic should aim to include as well.

On the topic of addictive social media design, this study has contributed to the body of work on features that have already been identified as addictive, such as the infinite scroll. This study has confirmed that it is indeed a problematic feature that contributes to behaviours such as compulsive scrolling. This study takes a different aim by focussing on the positive aspects of addictive features as well, creating a more balanced overview of the addictive features. As this is not a well-researched topic, this thesis also provides new features that can be identified as addictive, such as the typing awareness indicator, which lets users stay longer in a social media app than they would like to, in hindsight. Thus, this thesis expands on what is known about addictive social media design significantly, most importantly by contributing features newly identified as addictive.

Lastly, the literature review described solutions against compulsive social use and concluded that many solutions are imperfect due to being invasive. The results confirm that users indeed feel like solutions such as nudges, as they are currently implemented, are experienced as invasive. The literature review also indicated that people find screen time trackers to uncover interesting insights, but they do not inspire people to change their behaviour, which was also confirmed to be the case in this study. For this thesis, improvements for these solutions were made up to make them less invasive and more useful, respectively. Lastly, this thesis also contributed novel, integrated solutions that are likely to be more effective compared to the previous solutions, as was the purpose of the overall thesis.

7.2 Opportunities

As described in the previous section, since little research has been conducted on addictive social media design, the results of this study contribute to the overall understanding of this phenomenon within Human Computer Interaction research. Compulsive social media use has mostly been researched from the perspective of behavioural sciences, as this compulsive behaviour is seen as a person's individual issue, ignoring that addictive social media design may contribute. Thus, the results of this study can inform this field as well. This study also identified specific addictive features that have not been mentioned in Human Computer Interaction research in relation to addiction, such as the typing awareness indicator. Thus, the results of this study contribute significantly to researching addictive social media design.

The results of this study can contribute to existing social media designs and can inform creators on how to design their platforms to foster healthier, more conscious use. Though compulsive use cannot be fully prevented by these platforms, social media platforms should still be kept responsible for contributing to problematic social media use, as they should keep the users' best interests at heart. The results of this study on how to improve addictive social media design can be used by these platform creators. Even if social media platforms do not want to alter their designs voluntarily, it will further substantiate the critiques from activists and ongoing lawsuits against addictive social media design to possibly still inspire, or force, necessary action from social media platforms. The results of this study will

7.3 Limitations

The current study has some limitations, which are presented below. Some insights and possible solutions on how their influence could have been prevented, or at least limited, are also discussed.

There were a few limitations associated with the initial phase of the study, which involved conducting a survey. One limitation of the survey study is its format. Though surveys are a method that is useful for collecting a large number of results, the level of detail in the answers to the open questions differed a lot. Some answers were incomplete. For example, when asked about sentiment and reason, sometimes only a sentiment was given. Other methods, such as interviews, allow for far more in-depth results. Where answers are too limited to interpret clearly, an interview would have allowed for further questions and discussions to get a deeper understanding of a participant's answer. Future research on this topic could include interviews on how people use social media, to gain a more in-depth understanding, and will give researchers the opportunity to get further information about certain questions.

Another limitation is that there were a handful of instances where the answers did not match the questions. One question, *"Which types of social media notifications do you find useful?"* was even answered by one participant with *"I don't understand what you mean"*. Likely, this participant did not understand what differences there could be between social media notifications. The survey questions were only pre-evaluated by people knowledgeable in human-computer interaction. To target even the less tech-savvy social media users, a pilot study should have been conducted with such individuals. Then, the answers could have been tailored better to all participants' knowledge level of social media. Future research should aim to be mindful of how questions are worded and presented to a participant, by conducting more extensive pilot studies.

The secondary phase of the study, the interview, also presented several limitations. One prominent limitation is

that participants were not able to test out the design proposals. All data gathered in the interviews come down to hypothetical answers i.e. *"I think this is how I would feel when using..."*. Conducting an experiment where participants actually use social media with the proposed designs could be highly beneficial in creating confident conclusions about the proposed designs. This was mostly excluded due to the fact that a high amount of evaluated features were aimed to be evaluated. However, alternatively, a prototype could be created. Since compulsive social media use is most associated with smartphone apps, it should be tested in these versions of social media platforms. However, it is not possible to make differences to the UI of smartphone apps that are not already options from the apps themselves. This is unlike web-based versions, where plugins can be incorporated as a form of implementing the design solutions, but testing web-based versions would lead to inauthentic experiences for most social media users. A possibility is that future studies could collaborate with existing platforms to test the proposed design solutions in their apps. Instagram has already previously experimented with the removal of likes to decrease social comparisons. When testing, the format could be a diary study, where the participant tracks their regular usage for a week and then tracks their usage with different feature designs for another week. Then, the usage and opinions on these features can be compared and analysed. This will likely uncover aspects of the design features that cannot be thought of when discussing hypothetical scenarios.

Another limitation of the interviews is that the solutions proposed by the participants have not been evaluated by other participants. Thus, the status of each participant's proposed design alternative to addictive elements is that it is likely a good implementation for that particular participant who suggested it. This is not substantial enough to make any solid conclusions about. Alternatively, a second round of interviews, with both the edited initial solutions and the participants' own solutions could have been done. Although interviews provided interesting insights into new design ideas, focus groups could even further enhance creativity when thinking of new solutions, as participants can build on each others' ideas. This would have also allowed opportunities for other participants to comment on these suggestions and share their thoughts about them. Then, newly suggested solutions could immediately be evaluated. A future study could either implement more interviews or implement focus groups in its experiment design.

A limitation that both studies share, though particularly apparent with the interviews, is that the demographics of the participants were fairly limited. The participant demographic skews towards a younger age and the majority of participants were female. As described, gender and age may have an impact on how social media is used and perceived since studies have shown that people of different ages and genders tend to use social media differently [37] [20]. Alternatively, more care should have been taken to include a wide range of participant demographics, to ensure that results speak of the wider range of social media users. This should also include participants from different cultures. This current study only included Dutch-speaking citizens in the Netherlands due to convenience and snowball sampling. Cultural background and country of residence may also have an impact on how addictive social media design is experienced and perceived. For example, popular social media platforms differ significantly from countries like China compared to the Netherlands [90]. Thus, the results are not only applied to a specific age and gender group, they only count for Dutch-speaking residents in the Netherlands.

7.4   Future Work

Future work should all take into account the previously discussed limitations and the corresponding alternative decisions and experiments that could provide more conclusive and expansive research. Next to remedying the limitations, there are also additional opportunities to delve deeper into the subject matter of this thesis for future studies.

Overall, very little scientific research has been done on addictive social media design and how it affects users. Though this thesis studied several features that were identified as addictive based on the literature review, it is unclear whether other social media features may also possibly be addictive. Though participants in the interview sessions were asked if they felt like any other feature may be addictive for them, where no other features were identified, the small sample size means that any possible other addictive features cannot be excluded. Future research should experiment with altering other features as well, to see if it has any impact on a user's behaviour.

Extensions to the currently studied features can also be made when studying them. For example, notifications on the start screen, outside of social media, were the main focus of the current study. However, notifications, as they appear inside an app, may also have an effect on the user, or other types of notifications such as e-mails may also have an impact. For example, Linkedin sends e-mails to users when they receive a message, without sharing its content, thus hiding intent similar to notifications on the start screen. Another way to extend the currently studied features is to study their implementation outside of social media. Though this cannot apply to features like the typing indicator, the comparison of the streaks feature and how it is incorporated in the language-learning app Duolingo was made by some participants. This feature could thus be studied in a different context like Duolingo, perhaps to confirm it is toxic only in social media like Snapchat, or to confirm it may be toxic in other types of platforms as well. All in all, there are plenty of opportunities to delve deeper and expand on the topics handled in the current research.

Another research possibility is to create a tool that educates and informs users on the existence and effects of addictive social media design. It is yet unknown what awareness of addictive features may mean to how a user engages with their social media. Possibly, when a user has been pointed out that a feature like the infinite scroll design is likely to lead to mindless scrolling, they may use social media more consciously. Different types of solutions for addictive social media design can be explored in future research, now that certain features have been established as addictive. Future studies should then research the long-term effects of awareness about addictive social media design.

Lastly, based on the literature review and confirmed by the survey study, it was found that adolescents are especially prone to excessive and addictive social media use. Furthermore, developmental theories for adolescents indicate that they may be especially sensitive to addictive design features, compared to adults [23]. For example, according to previous studies, adolescents may be more prone to social comparison, especially on social media, as social comparison is linked to the addictive likes system. During the interviews about addictive design elements, multiple participants brought up certain elements, like streaks, and how they were more invested in them during their teenage years compared to their current level of interest as an adult. Thus, studying this topic with this demographic could lead to even more compelling and conclusive results compared to this study.

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A   SURVEY SCREENS

Dear social media user, it's great that you want to participate in my research! For many people, social media is the primary source of social contact, entertainment, and news. That's why I'm conducting research on how you use social media and what you think of it. By reflecting on your social media use, I'll receive the necessary data for my research, and you might learn more about yourself!

This survey is part of a thesis research for the Master's in Human-Computer Interaction at Utrecht University. It will take approximately 10 to 15 minutes to complete.

To participate, you must be 18 years or older. All answers will be completely anonymized. Your answers in this survey will only be used for this thesis research. You can always stop during the survey. Then, your answers will not be saved and will not be used for the research. By completing and submitting the survey, you consent to the use of your answers as data for this research.

If you have any questions or comments, please do not hesitate to contact Paulina Moerland (p.moerland@students.uu.nl).

○ I have read the information sheet and understood it.

→

Before we begin I would like to ask a few short questions in order to get to know you better.

What is your gender?

○ Male

○ Female

○ Non-binary

○ I would rather not say

What is your age?

○ 18-25

○ 26-35

○ 36-45

○ 46-55

○ 56-65

○ 65+

Do you use social media? If selecting "no", the survey will end

○ Ja

○ Nee

Which social media do you use?

- ☐ Whatsapp

- ☐ Snapchat

- ☐ Instagram

- ☐ Facebook

- ☐ Twitter

- ☐ Linkedin

- ☐ Pinterest

- ☐ Youtube

- ☐ TikTok

- ☐ Others

Do you use the following social media **passively** (= consuming content: viewing posts, such as videos and comments, posted by other users) or **actively** (= offering content: placing your own posts and comments and chatting)? Select N.A. if you do not use them.

	Only actively	Mostly actively	Passively and actively	Mostly Passively	Only passively	N.A.
Whatsapp	○	○	○	○	○	○
Snapchat	○	○	○	○	○	○
Instagram	○	○	○	○	○	○
Facebook	○	○	○	○	○	○
Twitter	○	○	○	○	○	○
Linkedin	○	○	○	○	○	○
Pinterest	○	○	○	○	○	○
Youtube	○	○	○	○	○	○
TikTok	○	○	○	○	○	○

In case you use social media actively, which type of content do you share?

For example: personal pictures, funny videos, links to news articles.

In case you use social media passively, which type of content do you share?

For example: pictures of friends, funny videos, news articles.

How many hours per day do you think you spend on social media in total?

○ Less than 1 hour per day

○ 1 to 3 hours per day

○ 3 to 5 hours per day

○ 5 to 7 hours per day

○ More than 7 hours per day

Which moments are you prompted to use social media?

For example: when you receive a notification or when you are sitting in a train.

[   ]

Which moments are you prompted to close social media?

For example: when you reach the end of the feed, or you are interrupted.

[   ]

Do you use social media with notifications?

○ Yes

○ No

Do you use social media where you can see when others are typing?

For example: Whatsapp, Snapchat, Instagram, etc.

○ Yes

○ No

Do you use social media with streaks?

For example: Snapchat.

○ Yes

○ No

Do you use social media with likes?

For example: Facebook, Instagram, Linkedin, etc.

○ Yes

○ No

→

Do you react to social media notifications?

- ○ Immediately
- ○ As soon as possible
- ○ At a later time
- ○ When it suits me
- ○ Never

To which types of social media notifications do you react?

Which types of social media notifications do you find useful?

Do you spend more attention on notifications or scrolling through your feed?

○ Only scrolling through my feed

○ Mostly scrolling through my feed

○ Scrolling through my feed and notifications equally

○ Mostly notifications

○ Only notifications

Have you ever edited the settings for your notifications?

For example: Silent notifications or completely turned off.

○ Yes

○ No

If yes, how and why did you edit notifications and for which social media?

Do you stay longer on social media when you see someone else is typing in a chat?

○ Never

○ Sometimes

○ Often

○ Always

What do you think of the ability to see that someone else is typing?

What do you think of how others can see that you are typing?

→

What do you think of streaks?

Do you open social media with the purpose of maintaining your streak?

○ Never

○ Sometimes

○ Often

○ Always

How do you feel when a (long) streak breaks?

→

What do you think of social media likes?

[ ]

Do you check how many likes your social media posts receive?

○ Never

○ Sometimes

○ Often

○ Always

Why do you or do you not look at social media likes?

[ ]

Have you ever changed the settings of likes? If yes, why?

For example: likes can be turned off on Instagram.

[ ]

→

How do you feel about the way you spend time on social media?

○ Very dissatisfied

○ Dissatisfied

○ Neutral

○ Satisfied

○ Very satisfied

Would you like to use social media differently than you do now?

○ Yes

○ No

Have you ever tried to change the way you use social media?

For example: decrease screen time, seek out more valuable content.

○ Yes

○ No

If yes, how have you tried to change the way you use social media?

→

B   INTERVIEW PROTOCOL

Starting the interview:

Re-introduce the topic at hand:

- Remind the participant of the previous survey: "*In the previous survey, you were asked to share how you use certain features in social media and how you feel about them. The features you evaluated, like your feed, were found to be 'addictive', meaning they are made to make you use social media maybe more than you like or plan to*".
- Explain what has been concluded from the survey and make a connection to this interview and explain briefly what the interview will be about: "*Based on the answers in the survey, I have made some proposals on how these features could be changed for the better. Together, we will take a look at these ideas, and think of new ones, and discuss whether you think they are effective in being less addictive, but are still useful, practical or fun*".

Consent:

Provide consent:

- Ensure participant is aware that the results of the interview will be anonymized.
- Ensure participants are aware that the produced data will be used only in this research.
- Ensure participants know they can stop at any for any reason.
- Ask for permission for an audio recording.
- Start recording, if permission is given.

Main interview:

(As a semi-structured interview, this is not the full set of questions for each participant, but the base set of questions is open to changes and expansions based on the participant's answers. Adjust questions according to survey results. A participant must use a feature to adequately answer questions about it. I.E. if a participant does not use the streak feature, its questions will be skipped,).

1. Get further information on how the participant would like to change their social media use and how they perceive tools for behaviour change:

- Confirm interest in behaviour change is still there since the survey.
- Would you like to change anything about your social media use?
- Ask further questions on why and how they use social media in this way:
    - Why do think you use social media like this, despite wanting to use it differently? Have you tried to change this behaviour?
    - If so: how have you tried to change this behaviour?
    - Why did it, or did it not work out? Why?
    - If not: any particular reason as to why not?
    - Are there any social media platforms where you feel like this behaviour occurs the most?
    - Do you think this behaviour may be influenced by how social media is designed? If so, how?

2. Introduce this phase of the interview: discuss current designs and potential "healthier" design solutions and think of new solutions for these designs together. Discuss one addictive design element at a time:

Infinite scroll:

- Do you ever find yourself mindlessly scrolling? *(if not already part of mentioned behaviour change. Otherwise, stress the topic again.)* How do you feel about this?
- Show slide 1 (figure 31 in appendix C).
- Do you understand the difference between the infinite scroll vs. pagination vs. "load more" navigation.
    - Do you think the infinite scroll has an effect on your scrolling behaviour, as opposed to paginated content?
    - Do you think that making a paginated or "load more" feed would alter your behaviour? Do you think it is still nice to use then?
    - Do you think there is a difference between pagination and "load more"?
- Do you think that certain content helps you scroll mindlessly?
- Do you think that certain content makes you stop scrolling mindlessly?
    - Do you think it would help to purposefully include this content? Maybe at the end of a paginated or "load more" feed?
- Show slide 2 (figure 32 in appendix C).
- Do you think it would help to set a "scrolling limit" for yourself? E.g. you can only scroll 15 minutes a day.
    - Do you think you would then like to receive a pop-up that says: You've reached your limit.
    - How do you think this message should be presented?
    - Do you think a message should be firm or kind? What would work for you?
- Do you have any other ideas to help stop mindless scrolling?

Notifications:

- Do notifications make you start using social media? *(if not already part of mentioned behaviour change. Otherwise, stress the topic again.)* How do you feel about this?
- Show slide 3 (figure 33 in appendix C).
- Do you think that filtering certain notifications could help?
    - Which types would you filter out?
    - Do you think it could help to filter out notifications from certain people or types of chats? Do you maybe have an example where you might do this?
- Do you think that adding certain information, like message content, would help? For example showing the first sentences of the message or the full message.
- Do you think it would be helpful to add priority labels to certain types of notifications?
- Show slide 4 (figure 34 in appendix C).
- Do you think the order in which notifications appear may have an effect?

- Do you think delaying notifications, e.g. after school/work hours could prevent you from compulsively starting up social media?
    - How do you feel about the senders of notifications being aware you have set specific limits to their notifications? Would you rather it be hidden?
    - Should people get a message you are delaying their notification?
    - Should people be able to override this?
- Do you have any other ideas to improve engagement with notifications?

Typing indicator:

- Do you ever stay longer in a chat when you see someone typing?
    - Do you do this with specific types of conversations, or anytime you see it?
    - Do you think this is useful? Or maybe only in certain situations?
- Show slide 5 (figure 35 in appendix C).
- Do you think that it would help if you see someone typing, only when you are in a chat?
- Do you think the time it appears has an effect? Do you think the indicator should disappear or change after a few seconds?
- Do you think it would help to see what someone else is typing?
    - Would you be ok with someone seeing what you are typing?
- Do you have any other ideas to improve engagement with the typing indicator?

Streaks:

- Do you like to use the streak feature?
    - Why do you like to use it?
    - Do you know your highest streak number (approximately)?
- Do you ever open up a social media app only to retain your streak? *(if not already part of mentioned behaviour change. Otherwise, stress the topic again.)*
- As streaks can be stressful *(if experienced by the participant. Otherwise: Streaks can be - experienced as stressful by some)*, do you think it will still be fun if made more lenient?
- Show slide 6 (figure 36 in appendix C).
- Do you think it would help to add some kind of "streak freeze" for busy days?
- Do you think it would help to make streaks not for days, but for weeks?
- Do you think it would help to make streaks a total tally instead and not need it to last consecutive days?
- Do you have any other ideas to improve engagement with streaks?

Likes

- - Do you care about the likes you get? When and why?
- Do you think this has any effect on the way you post on social media?
- Do you look at the amount of likes others get? When and why? *(if not already part of mentioned behaviour change. Otherwise, stress the topic again.)*
- Are you more likely to check out a post if it has a lot of likes?
- Show slide 7 (figure 37 in appendix C).
- Do you think it would help to make likes invisible for everyone but your own post?

- Do you think setting a limit to likes could help? E.g. you get 5 opportunities to give a like each day.
- Do you have any other ideas to improve engagement with likes?

3. Discuss screen time trackers as an existing solution *(if not already mentioned in section 1.Otherwise: ask the following questions at that point).*

Screen time trackers:
- Have you ever used a screen time tracker? What do you think of seeing your screen time?
- Do you think it is encouraging or discouraging to see your usage?
- Do you think it has helped you/would it help you?
- Would you like for systems to give you suggestions or would you rather make your own decisions? E.G. *"you spend most time in Instagram, maybe you should aim to halve this time".*
- Is there any other way for screen time trackers to improve?

Further design ideas:
- Do you think any other features could influence your behaviour?
    - Why do you think so?
    - How do you think these features can be positively altered?

Closing:
- Repeat key points of what the participant has stated.
- Ask if the participant has anything else to add to the discussion.
- Thank the participant for their time.
- End recording, if permission was given.
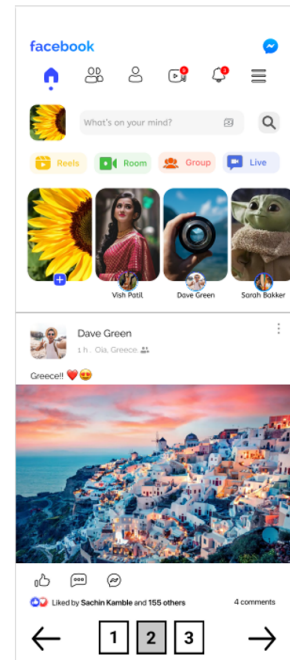
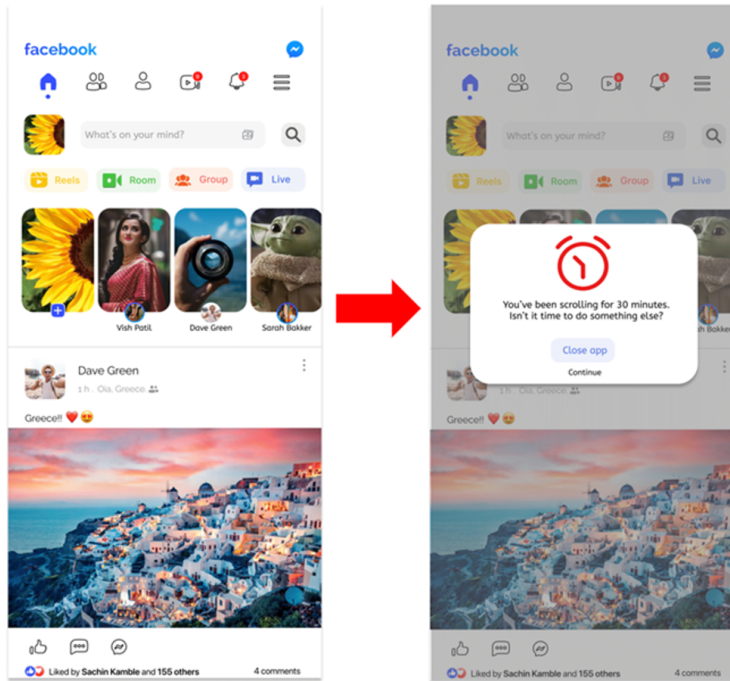## C INTERVIEW FIGURES

Standard:
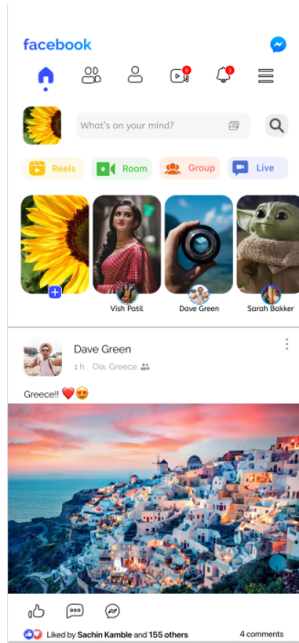
"load more":
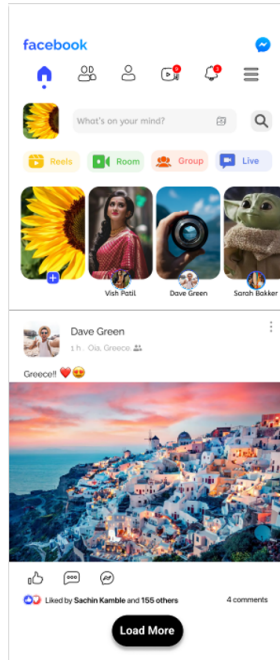
pagination:

Mindless scrolling

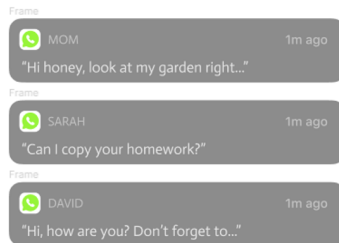Fig. 31. An example of the infinite scroll and "load more" and pagination alternatives.
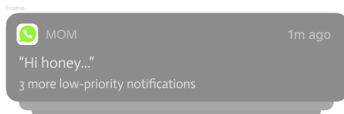
App limit pop-up:

Mindless scrolling

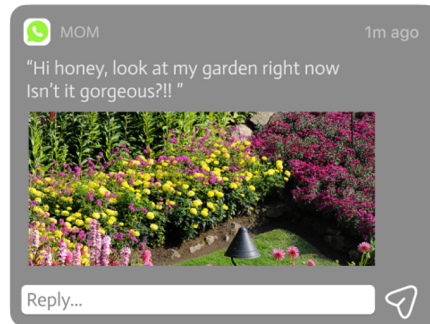Fig. 32. An example of a screen time pop-up.
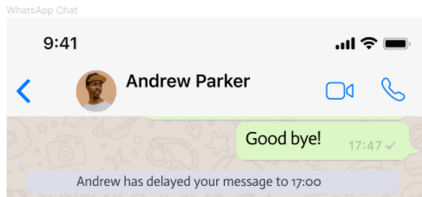
Standard:

Set priority:
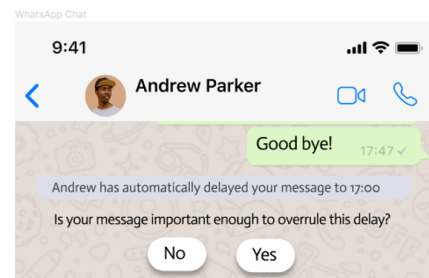

Full message:

No content preview:

Notifications

Fig. 33. Different types of notification designs and features.

Set a delay for notifications:

Overrule delays:

Notifications

Fig. 34. An example of how a notification can be delayed.

Standard:
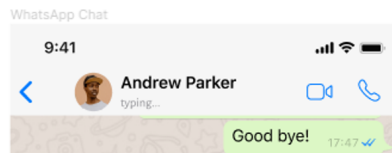

Changes with time:

See what the other is typing:
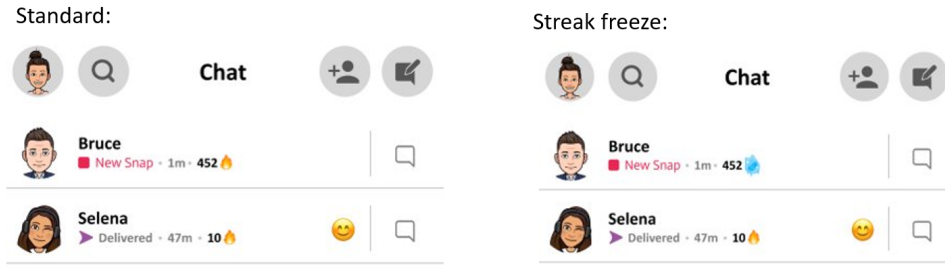

See how much the other is typing:

Indicator *only* inside the chat:

Typing indicator

Fig. 35. Design alternatives for the typing indicator.

Standard:

Streak freeze:

Bruce
New Snap · 1m · 452 🔥

Selena
Delivered · 47m · 10 🔥

Bruce
New Snap · 1m · 452 ❄️

Selena
Delivered · 47m · 10 🔥

Streaks

Fig. 36. An example of the streak freeze feature.

Standard:

👍 💬 ⊘

Liked by Sachin Kamble and 155 others

Likes limit:

❤️ You have 3 likes left

Liked by You and 156 others

Invisible likes:

👍 💬 ⊘

Liked by Sachin Kamble and others

Likes

Fig. 37. Design alternatives for the likes feature.