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Engagement-driven Strategies on Social Media: User
Perceptions and Implications for a Digital Advice Tool

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Abstract

Social media platforms have shifted from primarily facilitating social connections to optimising user engagement through a range of engagement-driven strategies (EDS). Increased engagement with these platforms and time spent on them have been associated with cognitive, emotional, and autonomy-related consequences. Although European regulations aim to increase transparency and user choice, these formal safeguards do not always translate into effective control for users, as available options are often unclear or difficult to use in practice. Against this background, this study adopts a user-centred perspective on EDS.

This research first identifies a set of visible and non-visible EDS used by social media platforms and relates these strategies to underlying psychological mechanisms. Subsequently, a survey study examines how users perceive these strategies in terms of noticing, perceived usefulness, perceived manipulation, perceived increase in time spent, and preference for disablement options. Finally, the study explores how these insights can be translated into a digital well-being advice tool through a participatory design process.

The findings show that EDS differ substantially in how they are noticed and evaluated by users. Strategies that operate largely in the background are less likely to be consciously noticed, which limits users' ability to evaluate and manage their influence. Across strategies, perceived manipulation is more strongly associated with perceived loss of control, habitual use, and spending more time than intended than with perceived usefulness. Moreover, a strong relationship is observed between perceived manipulation and users' preference for disablement options.

Building on these findings, the developed advice tool (tool.emilebol.nl) demonstrates how users' experiences of EDS can be translated into personalised, non-normative guidance. By focusing on awareness, transparency, and perceived control, the tool illustrates how design-oriented interventions can support users in managing their social media use in line with their own preferences.

Contents

1 Introduction

In 1998 filmmaker Frans Bromet asked people on the street if they had a mobile phone and whether they were interested in one [Bro98]. Only one person thought it was a handy invention, almost all of them did not see the purpose of it. People did not see the point of being able to stay in contact with each other at all times. Most people said that if someone wanted to reach them, they can send them a letter or, if they needed a response quickly, call their home phone. Times have changed at a rapid pace. Many people today could hardly imagine how limited the role of mobile phones is in this video.

Since this video, a lot has changed. In 2024 97% of the young people in the EU (aged between 16 and 29 years old) used the internet on a daily basis and even more importantly 88% of the young people in the EU used social media on a daily basis [Eur25]. This effect is especially prominent among youth, but the whole world has changed. Society has reached a point where social media has become part of daily life. Much communication goes through social media; schools, restaurants, important political figures and even cities and countries have an Instagram account. When a candidate applies for a job, there is a good chance that the interviewer will look them up on LinkedIn. Much of our communication has shifted from offline to online.

While the results vary, a study reports that the average social media usage of teens per day is 4.8 hours [Dem25]. A simple calculation converts that to 33.6 hours per week, which comes close to the time of a full-time job. Not only does social media take a lot of time, it also is associated with consequences for users, such as cognitive performance and mental health. Research indicates that excessive social media usage is linked to several cognitive effects like impaired attention, reduced working memory, and diminished executive functioning. [NMKJ25] Also, a significant correlation exists between problematic social media use and depression, anxiety and stress. [SBV+22]

Despite these documented disadvantages, social media platforms continue to be used extensively. Part of this can be explained by the way social media fits smoothly into everyday routines. Platforms benefit from high and frequent user engagement, because their business models depend on attention and data. Many design features are built to encourage repeated use, which can make social media part of users' daily routines. As a result, people not only use social media because they enjoy it, but also because the design of the platforms facilitates frequent checking and longer sessions. This can partly be explained by engagement-driven strategies (EDS).

To prevent this from getting really out of hand, the EU created acts to set limits on how far social media platforms can go. This is to prevent platforms from manipulating their users and also to make sure platforms are somewhat transparent about their ways of using algorithms in their platforms and give users some control over these algorithms. The Digital Services Act of 2022 [Eur22] states for example that big platforms should provide users an option to turn off the recommending algorithm that profiles content for the users. Although this should give users some sense of control, it is not always clear how and where this option is offered. This can lead platforms to place this function deep in their settings, which can reduce discoverability and make the feature harder to find. The speed of platform innovation makes it difficult for governments to create stable and updated limits.

Although this regulatory race can require substantial effort from both governments and platforms, it does not necessarily lead to immediate improvements in usability or perceived control for users. In these discussions, the primary focus often tends to lie on compliance rather than on users and their experience. There is limited research on how users perceive EDS and the algorithms that

shape their feeds. Against this background, this study focuses on users. This study identifies EDS that platforms use to stimulate user activity. This was then used in the survey to examine how users think about the strategies in terms of helpfulness and manipulativeness. Finally, this information was used for finding out how a tool can help users understand and manage these strategies. This tool should support users in regaining a sense of control over their social media experience.

2 Background and Literature Review

2.1 Generations of social media

When Facebook launched in 2004, the experience for the users of the platform looked fundamentally different from what we see today. Social media developed over time. The development of social media is often described as consisting of two generations: 'networked publics' and 'clustered publics'. Generally, the first generation was about the network of and between the users, while the second generation is more about constructing neighbourhoods of users based on their behaviour on the platform. [Ger24]

The first generation, 'networked publics', was centred around the people and their explicit connections. The platform creates an online environment and the users construct the public. The users constructed their connections and thereby largely determined what appeared in their feed (the personalised stream of content presented by the platform). Friends lists, profile pages, visible network structures and manually created connections played a central role. [Boy10]

With the rise of TikTok, a second generation emerged. Gerbaudo describes this as 'clustered publics'. This generation is less about explicit social connections, but is rather about algorithmic clustering based on shared interests, algorithmic matching and behavioural patterns. Here, the connection between people is less important and the content that users consume plays a major role. [Ger24]

This development of content selection, is important for this research. The control over what was shown to users in the first generation lay primarily on the users' side, because it was determined by their contacts, which they selected explicitly. However, in the second generation this selection is no longer based on explicit decisions by users, but on a complex system that relies on a recommender system (an algorithmic system that selects and ranks content for users). This development causes a decrease in transparency in why the users get to see what they see, also called their 'feed'. [Ger24]

Another important difference is the production and consumption of the content. In the networked publics, a big part of the platform was users posting status updates, photos and comments. This transformed into the clustered publics, where the users primarily consume content rather than posting for their networks. [Ger24]

2.2 Surveillance Capitalism

This raises the question of why platforms changed in the first place. Zuboff provides an explanation by describing a new form of capitalism, called 'surveillance capitalism' [Zub19]. This model explains how engagement and data from users can increase the revenue for the platforms.

The behaviour of the users on the platform is captured as data. This includes clicks, likes, comments, watch time, how and when the users open and close the app. All this data is used

to make predictions about the behaviour of their users. Predictions can concern what users are interested in or how they are likely to respond.

These predictions are economically valuable, as they can be used to support targeted advertising. Accurate predictions are very valuable for advertisers, because they can be used to run more targeted ads, by finding the potentially interested users and predicting how they will react. These predictions can also be reused to compose a new feed for the users, which again generates data that can improve the predictions. This makes it possible to create a personalised feed and enables platforms to test their predictions directly on the same users. This closes the reinforcing feedback loop, which makes the quality of the predictions even more valuable.

To optimize this process, the platforms need more, richer and more continuous behavioural data from users. To improve these, the users should spend as long as possible on the platforms, be shown different forms of content and stimuli and return to the platform as often as possible. These are all goals to increase engagement of the users, which has become a core goal for social media platforms.[Zub19]

2.3   How platforms maximize engagement

The previous subsection pointed out why engagement is important for platforms. This subsection examines how platforms attempt to increase engagement.

Hooked is a book, written by Nir Eyal, which describes what is important in order to increase engagement. This is explained by a loop of 4 stages: trigger, action, investment, variable reward. The trigger initiates the desired behaviour. This can be external, such as a notification, or internal, like a habit. The action itself is done by the user, for example opening an app. This action should be quick, easy and in anticipation of a reward. The reward itself should be unpredictable, like the next video on your feed: is it funny or not? According to Eyal, the unpredictability of the reward is an important factor in the habit-forming. The investment stage refers to situations in which users provide the product with something that increases the likelihood that they will return [Eya14].

While Hooked describes how this loop is applied in practice, behavioural psychology explains why it is effective. In particular, research on schedules of reinforcement shows that unpredictable, variable rewards are especially powerful in shaping and maintaining behaviour [FS57]. There are different schedules to reward the desired behaviour. The schedule that produces by far the most persistent behaviour is variable ratio. This means that the rewards come after a certain number of responses, but this number varies unpredictably. The fact that the next reward might be 'one action away', increases the response rate and makes it highly resistant to extinction.

Dopamine provides the neurobiological explanation for this pattern. Dopamine doesn't simply create pleasure, but signals when an outcome is better or worse than expected, this mechanism is called the 'reward prediction error'. When behaviour occasionally leads to an unexpectedly positive outcome, dopamine activity increases, strengthening the chances of repeating that behaviour [Sch98].

2.4   Consequences of social media: Cognitive, Emotional, and Autonomy-Related

While these mechanisms are highly beneficial for the platforms themselves, they may conflict with the health and well-being of users. There is a lot of research done on the consequences of using social

media for the human brain and body. The design choices not only influence how often users interact with the platform, but can also influence how the users think, feel and exercise control. These concepts transformed into psychological categories are cognitive, emotional and autonomy-related consequences. Together, these consequences form the basis for understanding how users perceive and respond to engagement-optimizing platform design.

Engagement-optimizing features on social media influence core cognitive processes, such as attention, working memory and executive functions. A study showed that excessive use of social media was associated with impaired attention, reduced working memory and diminished executive functioning, particularly among adolescents with social media addiction. This effect was even stronger found among adolescents [NMKJ25]. An empirical EEG study showed patterns of how social media affects the brain. The effect of social media use was an alteration in brainwave patterns that resemble responses that are seen with addictions. [SSBJ25].

EDS in social media do not only affect the cognitive processes, but also the emotional experiences of users are affected. There is a significant correlation found between problematic social media use and depression, anxiety and stress. This research also emphasizes that these outcomes appear to be driven by variable reward systems, infinite scrolling and the psychological mechanism of behavioural addictions [ZZ+22]. Another research focussed on the Fear of Missing Out (FOMO) and found that higher levels of FOMO are associated with increased problematic social media usage. The combination of social media and FOMO creates a cycle: the user experiences FOMO, this drives the user to check social media more frequently, this exposes them to content of others' experience, this intensifies the FOMO and reinforces the urge to check social media more frequently again.

Beyond cognitive and emotional effects, engagement-driven design also has consequences for the human autonomy. Autonomy here means perceived agency over attention, time, and behaviour. Compulsive social media usage is significantly related to lower self-concept clarity. Adolescents exposed to diverse identities and social comparison on social media struggle to develop a clear, stable sense of who they are. This causes them to experience their behaviour as less self-endorsed, reducing the autonomy satisfaction [Hoe25].

2.5 Regulation

EDS in social media platforms are not only studied from a design or psychological perspective, but are also a regulatory concern. This makes regulation a relevant contextual component for a user-centred study. This subsection focuses on regulations in the European Union, as this is the context in which the research takes place and therefore the most relevant regulatory framework for this study. Rather than analysing regulation exhaustively, this section focuses on those regulatory aspects that are specifically relevant to EDS, such as algorithmic systems and user choice.

The Digital Services Act (DSA) is a central EU regulation in force since 2022 that addresses how platforms algorithmically curate content [Eur22]. Article 27 of the DSA requires providers of platforms to set out the main parameters used in their recommender systems as well as any options to modify or influence these parameters. Article 38 obliges providers of very large online platforms and very large online search engines to provide users "at least one option for each of their recommender systems which is not based on profiling" [Eur22]. In practice, this means that the platforms examined in this research should offer users the option to receive a feed that is not based on profiling, resulting in a feed consisting of non-curated or "random" content. 'Profiling' is defined in the DSA as the automated processing of personal data to evaluate or predict aspects of

an individual's behaviour, preferences, or interests, for example by using prior viewing behaviour, likes, or interaction history to personalise a user's content feed. Together, these articles from the DSA aim for transparency and user choice, however this implicitly assumes that users are aware of these options and are able to make use of them.

The Artificial Intelligence Act, adopted in 2024, constitutes the European Union's first comprehensive regulatory framework for artificial intelligence systems [Eur24]. This regulation introduces a risk-based approach, distinguishing between unacceptable, high, limited, or minimal risks. For this research, Article 5 is the most relevant. Article 5 prohibits an AI system that uses specific, extreme forms of manipulation that materially distort behaviour and are likely to cause significant harm. The AI Act defines manipulation much more narrowly than psychology research does. As a result, most EDS on social media platforms operate within a legally permissible grey zone: they may influence user behaviour, but generally do not meet the legal threshold for prohibited manipulation.

Although the EU sees the urgency of defining regulations for social media platforms, there remains a gap between formal and practical control. What regulation guarantees on paper does not always meet what users can actually notice, understand, and use. These regulations assume a rational, informed user, while the user does not always know which options exist. Regulations assume transparency leads to understanding and choices lead to control, while explanations are not clear for every user and settings may be hidden or fragmented. Because regulation focuses on formal safeguards, it remains an open empirical question how users experience, interpret, and make use of these controls in practice.

Taken together, current EU regulation reflects growing concern about the influence of EDS and algorithms. At the same time, these regulations have limits in offering a solution for users in everyday platform use. This highlights the relevance of the user experience perspective, as an addition to the legal and technical perspective.

2.6 State of the art

Research on engagement-driven social media design spans a wide range of perspectives, including technical studies of recommender systems and research on cognitive or neurological effects of platform use. Within this background chapter, the focus is placed on user-centred literature that examines how users perceive, interpret, and evaluate EDS in everyday platform use.

Existing user-centred research on EDS has primarily examined whether users are aware of algorithmic content curation and how they understand this process [ÖHWH23]. Studies consistently suggest that awareness and understanding are unevenly distributed across users, with many holding incomplete or inaccurate mental models of how algorithms function [ZHdV21]. Research on awareness tends to focus on algorithmic feeds in general or on single EDS, while comparative analyses of awareness across different strategies remain limited.

Beyond awareness, existing research has examined how users evaluate EDS in terms of perceived usefulness, manipulation, and autonomy. Findings indicate that users often experience engagement features ambivalently, describing the same mechanisms as both convenient or enjoyable and overly intrusive or controlling [Rad20]. Again, much of this work focuses on individual mechanisms in isolation, offering limited comparative insight into how different EDS are evaluated relative to one another.

Despite this growing body of research, several gaps remain. User-centred studies tend to examine awareness and evaluation separately, and often focus on algorithmic feeds or single EDS rather

than comparing multiple strategies within one integrated framework. As a result, there is limited insight into how users simultaneously notice and judge different EDS in terms of usefulness, manipulation, and perceived impact on time spent. Moreover, existing research rarely examines how these perceptions translate into users' preference for disablement options for specific features or manage them in line with their own preferences. Finally, while digital well-being tools and platform controls exist, there is limited work on user-centred advice tools that explicitly build on users' perceptions of EDS and support more deliberate, preference-aligned choices. These gaps motivate the present study.

3 Research Questions

3.1 Problem statement and aim

Although the topic of social media is widely discussed, the perspective of users themselves is often underexplored. This thesis aims to shift the focus back to users by examining how they perceive EDS on social media platforms and how they can be supported by a digital tool.

3.2 Main Research Question

The main question of this thesis is:

> How do users experience engagement-driven design strategies on social media platforms, and how can a digital tool support users in increasing awareness and regaining control over their social media use?

3.3 Sub-questions

To address the main research question, the following sub-questions are formulated:

1. **RQ1:** Which engagement-driven design strategies are used by social media platforms, how do they work, and what psychological mechanisms underlie them?

2. **RQ2:** How do users notice engagement-driven strategies and evaluate them in terms of usefulness, manipulation, perceived increases in time spent, and preferences for disablement options, and how are these evaluations associated with users' self-reported social media use

3. **RQ3:** How could a digital well-being advice tool be designed to support users in increasing awareness of engagement-driven design strategies and regaining perceived control over their social media use?

3.4 Scope

This thesis focuses on social media platforms that expose users to algorithmically recommended or engagement-optimised content. The selected platforms are: Instagram, YouTube, YouTube Shorts, X, TikTok, Facebook, BeReal, Snapchat, LinkedIn, and Pinterest.

Chat-focused applications such as WhatsApp are excluded, because they do not provide a feed or content discovery mechanism in which EDS typically appear. The included platforms correspond to what is described in the background theory as second-generation social media, characterised by algorithmic recommendation and clustering based on user interests.

3.5   Relation to research design

Since social media platforms are not transparent about their EDS, and because many of these strategies function unnoticed, RQ1 is about identifying and describing these strategies in detail. This also includes understanding how they work technically and which psychological mechanisms they rely on. Once the strategies have been identified, the participants can be asked about them in the survey.

In order to find the real needs of the users, RQ2 investigates how users perceive these specific strategies. For each strategy, we look at whether users notice it, whether they find it useful or manipulative, whether the feature causes them to spend more time than intended, and whether they would prefer to disable it. Based on these results, decisions can be made about the tool itself, for example in which cases it should warn users or which strategies are most commonly experienced as manipulative. The findings of RQ2 make it possible to understand which strategies are experienced as problematic and which are valued, providing essential input for the design of the tool.

Finally, RQ3 builds directly on the outcomes of RQ1 and RQ2. Using the identified strategies and user perceptions, this question explores how a digital well-being advice tool can be designed to support users.

4   Method

This research consists of three sub-questions, each requiring different methods, operationalisations, and analyses. To answer these questions properly, each question is treated individually, which is described in a separate chapter.

RQ1 is answered based on literature review and existing academic frameworks and therefore does not involve participants. RQ2 and RQ3 are answered using participants.

In RQ2, the participants completed a survey about their perception of the different EDS and reflect on their own social media behaviour. This provided the quantitative part of the research. Once the answers to the survey are collected, RQ3 focuses on the development of the tool. This was done in a participatory design setup. The participants helped individually design and develop a tool based on the output of the survey and their needs. The goal is not a fully functional product, but rather a clickable prototype. This phase was primarily qualitative, as it takes more time to go deeper into the wishes and needs than the first phase.

The recruitment of participants in RQ2 was done by spreading a message, containing a small explanation about the research and a hyperlink to the survey. This message was spread via the researcher's personal network. At the end of the survey the participants were asked whether they are interested in leaving their details for a follow-up study for the tool. If so, they were directed to another survey to leave their details.

The following sections dive deeper into the methods, materials, setup and results and deal with these research questions one by one.

5 Engagement-driven Strategies

In this chapter, the term 'strategy' is used to refer to an engagement-driven strategy as defined in the previous sections.

5.1 Method

In order to identify these different EDS, this research examined three areas. The first area is in scientific papers. Since it is thinkable that this will not cover all of the EDS, the second area consists of non-scientific sources, such as technology news websites, digital policy reports, and journalistic investigations. In some cases there will be a possibility to conduct own observations of strategies, which covers the third area. In this case the strategy will be described in terms of what is observed and in which platforms this is observed.

For each strategy, this research is interested in three things. The first question is 'what is the strategy?', this component identifies the strategies as one. Secondly, this research will examine how the strategy technically works. The third component consists of the psychological mechanisms that are involved the strategy. These things altogether should form a logical identification and explanation of each strategy.

There are two criteria on what a strategy is tested. First, the strategy should influence the behaviour of the user of the platform in terms of engagement: time spent, scrolling length, frequency of returning, etc. Secondly, the strategy should appear across multiple platforms or represents a unique but influential example of engagement design on a major platform.

These strategies are divided between two categories: visible and non-visible. The difference is whether the user is hypothetically able to observe the strategy directly. This can be for example in the user interface. Non-visible EDS cover strategies that happen under the hood and are not visible, even when attended to. The decisions made by recommender systems are for example not transparent and therefore non-visible. It can therefore occur that some strategies are in principle visible, while the logic behind it is invisible, these cases are still be categorized as visible. This division will be used in the results and is necessary for RQ2, because users are limited in sharing perceptions on things they have not seen in some cases.

5.2 Results

This study identified 12 different EDS, 7 visible and 5 non-visible. The first paragraph explains what the strategy is and how it works, and the second paragraph describes the relevant psychological phenomena. The visible EDS are discussed first, followed by the non-visible EDS. Each strategy is discussed following this structure.

5.2.1 Visible

Infinite Scroll   Infinite Scroll is a design choice that has become the standard for almost all major social media platforms. The platforms dynamically load additional content, while the users scroll downwards. This makes it possible for the user to scroll forever. [RMG+23]

Literature describes that the possibility of scrolling forever makes a natural stopping point disappear and possibly causes people to lose track of time [A+24]. Infinite Scroll facilitates the

process of rewarding the user by giving them a constant stream of new experiences. In terms of Eyal's Hooked model [Eya14], this strategy applies to the action stage of the loop, where the desired behaviour should be as effortless as possible.

Autoplay Autoplay is a design feature that plays one video after another without explicit choice or consent of the user. In some cases, the next video automatically plays after another if the user does not cancel this in 5 seconds [CKSS24].

Doing nothing starts the next video in some cases. The status quo bias is a psychological phenomenon that shows that people tend to stay with the status quo (watching videos), even though they are aware that choosing an alternative (stop watching videos) would lead to better outcomes. [SZ88]. This could explain why people would spend more time on a platform due to this strategy.

Pull to refresh Touching the screen, dragging it downwards and then releasing it will trigger almost all of the platforms to refresh the contents of the screen. This is not always just a chronological update. Based on observational analysis of Instagram (December 2025), refreshing the feed frequently surfaced newly recommended videos at the top. These videos did not appear to be newly uploaded content but rather algorithmically selected posts.

Researchers in Human–Computer Interaction (HCI) have been warning against this technique, as it offers a variable reward to the users [MRDR22]. After refreshing, the new video can be more or less rewarding to the user. This mechanism resembles psychological processes observed in gambling. The psychological and physiological mechanisms are explained in subsection 2.3.

Likes count For every item the user encounters in their feed, social feedback metrics such as likes, view counts, shares and reposts are visible. This could influence how much users like what they see.

Research has shown that adolescents are more likely to like photos with many likes than photos with few likes, because high-like posts function as a visible form of peer endorsement [SPH+16]. This research also found that viewing a photo with many likes activated neural regions involved in reward processing, which may help explain why posts with higher like counts appear more appealing to users.

Variable notifications Users often receive notifications from platforms. For the platform, the notifications are tools to bring the users back to the platform. These notifications can come in various forms. They inform the users of events but often also trigger the users to open the platform. For example, Instagram uses machine learning models to decide who receives which notifications and decide when they are sent [Ins25].

In Eyal's cycle, this relates to the 'trigger' [Eya14], as this can initiate the desired behaviour, namely opening the platform and spending time there. In this case, the trigger is external, as platforms send the trigger to users. The same mechanism can also function as a reward. For example, receiving 'likes' is associated with activation of brain circuits implicated in reward processing [SPH+16]. As both the timing and the amount of likes are uncertain, this reward is unpredictable, which characterizes it as a variable reward.

Intermittent feedback   If a platform deploys its variable notifications to its users effectively, users can be pulled back to their platform. The concept behind intermittent feedback goes even further. However, it should be stated explicitly that there is no hard proof that this happens yet. The concept is that if notifications, i.e. likes, are held back and delayed and later combined with other notifications, the trigger becomes even stronger. While there is currently no evidence that this mechanism is used in this way, Instagram already uses machine learning–based algorithms to optimize the timing of notifications [Ins25].

The psychological background partly overlaps with mechanisms underlying variable notifications. The less predictable the content of a notification is, the greater the variability of the reward becomes. This increases the strength of the intermittent reinforcement effect.

Streaks   Streaks are a visible feature that display how many consecutive days a user has performed a targeted behaviour. These streaks can take several forms across different platforms. For example, Snapchat features a 'Snap Streak', which requires users to send at least one Snap within a 24-hour period to maintain the streak. If no Snap is sent within this timeframe, the streak disappears and resets to zero. Such designs encourage users to return to the platform on a daily basis in order to maintain continuity. [Uni19]

From a psychological perspective, streaks rely strongly on loss aversion. Losing an existing streak is experienced as more negative than the effort required to maintain it, which motivates users to keep engaging to avoid losing what they have already built [UXM20]. In terms of Eyal's Hooked model, this strategy is closely related to the investment stage. By investing time and effort into building a streak, users increase their commitment to the platform, making disengagement more costly [Eya14]. In addition, the visible counter provides continuous feedback on progress, which can contribute to habit formation by reinforcing repeated daily interaction.

5.2.2   Non-visible

Emotional amplification   Emotionally charged content, such as hateful or highly negative material, is known to generate higher engagement [SFR21]. The increased engagement results from users responding more frequently, for example by commenting or sharing. Since platforms often aim to increase their engagement, this phenomenon can be used to their benefit. In a pre-registered randomized experiment, Twitter/X's engagement-based ranking algorithm was found to amplify emotionally charged content relative to a reverse-chronological timeline, in which posts are ordered solely by recency rather than by predicted engagement.[Kni23].

Emotion has an impact on the perception, attention and memory of users. Stimuli with higher emotional intensity attract more attention [TASM17]. Negative events or information systematically impact people more than positive ones. This is called the negativity bias [VGW08].

Mood targeting   With mood targeting, the recommender system adapts to the user's (likely) mood. Research has shown that recommender systems can detect the emotional characteristics of content [RRS15]. This can be used to select content that matches the mood of the user.

The current mood of users influences how they evaluate information. When people are in a positive mood, they show more openness, but when people are in a negative mood, they show more impulsive behaviour. This influences what the user enjoys seeing. When content matches a user's

mood, it may feel more relevant, empathetic, and less jarring. This can increase engagement for platforms.

Confirmation reinforcement Recommender systems choose content that aligns with the interests of the users. [LSR⁺22]. This increases the likelihood of users seeing the content that matches their beliefs repeatedly. This phenomenon is referred to as echo chambers [JKC⁺21], in which users primarily encounter their own viewpoints and lack exposure to opposing perspectives.

People dislike holding conflicting beliefs, as contradictory information creates psychological discomfort [FLK⁺11]. The confirmation bias says that people tend to search for, interpret, remember and pay more attention to information that confirms their beliefs [MSGD21]. This helps explain why people engage more with content they agree with. The downside of this is that people do not get exposed to diverse or opposing perspectives, which can reinforce echo chambers. These echo chambers can cause polarisation and even beliefs in conspiracy theories [CEA⁺22].

Variable Reinforcement Research has compared social media to gambling methods such as slot machines [Ins21]. Unpredictable novel content, as well as likes and comments, function as variable rewards. These variable rewards reinforce engagement behaviours.

As explained in section 2.3, variable rewards are the most powerful way to create behaviour patterns. These variable rewards are found on the platforms as well. Unpredictable novel content, as well as likes and comments, relate to variable rewards. Because rewards are unpredictable but possible at any moment, users keep performing the behaviour (scrolling, refreshing, checking).

Manual boosting/Heating Manual boosting or heating refers to when certain content visibility is boosted manually in the recommender system by people who have the power to do so, often platform staff or curators. This involves pushing selected content to gain additional reach, even when the algorithm would not have promoted it naturally. For example, Bytedance, the company that owns TikTok, is accused of 'using the heating button' [BW23].

These manual manipulations of the algorithm can create false impressions about the opinions of other users. Users believe that visibility is determined by the behaviour of other users and content quality. This can erode trust: people may feel the system is "rigged". This gives the platforms a lot of power over their users.

6   Perceptions of Engagement Strategies

6.1   Method

The subquestion of this section is 'How do users notice engagement-driven strategies and evaluate them in terms of usefulness, manipulation, perceived increases in time spent, and preferences for disablement options, and how are these evaluations associated with users' self-reported social media use'. This question is focused on the perception of the user, which can not be observed directly. For example: whether certain strategies cause the participant to spend more time on the platform is a subjective experience of the participant. This research lets the participants report their perceptions themselves, and does that by a survey. The benefits of a survey in this research are that it allows to systematic measurement and analyses on multiple dimensions. The output of the survey allows

to compare between different EDS and even compare other information of the survey to certain strategies. Self-report is appropriate, since the research is about user perceptions and the questions are evaluative.

This survey asks for each strategy on the basis of the Likert-scale, with 5 scale-points. A yes or no answer would not be suitable, since the experiences and perceptions are on a continuous scale. Each engagement strategy was evaluated using the same set of questions. Using identical items across strategies allowed for direct comparison between EDS. In addition to strategy-specific evaluations, the survey included a reflection of general social media use and awareness of platform engagement goals. These measures allow for exploratory analysis of associations between user awareness, usage patterns, and perceptions of EDS.

Responses were recorded on a 5-point Likert scale. The response option "weet ik niet" ("I don't know") was treated as missing data (NA) and excluded from scale calculations. Participants who provided missing responses on more than 20 % of the manipulativeness items were excluded from the dataset prior to analysis. The streaks strategy item was displayed only to participants who indicated that they used a platform featuring streaks. Missing values on this conditionally displayed item were not considered in the exclusion criteria, as participants who did not use such platforms were not presented with the item.

For every strategy the survey contains questions that evaluate the perception on multiple dimensions. These dimensions are: noticing, perceived usefulness, perceived manipulation, perceived increase in time spent and preference for disablement options. For visible strategies the participant is also asked whether the strategy causes the participant to spend more time on the platform, because the feeling of whether it impacts the duration is important for the experience. Every dimension is asked separately, because multiple dimensions can be true at the same time. For example a strategy can be useful and manipulative. If the participant wants to be able to disable a strategy, this does not have to mean the participant wants to do so or finds it manipulative. The separation is necessary for a more nuanced analysis of user perceptions.

This survey asks all questions of all strategies and the same set of reflective questions to all participants. This approach allows for direct comparison of how different strategies are experienced by the same individuals. This also reduces the influence of individual differences. In addition to the strategy-specific questions, the reflection and awareness question enables exploratory analyses of associations between user characteristics and perceptions of specific EDS.

6.2 Materials

Data were collected using a structured online survey. The survey consisted of some information with a consent form, questions about general usage of social media and some reflection on the consciousness of their social media usage and the existence of EDS, strategy-specific questions about visible and non-visible EDS, demographic information about the participant and an option to leave details for a participatory design session.

Arrived at the strategy-specific questions, there is a page that has just a text field that explains what 'engagement' means in this context and that the participant gets shown a number of strategies with every time the same set of questions. The visible strategies are shown first and the non-visible strategies are shown afterwards. For every strategy, there is a page with a brief explanation of the strategy and a table with statements with likert-scale responses. The statements are (translated from dutch)

1. I had noticed this strategy before taking part in this survey

2. I find this strategy useful / it improves my user experience

3. I find this strategy manipulative

4. This strategy causes me to spend more time on social media than I would like (only shown for visible strategies)

5. I would like to be able to disable this strategy

The fourth statement is only shown for the visible strategies, as it is not possible to assign an how much cause a strategy has, when it is not possible to observe the strategy at all.

The general questions appear one time when filling the survey. The question about general social media usage are:

1. How much time do you spend on average per day on social media?

2. How often do you open social media on average per day?

3. Which social media platforms do you use?

4. Which social media platforms do you use the most?

5. What is your main reason for using social media?

6. Is there anything you notice about your own social media use?

The questions about the consciousness of their social media usage and existence of EDS are:

1. I feel that I decide for myself how much time I spend on social media.

2. I often open social media without consciously choosing to do so.

3. I am aware that social media platforms use algorithms to determine which content I see.

4. I know that platforms adapt what I see and in what order to increase engagement (especially watch time).

5. I know that some social media platforms offer settings to see less personalised content.

6. I use settings to see less personalised content.

6.3 Setup

The survey was administered online using the Qualtrics platform. The survey was conducted in Dutch, as participants were primarily native Dutch speakers. Participants completed the survey individually on their own devices, and no time limit was imposed.

6.4   Results

89 participants started the survey. 38 were excluded based on predefined criteria. This resulted in a final sample size of 51 participants. The majority of the participants were aged 18-24 (74.5%). Smaller proportions of participants were aged 25–34 years (9.8%), with limited representation from older age groups. In terms of gender, 66.7% of participants identified as male and 31.4% as female, while 2% preferred not to disclose their gender.

6.4.1   Description of the 5 dimensions

Noticing of engagement strategies   Figure 1a shows that the average scores for noticing the EDS varied considerably across the different strategies. Visible features, such as streaks and infinite scroll showed the highest average scores, whereas non-visible EDS received generally lower scores.

Perceived usefulness   As Figure 1b shows, the average perceived usefulness differed substantially between the EDS. The usefulness scores ranged between 2.5 to 3.5 on the 5-point Likert scale.

Perceived manipulation   As shown in Figure 1c, perceived manipulation ratings varied somewhat across EDS, between 2.5 to 3.5 on the 5-point Likert scale. Strategies like infinite scroll and manual boosting received a high manipulation score. Streaks scored moderately on the manipulation score.

Perceived increase in time spent   Figure 1d displays perceived increases in time spent for only the visible EDS. Variability across strategies indicates that perceived impact on time spent differs between EDS. Infinite scroll scores higher than the rest, while streaks scores again the lowest in this figure.

Preference for disablement options   Figure 1e presents the average preference for disablement options for each engagement strategy. preference for disablement options ratings differed across strategies, with some features more frequently identified as candidates for deactivation, such as variable notifications and manual boosting.

6.4.2   Correlation analysis at the user-level

Figure 2 presents the correlations at the user-level between the reflection on their usage combined with the awareness of the existence of EDS and average people score on the 5 dimensions. In this analysis, each data point represents an individual participant, allowing the examination of association between personal characteristics and overall perceptions of EDS.

Several significant correlations ($p < 0.05$) were observed at the user level. Perceived control was significantly negatively correlated with habitual use, perceived manipulation, perceived increase in time spent, and preference for disablement options. Habitual use was significantly positively correlated with perceived usefulness and perceived increase in time spent. Noticing was significantly positively correlated with awareness of algorithmic curation, awareness of platforms' engagement goals, and awareness of settings for reduced personalisation. The strongest correlation in the matrix was observed between perceived manipulation and preference for disablement options ($r = 0.77$).
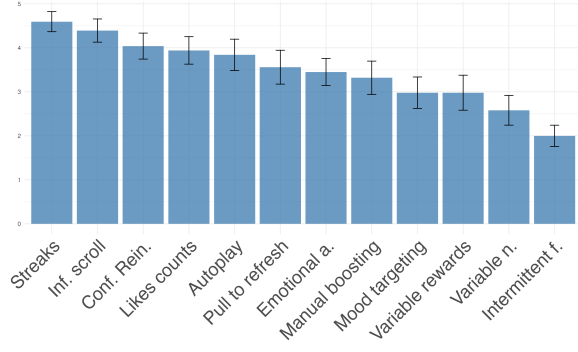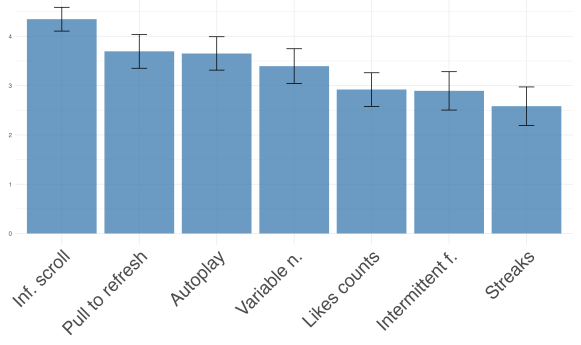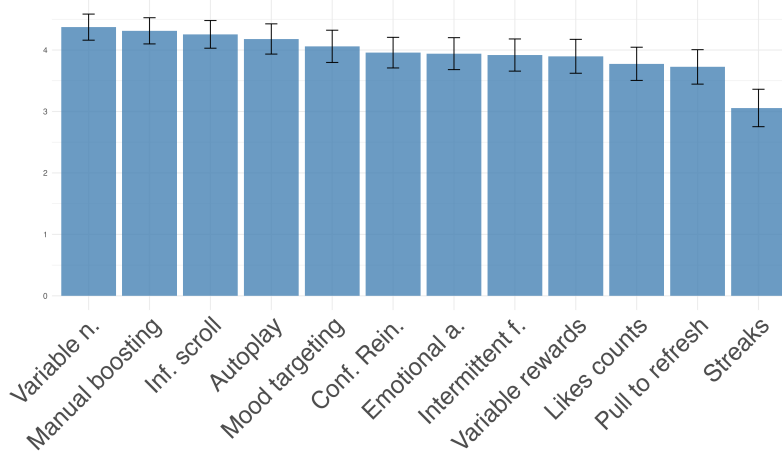
(a) Noticing
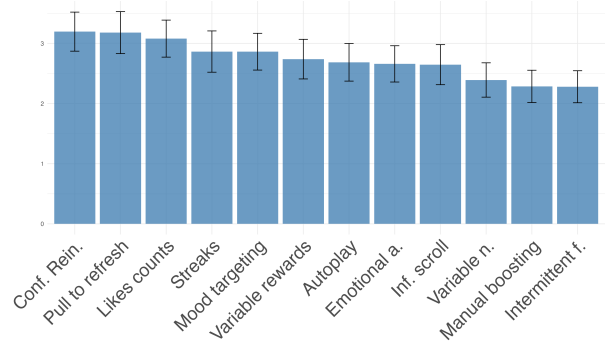
(b) Usefulness
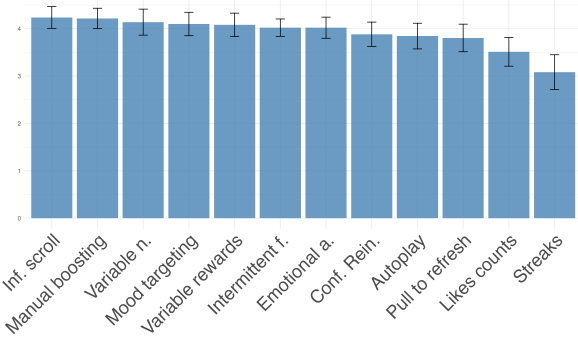
(c) Manipulation

(d) Time spent

(e) Disablement preference

Figure 1: Average scores per engagement strategy across five perceptual dimensions. Error bars represent standard errors.

These correlations describe relationships between personal attitudes, awareness, perceptions and experiences at individual level. They do not provide information about which EDS are more or less manipulative or other differences between the strategies. They reflect a user-centered perspective.
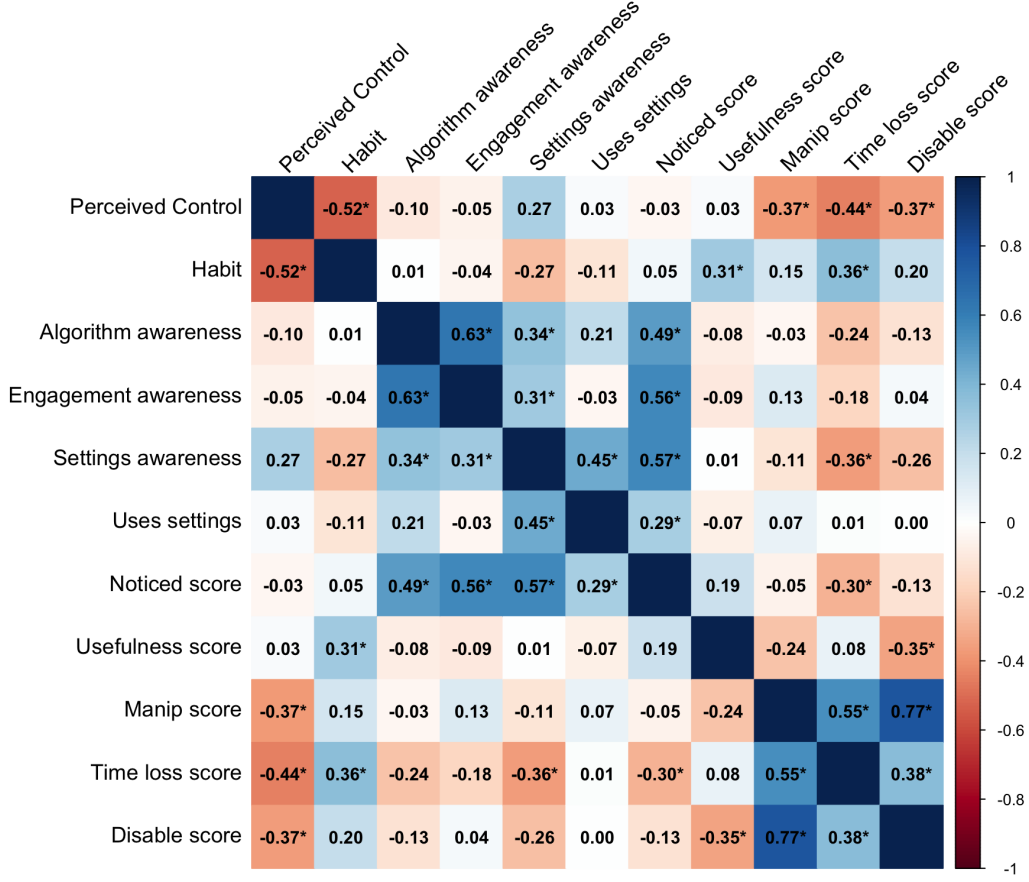

Figure 2: Correlations between average perception scores of engagement strategies. Significant correlations are indicated with an asterisk ($p < .05$).

6.4.3 Correlation analysis at the strategy-level

Figure 3 shows correlations at the strategy-level between the averages of the 4 dimensions of perception of the EDS. Since the time dimension was not tested on all strategies, it was left out in this analysis. In this analysis, each data point represents an engagement strategy, with scores averaged across all participants prior to correlation. This allows the examination of associations between those 4 dimensions of perception.

Usefulness and noticing were significantly positively correlated. Perceived manipulation was positively associated with preference for disablement options and negatively associated with usefulness. However, only the correlation between usefulness and noticing reached statistical significance; the other associations did not reach statistical significance.

These results describe patterns at the level of EDS rather than individual perceptions. They do not capture individual differences, but instead provide a design-oriented perspective on how EDS relate to one another.
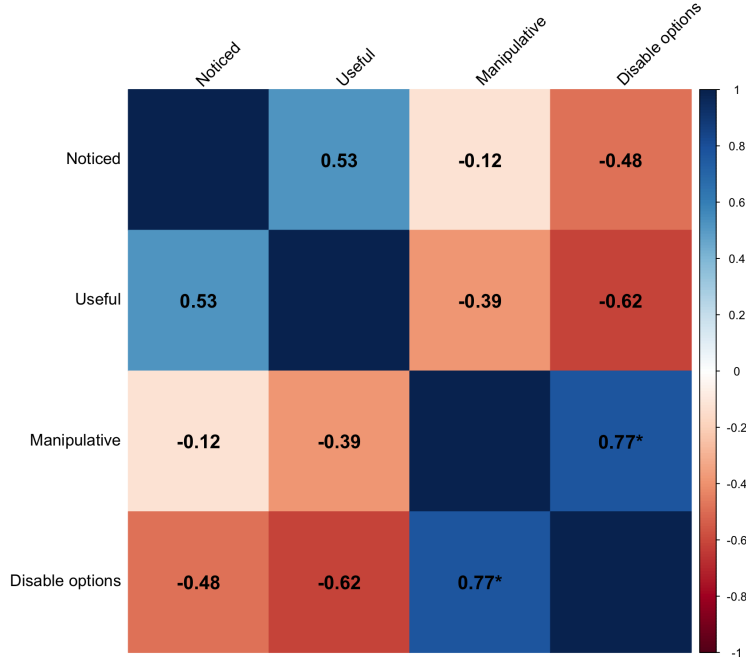
Figure 3: Correlations between average perception scores of engagement strategies, with significant correlations marked by an asterisk ($p < .05$).

6.5   Discussion

Usefulness and perceived manipulation were used as key indicators to assess users' experience of EDS. These perceptions, while not objective measures, provide valuable insights into how users interact with and respond to different EDS.

Visible features, for example in interface design, were noticed more consistently than non-visible features, such as recommender system strategies. Although this difference may appear intuitive, it suggests that there is room to increase the noticeability of non-visible strategies through user information. While there was some variation in preferences for disablement, all of them scored above three out of five. This shows that there is a demand for disablement options. Perceived spending more time than intended was also high for some strategies, like infinite scroll and pull to refresh. Non-visible strategies were not taken into account, so their scores are unknown.

The user-level correlation analysis further highlights the importance of individual differences in how EDS are experienced. Users who use social media more habitually often feel less control. Control seems to be an important factor, as it is seen in multiple correlations. Users who feel less control over their social media usage tend to find strategies more manipulative, tend to prefer disablement options, and report spending more time than intended. Users who report spending more time than intended and express a preference for disabling options tend to find strategies more manipulative. This indicates that control, time spent, the preference for disablement and habit are important factors in the user experience. The user-level analysis shows that users who are aware of algorithmic curation, platforms' engagement goals, and available settings, also seem to notice strategies more often.

The strategy-level analysis shows that strategies that are more noticed are also often seen as more useful. This indicates that awareness of strategies may improve the user experience. Usefulness

correlates negatively with perceived manipulation. Strategies that the users would like to disable are often perceived as manipulative. The strategy-level analysis shows that awareness and the possibility to disable strategies may be important factors in improving the experience.

The combination of these levels of analysis shows that the perception of time spent, control, and habit are important factors in the differences in user experience. Overall, increasing awareness and noticing of strategies may enhance the experience and reinforce users' sense of control. Having control over disablement options may positively impact the user experience.

These findings provide clear guidance for developing the advice tool. The consistent differences in how users notice EDS suggest that **increasing awareness of strategies**, as well as **providing more configurable settings**, may be beneficial for users. Also, the observed relationships show that **control, habit, and perception of time spent are important indicators** for individual differences. Together, these implications point toward an advice tool that **prioritises awareness and configurability and provides tailored guidance** based on users' self-reported experiences.

Several limitations should be noted. First, all measures were based on self-report, which means that perceptions are subjective experiences rather than objective outcomes. Second, the correlations do not allow causal conclusions, only associations between factors. Third, EDS that are less visible may be harder to perceive and control deliberately. This highlights a boundary condition for self-regulation, in which awareness is a prerequisite for ongoing evaluation and control. Fourth, the sample was relatively small and skewed toward younger participants, which may limit generalisability. Future research could combine self-report with objectively measurable behaviour and use a more diverse sample.

7 Advice Tool

7.1 Method

7.1.1 Design approach

While the regulations do not offer a solution for every social media user, the goal of the advice tool is to provide users with additional support in dealing with social media platforms. Since the results of RQ2 offered insights into user perceptions of EDS, these findings are used as the basis for the design of the advice tool.

Developing a concrete prototype allows these insights to be translated into an interactive form, making it possible to reflect on design choices in practice rather than only at a conceptual level. This, in turn, enables a participatory design approach, in which users can respond to specific features, structures, and formulations within the tool.

Accordingly, the advice tool is developed through several participatory design sessions. During these sessions, participants are not only invited to provide feedback on the prototype, but also to explain what they would consider useful in such a tool. This feedback is used to iteratively refine the prototype.

7.1.2 Participatory design procedure

The participatory design sessions were conducted individually, with one participant per session. Each session started with a short introduction of the tool and its overall goal. The participant was

then shown the current state of the tool and was given the opportunity to ask questions to ensure a clear understanding of the prototype.

Subsequently, the participant was asked, in an informal manner:

- what they thought about the tool,

- what they found clear or unclear,

- whether they would consider using such a tool, and

- what they felt was missing from the tool.

Participants did not complete a formal test or questionnaire, nor were any personal details collected. This approach was chosen to elicit qualitative, exploratory feedback and to identify opportunities for improving the advice tool rather than to evaluate its effectiveness.

7.1.3   Iterative development process

The iterative development process consisted of three phases. The first and second phase involved one participant. The third phase had five participants.

In the first phase, the advice tool was represented by a low-fidelity mock-up. This mock-up consisted of a small number of PowerPoint slides, which outlined the basic structure of the tool, its intended functionality and limitations, and the key findings from RQ2 that informed the design. This low-fidelity representation was used to provide the participant with a concrete impression of the concept, allowing them to reflect on the idea of the tool before engaging with a functional prototype.

In the second phase, a working prototype was developed in the form of a web application. The participant was able to interact with and test this prototype. Based on this experience, the participant provided feedback on the functional flow of the tool and the basic underlying logic.

In the third phase, the functionality of the tool was further developed and refined. At this stage, the prototype more closely resembled the intended end product, enabling the participants to form a clearer impression of how the tool would be used in practice. Feedback in this phase focused on the perceived usefulness of the tool and on suggestions for further refinement and clarification.

7.2   Materials

7.2.1   Prototype

The prototype is a web-based application designed for use on smartphones. The prototype is publicly accessible via tool.emilebol.nl. All interface text and content are provided in Dutch. It functions as an advice tool that provides information related to users' experiences with social media platforms. The tool does not measure behaviour, make diagnoses, or directly modify settings on the user's device. Instead, it focuses on users' subjective perceptions of their social media experience.

7.2.2 Explanation and intake components

As Figure 4a shows, when the tool is opened for the first time, users are presented with a pop-up window containing a short explanation of the tool. This message describes what the tool does and outlines its overall flow. At this stage, users can choose whether to allow the tool to store their intake responses locally on their device. If permission is granted, previously generated advice is shown when users return to the tool.

The intake component consists of three sections. The first section uses sliders to capture users' perceptions related to control, time spent, and habitual use of social media as seen in Figure 4b. The second section contains checkboxes addressing common usage behaviours, such as repeatedly refreshing for new content. In the final section, users can select the social media platforms they use, also through checkboxes. After completing the intake, users can proceed to the strategy overview by selecting the option to display the results. The second and third sections are shown in Figure 4c.
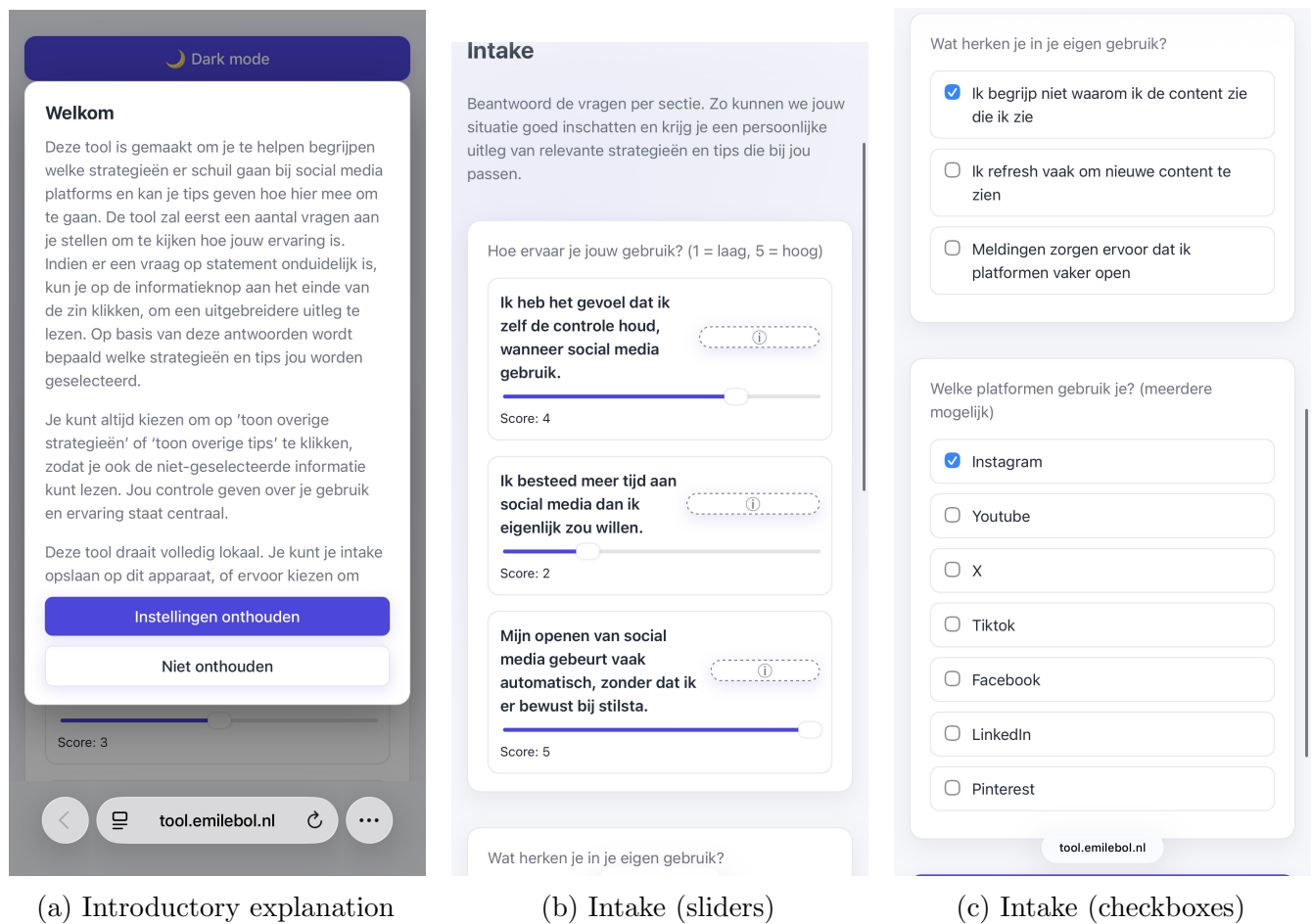

(a) Introductory explanation   (b) Intake (sliders)   (c) Intake (checkboxes)

Figure 4: Screenshots of the advice tool: (a) introductory explanation, (b) intake sliders, and (c) intake checkboxes.

7.2.3 Strategy and tips overview

After completing the intake, users are presented with an overview page as shown in Figure 5a. This overview contains two sections: one for EDS and one for tips. This is separated, because not all tips are directly linked to a single engagement strategy. When the user clicks a strategy or one of the tips, it expands and more information will be visible. This is shown in Figure 5b. When the intake does not indicate strong relevance for specific strategies or tips, the overview reflects this by showing no prominently highlighted items as shown in Figure 5c.
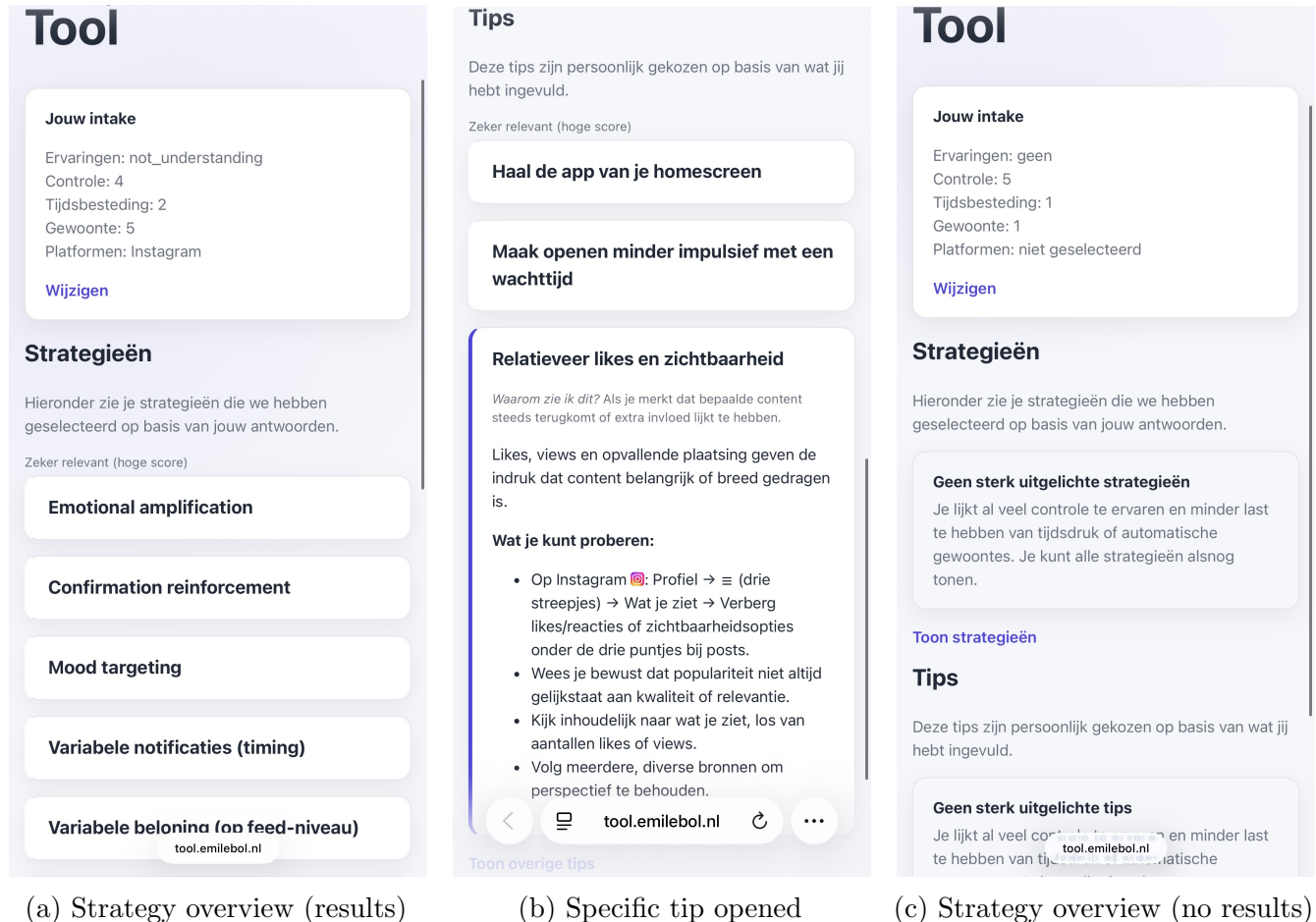

| (a) Strategy overview (results) | (b) Specific tip opened | (c) Strategy overview (no results) |

Figure 5: Screenshots of the advice tool: (a) strategy overview with results, (b) a specific tip opened, and (c) strategy overview with no results.

7.2.4 Personalisation and ranking logic

The personalisation determines which strategies and tips are presented to the user and in which order. It does not alter the content of strategies or tips themselves, but influences their selection and prioritisation within the overview.

The personalisation is implemented using a rule-based system. For each strategy and tip the tool calculates a relevance score. This score is based on a combination of intake inputs, which are weighted using predetermined coefficients and an importance factor.

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Strategies and tips are sorted based on their relevance scores. A threshold is applied to determine which items are highlighted as highly relevant. When no items exceed this threshold, the tool explicitly indicates that no highly relevant strategies or tips are identified. Users can nevertheless access the complete set of strategies and tips and can adjust their intake at any time, after which the personalisation is recalculated.

Users can indicate which platforms they use. This information is used to display platform-specific instructions within relevant tips, such as guidance on adjusting content preferences in platform settings.

7.3 Results

The participatory design procedure consisted of eight sessions. Each session involved one participant. In the first phase, the prototype consisted of a low-fidelity mock-up created using a small number of PowerPoint slides. In the second phase, a working web application was available, although the prototype was not yet fully developed. In the third phase, the web application was largely complete and required only refinements based on feedback from the participatory design session.

The goal of these sessions was to explore what users considered useful in an advice tool and to iteratively improve the prototype based on their feedback.

7.3.1 Phase 1: Low-fidelity mock-up

During the first participatory design session, the participant was presented with a low-fidelity mock-up of the advice tool. This mock-up did not allow for hands-on use of the tool, but provided a conceptual overview of its intended structure and functionality. Based on this overview, the participant was able to reflect on the idea and provide feedback.

The participant indicated that the general concept of the tool was clear and appeared well organised, and that it seemed likely to contain sufficient information. At this stage, the prototype did not yet include platform-specific tips. The participant suggested that instructions for adjusting platform settings could be valuable, which implied the need for an additional intake component to identify which platforms users use. In response, platform selection was later incorporated as part of the intake, and platform-specific tips were added to the tool.

At the time of this first session, strategies and tips were still combined within a single list. The participant suggested separating these into distinct sections to improve clarity. Based on this feedback, strategies and tips were later presented in separate lists within the overview. In addition, the participant indicated that users might want to modify their intake responses over time, as different EDS could become more relevant after following certain advice. This feedback informed the later inclusion of the option to revisit and adjust the intake.

The participant also suggested incorporating ideas from the book *The Anxious Generation* by Jonathan Haidt, particularly tips aimed at parents and teachers of children. Although this could be a very valuable idea, it was considered outside the scope of the present research and was therefore not further explored within the prototype. This suggestion is instead noted as a possible direction for future research.

7.3.2 Phase 2: Early web prototype

During the second participatory design session, the prototype consisted of a working web application. The participant was able to follow the intake-to-overview flow and to select individual items in the overview to expand them. This enabled the participant to provide feedback on the clarity of the flow and the usability of the prototype.

At this stage, the tool did not yet include a detailed introduction or a clear explanation of the overall flow. In addition, there was no option to access additional information linked to the sliders in the intake. The participant indicated that both elements were missing and recommended adding a more extensive introduction for first-time users, as well as information buttons providing extra explanation for the slider items.

The participant experienced the content of the strategy and tip items as helpful. In particular, the participant indicated that the prototype provided a balance between concise explanations and practical tips describing what users can do.

Finally, the participant reported using an external application to support her social media use, called *ScreenZen*. According to the participant, this application can delay opening an app (e.g., by five seconds) and displays a prompt asking why the user is opening the app. The participant described this as helpful for interrupting habitual social media use in situations such as boredom, and suggested that this type of approach could be relevant for users who experience difficulty controlling their social media behaviour.

7.3.3 Phase 3: More developed prototype

During the third participatory design session, the prototype was largely complete and fully functional as a web application. At this stage, the value of the feedback lay primarily in identifying remaining design considerations and limitations, rather than in further modifying the prototype itself. The feedback in this phase therefore focused on users' experiences and reflections on the tool. Where feasible and within the scope of the study, this feedback was incorporated into the prototype; however, not all suggestions resulted in further design changes.

All participants indicated that the user interface was generally clear and logically structured. They described the tool as "straightforward" and "not complicated". The explanation at the beginning of the tool was found to be very clear. However, one participant did not initially understand that the "strategies" referred to design choices made by platform developers rather than to users' own strategies. One participant pointed out that the overview could be more visual. When a larger number of strategies and tips were selected, the amount of information was experienced as potentially overwhelming.

In terms of content, participants were generally satisfied. The explanations of the strategies were described as clear and were experienced as interesting and, in some cases, surprising. While the tips were generally clear, some instructions were considered too unspecific. For example, advice such as "disable notifications in phone settings" could be explained in more detail. Participants indicated that they would be likely to follow the suggested tips. One participant noted that they would have liked to read more about certain topics and suggested that references or links to additional background information could be helpful and interesting.

Participants noticed that the tool provided personalised advice; however, the perceived degree of personalisation varied. While some participants indicated that the strategies and tips were highly relevant to them, another participant experienced the advice as relatively general rather

than specifically tailored to their situation. This suggests that the perceived effectiveness of the personalisation varied across users.

At this stage, the tool consistently displayed a fixed set of three strategies and three tips, regardless of the intake responses. One participant pointed out that in cases where the intake does not indicate notable issues, the tool should explicitly communicate that the user may not require advice. Conversely, when the intake indicates a stronger need for support, the participant suggested that a larger number of strategies and tips should be presented. At the same time, the participant emphasised that users should always retain the option to view additional strategies and tips if they are interested.

7.4 Discussion

The advice tool is closely connected to the empirical findings of RQ2. These findings showed that perceived control, spending more time than intended, and habitual social media use are important factors in how users experience EDS, particularly in terms of perceived manipulativeness. For this reason, these factors form the core inputs of the tool. In addition, the tool focuses on explaining EDS, as RQ2 indicated that several strategies are often not consciously noticed by users, while still strongly influencing their experience of social media use.

The scope of the tool is deliberately limited to providing advice intended to support users in gaining more control over their social media experience. Consequently, this research component does not aim to produce measurable outcomes regarding behavioural change, but rather explores the possibilities and design considerations of such an advice tool.

Several limitations should be noted. First, the participatory design sessions involved a small number of participants, which limits the diversity of perspectives and does not guarantee that the tool is equally suitable for all users.

Second, the tips are largely based on experiential knowledge rather than systematic empirical research. As the development and validation of such tips were not part of the research questions, this aspect of the tool could not be explored in greater depth within the scope of this study.

Third, one participant indicated that the amount of information was experienced as somewhat overwhelming, while another indicated that additional information on certain topics would be interesting. This suggests that a more dynamic presentation of information, allowing users to alternate between breadth and depth when desired, could be beneficial.

Fourth, the personalisation logic relies on predefined weights that were determined based on the researcher's informed judgement and refined through participatory feedback. Although this approach proved workable within the exploratory design process, these weights were not empirically validated and did not function equally well for all participants. Future iterations of the tool could benefit from incorporating user feedback on the relevance of suggested strategies and tips, or from testing alternative weighting approaches with larger samples.

Future research could further develop this tool by involving a broader and more diverse group of participants, extending the range and empirical grounding of the tips, implementing a more dynamic presentation of information, and improving the performance of the personalisation logic.

8   Discussion

Taken together, this research shows that a range of both visible and non-visible EDS can be described and related to underlying psychological phenomena. Although these strategies differ in form, they share a common goal of generating increased engagement. Non-visible EDS are often not consciously noticed by users. The perceived manipulation of EDS appears to be closely related to users' perceived control, spending more time than intended, and habitual social media use, whereas perceived usefulness showed weaker associations with these dimensions. The advice tool builds on these insights by translating them into personalised advice. It primarily emphasises awareness, transparency, and user control, as these factors appear crucial for improving the user experience and reducing perceptions of manipulation.

EDS are often presented as intentionally designed mechanisms resulting from explicit design decisions. At the same time, several strategies discussed in this study may also be interpreted as emergent phenomena arising from optimisation processes within large-scale platform systems. For example, while emotionally charged or polarising content is often assumed to be deliberately promoted by recommender systems to increase engagement, it can also be argued that such systems primarily prioritise content that already receives high levels of engagement, which may disproportionately include emotional or polarising material. A similar argument applies to variable reward mechanisms, where content selection may appear random, yet occasionally results in highly rewarding outcomes for users. Because platforms provide limited transparency regarding the functioning of their recommender systems, it remains difficult to determine to what extent these patterns reflect deliberate design intentions or emergent outcomes of optimisation processes. Critics have argued that awareness of such effects combined with inaction may be functionally equivalent to intentional design. However, the present research is primarily concerned with users' subjective experiences. From this perspective, the distinction between intentional and emergent EDS is less relevant.

This research did not include chat and messaging applications, as it focused on platforms centred around algorithmically recommended or engagement-optimised content. Chat-oriented applications typically do not provide a continuous feed or content discovery mechanism, and were therefore excluded from the scope of this study. As a result, the findings primarily apply to feed-based social media platforms. At the same time, the boundaries between social media and messaging applications are increasingly blurred. For example, WhatsApp has expanded its functionality by introducing features such as status updates and by integrating services such as Meta AI, which actively prompts user interaction. If messaging applications continue to develop along these lines, they may play a more prominent role in engagement generation in the future. Consequently, chat-based platforms may become increasingly relevant to consider in both future research and potential extensions of the advice tool.

The results of RQ2 and RQ3 are based on self-reported information and therefore reflect users' subjective experiences. As a consequence, these findings may be less generalisable than results based on objective behavioural measures. The study does not include objective data on actual behaviour, such as time spent on social media or usage frequency. In addition, the relationships identified in RQ2 are correlational in nature and do not allow conclusions about causality or the direction of effects. Finally, the sample size was relatively limited, which may restrict the generalisability of the findings and the stability of the observed relationships.

Future research could build on the findings of this study in several ways. First, replicating the

survey study underlying RQ2 with larger and more diverse samples could strengthen the robustness and generalisability of the observed relationships between EDS and user perceptions. Second, combining self-reported experiences with objective behavioural measures, such as screen time data, could provide a more comprehensive understanding of how perceived control and habitual use relate to actual behaviour over time. Longitudinal designs would be particularly valuable in examining how these perceptions and experiences develop.

Future research related to RQ3 could further explore how advice tools based on users' subjective perceptions can be developed and evaluated. The nature and effectiveness of different types of advice could be investigated, for example by empirically examining which tips are perceived as most helpful for specific engagement-related experiences. The range of advice could be expanded and further tailored to platform-specific contexts. Finally, future work could explore alternative approaches to personalisation, including validating weighting schemes or incorporating user feedback to refine the relevance of suggested strategies and tips over time.

9 Conclusion

This thesis set out from the observation that social media platforms are increasingly shaped by EDS that demand growing amounts of users' time and attention, and that have been associated in prior research with a range of cognitive and emotional consequences. Although European regulations such as the Digital Services Act and the AI Act aim to promote transparency and user choice, these formal safeguards do not necessarily translate into effective support for all users, as available options are often unclear, difficult to locate, or poorly understood in everyday use. Existing research largely focuses on technical, legal, or psychological perspectives on engagement, but pays comparatively little attention to how users themselves perceive, interpret, and evaluate EDS. Against this background, the aim of this study was to adopt a user-centred perspective by identifying common EDS, examining how users experience them in terms of usefulness, manipulation, and control, and exploring how these insights can be translated into a digital advice tool that supports more deliberate social media use.

Taken together, the findings of this study show that EDS on social media platforms can be systematically identified and meaningfully related to underlying psychological mechanisms, while differing in the extent to which they are visible to users. Strategies that operate largely in the background are less likely to be consciously noticed, which limits users' ability to evaluate and manage their influence. Across strategies, users' evaluations are primarily shaped by perceived control rather than by perceived usefulness: strategies experienced as more manipulative are consistently associated with spending more time than intended and with a stronger preference for disablement options, particularly when social media use is experienced as habitual or difficult to regulate. These results indicate that supporting awareness and perceived control is central to addressing users' experiences with engagement-driven design. Building on these insights, the advice tool developed in this study translates users' subjective experiences into personalised, non-normative guidance, using explanations of EDS and experience-based tips to support awareness, transparency, and perceived control.

In response to the main research question, this study shows that users experience EDS in varied ways, where perceived loss of control and habitual use play a more central role than perceived usefulness in shaping evaluations of manipulation and desirability of control. A digital advice tool

can support users by making these strategies more visible and understandable, and by offering experience-based guidance that helps users reflect on and manage their social media use in line with their own preferences.

More broadly, this study highlights the importance of complementing regulatory and technical approaches to engagement-driven design with a user-centred perspective that focuses on how strategies are actually experienced in everyday use. By foregrounding awareness and perceived control rather than prescriptive interventions, this work illustrates how design-oriented tools can support users without imposing normative judgments about social media use.

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