Social Media Distraction
– Investigating Users' Reasons for Distraction, Individual Differences, Visual and External Distraction, and the Effects on Performance

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Christina Kößmeier
aus
Lippstadt

1. Gutachter: Prof. Dr. Oliver Büttner
2. Gutachter: Prof. Dr. Stefan Stieglitz

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Zusammenfassung

Diese Arbeit befasste sich mit der Ablenkung durch Social Media. Wenn man fokussiert an einer Aufgabe arbeitet, um ein bestimmtes Ziel zu erreichen, haben Social Media das große Potential, von dieser Aufgabe abzulenken. Menschen haben nur eine begrenzte Möglichkeit, Reize zu verarbeiten und müssen deshalb relevante Reize selektieren. Es ist nicht möglich, sich gleichzeitig auf die Aufgabe und Social Media zu fokussieren. Aufgrund ihrer Gratifikationen, bilden Social Media Reize eine große Versuchung, dann auch tatsächlich Social Media zu nutzen, anstelle sich auf die eigentliche Aufgabe zu fokussieren. Durch die erlernten positiven Erfahrungen, die Nutzer durch die Nutzung von Social Media gemacht haben, können diese Reize die Aufmerksamkeit von Nutzern an sich ziehen um somit eine bevorzugte Verarbeitung im Gehirn erreichen.

Allerdings ist eine ständige Ablenkung nicht zielführend, und eine andauernde Unterbrechung der Aufgaben kann dazu führen, dass die Aufgabe länger dauern und auch das Ergebnis darunter leidet. Bisherige Forschungen haben gezeigt, dass ein häufiges Nutzen von Social Media, beispielsweise während des Lernens oder in einer Vorlesung, negative Auswirkungen auf die Testergebnisse oder auch die Note haben kann. Allerdings wurde bislang noch nicht näher untersucht, warum genau sich Nutzer ablenken lassen und welche Aufmerksamkeitsprozesse hierfür eine Rolle spielen. Dies wäre allerdings wichtig herauszufinden, um besser zu verstehen, wie Nutzer ihre Ablenkung besser in den Griff bekommen können, während sie sich auf eine Aufgabe fokussieren.

Aus diesem Grund ist es wichtig, Social Media Ablenkung besser zu verstehen. Die vorliegende Arbeit ist den Fragen nachgegangen, warum sich Nutzer durch Social Media ablenken lassen, welche individuelle Unterschiede hierfür eine Rolle spielen, was die zugrundeliegenden Prozesse sind (interne und externe Ablenkung), sowie welche Auswirkungen dies auf die Leistung beziehungswiese Ergebnis der Aufgabe hat. Mit drei Studien, welche in drei Publikationen aufgeführt sind, wurden diese Fragen beantwortet. Die erste Studie verwendete eine Umfrage zur Untersuchung warum sich Nutzer durch Social Media ablenken lassen und welche individuellen Unterschiede dies beeinflusst. Die zweite Studie untersuchte die visuelle Ablenkung von Social Media reizen mittels eines kognitiven Paradigmas welches die Fähigkeit, Distraktoren auszublenden misst, wobei inkludierte Social Media Symbole als Distraktoren hinzugefügt wurden. Die dritte Studie untersuchte die interne und vor allem aber visuelle Ablenkung von Smartphones während des Bearbeitens verschiedener Aufgabe mittels Eye Tracking.

Die Ergebnisse dieser Arbeit zeigen auf, dass Nutzer sich für soziale und aufgabenbezogenen Gründe ablenken lassen, welche durch die Angst, etwas zu verpassen (FoMO) sowie problematisches Nutzungsverhalten von Social Media beeinflusst wird. Darüber hinaus konnte die Arbeit zeigen, dass bei einer kognitiv anstrengenden Aufgabe Social Media Reize nicht ablenkender sind, als andere komplexere, neutrale Distraktoren. Allerdings konnte gezeigt werden, dass das Smartphone zwar ein Potential für visuelle Ablenkung birgt, allerdings konnten Nutzer ihre Aufmerksamkeit auf das Smartphone insoweit kontrollieren, dass sie nur während der Übergänge und nicht während der Aufgaben selbst dorthin schauten. Auch wurde gezeigt, dass die visuelle Präsenz des Smartphones eine interne Ablenkung in Form von erhöhter Vigilanz hervorbrachte. Allerdings konnten keine Auswirkungen von Social Media Reizen oder dem Smartphone auf die Leistung während der Aufgaben festgestellt werden.

Insgesamt konnte mit dieser Arbeit aufgezeigt werden, dass Social Media Nutzer sich ihrer Gründe für Ablenkung bewusst sind und auch ihre visuelle Aufmerksamkeit auf solche Reize zu einem gewissen Grad kontrollieren können. Dies weist darauf hin, dass Social Media Ablenkung nicht ein rein impulsives Verhalten ist, sondern auch eine reflektierte Komponente hat, weshalb Nutzer selbstkontrolliert handeln können. Diese Arbeit hat allerdings auch gezeigt, dass die Auswirkungen von Social Media Reizen keinen Einfluss auf die Leistung hat, zumindest im Rahmen dieser kurzweiligen Studien. Nichtsdestotrotz kann die Präsenz des Smartphones zu einer internen Ablenkung führen, was darauf hindeutet, dass es schon sinnvoll sein kann, visuelle Reize von Social Media zu vermeiden, wenn man sich auf eine Aufgabe vollkommen fokussieren möchte. Basierend auf dieser Arbeit gibt es viele Ausgangspunkte für weitere Forschung.

Abstract

This work focused on social media distraction. If a user focuses on a task to achieve a certain goal, social media bear the potential to distract from the task. People only have a limited capacity to process stimuli and thus, relevant stimuli need to be selected. Thus, it is not possible to simultaneously focus on a task and social media. Due to its proposed gratifications, social media impose a great temptation to engage in using social media instead of focusing on the task. Due to the learned positive experiences based on previous use of social media, social media cues can attract the user's attention and may even receive a preferred attentional processing.

However, for striving to attain one's goals, constant distractions from the task can lead to tasks taking longer and to have negative effects on performance. Previous research has indicated that frequent social media use, for instance during learning or in class, can have negative effects on the test or overall academic performance. Thus far, previous work has not yet investigated why users are getting distracted by social media or which attentional processes play a role for this distraction. However, this would be important to understand in order to enable users to better handle their social media distraction so that they can better focus on their tasks to achieve their goals.

Therefore, it is important to investigate social media distractions. This dissertation focused on understanding users' reasons for distraction, the influence of individual differences, the underlying processes (i.e., internal as well as external distraction) as well as the effects on performance. Three studies that have resulted in three publications, have answered these research questions. The first study employed a survey to investigate why users get distracted and which individual differences play a role for social media distraction. The second study investigated visual distractibility using a cognitive experiment which was extended by social media cues to be included as distractors. The third study used eye tracking to examine the internal as well as external visual distraction potential of smartphones while working on tasks.

The results showed that users' reasons for distraction can be social and task-related, while these are influenced by fear of missing out (FoMO) and problematic social media use. Further, this work revealed that during cognitive demanding tasks, social media cues are not in particular distracting, compared to neutral complex cues. However, findings showed that smartphones have the potential to visually distract users, but more so while they are not working on the tasks but during the transitions between tasks. This suggests that users can control their visual distraction in so far that they only look at their smartphones in those moments. Furthermore, this work showed that smartphone presence increased internal distraction in the

form of vigilance. Contrary to expectations, the studies do not suggest a negative impact of social media or smartphone distraction on performance.

Overall, this work could show that social media users are aware of their reasons for distraction and that they can control their visual attention towards these cues to a certain degree. This suggests that social media distraction is not a purely impulsive behavior but that reflective processes also play a role that allows users to control their behavior. This work also showed that social media cues do not have an impact on performance, at least in the context of the demanding tasks during these short studies. Nonetheless, findings suggested that smartphone presence can increase internal distraction. This might imply that it can be beneficial to try to avoid social media cues when trying to focus on a task. This work offers several points for future research to work on.

Publication Note

This work's studies have been published or submitted to international peer-reviewed journals. Moreover, the studies have been presented at national as well as international peer-reviewed conferences. The following presents the details of the publications and presentations.

Papers Included

At the submission date of this dissertation, *Study 1* was published in the peer-reviewed journal *Frontiers in Psychology, Study 3* was published in the peer-reviewed journal *Computers in Human Behavior*, and *Study 2* was submitted and under review. Please see the ORCID profile for any updates: **Christina Koessmeier** https://orcid.org/0000-0002-7027-0714

Study 1 / Paper 1:

Koessmeier, C., & Büttner, O. B. (2021). Why Are We Distracted by Social Media? Distraction Situations and Strategies, Reasons for Distraction, and Individual Differences. *Frontiers in Psychology. 12:711416.* doi: 10.3389/fpsyg.2021.711416

Study 2 / Paper 2:

Koessmeier, C., & Büttner, O. B. (2023). *Social Media Users' Ability to Filter Out Visual Distractions and Influencing Factors on Distractibility* [Manuscript submitted for publication and under review]. Economic and Consumer Psychology, Department of Computer Science and Applied Cognitive Science, University of Duisburg-Essen.

Study 3 / Paper 3:

Koessmeier, C., & Büttner, O. B. (2022). Beyond the smartphone's mere presence effect: A quantitative mobile eye tracking study on the visual and internal distraction potential of smartphones. *Computers in Human Behavior, 134:* 107333. doi: 10.1016/j.chb.2022.107333

Published Data Sets

Following the principles of open science and hence the guidelines of the APA as well as German research foundation (DFG), the collected data for this project has been published via the Open Science Framework (OSF). These data sets are also referenced in the respective paper. The following data sets were published:

Study 1 / Paper 1:

Koessmeier, C., & Büttner, O. B. (2021). *Why are we distracted by social media? Distraction situations and strategies, reasons for distraction, and individual differences* [Data set]. OSF. https://doi.org/10.17605/OSF.IO/5PVJ6

Study 2 / Paper 2:

Koessmeier, C., & Büttner, O. B. (2023). *Social Media Users' Distractibility and Influencing Factors* [Data set]. OSF. https://osf.io/a4p2c/?view_only=76d4aa02a5d342fb9b46ddbcaf28537c

Study 3 / Paper 3:

Koessmeier, C., & Büttner, O. B. (2022). Beyond the Smartphone's Mere Presence Effect: A Quantitative Mobile Eye Tracking Study [Data set]. OSF. https://doi.org/10.17605/OSF.IO/G7A96

Presentations at Conferences and Workshops

The studies of this dissertation have been presented at peer-reviewed conferences and workshops. To be able to present at these conferences, it was required to hand in either short or long abstracts and sometimes even whole working papers or manuscripts. Longer abstracts or the working papers were not published in the context of the conferences. This dissertation's work has been presented at the following conferences:

Koessmeier, C., & Büttner, O. B. (2020, October 1–4). *Striving for Social Media Reduces the Ability to Block Out Visual Distractors* [Poster presentation]. Virtual Association for Consumer Research (ACR) Conference, online.

Koessmeier, C., & Büttner, O. B. (2020, July 22–24). *Striving for Social Media Reduces the Ability to Block Out Visual Distractors* [Working paper presentation]. Eleventh International Conference on Social Media & Society, online.

Koessmeier, C., & Büttner, O. B. (2019, July 19–21). Why are We Distracted by Social Media? Examining Reasons for Distraction by Social Media, its Relation to Personality and Distraction Situations [Working paper presentation]. Tenth International Conference on Social Media & Society, Toronto, Canada.

Koessmeier, C., & Büttner, O. B. (2019, July 19–21). *The Effects of Chronic and Situational Desire to Engage in Social Media on the Ability to Block Out Distractions* [Poster presentation]. Tenth International Conference on Social Media & Society, Toronto, Canada.

Koessmeier, C., & Büttner, O. B. (2018, September 17–20). "I am totally in control of my distraction" – How people are distracted by social media and the use of distraction-handling strategies [Poster presentation]. Symposium of the German Society for Psychology (DGPs), Frankfurt, Germany.

Kößmeier, C., & Büttner, O. B. (2018, February 28–March 2). *"I need to know what is going on" – Motivation for using social media and its relation to distraction by social media* [Poster presentation]. General Online Research (GOR) conference, Cologne, Germany.

Kößmeier, C., (2018, February 28). *Social Media, Distraction, and Self-Regulation* [Working paper presentation]. DoktorandInnenworkshop der DGPuK-Fachgruppe Digitale Kommunikation & der Deutschen Gesellschaft für Online-Forschung (DGOF) [Joint PhD workshop of the German Communication Association, Division Digital Communication, and the German Society for Online Research], Cologne, Germany.

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1. Introduction

Social media has grown to become user's constant companions in live. Users carry their smartphones with them everywhere they go, including the most private moments, such as while lying in bed or being in the bathroom. What is more, users may even share more secrets through the smartphone and social media than in personal conversations with spouses or closest friends and family. Users have grown accustomed to being in a constant connection with their friends and the social media world. At the same time, users have also learned to be attentive to any new social media notifications coming in, probably to not miss anything and be responsive to their connections reaching out. It is even a (more or less) accepted custom to have the smartphone lying on the desk when talking to friends or during a meeting. Even using social media while at work, during a lecture or while studying has become normal in user's daily lives. Most notably, however, are the effects of such a behavior on the quality of the connection with friends and even more so, our work or learning outcomes. When social media cues or the smartphone are present while trying to focus, social media has the great potential to disrupt user's concentrated work.

The dilemma with social media is that it is designed to make its users hooked. Meanwhile, social media users have adopted behaviors and thought patterns that make them vigilant and susceptible to social media and its cues. Especially learned gratifications that users have experienced from using social media, can make social media so distracting. Users have learned that social media cues represent their connection to others (Bayer, Campbell, et al., 2016). Because we are permanently online and permanently connected (Vorderer et al., 2018), social media distractions can happen anytime, and users become constantly vigilant of social media and their smartphones (Johannes, Veling, et al., 2019; Reinecke, Klimmt, et al., 2018). However, people also have a limited attention and thus, distractions may interfere with daily lives.

Social media distractions arise through social media cues that catch the user's attention and pull it away from whatever they were focusing on before and instead towards social media (Paper 1, Koessmeier & Büttner, 2021). Such distractions can be external, in the form of incoming notifications, hearing a sound, or seeing the smartphone, or internal, by users thinking about social media in general, or unopened messages.

Disproportionate social media distraction bears the potential for leading to negative consequences. As such, research has shown that social media use and distraction can negatively impact academic (Brooks, 2015; Cain et al., 2016; Clayson & Haley, 2013; Marone et al., 2018;

May & Elder, 2018) and cognitive performance (Stothart et al., 2015). Moreover, research has suggested that it can also negatively impact well-being, stress, or life satisfaction (Brooks, 2015; Fitz et al., 2019; Hofmann et al., 2017; Reinecke, Meier, et al., 2018; Twenge, Martin, et al., 2018). Therefore, it is important to discover ways of handling social media distraction. To do so, the processes of social media distractions need to be investigated thoroughly.

This work aims for a better understanding of the underlying processes of social media distraction. To do so, this research answered the questions of why, how and with what effects people are distracted by social media. Following this rationale, the following research questions were developed. This work investigated (1) why users get distracted by social media, (2) the role of individual differences for distraction, (3) how users get distracted (i.e., the underlying processes), and (4) the effects of distraction on performance. These questions were addressed in three studies using a variety of research methods. The studies were an online survey to get the users perspective, cognitive experiments to investigate the processes, and an experiment using eye tracking to investigate visual distraction. Herewith, this work addresses the questions from multiple perspectives to create a converging understanding of social media distraction. The four research questions were addressed with three different studies, each presented in one research paper.

This work contributes to the understanding of social media distraction and the findings can help future research to help users become less distracted by social media. Although not all social media use is bad, distraction by social media can have negative effects on multiple areas of users' lives. This work identified underlying reasons for distraction, the distraction potential of visual social media cues and internal distraction, showed rather limited effects on performance, and tested one potential strategy (i.e., placing the smartphone out of sight). Future work can build on these findings and investigate the underlying processes further (especially the role of internal distraction or habits), focus on which tasks are particularly prone for distraction, and test potential behaviors users could adopt to reduce their distraction in moments of intended focus.

This dissertation is structured as follows: First, the theoretical foundation will be presented (chapter 2), based on which the research questions are derived (chapter 3), followed by the overview of the studies (chapter 4). Last, the findings will be discussed, including the contribution, limitations, avenues for future work, and the conclusion (chapter 5).

The theoretical background (chapter 2) details out the specifics of social media distraction and it will cover the theoretical understanding of attention and distraction, including the most important theories on attention and distraction (distraction-conflict theory, threaded

cognition theory, uses and gratifications approach, the dual systems perspective, and the role of habits and self-control), portraying why attention is limited and distraction has negative effects on performance. Moreover, the chapter argues based on theories, why social media users get distracted and which further influencing factors could play a role (individual differences, contextual factors).

Based on this theoretical foundation, chapter 3 explicates the four research questions investigated in this work, that are asking for the reasons for distraction, individual differences, underlying processes, and the impact on performance. Hereafter, chapter 4 briefly presents the three studies that are the core of this cumulative dissertation (the full papers are in the appendix).

Last, chapter 5 is the synthesis of this work and discusses the results in a joint manner by describing how the findings answer the posed research questions. A brief excursus gives more insights on how this work's findings can shed light on how users could reduce or better handle their social media distraction. A chapter on the theoretical and methodological contributions follows, and the limitations of this work, implications for future research and for practice are discussed, when this work ends with the conclusion.

2. Theoretical Background on Social Media, Distraction, and Attention

This work focused on understanding social media distractions from different angles. Social media distractions are caused by incoming external (e.g., hearing a notification) or internal (e.g., thinking about unanswered messages) social media cues that interrupt a person's momentarily performed goal-directed behavior (see Paper 1, Koessmeier & Büttner, 2021). Research has suggested that being distracted by social media and the smartphone can have negative effects on well-being, such as mood (Fitz et al., 2019), happiness (Brooks, 2015; Hobbiss et al., 2019), or life satisfaction (Brailovskaia et al., 2022) and it can heighten feelings of stress (Brooks, 2015; Brooks & Califf, 2017; Oraison et al., 2020). Reviews on distraction have shown the negative impacts on an academic (Jeong & Hwang, 2016) and cognitive level (Uncapher et al., 2017). Since previous studies have found negative effects that arise due to being distracted by social media, there is a convincing case to continue investigating the underlying processes of social media distraction to create a more nuanced understanding.

In the following sub-sections, social media, and its use in the context of this work are explained, the definitions of attention and distraction, and why these are important for this work, following the explanation of social media distraction, why social media is so distracting and which consequences this has. Later, a detailed theoretical background on attention as well as distraction and why these are important for social media distraction is provided to contextualize its meaning for this work.

2.1. Background on Social Media

The following sections describe the main construct of investigation, social media, and provides the definition of social media, how this term is used in the context of this work and discussed the broad directions of previous research on social media. In particular, it is discussed what previous works has found out about the potential effects of using social media. This understanding helps to better contextualize the following sections that focus on the distraction arising from social media.

2.1.1. Definition(s) of Social Media

Social media is broadly defined to include all user-generated communication via the Internet where users can create representations of themselves (profiles), (seemingly) interact

with others and with an audience big and/or small like posts or in chats (Carr & Hayes, 2015). The most essential parts of social media are a) that users can create profiles, b) there is some form of stream of user-generated content, and c) the possibility to create a network (Bayer et al., 2020). While social networking is a central part of social media, it is applying a stricter definition. Social networking sites (SNS) constitute that users can create a profile, connect with others, and visualize their network of connections (boyd & Ellison, 2007). The terms of social media and social networking sites have sometimes been used interchangeably (Bayer et al., 2020; Carr & Hayes, 2015). This work uses the term social media to include social networking site but also include those social distractions beyond it (e.g., instant messaging such as WhatsApp).

Thus, this work focuses on studying distractions from all social media platforms instead of limiting the research on one social medium or social networking site. Prior work has suggested that a new perspective on researching social media is needed and that research should go beyond focusing solely on one social media platform (Bayer et al., 2020). Furthermore, it has been indicated that limitations arise because of focusing on one social medium instead of investigating the social media landscape, most notably the lack of generalizability (Rains & Brunner, 2015). Therefore, prior work encouraged a broader view on social media, e.g. from the perspective of specific features (Rains & Brunner, 2015). Focusing not solely on one social media platform is thus beneficial since the individual platforms constantly change and even entirely new platforms enter the market and attract great numbers of users. Social media is undergoing constant changes of consumption and constant changes of popularity, hence limiting to one platform might constrain the generalizable value of the work.

Following the recommendation of previous research (e.g., Bayer et al., 2020; Rains & Brunner, 2015), this work does not solely focus on one social media platform but instead focuses on the phenomenon of distraction arising from social media platforms in general. In addition, it is likely that social media distractions are not specific to one platform but instead the associated behaviors are similar for multiple, if not all, platforms. Even more so, it might be challenging to identify unique behaviors that can be only accounted for by one social medium. Rather, the distraction behavior stems from the plethora of multiple social media together. Even if a certain distraction-relevant behavior were associated with a specific platform, it could be that this behavior would traverse to the others as well. Thus, focusing on distraction from all platforms enables to capture the full extent of social media distraction.

2.1.2. Previous Research on Social Media and its Effects

Previous research on social media has found positive as well as negative effects of using social media on its users. For instance, social media use helps building and maintaining social capital (Ellison et al., 2007; Koroleva et al., 2011), reinforcing communications on and off social media (Dienlin et al., 2017), increasing feelings of connection (Sheldon et al., 2011), social support (Liu & Yu, 2013), and reducing feelings of loneliness (Nowland et al., 2017; Teppers et al., 2014). Social media use does not only benefit social aspects, but it is also enjoyable. Research has shown that users felt entertained which resulted in greater well-being (Reinecke & Hofmann, 2016) and used it for recreational purposes and thus positively affected well-being (Reinecke & Eden, 2017). Smartphone use has been shown to help to recover (Rieger et al., 2017) and its use making people feel less excluded (Hunter et al., 2018). In sum, numerous studies have shown that social media use can have positive effects.

However, prior work has also suggested a number of negative effects due to social media use: Previous research has noted that social media can be a major source of stress, also sometimes labelled as technostress (e.g., Brooks & Califf, 2017). For instance, social media use can be a major source of stress because of the great communication load it imposes (Reinecke et al., 2016). This social media stress has been shown to be able to negatively impact well-being and productivity (Tarafdar et al., 2014). Research has shown that social media and smartphone use increase the likelihood for mental health problems (Twenge, Joiner, et al., 2018), negatively affect well-being in general (Twenge, Martin, et al., 2018), and mindfulness (Du et al., 2021). These negative effects can, in turn, also increase social media use; for instance, research showed that low life satisfaction can lead to failures to control one's social media use (Du et al., 2021). While research has found that even though social media can reduce loneliness, it can increase feeling lonely when people use social media as an outlet to escape the real world (Nowland et al., 2017). In sum, even though social media use brings numerous positive benefits, there is also a downside to its use. However, when it comes to social media distraction, these positive effects of using social media may contribute to making it difficult for users to regulate their social media use and refraining from using it.

Even though this work concerns the distraction potential of social media and how it could be limited, the intention is not to state that users should quit using social media entirely. The focus lies on the effects of distraction arising from social media while trying to focus on a task that requires sustained attention which interrupts goal-completion. For instance, refraining from using social media has shown to increase anxiety to check social media (Hartanto & Yang, 2016) and withdrawal symptoms (Stieger & Lewetz, 2018). Thus, not using social media at all

seems also not to be the solution for handling social media distractions. Instead, it rather requires finding a balance of using social media in a way that allows users to fulfill their goals. Studies on reducing social media use have shown that this has positive effects, such that reducing social media use decreased the feelings of loneliness, depression, anxiety and fear of missing out (FoMO; Hunt et al., 2018), reduced procrastination as well as increased life satisfaction (Hinsch & Sheldon, 2013), and increased overall well-being (Brailovskaia et al., 2022). The aim of this work is not to point out that any social media use is bad in general. Instead, social media users need to find ways to deliberately handle social media so that they can reduce distractions and especially get rid of the negative effects of social media distractions. The following chapter will detail out why distraction is so problematic and also point to possible influencing factors of distraction.

2.2. Previous Research on Social Media Distraction

Research on social media distraction is still a relatively new field and especially when this project began, it was still in the early stages. This work was among the earlier ones looking into social media distraction. Thus, identifying relevant previous research on social media distraction faced several challenges. First, there was not that much research on social media distraction; interest (and thus publications) in the field has significantly increased over the last couple of years. Google Scholar search of the term "social media distraction" showed merely 20,100 results up until 2017, while up until now in the beginning of 2023 it has 319,000 unfiltered search results[1].

Second, it was challenging to identify relevant research on social media distraction because terms have been used inconsistently. This could be either because terms are used that are not related to distraction or not related to social media. In both cases, it is challenging to identify relevant research since it yields findings either only on social media or distraction, but not on social media distraction. In addition, previous work has oftentimes used the umbrella term (media) multitasking when investigating social media or smartphone-related distraction. A great number of studies has focused on multitasking, which describes using (social) media while performing other tasks (Lang & Chrzan, 2015).

Research on multitasking can be broadly categorized into research in cognitive studies or those that try to resemble or directly observe multitasking in daily situations. These studies

[1] GoogleScholar search on January 15, 2023, with the terms: social media distraction. Search with the end date 2017 showed 20.100 results while the search without any time restrictions yielded 319.000 findings.

are situational investigations of prior research (e.g., receiving notifications while doing something, or freely switching between multiple tasks). Media multitasking studies investigated, for instance, TV watching while reading (Armstrong & Chung, 2000; Segijn et al., 2017), while browsing websites (Brasel & Gips, 2017), or while doing homework (Pool et al., 2003). Research on social media did also study the use of social media while watching TV (Beuckels et al., 2017; Kätsyri et al., 2016; Oviedo et al., 2015; Rubenking, 2017).

Numerous studies have focused on multitasking during learning or while in a classroom. In particular, research has investigated the effects on learning caused by frequent social media use (e.g., Junco & Cotten, 2012; Rosen et al., 2013); smartphone use (Clayson & Haley, 2013; Demirbilek & Talan, 2017; Gikas & Grant, 2013), or the specific form of instant messaging and chatting while studying (Bowman et al., 2010; Hayashi & Blessington, 2018; Kraushaar & Novak, 2010). There is also research on the effects of being distracted at work and potential mechanisms to limit such (Mark et al., 2018; Zaman et al., 2019). Few studies, however, have investigated social media distraction directly, for instance, by examining the effect of receiving notifications and users' response times to notifications (Berger et al., 2018), the effect of hearing notifications on performance (Stothart et al., 2015), or the effects of restricting notifications on well-being (Fitz et al., 2019; Kushlev et al., 2016).

Especially the phenomenon of the smartphone's mere presence has been investigated in previous work. This body of literature indicates that smartphones can be distracting by their mere presence – hence without hearing or seeing any notifications or interacting with it. Several studies showed effects of the smartphone's mere presence on cognitive performance (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017), on memory (Tanil & Yong, 2020), while driving (Chee et al., 2021) or for relationship formation (Przybylski & Weinstein, 2013), such as lower conversation satisfaction if the other perceived smartphone presence (Allred & Crowley, 2016) or fewer smiles between people (Kushlev et al., 2019). However, not all studies replicate the effect of the mere presence on cognitive (Johannes, Veling, et al., 2019); see Paper 3, Koessmeier & Büttner, 2022) or social outcomes (Crowley et al., 2018; Hartmann et al., 2020). Some findings suggest that smartphone dependence might play a role and effects are observable only for those highly depending on the smartphone (Cheever et al., 2014; Hartmann et al., 2020). Nonetheless, research has shown that the mere presence of the smartphone leads to vigilance and feeling distracted (Johannes, Veling, et al., 2019) and being separated from the smartphone makes people feel anxious (Cheever et al., 2014).

A further field of research focused on driver distraction or being distracted while participating in traffic. A great number of research has investigated being distracted while

driving or otherwise participating in traffic (Berenbaum et al., 2019; Dumitru et al., 2018; Meldrum et al., 2019; Vollrath et al., 2016), which negatively affected driving performance (Chee et al., 2021; Delgado et al., 2016; Ortiz et al., 2018; Strayer et al., 2003) and may lead to unsafe traffic behavior of pedestrians (Thompson et al., 2013). While getting distracted by a smartphone is very common (Gliklich et al., 2016), users underestimate the risks associated with it and assume others are doing it as well (Berenbaum et al., 2019).

Cognitive studies have investigated individual differences in task switching (Alzahabi & Becker, 2013; Alzahabi et al., 2017), executive functions (Magen, 2017; Murphy et al., 2017; Shin et al., 2019), or attention (Gorman & Green, 2016; Ralph et al., 2014; Ralph et al., 2015). A number of cognitive studies used the media multitasking index (MMI) from Ophir et al. (2009) to investigate the impact of daily multitasking intensity (high vs. low media multitaskers) on cognitive abilities, for instance task switching and filtering of distractors (Ophir et al., 2009; Uncapher et al., 2016; Wiradhany & Nieuwenstein, 2017), cognitive control (Alzahabi et al., 2017), inhibition (Murphy et al., 2017; Shin et al., 2019), or memory (Madore et al., 2020). Most studies have suggested impairments in cognition of people who multitask a lot in their daily life, so-called heavy media multitaskers (Uncapher et al., 2017).

In sum, most studies have in common that they focus on the effects of engaging in multitasking or being distracted. In particular, the largest body of literature has linked frequent social media use or using it while studying or during lectures, to reduced academic performance (Giunchiglia et al., 2018; Gupta & Irwin, 2016; Junco & Cotten, 2012; May & Elder, 2018). This shows the urgency needed for understanding how the effects of social media use and distractions in particular, can be reduced. To do so, the underlying processes need to first be understood better.

There is a gap in understanding the process and the reasons for why users are letting themselves get distracted. This research aims at filling this gap by focusing on the reasons for distraction and uncovering the underlying processes of distraction, namely visual and internal distraction. At the same time, this work takes up previous research by also investigating individual differences of distraction and effects on performance.

Most common methods in previous research were experiments (especially for the cognitive studies) or surveys (e.g., of the effect on social media use on academic outcomes) to investigate the effects of frequent social media use or using social media while doing something. Particularly the cognitive studies however, mostly relied on self-reported distraction in daily life, such as multitasking behavior, to try find out differences in task switching or executive functions. These studies did not directly investigate effects of social media or the

smartphone distraction. In addition, even though experiments with social media or the smartphone were conducted, these did not assess how distracting these stimuli are, they just focused on the effects of these. Hence, this work brings in novel perspectives by using methods measuring social media distraction and also employed objective measures for distraction in the form of eye tracking. For understanding the underlying mechanisms of (social media) distraction, it is important to consider attention and the role it plays for distraction. The following describes the interplay of attention, distraction, and especially social media distraction.

2.3. Attention, Distraction, and Social Media Distraction

Social media distractions are problematic since they draw user's attention. When people are focusing on a goal and trying to fulfill a task that is leading them to this goal, their focus lies on this task. However, social media, the smartphone, and their notifications are constantly available to their users and hence bring the potential of constant distraction. Attention determines the stimuli being cognitively processed (Anderson, 2013) and due to an abundance of those, certain stimuli are selected for being cognitively processed (Anderson, 2013). Those stimuli that receive users' attention, are those that are cognitively processed. This means the susceptibility for distractions is influenced by how attention is drawn to social media stimuli. People have a limited capacity to cognitively process information (Anderson, 2013; Pashler, 1994), meaning that "there is a limit to the number of things to which we can attend at any one time" (Deutsch & Deutsch, 1963, p. 1), otherwise it may negatively impact performance (Treisman, 1964). This limited capacity applies to information processed consciously as well as unconsciously (Lavie et al., 2014). Hence, when individuals are focusing on achieving a goal, it would be most beneficial to divert all attention only on that goal, since individuals only have a limited capacity to process.

Due to the abundance of stimuli that are constantly around and due to limited attentional capacities, people need to filter for the relevant information if they want to focus on a specific task. Filtering costs can easily arise when two or more objects compete for attention, because the necessary filtering of irrelevant stimuli takes up attentional capacity (Treisman et al., 1983). In the context of social media distractions, it is important to understand how attention is directed towards certain stimuli, while distractions are filtered out. When focusing on a task, users are required to filter out the irrelevant social media stimuli. However, the filtering of only relevant information is difficult because certain stimuli seem to automatically draw people's attention

(e.g., social media cues). Attentional capture, the "involuntary pull of attentional resources by salient stimuli" (Anderson & Folk, 2010, p. 342), describes exactly this process. Social media cues bear the great potential to capture user's attention and thus can become a distraction.

According to the goal-activation model (Altmann & Trafton, 2002), a goal is activated by paying attention to it. This is the case when someone is working on a particular task. Goals are the "mental representation of an intention to accomplish a task, achieve some specific state of the world, or take some mental or physical action" (Altmann & Trafton, 2002, p. 39). For an interruption to take place, it needs a certain amount of "goal strengthening", i.e., paying attention to the distracting stimuli, for the distracting stimuli to become the new active goal and replace the original goal (Altmann & Trafton, 2002). After such an interruption, goal-directed behavior can be resumed because of previously formed associations. Bringing back the attention to the original goal, by such stimuli, helps to reinstate the goal ones a person has been drawn away by distracting cues (Papies et al., 2008).

According to goal shielding theory, it sometimes requires individuals to shield their goal from other competing goals (Shah et al., 2002), such as social media notifications. To inhibit the following through with other goals depends on the goal's characteristics as well as individual motivations and emotions (Shah et al., 2002). Goal shielding is especially relevant when faced with distractions and requires self-regulatory capabilities (Shah et al., 2002). Especially for social media distractions that seem to automatically capture user's attention, a user needs to shield their goals.

Interfering in the process of focusing on one's goal are distractions, because they draw the attention away from fulfilling the intended goal. Distractions are "encountered stimuli that are irrelevant and intended to be ignored" (Clapp & Gazzaley, 2012, p. 2). Distractions are irrelevant to the task and thus interfere with goal-directed behavior. Therefore, distractions are problematic to goal-fulfillment since it requires additional effort to filter them out. Social media might encourage users to omit their goals and instead switch between tasks and the distracting social media stimuli. Task switching means that people disengage, switch, and reengage with the task (Allport & Wylie, 2000), which imposes a great potential to impact performance since these cues create a resumption lag, that is the time that passes between the upcoming distracting cue (i.e., a social media notification) until one reacts to this distraction, that is for instance to start with the activity of the interruption (i.e., checking social media).

The resumption lag also offers an opportunity for resisting the interruption (Altmann & Trafton, 2002). It suggests that a person has the time and opportunity to decide how to deal with the distraction (i.e., not starting to check social media). In this moment, the person is already

distracted, because the attention was being driving away from the task at hand. Even if the user chose to ignore the distraction, for a moment the attention was away from the task and needs to be redirect to the task. After an interference and goal-directed behavior is interrupted, the goal needs to be reactivated, by context cues that guide the person back to the original task. If an interruption took place and the person engaged in the interrupted task instead, then cues are needed to guide a person back to the task (i.e., that the person remembers the original task and where it was stopped). Being distracted also increases the likelihood of committing resumption errors (Monk et al., 2008), the mistakes a person makes after resuming to the task after being distracted. In sum, users have a limited capacity to process information, and thus distracting stimuli would need to be filtered out. If a distraction interrupted goal-directed behavior, it requires the user to direct the attention back to the original task. The following chapters explain in more detail what social media distractions are, how social media distractions arise, and why social media have such a great potential for distraction.

2.3.1. Understanding of Social Media Distractions

Since distractions draw the attention away from the task at hand, social media distractions can be a major threat for goal-fulfillment. In the social media context, this means that social media can distract a person from a task by interrupting a person's primary goal with cues that are strong enough to redirect the users' attention to the distracting social media cue. Social media distractions are caused by upcoming social media cues that disrupt goal-fulfillment and therefore should be ignored (Paper 1, Koessmeier & Büttner, 2021). Following goal shielding theory, users would require shielding their goals from social media distractions. In the context of this work, social media distractions are considered in moments during which users intend to focus on a specific task to fulfill a certain goal (other than using social media) that requires their full attention (e.g., studying, working). Situations such as waiting would not necessarily fall into the scope of a distraction, even though it may well be that people experience negative effects when using social media while waiting in line (e.g., not realizing that someone skipped the line, or it is already their turn).

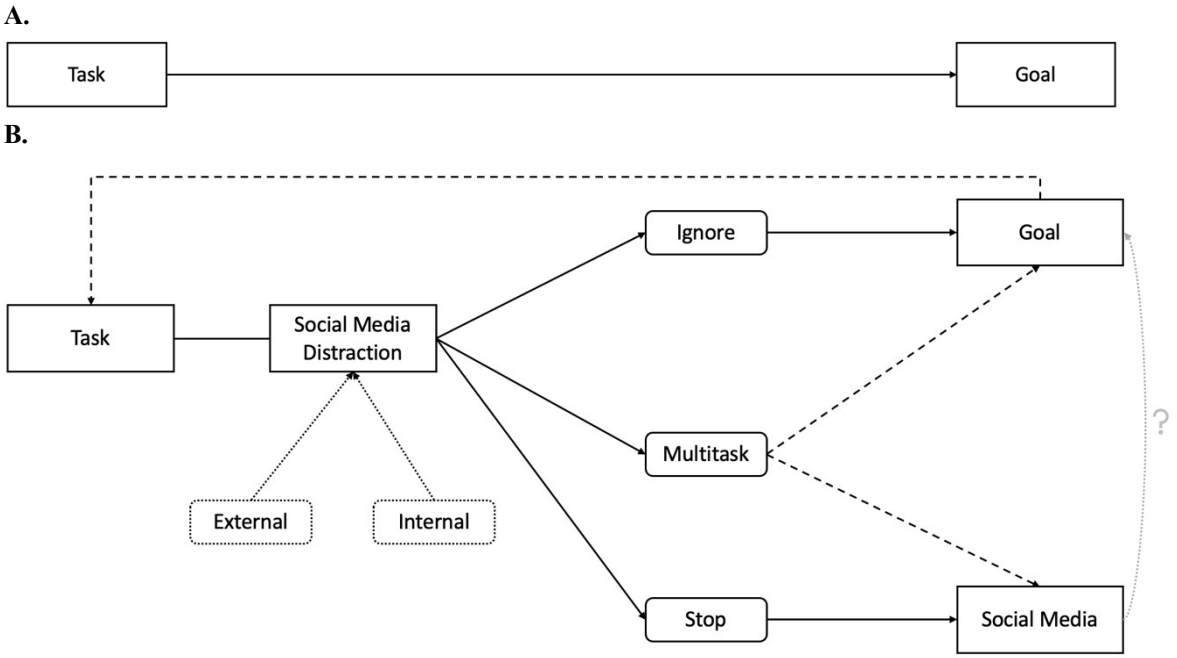
Social media distractions arise internally or externally (Paper 1, Koessmeier & Büttner, 2021). Internal social media distractions are upcoming thoughts about what might be going on in social media, for instance unanswered messages, how many likes a post might have received and so forth. For instance, research has shown that students thoughts wander to social media while learning (Hollis & Was, 2016). External social media distractions are external cues such

as receiving a notification from social media. As such, previous work has shown the distracting effect of hearing social media notifications (Stothart et al., 2015).

Besides being just interrupted, social media distractions oftentimes tend to lead to a) users stopping the task entirely to start using social media, or b) users starting to multitask with social media instead of c) ignoring the distraction and continuing with the task (Paper 1, Koessmeier & Büttner, 2021). Hence, a user has three options on how to react to social media distractions. Due to the time lag created when users get distracted (resumption lag), a user can decide whether to follow the distraction (and stop following the primary goal) or to resume with the task. In the context of social media distraction, it suggests that users have numerous stimuli towards which they could direct their attention to. When users are working on a task, they direct their full attention to achieving this goal. However, when getting distracted by social media, users would not filter out distracting stimuli such as social media cues but instead divert their attention to social media stimuli, hence not focusing on their primary goal anymore. Figure 1 shows this process of social media distraction.

Figure 1

Process Model of Social Media Distraction



Note. This model visualizes the process of users' social media distraction. *Figure 1A* describes the process when a person focuses on a goal and certain activities are required to reach that goal; users are working on a task with the aim to reach the goal. *Figure 1B* shows that when the user is focused on a task, social media distractions can disrupt this process of working on the task towards the goal. Internal and external social media cues create a social media distraction. The user has three possible reactions to these distractions – ignoring the distraction, starting to multitask, meaning to try both, working towards the previous goal but also using social media, or stop the task and thus goal attainment in favor of using social media instead. In the latter case, it is unclear, when the

goal attainment will be taken up again, if at all (hence the question mark). When deciding to multitask, users decide to continue their focus on their original goal, which means they go back to their task. This also means that they can again be distracted by social media.

One main enabler of social media distraction is the smartphone. Since the smartphone is mostly used to access social media (Statista, 2022), distractions arising from the smartphones are oftentimes social media distractions (or users expecting social media notifications). Because of the smartphone, social media distractions can happen anytime – smartphones are an entry gate for constant distraction. Social media and smartphones allow their users to be permanently online and permanently connected to the online world (Vorderer et al., 2018). However, this also brings the possibility and burden to be constantly distracted by social media, the smartphone, and their notifications. Hence, the smartphone appears to be the main connector to social media (e.g., at the beginning of Instagram, it was only possible to use this social medium via the app). Indeed, research using log data has shown that social media apps are the most used apps on the smartphone (Deng et al., 2018).

Smartphone and social media distraction are very connected constructs, with social media being the construct while the smartphone is the gadget to access. Research has shown that users associated thoughts about social relationships when seeing a smartphone (Kardos et al., 2018). It indicates how closely connected social media and the smartphone are. When seeing or thinking about the smartphone, users think about staying connected with their relationships, for they use social media. Thus, in this work, social media distraction and smartphone distraction are examined together.

Since most distractions and especially most distractions from social media are transferred to its users via the smartphone, it is as important to also investigate the distraction potential of smartphones. Hence, even though this work focuses on social media distraction, it cannot neglect distractions arising from the smartphone. Thus, in this work, the term social media distraction also includes smartphone distraction.

2.3.2. Internal and External Social Media Distraction

It is important to consider how people are distracted, and especially where the distraction is coming from in order to be able to handle distractions. There are different social media cues that could be potential sources of distraction. Distractions can arise from external or internal sources (alternatively used: exogenous and endogenous, see for instance Wilmer et al., 2017). *External distractions* refer to distractions caused by the environment; external stimuli that direct attention away from the task (see Paper 1, Koessmeier & Büttner, 2021; Wilmer et

al., 2017). *Internal distractions* refer to distractions caused by upcoming thoughts unrelated to the task (Fisher, 1998; Forster & Lavie, 2014), such as when users start thinking about social media or the smartphone (see Paper 1, Koessmeier & Büttner, 2021; Wilmer et al., 2017) potentially with the hope of immediate gratifications (Wilmer et al., 2017). For instance, people can start mind wandering and therewith create an internal distraction (McVay & Kane, 2010). Research suggested that mind wandering manifests in a general susceptibility for distractions (Forster & Lavie, 2014). Prior work has argued that both mind wandering as well as external distractions might be due to lowered attentional focus (Hobbiss et al., 2019). Therefore, it is crucial to not only investigate external distractions but also internal distractions. In the following, both sources of distraction are discussed.

External distractions arise from different sources, and these distracting social media cues can be *visual* (e.g., social media notifications, app symbols, the smartphone), *auditory* (e.g., hearing the ringtone), or *haptic* (e.g., vibrations) and are probably the distractions that one first thinks of. Previous research has shown that external cues can increase craving towards social media for instance when seeing social media symbols (Wegmann et al., 2017) and also distract users from their tasks when hearing the smartphone ring (Stothart et al., 2015). Moreover, research showed that merely seeing smartphone cues can create associations to relationships (Kardos et al., 2018), and even impact performance (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017) especially when distracted by notifications (Mendoza et al., 2018).

Social media distractions can also be internal, such as a person's mind wandering off to what might be going on in social media or people being constantly thinking about social media. Previous work has suggested that smartphones represent connection cues which represent an unconsciously trigger to direct attention to the smartphone (Bayer, Campbell, et al., 2016) and thus bear the potential of internal distraction. Previous work has suggested that also external cues, as the smartphone lying next to a user, can create an internal awareness of the smartphone and feeling of distraction (Johannes, Veling, et al., 2019). Hence, besides external cues distracting social media users, also internal social media distractions can come up.

Mind wandering to social media, or the smartphone, may also cause users to become internally distracted. People might fail to control their attention, resulting in social media-related thoughts, such as what may be going on in social media, potential new messages and posts, or unanswered messages. In specific, mind wandering describes "that goal maintenance is often hijacked by task-unrelated thoughts (TUT), resulting in both the subjective experience of mind wandering and habit-based errors" (McVay & Kane, 2010, p. 324). It means that mind

wandering comes from failing to control ones' attention (McVay & Kane, 2010). Even though users may focus on a specific task, they may start mind wandering which can become an internal distraction (McVay & Kane, 2010).

Research has indicated that students whose mind frequently wandered in daily life also showed higher overall stress and lower life satisfaction (Mrazek et al., 2013). Relatedly, prior results showed that both smartphone distractions and mind wandering were related to lower happiness (Hobbiss et al., 2019). Further, research has shown that students' mind wandering resulted in lower performance of a reading comprehension test (Mrazek et al., 2013). As such, previous research has shown that while students learn online, their thoughts wandered to social media quite frequently (Hollis & Was, 2016). Research has shown that mind wandering increases the susceptibility of distractions (Forster & Lavie, 2014). Mind wandering thus might create internal social media distractions which might impact their task performance.

Vigilance is an internal process that can also impose an internal social media distraction. In general, vigilance refers to sustaining attention (Oken et al., 2006), that is a maintained attentional focus "to remain alert to stimuli over prolonged periods of time" (Warm et al., 2008, p. 433). Vigilance in general is important for keeping the attention on the current task. Online vigilance, however, describes the constant orientation towards being connected, an ongoing attention to the online world, and the disposition to prioritize online communication (Reinecke, Klimmt, et al., 2018). Social media especially could create such an alertness and attention. Hence internal distraction by social media could, among others, be caused by vigilance. Previous work has also introduced smartphone vigilance as a constant awareness of being able to connect with others, check the Internet and being able to respond to any upcoming notifications (Johannes, Veling, et al., 2019). Users could be constantly vigilant of possible incoming notifications and be generally aware of what may be happening in social media and thus, a state of internal distraction is created.

2.3.3. Why are Social Media Distracting?

Social media can be very distracting to its regular users, because upcoming social media cues are oftentimes a great temptation (Paper 1, Koessmeier & Büttner, 2021). Resisting social media use is very challenging for regular social media users. Previous research has shown that it is difficult for users to stop using social media: Experimental intervention studies revealed that participants find it difficult to not use social media for a week and show withdrawal symptoms such as heightened craving and boredom (Stieger & Lewetz, 2018). In addition, research has indicated that reducing smartphone use can help make users less anxious (Hunt et

al., 2018). But what makes social media so distracting? Various factors may influence users' susceptibility for social media cues that may make them distracted.

Early work on distraction suggested that a meaningful distractor might be more distracting (Graydon & Eysenck, 1989). Prior work showed that reward associated stimuli are more distracting than non-reward-associated stimuli (Rusz et al., 2018). Especially the strive for social connection may be one factor influencing users' susceptibility to social media and make social media so meaningful to its users. Humans strive for social connection and their fundamental need to belong (Baumeister & Leary, 1995) may make users especially vulnerable to constant connection and therewith susceptible for distractions. It has gone so far as that users regard social media as the connecting cues to social contacts (Bayer, Campbell, et al., 2016). Curiosity of what may happen online might be one further driving factor. Research has shown that even though facing possible regrets, curiosity seems to be more convincing in driving a person's actions (van Dijk & Zeelenberg, 2007). A related concept specific to the social media is the fear of missing out on what is happening online, abbreviated as FoMO (Przybylski et al., 2013). Previous research has shown that high FoMO is related to higher social media use (Hunt et al., 2018; Müller et al., 2020; Oberst et al., 2017). In fact, a number of individual differences have been associated with high social media use or proneness for distraction (see chapter 2.8.1.).

The constant availability and, more importantly, constant possibility of receiving social media cues is one major influencing factor of why social media is so distracting. This constant availability of social media has led to behaviors and habits specific to social media. As such, previous work has indicated that social media cues evoke hedonic reactions (van Koningsbruggen et al., 2017). Resisting social media temptations is very difficult due to the promise of immediate gratifications, its strongly habitual use, the constant availability, and disrupting push notifications, all of which seem to make the exertion of self-control very difficult in the context of social media (Hofmann et al., 2017). Thus, users have further learned to associate certain immediate gratifications with using social media. Hence, awaiting such gratification may further drive users' susceptibility for social media distractions.

Over time and with repeated exposure to social media, notifications would lead to learned behavioral reactions such as directly opening the message because of the hedonic appeal and learned positive affect associated with the notification (Hofmann et al., 2017). Due to such learned behaviors and habits, social media distraction may have become so habitual and ingrained in users' behavior, that it can occur unconsciously. Prior work has suggested that engaging in social media while working on a task or being in a lecture does not happen with

full attention, but rather unconsciously, showing that social media cues can draw users in to distraction (Aagaard, 2015). Further, social media may have become so integral that even the mere presence of its cues (i.e., social media symbols, the smartphone) may already be inducing social media related thoughts and thus be distracting (Johannes, Veling, et al., 2019; Koessmeier & Büttner, 2022; Wegmann et al., 2017). The following chapter will explain in more depth, why distraction is so problematic, and which attentional processes help explain this.

2.4. Attention and its Limits: Why is Distraction a Problem?

To understand the problem of social media distraction and its underlying mechanisms, it is necessary to first considering the theoretical background on of the underlying attentional processes. The following paragraphs include the definition and current understanding of attention as well as further theoretical background on attention.

The initial understanding of attention was that it is either top-down – attention guided by the individuals' goals – or bottom-up – passive attention guided by the availability of stimuli (e.g., Anderson, 2016; Theeuwes, 2010). Visual attention selects visual cues that are further cognitively processed (Kastner & Buschmann, 2017). Research has suggested that first bottom-up processes play a role for visual attention, upon which follows top-down processing (Theeuwes, 2010). As such, *stimulus-driven attentional selection* proposes that following the initial bottom-up visual attention, top-down attentional selection guides the further cognitive processing (Theeuwes, 2010).

The working memory is storing and processing the stimuli and information that individuals perceive (Baddeley, 1992). This ability is necessary for performing complex cognitive tasks. However, the working memory capacity is limited and therefore, people's capacity to process information is limited (Cowan, 2001). Research has suggested that there is even a central capacity limit of three to five chunks of information (Cowan, 2010). People therefore have to select stimuli to be processed; selective attention refers to attending to certain stimuli while neglecting others (Kahneman, 1973; Treisman, 1969) which might not be so easy (Treisman, 1969). When people are focusing on a specific task, they are focusing their attention on only task-relevant stimuli and would ignore distracting stimuli, such as social media cues.

Focused attention refers to attending only to specific stimuli while ignoring others; it includes sustained attention, being able to hold the attention on specific stimuli (Wilmer et al., 2017). Divided attention, on the other hand, refers to attending to multiple stimuli

simultaneously (Wilmer et al., 2017), which can happen when stimuli only differ in one feature or vary along different dimensions (Treisman, 1977). The following chapter dives deeper into theories of attention and the role for social media distraction.

2.4.1. Early vs. Late Processing

Early theories on attention discussed when a stimulus is being perceived and cognitively processed and assumed that the processing of information flows through a bottleneck where not all stimuli can be attended to simultaneously, but must be processed sequentially (Pashler & Johnston, 1998). Just like a bottleneck prevents from the whole fluid pouring out of the bottle at once, a similar filter is letting through only some stimuli. Early selection theories of attention, such as Broadbent's (1958) *filter theory*, stated that only a limited number of stimuli can be processed. While a stimulus is being processed, the others will wait for eventual later processing (Broadbent, 1958). However, research has demonstrated that more information is led through such a filter than originally assumed by the filter theory and people can catch up on other information as well (Treisman, 1964). Instead of entirely blocking stimuli as Broadbent (1958) suggested, Treisman (1964) argued that stimuli are rather attenuated, so that certain stimuli (e.g., stimuli with high importance or that are very familiar) can be easily picked up.

Other theories have rather argued for a late selection of stimuli, such as Deutsch and Deutsch (1963) who stated that the importance of a stimulus influences the attention it receives. Stimuli of high importance may be more likely to be perceived (Deutsch & Deutsch, 1963). Hence, attention is determined after the stimulus is being perceived and evaluated (for instance based on personal importance). Given that social media might be very important to its regular users, social media stimuli could get more attention than, for instance, stimuli that are relevant to the task they ought to fulfill.

According to the *theory of visual attention* (TVA), stimuli are perceptually categorized when entering the limited short-term memory (Bundesen, 1990). The selection of stimuli happens by a so-called processing race for potential perceptual categorization (Bundesen, 1990). The role of new information entering the working memory compared to already existing information is discussed in cognitive load theory. *Cognitive load theory* (Sweller, 1988) stated that primary knowledge accounts for rather unconscious tasks which means that such task require less cognitive load. Secondary knowledge is rooted in cultural habits and requires more cognitive load; thus, it is related to more conscious actions (Sweller, 1988; Sweller, 2011). Following the cognitive load theory, people have a limited working memory to process novel information, and a long-term memory in which new information then is stored (Sweller, 1988;

Sweller, 2011). However, following *attentional control theory*, anxiety impairs executive functioning, including inhibition, and more the processing efficiency than quality of performance (Eysenck & Derakshan, 2011).

While the processing system is responsible for processing new stimuli, decision making, and results, the attention system uses a network of three anatomical areas (alerting, orienting, executive), which are responsible for different attentional processes (Petersen & Posner, 2012; Posner & Petersen, 1990): The alerting network is constantly alert and vigilant, the orienting network processes and prioritizes new stimuli, and the executive control (formerly described as target detection) describes the limited capacity which is used to direct attention to the relevant stimuli (i.e., target detection) and its awareness (Petersen & Posner, 2012; Posner & Petersen, 1990). The framework has been extended in several ways, by taking into account self-regulation capabilities, individual differences, training effects, and recognizing that more systems may be detected in the future (Petersen & Posner, 2012). In summary, early work on attention has highlighted that attention is limited and due to the limitations, stimuli are constantly competing for the user's attention. The above-mentioned theories discuss how stimuli are being selected for processing. It remains the question on why social media in particular could be competing for attention, and how the competing stimuli (social media versus a goal) would be processed. The next chapters therefore introduce the concepts of value-driven attention and attentional bias.

2.4.2. Value-Driven Attention

The question persists why social media stimuli are likely to draw user's attention, even though social media stimuli could be considered as goal-irrelevant and thus might be ignored. The previous chapter has described the early, fundamental understanding of attention which suggested a two-process understanding of attention (i.e., bottom-up vs. top-down attentional processes). However, prior work has argued that such a two-process model of attention may not sufficiently describe the process of attentional capture (Anderson & Folk, 2010). In Anderson's (2013) framework, the two attentional processes are called goal-driven and salience-driven attention. *Goal-driven attention* means that goal-related stimuli are preferably processed and attended to, a process that is cognitively demanding (Anderson, 2013). *Salience-driven attention* refers to attention that is automatically captured by the presence of stimuli (Anderson, 2013). This includes novel, unknown, or unexpected stimuli that capture one's attention, but also means that salient distractors will be processed (Anderson, 2013).

Anderson (2013) argued that besides goal-driven and salience-driven attention, stimuli that are based on previously learned rewards may capture attention (Anderson, 2013), hence describing a *value-driven* understanding of attentional selection. *Value-driven attention* means that experiencing rewards leads to preferred attentional capture, making people primed to these stimuli (Anderson, 2013). Other research has referred to value-driven attention as reward-driven attentional mechanism or value-modulated attentional capture (Le Pelley et al., 2016; Rusz et al., 2018).

Such reward-associated stimuli seem to be more capturing than when encountering goal-relevant stimuli (Anderson, 2013). Attention that is learned based on reward associations is quickly formed and very strong (Anderson, 2013) – these associations are so strong that they tend to automatically capture people's attention (Anderson, 2016). Hence, distracting stimuli can draw an individual's attention if stimuli have been previously associated with rewards. These stimuli receive a greater attentional priority and therewith can compete for the limited attention even with tasks or goals to be fulfilled (Anderson, 2016). These learned automatic attentional processes can become habitual (Anderson, 2016). Already early work on attention has highlighted the learning effects of attending to certain stimuli, reinforcing this attentional behavior that eventually results in ignoring or attending to certain stimuli (Mackintosh, 1975). This implies what makes social media in particular so distracting – social media stimuli receive heightened importance due to the learned associations and rewards from using it. Value-driven attention is so strong that it even undermines other, more important stimuli: "When stimuli are learned to predict reward, these stimuli gain a competitive advantage in perception that promotes selection even when they are nonsalient and task-irrelevant" (Anderson, 2013, p. 12).

Social media stimuli hence draw users' attention on two important realms. First, stimuli that have social meaning have the potential to capture attention (Anderson, 2013). Social media is highly socially relevant and thus bears the potential to capture user's attention. Secondly, because of the rewards and associations learned by using social media, users might have formed value-driven attentional patterns for social media. This combination makes social media stimuli especially attention-capturing that possess the power to even draw the attention away from important tasks that people intend to fulfill, meaning it brings the potential to distract.

2.4.3. Attentional Bias

Users are not only likely to preferably process social media cues, but they might also form a bias towards social media-related stimuli. The attentional preference based on rewarding experiences can also form attentional biases. Attentional bias refers to certain cues that catch

users' attention by receiving a heightened priority for cognitive processing (Field & Cox, 2008). Usually, an attentional bias is a helpful way of obtaining goals. When striving towards a goal, it is beneficial to give goal-related stimuli heightened priority for processing (Shah et al., 2002). Reward-associated stimuli create attentional biases via classical conditioning (Field & Cox, 2008). Through the repetitive association of certain stimuli and subsequent rewards, users learned to associate these rewards with these stimuli, such that the stimuli automatically receive preferred attention. This implies that learning the positive rewards from using social media, or the rewards of quickly responding to social media cues, these rewards become directly associated with the cues. Thus, users form attentional biases towards social media cues.

A facilitator of forming and keeping attentional biases is user's craving towards reward-associated stimuli (Field & Cox, 2008). Previous work has concluded that attentional biases and craving are closely related, especially when the attentional bias is formed by visual attention (Field et al., 2009). Visual attention is an important mechanism for problematic behavior based on attentional biases (Field & Cox, 2008). Research has demonstrated that attentional bias is indicated by visual attention towards the reward-associate cues for which a person has formed an attentional bias (Papies et al., 2008). As such, prior work has shown that attentional biases can increase the visual attentional scope in favor of the cued behavior (Büttner et al., 2014). However, this could in turn lead to more distractions, such as previous research that showed impulsive shoppers are more distracted by irrelevant products in shopping situations (Büttner et al., 2014). However, prior work has demonstrated that motivational states can also direct people's attention to cues related to their current state (Papies et al., 2008). Taken together, In the context of social media distraction, it is important to highlight that especially those stimuli are selected, that have previously been proven to be rewarding. On the one hand, users are likely to form habits due to learned positive associations with social media, and on the other hand are driven very momentary, for instance in the case of trying to avoid unpleasant situations. The following chapters explain in more detail the theoretical background that helps understand distractions.

2.5. Distraction and its Specific Form Social Media Distraction

The previous section argued why social media cues are likely to draw a user's attention and therefore tempt users into distraction. The following section shows how distraction is likely to influence social media. But first, it needs to be stressed that distraction and its effects is more nuanced, it is not inherently negative, and there are also positive forms and effects of distraction.

Not every type of distraction may result in negative effects for a person's goals. Early research on distraction has highlighted the beneficial effects of distraction. For instance, prior work has highlighted the positive effects of distractions in coping with pain (McCaul & Malott, 1984). Distraction can work because pain is merely an interpretation of sensations and there is limited capacity to process information and therefore, diverting the attention to something else can help (McCaul & Malott, 1984). Other research has suggested that distraction could help in the case of depression; In context of *response-style theory*, distraction has been discussed as one of three (besides rumination and problem-solving) responses to depressive symptoms in both severity and duration (Abela et al., 2007; Nolen-Hoeksema, 1991; Roelofs et al., 2009). Especially distractions (along with problem-solving) can help reduce depressive symptoms (Abela et al., 2007; Roelofs et al., 2009). Further previous research has investigated the positive effect of distractions in delaying rewards; distractions help to wait longer for gratifications (Mischel & Ebbesen, 1970; Mischel et al., 1972). Being able to delay rewards is considered one of the most important skills for self-regulation and thus goal-fulfillment. Even though this work focuses on distraction in the context of disrupting tasks that require full attention, it has to be stressed that distraction is not generally negative.

Nonetheless of these positive effects that distractions can have, in the context of trying to focus on a goal for which focused attention on a task is required, distractions can be harmful. The following chapters focus on theories describing the detrimental effects of distraction in the context of disrupting work.

Early research on distraction has already established that distraction negatively affects cognitive performance (Graydon & Eyesenck, 1989). This effect of distraction on performance is influenced by task complexity, distractor-task similarity, distractor's meaningfulness, task practice (Graydon & Eyesenck, 1989). Especially the meaningfulness of distractors might be relevant for social media distraction; social media tends to be meaningful to its users and hence this may make them particularly distracting.

According to the *bias competition model* (Desimone & Duncan, 1995), visual stimuli are competing for limited processing capacity. While previous studies have suggested that attention means only certain stimuli are perceived, this work demonstrates that attention is the suppression of neuronal representation of behaviorally irrelevant stimuli (Desimone, 1998). A bias is created by bottom-up and top-down mechanisms of all competing stimuli (Desimone & Duncan, 1995). Research has argued that there are two systems involved in the selection of stimuli. One system is applying goal-directed (top-down) selection of stimuli and responses while the other focuses on detecting relevant stimuli, especially those that are salient or

unexpected. Thus, there is the conscious process of attention (top-down) and the unconscious or salient processes that both direct attention (Corbetta & Shulman, 2002). While the goal-directed top-down attentional mechanism might be responsible for maintaining the attention on the task at hand, social media cues could compete for the attention via bottom-up processes and therewith distract from a task. The following chapters present theories explaining distraction in more detail. These theories can help explain the negative effects of distractions on performance while working on a task to reach a goal.

2.5.1. Distraction-Conflict Theory

One of the theories commonly used to describe the effects of distraction is *distraction-conflict theory* (Baron, 1986) which explains in more detail how distractions are interfering with goal fulfillment. Baron (1986) defined distraction as "a manipulation that taxes attentional capacity leading the organism to make priorities, take cognitive shortcuts, and ignore certain stimuli and tasks" (p. 29). This definition highlights the importance of limited attentional resources mentioned earlier and the importance of selecting stimuli to be processed.

Distraction-conflict theory states that any attentional conflicts create "*drivelike* effects on task performance and motor behavior" (Baron, 1986, p. 6). Such attentional conflicts are caused by distractions that are tempting and difficult to ignore during tasks that need to be finished under pressure, while both, the distraction and task, cannot be performed simultaneously (Baron, 1986). Social media distractions have the potential to impose attentional conflicts due to it being so tempting to its users that can create drive-like reactions. In these situations, attentional conflicts can arise "not only by external distractions but also by internal distractions, i.e., cognitive activity that is not directly relevant to task solution" (Baron, 1986, p. 7).

In sum, distraction-conflict theory states that distraction create a conflict between a goal-directed behavior and the distracting stimuli, both cannot be performed simultaneously. In addition, Baron (1986) described the importance of considering internal distractions that can disrupt task performance besides the external distractions.

2.5.2. Perceptual Load Theory

While distraction-conflict theory describes the process of distraction, *perceptual load theory* describes the circumstances under which distracting stimuli can be perceived at all. The theory was thought of as a compromise to the early versus late selection debate of attention (Lavie, 2010; see chapter 2.4.1). According to perceptual load theory, when all cognitive

capacities are needed for fulfilling a task, there is no further capacity left to devote to distractors; this represents the early selection of attention (Lavie, 2010; Lavie & Dalton, 2014). However, when not all cognitive capacities are needed, there are capacities left that could be devoted to distractors instead (Lavie, 2010; Lavie & Dalton, 2014). It suggests that "[o]wing to the involuntary nature of perception, irrelevant information that people intend to ignore can reach full awareness under conditions of low perceptual load (resulting in late attentional selection)" (Lavie et al., 2014, p. 2). This indicates that people become aware of distracting stimuli during low perceptual load.

According to perceptual load theory, social media distractions would be particularly distracting for tasks that do not require all mental capacities. People can become aware of social media stimuli they intended to ignore when tasks require only low capacity. Hence, social media users might be most prone for distraction when their currently performed task is not requiring all cognitive resources.

Not only external distractions are less likely to distract during high cognitive tasks. In the realm of perceptual load theory, also internal distractions such as mind wandering have been shown to be lower during tasks of high cognitive load (Lavie, 2010). Thus, the theory indicates that both external as well as internal social media distraction can interfere with a task, but more likely so under low cognitive load. It suggests that internal distractions are more likely when people are currently working on tasks not requiring their full capacities.

2.5.3. Threaded Cognition Theory

While perceptual load theory describes when distracting stimuli have a chance to be perceived by its users, threaded cognition theory helps to explain negative effects of (social media) distraction, since it answers the question on how competing tasks are handled. According to *threaded cognition theory* (Salvucci & Taatgen, 2008), tasks requiring the same resources (i.e., perceptual, cognitive, motor) cannot be performed at the same time. As such, watching a movie while at the same time reacting to social media is not possible, since the same main resources (cognitive) are needed. In general, however, threaded cognition theory assumes that people are capable of performing tasks simultaneously, if they are not interfering with each other (e.g., using social media while listening to music).

When a person is interrupted while working on a task, it creates an interruption lag – a moment during which users think whether they should engage in the distraction or not (Salvucci et al., 2009). If people decide to follow up on the distraction (i.e., using social media), they might at some point, want to go back to their primary task. This will create the resumption lag

– the time that people need to find their way back into their primary task (Salvucci et al., 2009). These two lags following a distraction, the interruption as well as resumption lag, are time costly. Thus, getting distracted by social media (or other) is not only counter-productive to a task indented to fulfill, but also inefficient. Thus, it opens up the question why users are getting distracted if it is so cognitive exhausting as well as time-consuming.

2.6. Why do Users Get Distracted? Explaining the Process of Distraction

The question, then, given these possible negative influences is why people get distracted by social media. In the following, this work investigates the underlying processes that play a role for social media distraction. Based on the current literature, several aspects may play an important role here. As social media use can be driven consciously and also unconsciously (Bayer, Dal Cin, et al., 2016). The following chapter will bring examples of such underlying processes of conscious and unconscious social media distraction. As a conscious process, the uses and gratifications approach may help explain that user's distraction can be driven by certain needs and gratifications that the user is aware of. In line with dual systems perspective, this work argues for both systems playing a role, the reflective and impulsive. As unconscious distraction, the role of impulses as well as habits and self-regulation are considered.

2.6.1. Uses & Gratifications of Social Media Distraction

When trying to understand what drives users to social media distraction, the *uses and gratifications approach* (U&G) can provide a user-centric perspective on why users decide to use media and thus, social media distraction. The uses and gratifications approach (Katz et al., 1974) states that users play an active role in choosing media according to their current needs and gratifications (Rubin, 2002) and has been commonly used to explain why people use media (Ruggiero, 2000). Likewise, U&G may help explain why users are letting themselves get distracted by social media. Different factors influence media use, such as social and psychological factors, the context and consequently also media effects (Rubin, 2002), and for instance mediate such effects (Rubin, 2009). Hence, U&G could be seen as advocating for users being not merely impulsive in their media choices, but that users can make media choices consciously.

Like prior work arguing that users have an active choice in using media (Rubin, 2002, 2009) and social media (Papacharissi & Mendelson, 2010; Quan-Haase & Young, 2010; Whiting & Williams, 2013), this work proposes that users also have an active choice on how to

react to a distraction which is guided by user's underlying needs and gratifications (see Paper 1, Koessmeier & Büttner, 2021). Users' momentary needs and sought gratifications might also influence attentional control and how susceptible they are to distractions. This behavior can be illustrated by actions such as placing the smartphone on purpose within reach to be readily waiting for notifications or also by being more alert and vigilant towards social media cues.

2.6.2. Dual-System Perspective on Social Media Distraction

A theoretical consideration from the dual-processing perspective can also be relevant for understanding social media distraction. Several dual-process theories exist, but they share the common understanding of two categories of cognitive processing, with one cognitive process being "fast, automatic, and unconscious" while the other is "slow, deliberative, and conscious" (Evans, 2008, p. 255). Despite such similarities, the dual-process theories are yet distinct such as in the application (e.g., judgments, decision making, learning), processing paths (e.g., parallel, sequential), or scientific fields (e.g., economics, social psychology) and hence are difficult to combine in one overarching dual-system theory (Evans, 2008).

One of such dual systems theories is the *reflective-impulsive model* (RIM) proposed by Strack and Deutsch (2004), which is a behavioral model, in contrast to other dual system theories which often focus on judgment and decision making (Strack & Deutsch, 2004). Previous research has indeed focused on how the reflective and impulsive systems play a role for problematic social media use (Zahrai et al., 2022). While the *reflective* system results in behavior based on a decision that activates the according behavioral processes, the *impulsive* system creates unintended behavior that results from an activation of behavioral processes that stem from perceptual input or previous reflective behaviors (Strack & Deutsch, 2004). This behavior is moderated by motivational states or due to deprivation (Strack & Deutsch, 2004). The impulsive system is always activated, and it depends on the attention and previous reactivation, whether the reflective system will also be activated, but both systems are competing for control the behaviors (Strack & Deutsch, 2004).

Processing information in the reflective system requires substantially greater cognitive capacities than in the impulsive system (Strack & Deutsch, 2004). This results in the impulsive system acting fast and rather immediate by activating associations in the network and needing no attentional resources, while the reflective system requires some time to process semantic relations (Strack & Deutsch, 2004). Often co-occurring reflective pathways can create associations that can be linked to impulsive behaviors. For instance, social media cues could become such cues that create associations. Reflective and impulsive systems can activate

different behavioral schemata which results in conflict (Strack & Deutsch, 2004). Especially social media distractions bear the potential for such a conflict as social media cues may be processed in the impulsive system to activate the behavior to check the social media cue while the reflective system may try to inhibit this response and instead ignore the distraction to carry on with the task at hand.

Deprivation will re-activate behavioral patterns that have led to satisfying needs before (Strack & Deutsch, 2004) which means people turn their attention to stimuli that can reduce their current needs. For social media distraction, this would suggest that when for instance, users' social needs are deprived, they would activate behaviors to satisfy these needs with social media. This might make users also more susceptible to social media cues and hence more easily distracted.

Behaviors can become automatic through repetitive execution. In line with the RIM, behaviors become automatic when they are frequently activated by the reflective system, associated with certain situations, or repetitions makes complex task easier retrievable. These mechanisms thus create associations that the impulsive system can rely on in the future (Strack & Deutsch, 2004). It would suggest that social media distractions might stem from user's having repeatedly activated social media cues in certain situations which might originate from reflective behavior but became impulsive behavior. In sum, the reflective-impulsive models can help to better understand why and how users get distracted by social media.

Especially with regards to the outcome of social media distraction, it becomes interesting how such a dual system perspective may help explain the reaction to this temptation. A further dual-systems perspective that builds on the RIM (Strack & Deutsch, 2004) offer Hofmann et al. (2009) by focusing on impulsive versus self-control behavior, which may help explain how users react to social media distractions and with what outcome. Impulses come up in situations when general motivations come together with the activation of certain stimuli, and these tempting stimuli create a hedonic reaction that creates the urge to the templating behavior with a focus only on the short-term perspective (Hofmann et al., 2009). The problem of impulses is that they oftentimes interfere with goal fulfillment and thus self-control is required, the ability to override impulses and instead focus on the longer-term perspective which requires will-power and self-discipline (Hofmann et al., 2009). Most importantly, Hofmann et al. (2009) propose to include not only the reflective system but also consider the impulsive system, along with the situational or dispositional conditions, to predict self-control outcomes. This includes that both systems should be considered jointly to better predict outcomes (Hofmann et al., 2009). The authors suggest that this joint consideration might help in better predicting self-

control outcomes, but also account for individual differences (Hofmann et al., 2009). Hence, it is important to not only think about whether users react either impulsively or reflectively to a distraction, but how both systems as well as the context might impact the reaction (i.e., self-control outcome, which is either to give in to the distraction or ignore it).

This dual-systems model proposes that impulsive behavior is elicited by stimuli yielding to automatic reactions, neglecting other goals, or currently performed tasks (Hofmann et al., 2009). In this case, distraction in the form of social media notifications or thoughts trigger automated responses. Depending on dispositional (e.g., self-control capacities) or situational factors, the reflective system could rely on strategies to handle the situation (Hofmann et al., 2009). Ego-depletion and high cognitive load, such as while multitasking or performing demanding tasks, undermines self-regulatory behavior (Hofmann et al., 2009). Thus, impulsive behavior is more likely to occur under these circumstances. Impulsive and reflective systems are further influenced by the situation and context that results in a certain behavior, that is the self-control outcome (Hofmann et al., 2009). This suggests that how social media users react to distraction and whether they can control their behavior and divert their attention back to the task depends also on the context.

2.6.3. Habitual Social Media Distraction

Through repetition of the impulsive system behavior and frequent activation of social media cues, users may have formed strong social media distraction habits. Stimuli associated with rewards lead to automatically capture attention, which eventually results in attentional habits formed towards these stimuli (Anderson, 2016). Previous research has shown that social media use is highly automatic and habitual; especially frequently used social media is habitually used (Anderson & Wood, 2020). Prior work has argued that social media use is strongly based on habits and thus makes users more prone to the temptations of social media and self-control failure (Hofmann et al., 2017). The habit model (Wood & Neal, 2007) suggests that habits are formed through automatically behaving in a certain context with a specific response. This means that a specific context can already cue the habitual behavior which can be beneficial or harming a current goal, depending on the context (Wood & Neal, 2007). Previous work has also stressed that habits are not necessarily characterized by frequent behavior, but more importantly are characterized by automaticity (Verplanken, 2006).

Even though good habits exist and allow individuals to effortlessly perform a certain behavior, bad habits may negatively impact a person's life, such as constant checking of social media instead of focusing on a task. By performing the same actions in a specific context

repeatedly, people's driving goal and intention to perform these actions become less important, while developing instead implicit associations (Carden & Wood, 2018). Thus, habits are formed by actions that once served a specific goal, but then were performed rather routinely, with the underlying goal not being a major driver of the action anymore. Moreover, habitual behavior can also be triggered by a cue in a certain context (Carden & Wood, 2018).

Hofmann and colleagues (2017) suggest that (social) media usage becomes a habit-driven behavior because of lacking self-control. This may help explain why changing distracting social media habits (e.g., placing the smartphone always in sight, or turning the sounds on to hear notifications) could be difficult. As such, prior work has argued that habits rather reflect the automatic reactions to social media cues (Reinecke, Klimmt, et al., 2018). Previous work has argued that users form connection habits – automatic reactions to connection cues which cue the connection to others online (Bayer, Campbell, et al., 2016). Such connection habits would emerge due to the salience of these connection cues as well as due to automatically directing the attention towards such cues (Bayer, Campbell, et al., 2016). Concluding, social media cues bear the great potential for forming habitual distraction behavior.

2.6.4. Self-Regulating Social Media Distraction

Self-regulation refers to the ability to exert control over the own behavior (Baumeister & Heatherton, 1996). In order for social media users to exert any control over their social media use and the distractions and temptations coming from social media cues, users need their executive functions: inhibition, working memory, and cognitive flexibility (Diamond, 2013). Working memory capacity (WMC) refers to the process of holding and processing information in the brain (Diamond, 2013). Cognitive flexibility means that people can change the way they think, take on different perspectives and update information stored in the brain (Diamond, 2013). Relevant for this context is inhibition, which refers to overriding temptations, controlling the behavior, thoughts, emotions, and attention (Diamond, 2013). Being able to inhibit responses means to exert self-control over one's behavior. This is required to avoiding distractions to disrupt goal-striving. Self-control means being able to resist temptation and control one's behavior so that one is able to focus on tasks and not get distracted (Diamond, 2013).

Self-control plays an important role for social media distraction, since "having the discipline to stay on task despite distractions" can be challenged by social media cues (Diamond, 2013, p. 138). Conflicting goals have the potential to cause users to fail in monitoring their behavior (Baumeister, 2002). Therefore, controlling one's attention is

important for self-regulation (Baumeister & Heatherton, 1996). Social media cues thus impose a threat to self-control because they can create bring up goal conflicts (e.g., focusing on the task versus using social media). Self-control allows users to override their initial behavioral response (Baumeister et al., 2007). This suggests that self-controlled people would be able to resist the temptation of distracting social media cues. Research has shown that self-control could predict media use and users with lower self-control are likely to use social media more (Hofmann et al., 2017; Reinecke & Hofmann, 2016). Moreover, prior work has shown that low self-control is related to higher smartphone use and lower performance (Troll et al., 2021) as well as higher social media use (Du et al., 2018). These findings show the important role that self-control plays for social media distraction.

What is more, research has indicated that highly self-controlled people try to avoid situation that may cause temptations (Ent et al., 2015) which may result in more favorable behavior outcomes, such as higher school grades (Milyavskaya & Inzlicht, 2017). Hence, self-control is likely to be an important influencing factor for social media distraction. Research has shown that people with higher self-control may also avoid distractions (Ent et al., 2015). This suggests that self-controlled users might avoid social media temptations, which might also help them in avoiding social media distractions more successfully. Research has shown that students using such strategies to avoid social media temptations (e.g., placing the smartphone out of sight), were more likely to reach their academic goals and felt less tempted by distractions (Duckworth et al., 2016). In sum, self-control plays an important role for controlling social media distractions.

One form of impulsive and habitual behavior that emerges where users fail to self-control their behavior is procrastination. User's procrastination might make them more susceptible to social media distractions. Procrastination refers to the process of "voluntarily delay an intended course of action despite expecting to be worse off for the delay" (Steel, 2007, p. 66) and means that people spent more time online and may have problems in controlling their use (Reinecke, Meier, et al., 2018). Certain task characteristics and an aversion towards the task together with individual characteristics, such as impulsiveness or self-control, may impact procrastination (Steel, 2007). Moreover, habitual behavior as well as enjoying social media use can lead to procrastination (Meier et al., 2016). Especially people with low self-control have problems with procrastination (i.e., they spent more time procrastinating) which has a negative impact on stress, anxiety, and depressive symptoms (Reinecke, Meier, et al., 2018). Research has shown that low self-control helps explain social media procrastination (Sümer & Büttner, 2022) and that decreasing social media use helps also in decreasing procrastination (Hinsch &

Sheldon, 2013). Taken together, procrastination might make users also more susceptible to distractions, especially when they have problems in self-control. The following chapter describes further potential influences of social media distraction.

2.7. Further Contextual and Individual Factors of Social Media Distraction

Thus far, several processes and constructs have been mentioned that could influence social media distraction. However, this enumeration is not exhaustive and further individual as well as contextual factors are likely to impact social media distraction. On the one hand, the situation in which a person currently is, might have a major impact on how susceptible a person is to distraction and how they might react to a distraction. On the other hand, the strategies that users may have already discovered and used in handling their social media use and distraction, might influence their distraction. Moreover, previous research has included and suggested further individual differences might impact social media distraction. The following sections include an overview of the individual differences that were included in this work's studies. An overview of all the factors investigated in this work is in Table A1 in Appendix A. The following sections will describe the role of individual differences as well as contextual influences on social media distraction.

2.7.1. Individual Differences Potentially Influencing Social Media Distraction

This work has already mentioned self-control and mind wandering as potentially increasing an individual's susceptibility for social media distraction. Research has shown that *impulsivity* is related to higher media multitasking behaviors in daily life (Cain et al., 2016; Shin et al., 2019). For instance, impulsivity has been shown to be related to social media/smartphone use in classroom (Hayashi & Blessington, 2018) and moderating the negative effect of smartphone presence on performance (Canale et al., 2019). Prior work has found attentional impulsiveness as one dimension of smartphone distraction (Throuvala et al., 2021). Hence, general individual differences such as mind wandering, self-control, and impulsivity are likely to impact a user's distraction behavior.

In addition to these general factors, there are also several individual differences that are specific to social media use that might play a role for social media distraction. Prior work has investigated *social media self-control failure* as a conceptually new dimension of general self-control which is related to higher social media use (Du et al., 2018). Further, an individual's tendency for *problematic social media use* might enhance a user's susceptibility to social media

distraction. Previous work has argued that addictive tendencies and problematic behavior might result from a need for social reassurance (Seo et al., 2015), loneliness, lacking social support (Wegmann & Brand, 2016), procrastination, or FoMO (Müller et al., 2020). A consequence of problematic social media use is lower productivity at work and at home (Duke & Montag, 2017), higher smartphone use (Oraison et al., 2020) and it may influence social media use in classes (Rozgonjuk et al., 2018).

Fear of missing out (FoMO) might also make users more susceptible for social media distractions. Prior work has indicated that high FoMO leads to higher social media use (Hunt et al., 2018; Oberst et al., 2017), to negative impacts on academic performance (Rosen et al., 2018) and on productivity (Rozgonjuk et al., 2020). Studies have shown that users especially experience FoMO when having to work on a task and that people with FoMO are more easily distracted and less focused (Milyavskaya et al., 2018).

Cyberostracism, the feeling of being excluded online (Williams et al., 2000), may influence an individual's susceptibility for social media distractions. While research has suggested that social media use can be beneficial if feeling ostracized (Iannone et al., 2018), prior work has shown that limited or no reactions to social media posts (e.g., likes) threatens user's need to belong (Tobin et al., 2015) and can even make users feel ostracized (Reich et al., 2018). This may make user's more susceptible for social media cues and hence more prone for social media distractions. Prior work has studied numerous individual differences, out of which the above were selected to be included in these studies. This work selected the most relevant of these individual differences to be included.

2.7.2. Contextual Factors Influencing Distraction

Besides individual differences, the context and situational factors may influence a user's social media distraction. The strategies users might have adopted influences how susceptible users are to distractions. If someone is already using strategies that are efficient in shielding them from distractions or may even chose from a selection of such strategies, this is likely to influence an individual's distraction and how likely (or not) they are getting distracted by social media. Prior work has suggested to reduce the inference possibilities of incoming social media distractions with strategies such as turning off notifications, placing the device out of sight (Kushlev et al., 2016), or in another room (Stothart et al., 2015). Moreover, research has revealed that forming implementation intentions, or training mindfulness can help reduce distractions (Miller & Brannon, 2017). Even though there are quite some studies that have tested diverse strategies that may help reduce distractions, the effectiveness and practicability

in user's daily lives is not yet fully investigated. As distraction is manifold, different strategies may be needed to react upon different situations, distractors and individuals (Chen & Yan, 2016).

Certain situations might be more prone to distractions than others, while the effects for some might be more problematic than others. Prior work has investigated social media distractions in social situations and found that it may, for instance, affect a person's relationship formation (Przybylski & Weinstein, 2013) or well-being (Xu et al., 2016). Research has also investigated distractions while watching movies (Rubenking, 2017; Xu et al., 2016). For instance, prior research has suggested that boredom, i.e., low-interest lectures (Gupta & Irwin, 2016) or unpleasant situations (Reinecke, Meier, et al., 2018) might make users more susceptible for social media distractions. Previous studies have focused on distraction mostly while studying, by depicting one specific situation, and analyzing distraction in this context (for a review see Chen & Yan, 2016). For instance, research has shown that students get distracted by social media in classrooms (Clayson & Haley, 2013; Demirbilek & Talan, 2017; Hayashi & Blessington, 2018) or while studying (Rosen et al., 2013), with negative effects on academic performance. For workplace distraction, research has found that blocked notifications increased productivity for those with lower control of their distraction, while those already high in control perceived more stress (Mark et al., 2018). Hence, it is important to consider the user's situational context in combination with individual differences when it comes to distraction, since some situations may encourage distractions more than others and for some being the consequences more severe than for others.

2.8. Summary: Theoretical Understanding of Social Media Distraction

In the realm of this work, social media distraction was considered as interfering with a user's goal attainment. Goals are activated by users paying attention to it (Altmann & Trafton, 2002). Other goals can be strengthened by paying attention towards those instead, such as distracting stimuli (Altmann & Trafton, 2002). It thus requires users to shield their goals from other competing goals (Shah et al., 2002). For instance, the competing goal to use social media can be strengthened by paying attention to social media cues. Users would be required to shield themselves from these cues if they want to keep striving towards the original goal.

Attention selects the stimuli that are cognitively processed (Anderson, 2013); however, a person only has a limited capacity to process stimuli (Anderson, 2013; Desimone & Duncan, 1995; Deutsch & Deutsch, 1963; Lavie & Dalton, 2014; Pashler, 1994). While the attention system is alert for capturing new stimuli, the processing system processes the stimuli (Petersen & Posner, 2012; Posner & Petersen, 1990). The storing and processing of stimuli in the working memory takes up its limited capacity (Baddeley, 1992; Cowan, 2001; Sweller, 2011).

When there are multiple stimuli competing for attention (such as when following a goal and focus on the related task, while social media cues, such as notifications, appear), stimuli that are processed have to be selected. Selective attention means that specific stimuli receive the attention, while others are being ignored (Kahneman, 1973; Treisman, 1969). It requires a person to filter only for relevant stimuli while suppressing irrelevant ones which can come with filtering costs (Desimone, 1998; Treisman, 1964). This means that a person needs to filter out the distracting social media cues when trying to focus on a task.

Certain stimuli draw a user's attention, that is these stimuli have the ability to capture the user's attention (Anderson & Folk, 2010). As such, goal-driven attention refers to attention that is guided by goal-related stimuli, while salience-driven attention refers to attention devoted to stimuli that are present (Anderson, 2013). When a person is working on a task, the attention is likely to be goal-driven.

Especially stimuli that appear important, are meaningful or a person has learned to associate with specific rewards capture a user's attention (Deutsch & Deutsch, 1963; Graydon & Eysenck, 1989; Mackintosh, 1975; Rusz et al., 2018). Social media cues in particular have the potential to capture a user's attention due to social media's rewards and hedonic temptation. An attentional bias forms towards stimuli that a user associates with rewards and this implies that these stimuli receive preferred attention (Field & Cox, 2008). Such value-driven attention tends to automatically capture attention and is thus more likely to capture attention than goal-driven stimuli (Anderson, 2016). This implies that social media cues, given that these would

receive value-driven attention, are more likely to capture the user's attention than stimuli related to their goal. Thus, social media cues bear the potential to drive the attention away from the task that is leading the user to its intended goal.

When a user is focusing on a specific goal-directed behavior, arising social media cues are likely to distract a user from the task. Distractions can arise internally or externally (Baron, 1986; Fisher, 1998; Forster & Lavie, 2014; Koessmeier & Büttner, 2021; Wilmer et al., 2017). These distractions can create attentional conflicts, because distracting cues can foster drive-like behavior towards the distracting cue (Baron, 1986). If the distracting cue is value-driven, such as in the case with social media cues, these cues can create an attentional conflict in favor of the social media distraction.

A user's needs and gratifications may play already a role for the susceptibility to social media cues. Users play an active role for when and how to use which media (Rubin, 2002) and their current needs and gratifications influence why users may engage with certain media (Ruggiero, 2000). In addition, distractions are most likely to arise when a task is not requiring all cognitive resources (Lavie, 2010; Lavie & Dalton, 2014). Users might be more susceptible for distractions when the task currently working on is not requiring their full cognitive capacities.

When a distraction appears, users have the choice how to react to the distraction. The interruption lag that is created by a distraction (Salvucci et al., 2009) allows the user to take the possibility to resist the temptation. It also means that users have to (at least very briefly) disengage from the task, switch their attention towards the distraction and eventually re-engage with the task (Allport & Wylie, 2000; Salvucci et al., 2009). The reaction towards the distraction is also influenced by reflective and impulsive processes. Reflective processes are slower, based on deliberative decisions, while impulsive processes are faster, more automatic responses to cues (Strack & Deutsch, 2004). Together with situational and dispositional influences, they help predict a users' self-control behavior (Hofmann et al., 2009), that is whether a user is going to react to the distraction (i.e., using social media), or rather exerting self-control to resist the temptation and instead focus on the task.

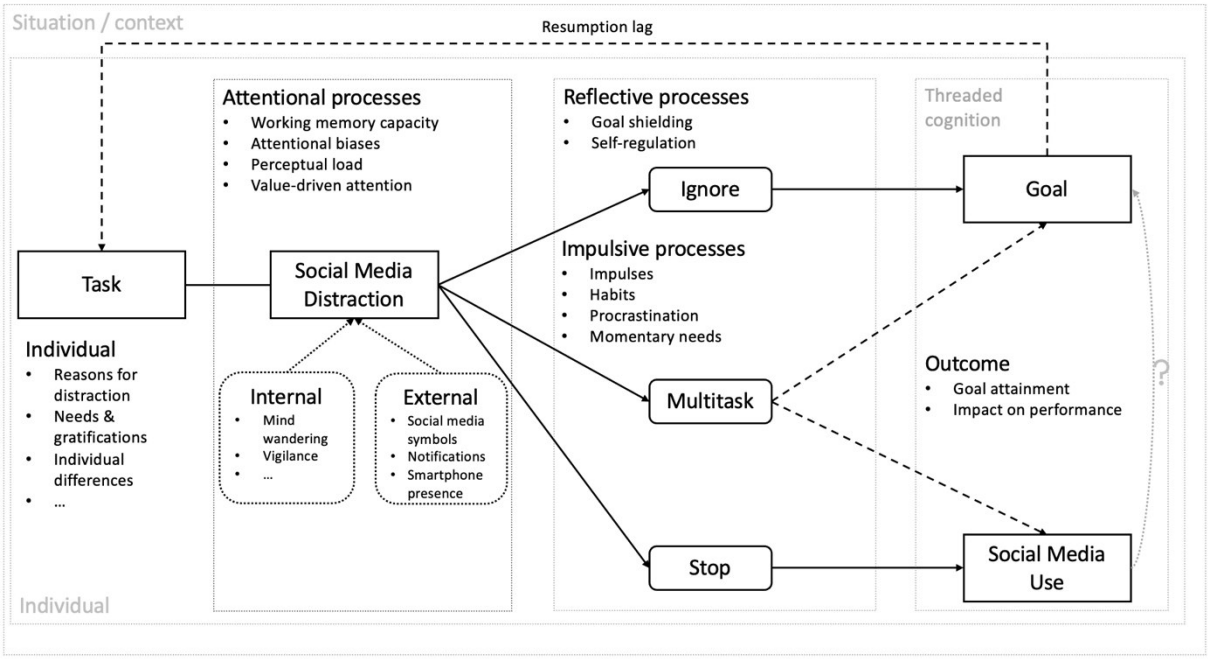
Negative effects on performance arise when trying to process more stimuli (Graydon & Eysenck, 1989; Treisman, 1964) and it is not possible to work on tasks requiring the same resources (Salvucci & Taatgen, 2008). Therefore, social media distractions bear the potential of negatively impacting performance or may even result in stopping the task or trying to multitask. Further relevant influences on distraction are the individual motivations (Hofmann et al., 2009; Rubin, 2002; Shah et al., 2002), as well as the context or specific situation

(Hofmann et al., 2009; Rubin, 2002). Users' motivations may thus also have an impact on who susceptible they are for distraction in a specific motivation. For instance, a user might be more susceptive for distraction when awaiting a certain response or after having posted something a waiting for like and reactions for the followers than when not having posted something.

In sum, social media cues are likely to draw value-driven attention even when working on a task that would lead the user to a specific primary goal (which is not using social media). Internal and external social media distractions can draw the attention away from the task. A user has three possible reactions to the distraction (ignore, multitask, stop) for which reflective and impulsive processes play a role, but that is also influenced by user's needs and current motivations. Stopping the task to instead use social media leaves the question open, whether and when the user goes back to striving towards the goal. Figure 2 shows the proposed process model of distraction that is based on Figure 1 but includes the proposed relevant theoretical processes that play a role for social media distraction.

Figure 2

Proposed Process Model of Social Media Distraction



3. Research Aims and Questions

As discussed above, several processes and individual factors bring the potential of influencing a user's social media distraction. This work aimed at understanding why people get distracted and the role of individual difference, how people are distracted, i.e., the underlying processes (internal versus external), and which effects distraction has on performance. The findings can help deriving insights on strategies that may enable users to avoid or better handle social media distractions. The following sections will describe the research questions investigated in this work more closely. This dissertation's main aim is to understand social media distraction and to gain insights into the underlying mechanism so that users can be empowered in their social media use.

The previous chapters touched upon some of the most important concepts necessary for investigating and understanding social media distraction. People have limited capacity to process information and thus should be careful to what they are paying attention, especially in the context of following a goal and fulfilling a specific task. Social media, however, has made its users hooked for distractions and thus provides a major risk for fulfilling users' goals. Even though social media use might be a rather impulsive behavior, there might also be a reflective behavior from the user, guided by users' underlying motivations and self-regulatory capabilities. This imposes the question on the reasons for why social media users may get distracted (RQ 1). Further, specific user characteristics and traits may make certain people more vulnerable for social media cues than others. In particular, this work investigates how self-control, impulsivity, FoMO, problematic social media use, cyberostracism, and smartphone vigilance, might influence (social media) distraction (RQ 2). Social media distraction can arise due to internal or external distraction. Hence, this work also aims at understanding the underlying processes of internal (i.e., ability to filter out distractions, mind wandering, and vigilance) and external (i.e., visual attention) distraction (RQ 3). As described above, social media distractions have the potential to disrupt goal fulfillment and can have numerous negative effects. This work also investigated the effects of social media distractions on performance (RQ 4). The following sections explain these research questions in more detail.

3.1. RQ1: Understanding Reasons for Distraction

The first aim of this research project was to better understand the underlying reasons of social media users for their distraction. Even though it is apparent that social media distraction has negative effects, for instance, on academic performance (Brooks, 2015; Cain et al., 2016; Clayson & Haley, 2013; Marone et al., 2018; May & Elder, 2018), why do users persist with this behavior? Why are they drawn into distraction by social media?

Previous work has argued that social media distraction may stem from habitual and impulsive behavior (van Koningsbruggen et al., 2018). However, users may not only be passive and merely reacting to social media cues but could also have an active role in the social media distraction process, especially in how susceptible they are to social media cues and how they react to those. Research is thus far missing the angle of the social media distraction not only being a purely habitual and impulsive behavior, but that users have a more active role in their distraction.

It is essential to investigate the motivations and reasons for social media distraction since this may influence their susceptibility to social media distractions. Goal shielding theory attributes a major role to an individual's motivation on how successful someone is in shielding their goal from distractions (Shah et al., 2002). Furthermore, this work argued that users form attentional biases towards social media cues leading to social media distraction. Research has argued that the formation of such attentional biases may depend on individual motivational differences (Papies et al., 2008), highlighting the role of motivation in this process. Further, previous research described that motivation influences vigilance (Oken et al., 2006), indicating that underlying motivations may make users more susceptible for social media distractions. Thus, it is important to investigate the user perspective on why they let themselves get distracted.

An individual's current needs and gratifications can also influence their media behavior, and thus, these need to be considered for trying to understand social media distractions (Paper 1, Koessmeier & Büttner, 2021). The commonly used uses and gratifications approach states that people seek and use media in order to satisfy their needs and gratifications (Katz et al., 1974). In line with the uses and gratifications approach, social media users are not only passive in their social media distraction process, but users can also be active, for instance with an increased susceptibility to social media cues or how they react to social media distractions (e.g., letting themselves get distracted or ignore it; see Paper 1, Koessmeier & Büttner, 2021). Social media users have the choice how they position themselves and thus, how susceptible they are for distractions. In addition, when a distraction arises, the interruption lag gives users the

opportunity to decide how they react to it – stopping the task to use social media, engage in multitasking or ignore the distraction. Thus, social media users have also an active choice in their social media distraction. But why do they choose to be distracted?

Moreover, prior work has investigated general motivations for using social media, such as communicating, connecting, or seeking entertainment (Papacharissi & Mendelson, 2010; Quan-Haase & Young, 2010; Whiting & Williams, 2013). However, there is a research gap for investigating the underlying reasons for users' social media distraction, since these are likely to increase susceptibility to social media distractions (Paper 1, Koessmeier & Büttner, 2021). Hence the first research question addresses the underlying motivations driving people to distraction. This research question is primarily answered in Study 1 (Paper 1, Koessmeier & Büttner, 2021), but also addressed in Study 2 (see Paper 2, Koessmeier & Büttner, 2023).

RQ1: What are users' reasons for social media distraction? (Study 1, 2)

3.2. RQ2: Individual Differences Influencing Distraction

Besides user's specific motivations that may influence their social media distraction, also the individual differences, i.e., user characteristics and traits, might influence a user's susceptibility for social media distractions. In light of the uses and gratifications approach, prior work has suggested that individual differences impact media use and effects (Rubin, 2002; Sherry & Boyan, 2008). Hence, it is likely that individual differences may also influence user's distraction.

Research has shown that individual differences impact attention, which suggests that it could influence social media distraction. As such, prior work has argued that individual differences play an important role for attention and especially for value-driven attention (Anderson, 2013). Since, as argued above (see chapter 2.4.2), social media distractions may stem from value-driven attention, it is important to investigate individual differences in attention to social media cues and especially social media distraction. Additionally, prior work has shown that traits related to impulsive behaviors are related to individuals attending to cues towards which they hold attentional biases (Field & Cox, 2008).

Previous research has studied the influence of individual differences on social media and found that, among other, individual differences such as media multitasking tendency (e.g., Ophir et al., 2009; Uncapher et al., 2016), high impulsivity (e.g., Sanbonmatsu et al., 2013), low self-control (Berger et al., 2018), or high FoMO (e.g., Fitz et al., 2019; Hunt et al., 2018)

influenced social media use. Such individual differences could suggest that some users are more susceptible for distractions.

Since prior work has indicated that individual differences play a crucial role in social media behavior, this dissertation investigated which individual differences impact social media distraction. All studies include some constructs assessing individual differences – general individual differences and social media-specific individual differences – to explore how these influence social media distraction include. In particular, this work examined the impact of self-control, impulsivity, FoMO, problematic social media use, cyberostracism, smartphone vigilance on social media distraction (for a complete overview of investigated constructs and in which study, see Table A1 in Appendix A).

RQ2: How do individual differences influence social media distraction? (Study 1, 2, 3)

3.3. RQ3: Underlying Processes of Distraction

Even though several studies investigated consequences of social media distraction in some form or the other, a deeper understanding of the underlying mechanisms of distraction is missing. Aim of this work was to investigate the underlying processes of distraction, focusing on internal and external distraction. In the context of social media, this is a worthwhile investigation since studies have shown that social media can influence thoughts and behavior (thinking about social media; impacts on performance) even when users are not interacting with it (e.g., Stothart et al., 2015), such that even the mere presence can influence performance (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017). These studies, however, leave the question unanswered on why these social media cues, such as even the mere presence of social media or a smartphone, can have these distracting effects. In particular, it is unclear which processes lead to potential performance decrements.

Since people can only process a limited amount of information (Anderson, 2013; Desimone & Duncan, 1995; Deutsch & Deutsch, 1963; Lavie & Dalton, 2014; Pashler, 1994) and users nowadays tend to be overwhelmed with information, it is crucial to understand the role of attention in the process of getting distracted.

As argued above, the immediate gratifications from using social media, which users have learned over time, may have created also habitual reactions. Social media cues can be the cues for connection that attracts the attention (Bayer, Campbell, et al., 2016). Moreover, research has shown that users perceive social app symbols as more rewarding (compared to seeing non-social media apps; Johannes, Dora, et al., 2019) and seeing social media cues

increased craving (Wegmann et al., 2017), highlighting the special meaning that social media cues can have. Especially for the value-driven attention described by Anderson (2013; 2016), social media cues could be a major factor for external social media distraction. Research on attentional bias has indicated that especially visual attention plays an important role (Field & Cox, 2008). Thus, this work investigated in the role of external distraction in the form of visual attention.

Internal processes could also influence user's distraction, such as vigilance and mind wandering (see chapter 2.3.2). Research has shown that smartphone cues increased vigilance which made people feel more distracted as well (Johannes, Veling, et al., 2019). Starting to mind wander creates an internal distraction (McVay & Kane, 2010) that increases susceptibility for distractions (Forster & Lavie, 2014) and research has suggested that mind wandering to social media is common among students (Hollis & Was, 2016). Research employing experience sampling has shown that mind wandering was related to external distraction (Hobbiss et al., 2019), suggesting that mind wandering could also create an external distraction, such as looking at social media cues.

Hence, this work aimed to better understand the underlying processes of social media distraction and specifically, to investigate the visual and internal processes underlying social media distraction. This dissertation assessed the visual distraction potential of social media in Studies 2 and 3) and internal distraction in Study 3. Study 2 investigated the visual distraction potential of social media cues (see Paper 2; Koessmeier & Büttner, 2023). Study 3 investigated visual distraction potential of a smartphone and in addition also included internal distractions (see Paper 3; Koessmeier & Büttner, 2022).

RQ3: How internally and externally distracting are social media cues? (Study 2, 3)

3.4. RQ4: Influence of Distraction on Performance

Numerous studies have investigated how social media distractions have influenced users' lives. Research has shown how social media distraction influenced academic performance (Demirbilek & Talan, 2017; Giunchiglia et al., 2018) and even affects it over longer periods of time, mostly in GPA developments (Chen & Yan, 2016; Junco & Cotten, 2012; Kirschner & Karpinski, 2010; May & Elder, 2018; Rosen et al., 2013). Most notably, prior work has also investigated momentary performance in cognitive tasks (Johannes et al., 2018; Minear et al., 2013; Ophir et al., 2009; Sanbonmatsu et al., 2013; Thornton et al., 2014; Uncapher et al., 2016; Ward et al., 2017). Relatedly, distraction-conflict theory suggests that

distractions lead to attentional conflicts that can negatively impact performance (Baron, 1986). Social media stimuli can be especially prone for creating an effect on performance due to its potential for value-driven attentional capture. Relatedly, a review on 91 studies showed that across studies distractors associated with rewards impaired cognitive performance (Rusz et al., 2020).

Thus, this work aimed at finding out how social media distractions impact performance. This research question will be investigated in Studies 2 and 3 in the form of momentary cognitive performance as well as performance in a setting closer to real life (Study 3). In Study 2, performance will be investigated in the form of the ability to filter out neutral and social media distractions (see Paper 2, Koessmeier & Büttner, 2023). Study 3 investigated the effect of smartphone presence on performance in several cognitive tasks as well as a reading task (see Paper 3).

RQ4: How do social media cues influence distraction and performance? (Study 2, 3)

3.5. Research Model

Overall, this work tackled the phenomenon social media distraction from a variety of different angles, in an aim to understand social media distraction as comprehensive as possible within the context of this dissertation. Social media distractions arise when an individual is following a task for a specific goal, while upcoming social media cues then distract from this goal. Individual aspects that make up and shape the individual are important influencing factors of social media distraction. In particular, an individual's motivation (RQ 1, Study 1—2), individual differences (RQ 2, Study 1—3) and the potential strategies someone has already adopted (RQ 5, Study 1, Study 3) impact how susceptible people are to distractions and are (likely) going to deal with distractions. These individual aspects impact how the distraction can arise. The distraction can arise due to external, in the context of this work examined as visual distraction, or internal distraction processes (RQ 3, Study 2—3). Lastly, the distraction has an outcome which is, among other things, a potential impact on the performance of the goal someone originally indented to fulfill which the social media distractions interfered in (RQ 4, Study 2—3). Hence, this work investigates the input, that is the individual, the underlying processes of distraction and what outcome, i.e., effects on performance, distraction can have. Table 1 gives an overview of the investigated constructs and, how these are addressed in the research questions and which studies target these constructs and questions. Figure 3 visualizes the investigated constructs and shows how connected the research questions and studies are.

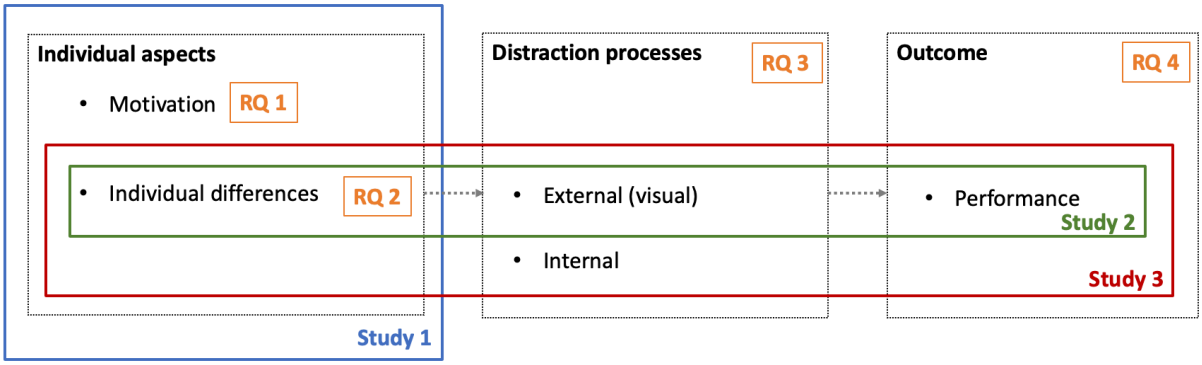
Table 1

Overview of Which Research Questions and Study Investigates Which Construct

	Research Question	*Study 1*	*Study 2*	*Study 3*
Individual aspects	*RQ 1, 2*			
Motivation	*RQ 1*	X		
Individual differences	*RQ 2*	X	X	X
Underlying distraction processes	*RQ 3*			
External distraction			X	X
Internal distraction				X
Outcome / Effects	*RQ 4*			
Performance			X	X

Figure 3

Research Model of this Dissertation



Note. This model visualizes the research questions (orange), and in which study they are addressed with the most important constructs investigated. In this work, social media users are investigated in *(RQ 1)* why they get distracted (Study 1), *(RQ 2)* how individual differences influence social media distraction (Study 1, 2, 3), *(RQ 3)* the underlying processes of distraction (external, internal), *(RQ 4)* how distraction influences performance (Study 2, 3).

4. Overview of the Studies

The essence of this dissertation are the three papers that were submitted and published. The following sections on the studies' purpose and methods aim to present each of the studies and especially show the focus of each while also indicating how they build on each other. Afterwards, there is a dedicated chapter presenting each study in more detail.

Study 1: Paper 1, accepted and published in "*Frontiers in Psychology*"; Submitted May 18, accepted November 8, 2021
Study 2: Paper 2, submitted and under review
Study 3: Paper 3, accepted and published in "*Computers in Human Behavior*"; Submitted November 5, 2021, accepted May 9, 2022

4.1. Purposes and Research Aims of the Studies

Each of the studies conducted within the frame of this dissertation served its own purpose by combining several of the constructs and addressing multiple research questions employing different methods. Figure 3 shows an overview of the investigated main constructs, the research questions and which study addresses which research question. Table 2 lists the research questions and shows which study answers which question.

Study 1 takes a broader perspective on social media distraction, trying to understand the motivations of why users get distracted, when users are distracted and how they (thus far) tackle these distractions with strategies. In this study, RQ1 and RQ2 are addressed.

Since Study 1 was descriptive, Study 2 investigated the ability to filter out distractors in a cognitive experiment. After Study 1 provided the user perspective, the purpose of this study was to investigate user's objective distractibility. Here, the visual distraction potential of social media cues was investigated as well as potential influencing factors relevant in the context of social media distraction. This study tackles RQ2, RQ3 and RQ4; it tests the visual distractibility, i.e., the ability to filter out distractors as underlying mechanism, performance effects of distraction, and investigates potential influencing variables relevant for distraction.

After Study 2 solely focused on visual attention, the aim of Study 3 was to uncover how visual and internal processes are impact distractions. Since it was unclear after Study 2, whether people perceived the social media cues (i.e., looked at the cues), Study 3 employed eye tracking to monitor the visual attention towards the distracting cues. This is study takes up on previous research on the smartphone's mere presence and tests whether this negatively impacts

performance, is visually and internally distracting. Hence, this study tackles RQ2, RQ3, and RQ4. In addition, RQ 5 is also addressed by testing the strategy of placing a smartphone out of sight.

Table 2

Overview of Research Questions and Studies

Research Questions		*Study 1*	*Study 2*	*Study 3*
RQ1:	What are users' reasons for social media distraction?	X	X	
RQ2:	How do individual differences influence social media distraction?	X	X	X
RQ3:	How internally and externally distracting are social media cues?		X	X
RQ4:	How do social media cues influence distraction and performance?		X	X

4.2. Methods of the Studies

An overview of the methods used and investigated concepts of individual differences is in Table 3 (and an even more detailed version in Table A1 in Appendix A). Overall, this work used a multi-method approach by including diverse methods, ranging from an online survey to cognitive experiments, to mobile eye tracking experiment.

Study 1 focused on the user's perspective on distraction (i.e., how users perceive their distraction) and used an online survey to get an overview on how users directly perceive their distraction. The study used self-reported measures of distraction which enabled to understand the user perspective of distraction alongside with several individual differences (see Table 1).

Study 2 used cognitive experiments for investigating visual distraction to get the objective distraction behavior. In three experiments, we employed the filter task (Ophir et al., 2009; Vogel et al., 2005) which is a well-established measure of distractibility (i.e., the ability to filter out distractions). To transfer this task to the social media context, the filter task that usually relies on neutral distractors was extended to that it includes social media distractors. Hence, this study used an objective measure of how distracted people are, and how individual differences, but also momentary states influenced distractibility.

Study 3 used mobile eye tracking to investigate a phenomenon observed in prior research, namely the negative effect of mere smartphone presence on performance. In this study, we combined cognitive tasks that prior work has used but also extended it with a reading task. Hence, this study builds on a series of papers investigating mere presence and 1) adapted the set up (people work on a task) but extended by including a further task (reading task) to the cognitive tasks, and 2) included an objective measure of visual attention, mobile eye tracking. Moreover, this study also included measures of internal distraction to investigate the internal

processes. Table 1 gives a detailed overview of the studies included in this work as well as the main constructs investigated in each study.

With this approach combining different study designs and methods, this work was able to investigate social media distraction from different angles to understand the phenomenon social media distraction better. First, it looked at social media distraction from the user perspective in Study 1, investigating the reasons for distraction as well as individual aspects that impact social media distraction with an online survey. Then, Study 2 investigated the effects of social media distraction in the form of external distraction (social media cues) in the controlled environment of a laboratory with a cognitive experiment. Study 3 was closer to reality so that social media users and investigated visual distraction in a closer to real life study setting using mobile eye tracking, but also included the internal processes that may foster social media distraction. The following sections are dedicated to presenting each of the studies in more detail.

Table 3

Study Overview with RQs, Methods, Dependent Variable, and Investigated Constructs

	RQs	*Method*	*Dependent variable*	*Main constructs*
Study 1	RQ 1, RQ 2	Online survey	Reasons for distraction	Self-control, impulsivity, problematic social media use, FoMO
Study 2	RQ 2, RQ 3, RQ 4	Cognitive Experiments (3)	Distractibility	Self-control, impulsivity, problematic social media use, FoMO*, mind wandering, cyberostracism*
Study 3	RQ 2, RQ 3, RQ 4	Mobile Eye Tracking Experiment	Performance, Distractibility	Self-control, impulsivity, problematic social media use, FoMO, smartphone craving, vigilance

*Note. Constructs indicated with * are (also) investigated as experimental manipulation*

4.3. Study 1 – Investigating Reasons for Distraction, Distraction Situations, and Strategies from the User Perspective

This study argued that because of the strong temptation arising from social media that draw users in, social media impose a major potential thread to concentrated work. Thus, for focused work, social media distraction should be limited. Backed up by numerous studies indicating negative effects of various forms of social media distractions (e.g., Giunchiglia et al., 2018; Jeong & Hwang, 2016; Junco & Cotten, 2012), this study aimed at uncovering what drives people to getting distracted by social media.

In this first study, the aim was to get an overview of the current situation of distraction. Moreover, with the overall goal in mind to reduce user's distraction in the context of focused work, it is also necessary to know its context. Following U&G, the context can influence how media is used and which effects it may have on users (Rubin, 2002; Ruggiero, 2000). Therefore, this paper included questions on distraction situations, to uncover common situations prone for social media distraction. In addition, this paper explored the strategies people already employ to get less distracted.

To our knowledge, previous work on social media distractions had not yet investigated the underlying motivations of distraction. Based on the uses and gratifications approach (Katz et al., 1974) stating that users seek media to satisfy their needs, this paper argued that investigating underlying reasons is essential for understanding potential media effects (Rubin, 2002; Ruggiero, 2000). Understanding what drives users to social media distraction is essential for finding ways to handle distractions in the future. Therefore, we investigated users' underlying reasons for social media distraction. In addition, it was interesting to find out how individual differences might play a role in driving the reasons for social media distraction.

This study used a quantitative online survey across a large, heterogenous German sample obtained via a survey-recruiting platform. As pre-study, we asked students in semi-structured interviews about their social media distraction, possible motivations, distraction situations and strategies. Based on these insights combined with previous literature, we derived 15 items on reasons for distraction, ten on typical situations, and 15 on strategies. The aim of this paper was not to develop a scale per se, but rather find a way of investigating users' perspective. Moreover, we investigated individual differences with basic motives, self-control, impulsivity, FoMO, and problematic social media use which might influence reasons for distraction.

Results identified the typical situations for social media distraction – for instance, when watching a movie, not wanting to start a task after a break or trying to delay the start of a task. Typical strategies used by participants are silencing the smartphone, placing it somewhere else, or deactivating notifications. Using exploratory factor analysis, we identified social and task-avoiding reasons for distraction. Hierarchical regression analysis revealed that online FoMO and affiliation motives affect social distraction, and problematic social media use and FoMO affect task-avoiding distraction.

This study revealed common distraction situations and strategies. Moreover, this study showed that social media distraction is mainly driven by social and task-related distraction. Social distraction was positively related with need for affiliation and online FoMO. This highlights the social aspects of distraction. It shows that distraction is, on the one hand, a highly social process, guided by the wish to stay connected with others. Task-related distraction is influenced by problematic social media use and FoMO. This indicates that distraction is, on the other hand, an avoidance behavior that may favor connectivity above anything else. Thus, this study showed that especially affiliation, online FoMO but also problematic social media use and FoMO are important influencing factors of distraction. This study is only relying on user's self-reported distraction. While this allowed to gain insights into user's perception of distraction and their underlying motivations, it only focused on the user perspective and does not actually measure distraction. The next study tackled this specific limitation.

4.4. Study 2 – The Distraction Potential of Social Media Cues on Cognitive Performance and Influencing Factors

The purpose of this study was to investigate the actual social media distraction by looking at how distracting social media cues are. After finding out why people are distracted and that certain individual differences play an important role, it was interesting to investigate how these individual differences might influence the ability to filter out distractions. For focused work, for instance, it is vital for its users to be able to shut out visual cues of social media. The question is how distracting social media cues are and, how these cues influence the ability to filter out distractions. Prior research has indicated that heavy media multitaskers, those who frequently use multiple media at the same time, showed problems in the ability to filter out distractions (e.g., Ophir et al., 2009; Uncapher et al., 2016). In this context, we were interested in finding out what individual difference that prior work has identified as relevant to social media behavior influence the ability to filter out distractions and especially how visually distracting social media cues in particular are.

This study used a cognitive paradigm developed by Vogel et al. (2005) that prior work has also used to investigate the effect of filtering ability in high media multitaskers (Ophir et al., 2009; Uncapher et al., 2016). In the filter task, participants focus on two red rectangles and memorize their orientation. In a following image, participants indicate whether the one of the two targets rotated. A varying number of blue rectangles that were the distractors was shown along with the red target rectangles (0, 2, 4, or 6 distractors).

Since Uncapher et al. (2016) extended this task to use line-drawings of common objects instead of rectangles, this study transferred the task to the social media context and included social media apps symbols as distractors. This study created a new perspective on how to objectively measure distractibility to social media cues. In addition to individual differences (Experiment 1), the studies manipulated cyberostracism (Experiment 2) and FoMO (Experiment 3) to investigate how these might influence distractibility.

Based on the calculated two-way (Experiment 1) and three-way mixed ANOVAs (Experiment 2–3), results showed that social media cues can be more distracting compared to simple, neutral cues (i.e., rectangles) but are not in particular more distracting compared to complex, but neutral cues (i.e., the common objects). Additionally, across all three experiments, higher distractor load (i.e., the number of distractors) lead to greater distractibility. Moreover, while Experiment 1 revealed that none of the included individual differences had a significant impact on distractibility, Experiment 2 showed an interaction of cyberostracism (versus none)

and number of distractors in all blocks. Those who were socially excluded, performed significantly worse for lower distractor load, but this difference reduced with an increasing distractor number. In addition, Experiment 3 showed no effects of the manipulation of FoMO but found an effect of mind wandering on distractibility.

With this study, we extended prior work on filtering ability by including a block on social media. Overall, we found that higher distractor load leads to greater distractibility. In addition, we found no effects of social media specifically; the experiments mainly showed similar results of the social media and rectangles blocks. Findings suggest that cyberostracism increased distractibility and that mind wandering partially influenced distractibility. Besides, the study found largely no effects of individual differences. Limitation of this study was that it may be too abstract since it was a cognitive task and does not measure actual distraction in our daily life. The following study tried to close exactly this gap.

4.5. Study 3 – Visual and Internal Attention to Smartphone's Mere Presence – A mobile eye tracking experiment

After having asked participants about their distraction in Study 1 and investigated distractibility in a cognitive experiment in Study 2, it appeared relevant to investigate social media distraction in a more realistic setting. A number of studies has shown that yet alone the mere presence of a smartphone can negatively impact cognitive performance (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017). Most notably, however, it remains largely unclear why the mere presence is distracting and a deeper investigation of the underlying processes of the smartphone's presence effect is missing thus far. Therefore, Study 3 investigated how this effect on performance could be explained and looked at the underlying processes: Are people looking so much at their smartphones or rather, are internal processes, such as smartphone-related thoughts making people distracted?

Hence, this study investigates the visual (i.e., looking at it) as well as internal attention (i.e., smartphone-related thoughts) as potential underlying processes affecting performance. In addition, since not all studies found this effect of smartphone presence on performance (Hartmann et al., 2020; Johannes, Veling, et al., 2019), we re-investigated this effect using the same task one study used but extended the study with a second task. Since all studies investigated cognitive tasks, we included a reading task that is more closely to daily activities instead of cognitive functions.

Study 3 used an experiment with mobile eye tracking glasses to investigate the visual distraction of smartphones. Like the previous studies examining the mere presence effect, this study used a two-group experimental design (a group with smartphone present and a control group with their smartphone absent). In this study, participants completed the cognitive tasks adapted from Thornton et al. (2014) on a paper and a reading task on the computer. To assess visual attention, the mobile eye tracking glasses tracked participant's gazes during the cognitive and reading tasks while internal attention to smartphones was assessed via questionnaires afterwards.

Regarding performance, results showed no significant effects of smartphone presence versus those with smartphone absent on overall performance (and neither for the cognitive tasks and reading task), only that those with the smartphone present needed significantly longer to answer the questions on the reading task. Measure of visual attention to smartphones was the number of fixations on the distractor during each part of the experiment. Comparing visual attention between both groups showed that participants with their smartphones present looked

significantly more during the transitions, that is the transitions between tasks, during the instructions, at the start and the beginning. There is, however, no significant relation of visual attention to performance in any task. Internal attention, in the form of smartphone vigilance, was significantly higher in the smartphone group, but this did not affect performance.

Concluding, this study indicated that the mere presence of smartphones may not necessarily affect performance, even when controlling for individual differences. Most importantly, this study revealed that users can control their visual attention to smartphones since participants only looked at the smartphones during the transitions and breaks of the tasks. At the same time, it shows that the smartphone's mere presence can be visually distracting. In addition, smartphone presence increased internal attention to the smartphones. This indicates that even though participants only rarely looked at their smartphone, the mere presence of it already increased internal awareness of smartphones.

5. Synthesis and Discussion

To summarize, Study 1 revealed task-related and social distraction as underlying motives for social media distraction and how these are influenced by individual differences. Moreover, it revealed typical situations and common strategies of distraction. Study 2 showed that more distractors are more distracting and that social media cues are not in particular distracting (compared to complex neutral cues), but that states such as cyberostracism can influence general distractibility. Study 3 showed that the smartphone can be visually distracting in moments of not having to focus on a specific task, but, contrary to expectations, that the mere presence does not affect performance.

Overall, the studies of this dissertation build on each other to gain a deeper understanding of social media distraction. Study 1 builds the groundwork of this dissertation, since it gives a broad and user-centric perspective of social media distraction. Based on this study, reasons for distraction could be derived. Also, it showed individual differences relevant for distraction which were used in the following studies. Since this study was focused on self-report and uncovered the user perspective of distraction, the following studies were thought to measure social media distraction in particular.

Study 2 tested the general ability to filter out visual distractions and how individual differences important for social media use (as seen in Study 1) may influence this ability. Study 2 tried to find out how visually distracting social media stimuli can be. Since the results of Study 2 were not giving enough insights as to whether social media cues are visually distracting or rather internally causing a distraction, the idea was to test this with an eye tracking study in the following study to investigate whether people are more internally distracted or really looking at the distraction.

Study 3, then, investigated one specific situation (cognitive work and studying) and tested one specific strategy (placing the smartphone out of sight and reach). In Study 1, we saw that studying/working is one of the main situations prone for social media distraction. Further, Study 1 showed that one popular strategy that users employed is to place the smartphone away. Hence, in Study 3, we picked up these two aspects and investigated these deeper in the study. Since we found some effects of individual differences in the first two studies, these were also included in the last study. The following chapters discuss each of the research questions and show how the studies answer the research questions jointly.

5.1. RQ1: What are the Reasons for Users' Social Media Distraction?

The first research question asked for the underlying motivations of social media distraction which was directly addressed in Study 1 and enriched with findings from Study 2. Findings revealed social and task-related reasons that are underlying social media distraction: While social distraction makes users want to socially connect and fulfill the expectations of others, task-related distraction stems from users wanting to avoid unpleasant situations or tasks that increase susceptibility to social media cues (see Paper 1, Koessmeier & Büttner, 2021). These findings fit well into previous literature; While finding social distraction corresponds to prior work indicating that social media use is socially motivated by social norms and expectations (Bayer, Campbell, et al., 2016), task-related distraction corresponds to prior work showing that social media use is motivated by regulating mood (Reinecke, Meier, et al., 2018) and procrastinating (Rozgonjuk et al., 2018).

In addition, further results showed that momentary states can influence users' distractibility (Study 2) and in particular, the findings showed that state cyberostracism can make users more susceptible for distractions (see Paper 2, Koessmeier & Büttner, 2023). This further enhances the idea that social media distraction can be motivated by users' needs and gratifications, as argued within the framework of U&G. Momentary cyberostracism will likely activate social reasons for distraction and hence make users more susceptible for distraction.

By finding underlying reasons for distraction, this work indicates that not only social media use, but also social media distraction can have underlying reasons that motivate social media distraction. In light of the uses and gratifications approach (Katz et al., 1974; Rubin, 2002), it shows that users have certain needs and gratifications that influence not only their social media use in general, but also their social media distraction. In addition, considering the impulsive-reflective model (Strack & Deutsch, 2004), finding underlying reasons for distraction shows that social media distraction is not purely an impulsive behavior, but that users are aware of certain underlying aspects of distraction that could guide reflective processes.

Finding out these reasons for distractions helps explaining why users get distracted by social media. Users' motivations are likely to play also a role in shielding their goals from distraction, as assumed by goal shielding theory (Shah et al., 2002). User's social and task-related distraction, maybe even activated by momentary states, thus could indeed influence users' distractibility and how well they handle these. In addition, research had indicated that motivations influence whether attentional biases are formed (Papies et al., 2008) and thus social and task-related distraction might influence user's susceptibility to social media cues. In

addition, prior work had also indicated that motivation influences vigilance suggesting that the reasons for distraction may also influence internal distraction (Oken et al., 2006).

In sum, this work showed that there are different underlying motivations for getting distracted by social media. It confirmed that users have a more active role not only in social media use per se but also in how susceptible they are to distractions. Most notably, this work showed that there are social and task-related reasons underlying social media distraction. This work further suggests that rather stable (see Paper 1, Koessmeier & Büttner, 2021), but also momentary (see Paper 2, Koessmeier & Büttner, 2023) motivations influence social media distraction.

5.2. RQ2: How do Individual Differences Influence Distraction and its Potential Effects on Performance?

The second research question asked for the individual differences that may influence distraction and performance. This work showed that individual differences influence the reasons for distraction (Study 1), but they influence neither distractibility (Study 2), visual attention to social media cues (Study 3), nor performance (Study 3).

Most notably, this work revealed that individual differences can impact social and task-related distraction (see Paper 1, Koessmeier & Büttner, 2021). This corresponds to work on the uses and gratifications approach suggesting that social and psychological factors can influence media effects (Rubin, 2002). In particular, for social distraction, FoMO was the most important predictor (Study 1). Relatedly, research showed that receiving no notifications increased FoMO (Fitz et al., 2019), which may make users more susceptible to social media cues and thus increase distractibility. For task-related distraction, problematic social media cues and FoMO were the most important predictors (see Paper 1, Koessmeier & Büttner, 2021). Correspondingly, prior research has highlighted the importance of problematic social media use for social media distraction by showing that, for instance problematic social media use is impacts the amount of social media use (Oraison et al., 2020) and lower productivity (Duke & Montag, 2017).

While self-control was a significant contributor for both social and task-related distraction, this effect only emerged when not considering the social media-specific variables FoMO and problematic social media use (see Paper 1, Koessmeier & Büttner, 2021). Conversely, prior work has indicated that self-control was, for instance, related to media multitasking (e.g., Shin et al., 2019) or quickly responding to messages (Berger et al., 2018).

The findings from Study 1 however, suggest that self-control is not as important as FoMO or problematic social media use.

Even though individual differences play a role for social and task-related distraction, findings showed that these individual differences do not influence the general ability to filter out distractions (Study 2, see Paper 2, Koessmeier & Büttner, 2023), visual attention to smartphones, nor performance (Study 3, see Paper 3, Koessmeier & Büttner, 2023). This seemed surprising given the assumption that individual differences play a role for media use and effects as suggested by U&G (Rubin, 2002, 2009). However, one potential implication might be that distractibility may rather be influenced by the individual's attentional capabilities. As such, previous research has indicated that people with low visual working memory capacities, that is the ability to handle the visually perceived stimuli perceived, have problems in focusing on task-relevant stimuli and are more easily distracted by task-irrelevant stimuli (Anderson, 2013). This highlights the importance of rather general attentional capabilities, such as the WM capacity, for social media distraction, that might be more important than individual differences.

Further findings suggested that individual differences in momentary states can impact users' susceptibility to distraction. Results found that momentary cyberostracism can negatively impact the ability to filter out distractions (Study 2; see also discussion of RQ 1). This finding corresponded to prior work indicating that individual motivations play a role for goal shielding (Shah et al., 2002) and impulsive behavior (Hofmann et al., 2009).

Overall, this work indicated that individual differences may in fact not play a such an important role for explaining distraction (Study 2, Study 3), even though it does impact reasons for distraction (Study 1). Situational differences, such as feeling excluded, however, may increase the feeling of distraction (Study 2). Concluding, these findings suggest that even though individual differences do influence the motivation behind social media distraction (see RQ 1), these do not necessarily influence the ability to block out distractors. Instead, it might be a seems to be a rather universal ability and needs further investigations.

5.3. RQ3: How Internally and Externally Distracting are Social Media Cues?

The third research question asked for the underlying mechanisms of distraction and in specifically investigated external and internal distraction. This dissertation investigated the visual distraction potential of social media cues (Study 2) and smartphones (Study 3). Furthermore, it investigated internal processes in the form of vigilance (Study 3) and mind

wandering (Study 2). Results showed that social media cues are not in particular distracting compared to other complex cues (Study 2) and that users seem to primarily divert their visual attention to the smartphone while not having to focus on a task (Study 3), while the mere presence of the smartphone increased vigilance (Study 3).

This work assumed that social media cues can be visually distracting, but results showed that users can control their attention and that cues are only visually distracted during breaks and transitions (see Paper 3, Koessmeier & Büttner, 2022). This finding has two main implications: First, in light of perceptual load theory (Lavie, 2010; Lavie & Dalton, 2014), it shows that when full attention is required to perform a task, users focus on their task and are only distracted, when they have attention to spare, that is during the breaks and transitions. This is further enriched through the results that social media cues are not in particular distracting compared to other complex distracting cues in the cognitive experiment filter task (Study 2, see Paper 2, Koessmeier & Büttner, 2023). Again, following perceptual load theory (Lavie, 2010; Lavie & Dalton, 2014), with such a demanding task that the filter task is, users have little to no attention left that would make them susceptible to perceiving the social media cues.

Even though participant's own smartphone was lying directly in their peripheral viewing field, they appeared to be able to control their visual attention towards it (Study 3, see Paper 3, Koessmeier & Büttner, 2021). This may suggest that users are at least partially able to exert self-control over their visual attention to the smartphone. Considering the reflective and impulsive processes (Hofmann et al., 2009; Strack & Deutsch, 2004), this finding gives further support of the idea that social media distraction is not a purely impulsive behavior – as was for instance suggested by van Koningsbruggen et al. (2018) – but users can, partially, suppress impulsive reactions and control at least their visual attention towards such cues. In Study 3, however, no notifications would appear on the smartphone and this conclusion may not hold for when notifications come in (see Paper 3, Koessmeier & Büttner, 2022), as prior work has shown that people look a lot more at the smartphone when people receive notifications (Mendoza et al., 2018). In addition, prior work has suggested that online vigilance can be a deliberate but also automatic process (Reinecke, Klimmt, et al., 2018), further supporting the idea that social media distraction is not necessarily a purely impulsive behavior.

Second, in light of value-driven attention (Anderson, 2013, 2016), social media cues have a specific value to users which is drawing their visual attention, as indicated by the finding that users are drawing their visual attention to the smartphone (Study 3, see Paper 3, Koessmeier & Büttner, 2022), suggesting that social media cues can impose a value-driven cue that is drawing visual attention. Relatedly, Anderson (2013) found that especially value-driven stimuli

are hard to ignore, but that attentional biases even hold on when the cue is no longer reward associated (Anderson, 2016). Moreover, prior work has found that reward-associated stimuli more distracting than non-reward-associated stimuli (Rusz et al., 2018). In addition, research has suggested that especially for habitual behavior, merely seeing a contextual cue may already create related thoughts (Quinn et al., 2010) and for instance, that seeing a smartphone may induce thoughts about relationships (Kardos et al., 2018). This further supports the idea that smartphones and social media cues could receive value-driven attention. In this light, prior work has argued that connection cues, such as the smartphone is not only influenced by habits but also strongly guided by norms (Bayer, Campbell, et al., 2016).

The idea that social media cues could be seen as value-driven cues for drawing visual attention, is further enriched by the results that smartphone presence increased vigilance, hence an internal awareness of the smartphone (while not looking at the smartphone). It implies that visual cues may cause internal distraction in the form of increased vigilance. In a similar vein, prior research has indicated that users perceive smartphones by its mere presence as distracting (Johannes, Veling, et al., 2019). As prior work has also found that visual social media cues induce craving (Wegmann et al., 2017), our findings may suggest that the smartphone cue may also create an internal distraction.

Thus, regarding internal distraction, this work showed that such value-driven cues can increase vigilance (Study 3, see Paper 3, Koessmeier & Büttner, 2022), but further findings also showed that social media cues do not prompt mind wandering to social media (Study 2, see Paper 2, Koessmeier & Büttner, 2023). Hence, this work suggests that briefly seeing a social media cue does not necessarily lead to social media-related thoughts even though previous work has shown that mind wandering is related to vigilance (Johannes et al., 2018) and that mind wandering resulted in lower cognitive performance (Unsworth & Robison, 2016). One possible explanation for not finding social media cue-induced mind wandering might be due to the short presentation of the social media cues. Since the smartphone was present throughout the whole duration in Study 3, it may explain why Study 3 showed that smartphone presence increased vigilance.

In sum, this work showed that social media cues can be distracting, in particular by drawing internal attention, while they can also be visually distracting, but only when users have the cognitive capacity and their task at hand does not require full attention. Hence, this work supports the idea of social media cues being a value-driven cue towards which users have formed attentional biases. Even more importantly, this work showed that a) users can control their visual attention in so far as they do not impulsively react towards social media cues

(smartphone presence), and that b) users can focus when it is required even though value-driven cues are present (during the tasks in Study 3; during the cognitively demanding task in Study 2) which is in line with perpetual load theory stating users are susceptible when there is spare attention.

5.4. RQ4: How do Social Media Cues Lead to Distraction and Impact Performance?

The fourth research question asked how distracting social media cues are and how these may impact performance. Performance effects were investigated in the form of greater distractibility in a cognitive task (Study 2), as well as effects on cognitive performance and a reading task (Study 3). Overall, this work showed limited to no effects on performance that would have arisen due to the presence of social media or smartphone cues.

This work could not show that social media cues are more distracting than complex neutral cues (Study 2, see Paper 2, Koessmeier & Büttner, 2023) and that smartphone presence influence performance (Study 3, see Paper 3, Koessmeier & Büttner, 20212). Even though the underlying meaning of social media cues and prior work has also indicated that social media cues could induce craving or social media-related thoughts (Johannes, Veling, et al., 2019; Wegmann et al., 2017), this work could not observe any effects on performance. Even though this work argued in the previous chapter on RQ 3 that social media cues draw value-driven attention, the studies could not show that this would manifest in negative effects on performance.

One possible explanation might be that the time that social media cues were present and the duration for potential measuring effects were not long enough combined with the fact that users were not allowed to interact with social media or the smartphone. Those studies that found effects on performance were oftentimes correlational studies investigating the relation of social media use and behavior with academic performance indicators such as the grade point average (e.g., Junco & Cotten, 2012; May & Elder, 2018) or over longer periods (e.g., a lecture) during which users really interacted with social media (e.g., Demirbilek & Talan, 2017; Gupta & Irwin, 2016; May & Elder, 2018). This would suggest that performance effects would be most likely to occur only after longer study periods and additionally, when users receive notifications and interact via social media. In addition, no notifications would appear in this work's studies, and other work only found distracting effects if notifications appeared (Mendoza et al., 2018). However, this work differed in three ways; the measured period was rather short, users were

not allowed to interact through social media, but merely perceiving the cues, and no notifications appeared.

This finding would again support the notion that users can control their attention for brief periods of time and therefore are not permanently distracted, contrary to previous assumptions. According to threaded cognition theory (Salvucci & Taatgen, 2008), effects would only arise if the same resources would be required. If, however, users were successfully controlling their attention and only direct it at the task, no effects on performance due to distraction would arise. In a similar manner, prior work has suggested that multitasking experience impacts how well they deal with such situations (Alzahabi & Becker, 2013) and that people successful at multitasking also show a higher working memory capacity (Pollard & Courage, 2017). Following distraction-conflict theory (Baron, 1986), social media cues might not create an attentional conflict because users can suppress the cues and hence any related behavior.

Furthermore, the findings suggested no effect of smartphone presence on performance (Study 3). Even though numerous studies have found a negative effect of the smartphone's mere presence on performance (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017), this work's finding is in line with other research countering the negative effect of smartphones on performance (Hartmann et al., 2020; Johannes, Veling, et al., 2019). This work would instead rather support the notion that interacting with smartphones and social media may affect performance, as previous research has shown (Mendoza et al., 2018), or that receiving notifications, such as hearing them ring (Stothart et al., 2015) can impact performance, while other work showed notifications just further increased vigilance and the feeling of distraction (Johannes, Veling, et al., 2019). In this work's studies, the visual social media cues were all passive cues with which users could not interact (seeing social media cues in Study 2 and seeing the smartphone in Study 3). This may suggest that not only the duration of the experiment, but also the possibility to interact with the smartphone or social media, may influence whether social media cues have an impact on performance.

Although this work could not show that internal distraction (i.e., vigilance) decreased performance (Study 3, see Paper 3, Koessmeier & Büttner, 2022), prior work has indicated that internal distraction might make people slower in their reactions than external distraction (Katidioti et al., 2014; Katidioti et al., 2016). Internal distraction might need more mental capabilities to process, and prior work showed that pupils dilate before the user is self-interrupting (Katidioti et al., 2014). Indeed, this work found that smartphone presence increased the time needed to answer on the reading task (Study 3). This is in line with prior work that has

found no performance difference, however longer time needed to read when they were distracted by instant messaging (Bowman et al., 2010; Fox et al., 2009).

Lastly, but unrelated to social media distraction, this work showed that an increasing distractor load (i.e., higher number of distractors) in general leads to worse performance (Study 2). Early work on attention has also suggested negative impacts on performance when more stimuli than those relevant to the task are presented which impose greater filter costs (Treisman et al., 1983). Relatedly, prior work has also found that increasing number of items increases perceptual load (Lavie et al., 2014), which can also be induced by more complex distractors (Lavie et al., 2014). Correspondingly, this work has also indicated that more visually complex are also more distracting than neutral, simple ones (Study 2, see Paper 2, Koessmeier & Büttner, 2023).

Overall, this work suggests that social media cues do not necessarily negatively impact performance during high-cognitive demanding tasks that require attention for limited, over short periods of time. Considering that numerous studies have found effects on performance, it may suggest for this work that a) tasks requiring high cognitive capacities and users have not attention to spare for distractions (in line with perceptual load theory) have been used, and that b) the social media cues were presented too and/or the task for measuring performance was not long enough, and c) users could not interact with social media nor receive notifications, which made the potential for social media distraction very subtle. It might underline the notion that social media users can control their attention for shorter periods of time and divert the attention away from social media and instead fully focus on the task.

5.5. Excursus: Insights on How to Better Handle Social Media Distractions

The insights gained in this work can help to derive potential strategies or ways that can help empower users in handling their social media distraction. This work revealed the most common strategies that users employ against distraction (Study 1) and tested one commonly discussed strategy, namely placing the smartphone out of sight (Study 3).

This work showed the common strategies that users employ when they want to be less distracted; they quite often use strategies targeting to reduce external distractions (e.g., silencing and turning off notifications, placing it out of sight; Study 1). In addition, this research has also shown that even though users already employ strategies, they rate these at not really effective (Study 1, see Paper 1, Koessmeier & Büttner, 2021). This highlights the importance of finding

strategies against social media distraction that would be able to really target distraction effectively.

In a similar vein, previous work has indicated that informing people about their (problematic) social media use is not enough in changing their behaviors (Loid et al., 2020) and that merely rising the awareness of potential negative consequences may not effectively lead to a more conscious behavior towards reducing social media distractions (Chen & Yan, 2016; Terry et al., 2016). This suggests that more needs to be considered in helping users regulate their distraction.

One comparatively feasible solution (besides stopping to use social media entirely) might reducing the social media use. Prior research has found that reducing its use can have positive effects on well-being (problematic use, depressive tendencies and anxiety; Brailovskaia et al., 2022). Research has shown that over time of four months, reducing smartphone use by an hour instead of trying to not use it at all has resulted in the strongest and most stable effects on well-being (Brailovskaia et al., 2022). Further research has suggested that providing notifications in batches might be a good approach in limiting such effects (Fitz et al., 2019).

This work also showed that the strategy of removing the smartphone from the visual field while working on a task reduced the internal distraction compared to when the smartphone was present, even with all notifications disabled (Study 3). Thus, this work tested one of the strategies mentioned in prior literature (e.g., Kushlev et al., 2016; Stothart et al., 2015), namely removing the smartphone out of sight and disabling notifications. Prior work has suggested that incoming notifications lead to more visual distraction (Mendoza et al., 2018) compared to receiving no notifications as in Study 3. This suggests that reducing the notifications might be crucial for reducing distraction. This also corresponds to further findings suggesting that especially a number of visual distractors makes it difficult to focus (Study 2, see Paper 2, Koessmeier & Büttner, 2023) as well as more visually complex distractors are also creating a greater distraction (Study 2, see Paper 2, Koessmeier & Büttner, 2023). In addition, prior work suggested that in order to improve self-control, removing temptations helps in preventing distractions (Ent et al., 2015). This work suggests that any visual distractions should be minimized when aiming to work focused. Hence, it would suggest that removing visual cues, even though not necessarily having an impact on performance, would be advisable if trying to reduce distractions.

Moreover, since this work also showed that visual cues can create an internal distraction, in the form of increased vigilance (Study 3, see Paper 3, Koessmeier & Büttner, 2023).

Relatedly, research has indicated that placing the bad habit cues out of sights helps to control bad habits and that vigilant monitoring a bad habit can help tackle these bad habits (Quinn et al., 2010). Hence, attempting to become more consciously aware and observe the own individual behavior and habits, including the internal distractions in the form of upcoming thoughts to social media, might help in tackling social media distraction.

Overall, this work shows that a) users already use strategies, mostly focusing on reducing external distraction, while not finding them very effective (Koessmeier & Büttner, 2021), b) more distractors are also more distracting (Paper 2, Koessmeier & Büttner, 2023), c) that such visual cues increase internal distraction, and d) attention to distracting stimuli can be controlled to some extent, indicating that social media distractions is not a fully unconscious process (Paper 3, Koessmeier & Büttner, 2022). Therefore, the availability of social media cues play an important role for social media distraction. However, this work also found that people were distracted not necessarily all the time. This work revealed that people seem to be able to be in control of their visual distraction and allowed themselves to look at distractions in breaks (see discussion of RQ 3, see Paper 3, Koessmeier & Büttner, 2022). In short, one efficient strategy that users could follow when not wanting to get distracted: placing any possible distractions out of sight. This would help users to avoid the temptations that might potentially lure them into distractions.

5.6. Proposed and Tested Model of Social Media Distraction

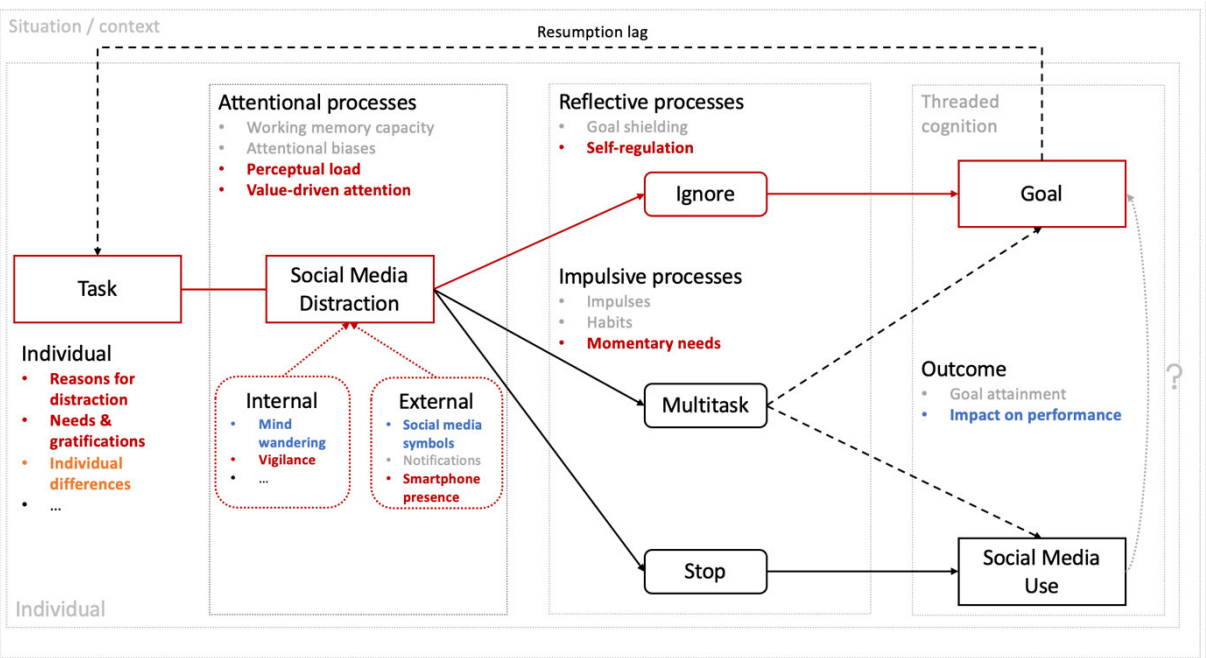
In this work, social media users were investigated in *(RQ1)* why they get distracted (Study 1, 2), *(RQ2)* how individual differences influence social media distraction (Study 1, 2, 3), (*RQ3*) how external and internal distraction, and (*RQ4*) how distraction influences performance (Study 2, 3). The individual, embedded in a situational context, equipped with some strategies (or not), driven by different motivating factors and individual differences (Study 1, 2), is encountering social media distractions that arise by internal and external distraction processes (Study 2, 3) to which the individual can react impulsively or reflectively. Following threaded cognition theory, it would suggest that these distractions might influence their performance of the task they originally thought to fulfill, which these studies did not show (Study 2, 3).

While Figure 3 showed the proposed theoretical foundation of social media distraction, Figure 4 shows the updated model and includes the concepts that were investigated in this work.

Figure 4 visualizes the investigated path in this work (red) and also the associated findings (red for having an effect, blue for not having an effect, grey was not tested).

Figure 4

Proposed and Tested Process Model of Social Media Distraction



Note. This model visualizes the prosed theoretical model of social media distraction highlighting the findings of this work's studies. The red path indicates the tested path in this work's studies. Red points indicate that these processes indeed played a role for social media distraction, blue points indicate that these studies did not find evidence that these processes are relevant for distraction, and orange points showed mixed results. The points in black have not been tested and would yield potential for future research.

Following the proposed and tested process model of social media distraction, the individual is focusing on a task that would lead to a goal. Hereby, the user is likely to be influenced by the surrounding context, individual traits, but also momentary needs and gratifications, and specific reasons for distraction. In scope of the U&G approach (Rubin, 2002), this research showed that users indeed have underlying reasons for their distraction, namely social and task-related distraction (see Paper 1, Koessmeier & Büttner, 2021). This shows that users' susceptibility to social media distractions is based on their current needs and gratifications sought (see Paper 1, Koessmeier & Büttner, 2021). This work also indicated that individual differences, such as FoMO and problematic social media use are influencing the underlying reasons for distraction.

Due to the limited attentional capacity (Anderson, 2013; Desimone & Duncan, 1995; Deutsch & Deutsch, 1963; Lavie & Dalton, 2014; Pashler, 1994), users have to select the stimuli which receive their attention. Social media distractions are competing for the user's attention

and are most likely to received preferred attention due to value-driven attentional mechanisms. This research showed that social media cues can attract value-driven attention, as indicated by the visual attention that the mere presence of smartphones received (see Paper 3, Koessmeier & Büttner, 2022). Since social media cues, however, did not prove to be particularly distracting (see Paper 2, Koessmeier & Büttner, 2023), future work is needed to investigate whether users have an attentional bias towards social media cues.

Even though social media cues are likely to receive preferred attention, this work showed that the perceptual load (Lavie, 2010; Lavie & Dalton, 2014) influences the likelihood to get distracted or not; with higher perceptual load, the likelihood to get distracted decreases (see Paper 2, Koessmeier & Büttner, 2023). Moreover, findings suggested that social media distraction is most likely to happen in moments between tasks, hence, during low cognitive load, instead of during tasks, which impose cognitive load (see Paper 3, Koessmeier & Büttner, 2022).

If social media cues have the conditions to be distracting, social media can distract users from their task due to internal as well as external cues. For internal distraction, this research showed that vigilance increased the feeling of distraction (see Paper 3, Koessmeier & Büttner, 2022), while mind wandering does not necessarily lead to a distraction (see Paper 2, Koessmeier & Büttner, 2023). Moreover, this work showed that external social media cues, in the form of a present smartphone, can distract users from their tasks, meaning that the smartphone received visual attention, even though only during moments of not having to focus on the particular task (see Paper 3, Koessmeier & Büttner, 2022).

With regard to reflective and impulsive processes (Hofmann et al., 2009; Strack & Deutsch, 2004), prior work has suggested that social media use is an impulsive behavior (e.g., van Koningsbruggen et al., 2018). Relatedly, this work indicated that momentary needs could impact impulsive processing, as users that were feeling excluded had problems in filtering out distractions (see Paper 2, Koessmeier & Büttner, 2023). The effect of momentary needs affecting distractibility diminished with higher perceptual load (see Paper 2, Koessmeier & Büttner, 2023), suggesting that high load conditions can override such momentary needs.

However, this work also suggested that reflective processes, such as self-controlling one's behavior, play a role for social media distraction. As such, findings showed that the smartphone received users' visual attention only during moments when they did not have to focus on the particular task (see Paper 3, Koessmeier & Büttner, 2022). This finding revealed that even though the smartphone is attracting attention, but that users can control their visual attention. This suggests that reflective processes play a role that enabled users to self-regulate

their attention to the distracting stimuli. This enabled users to finish the goal (in the study's sense, the tasks of the study) without any greater performance effects (see Paper 3, Koessmeier & Büttner, 2022).

Taken together, this work has proposed a theoretical process model of social media distraction (see Figure 3, chapter 2.8) which has been tested. These studies, however, did not directly test the other two possible reactions to social media distraction (multitask and stopping the task). Future work is required to investigate the further potentially relevant processes to get a full picture of the process of social media distraction.

5.7. Contributions

This work provides several theoretical and methodological contributions. While this work builds on the foundation of the current literature, it extends the state of the art with several meaningful contributions. The following sub-chapters highlight the novel approaches that this work provided and how the insights gained relate to previous theoretical models. First, the theoretical contributions are discussed, followed by the methodological contributions.

5.7.1. Theoretical Contributions

First, this dissertation investigated the concept of social media distraction. To do so, this work has proposed a process model of social media distraction (see Figure 4). With this, this work is among the first to investigate the phenomenon more systematically, provide a definition and especially consider social media distractions from the user perspective while also including objective measures. Hence, this research extends the understanding of distraction and allows for a more fine-grained investigation of the concept, instead of focusing on only related concepts such as multitasking. By investigating social media distraction from different angles, this research helped in defining the concept of social media distraction.

Second, this work advocated for understanding social media distraction as a process in which the users play an active role. While there were numerous studies investigating the motivations for using social media relying on the U&G approach (Papacharissi & Mendelson, 2010; Quan-Haase & Young, 2010; Whiting & Williams, 2013), none had yet focused on the reasons for social media distraction. This work showed that users have their own, specific uses and gratifications underlying social media distraction, namely social and task-related distraction (see Paper 1, Koessmeier & Büttner, 2021).

Furthermore, this work contributed to the discussion on the role of individual differences. While several studies have suggested that individual differences play a role for social media use and distracting behavior (e.g., Fitz et al., 2019; Hunt et al., 2018; Milyavskaya et al., 2018; Rozgonjuk et al., 2018), this work only found that individual differences have an influence on users' reasons for distraction (see Paper 1, Koessmeier & Büttner, 2021), but not on actual distraction (see Paper 2, Koessmeier & Büttner, 2023; see Paper 3, Koessmeier & Büttner, 2022). This work rather suggests that differences in the general attentional abilities might play a role (see Paper 2, Koessmeier & Büttner, 2023), such as prior work has suggested that the visual working memory plays a role for filtering out distractors (Anderson, 2013).

Additionally, this dissertation contributed to understanding external and internal distractions and their potential effects. Even though prior work has pointed out that for instance smartphone distraction could arise due to internal and external distraction, these have not focused on uncovering the source of distraction in more detail (e.g., Canale et al., 2019; Wilmer et al., 2017). This work, however, found a relation of external and internal distraction by revealing that those people with a smartphone present, i.e., the external distraction, also reported higher internal distraction (see Paper 3, Koessmeier & Büttner, 2022). Thus, this work suggests that there is the connection of external and internal distraction which future work needs to consider.

Moreover, this work contributed to the literature investigating the mere presence effect of smartphones. This work did not find an effect of the smartphone's mere presence on performance (see Paper 3, Koessmeier & Büttner, 2022) which is in line with other previous work (Hartmann et al., 2020; Johannes, Veling, et al., 2019). This further strengthens the assumptions that the mere presence of the smartphone does not need to impact performance, which is contrary to a numerous studies finding the effect (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017). It may suggest that not all social media distraction needs to be detrimental. The research on the mere presence effect also did not investigate the visual attention to the smartphone, hence whether users look at the smartphone or not, and how this might impact their performance. This work closed this gap by using eye tracking and found that users only divert their attention to the smartphone during breaks (see Paper 3, Koessmeier & Büttner, 2022).

Last, this dissertation contributes to the discussion of the underlying processes of distraction. The RIM (Strack & Deutsch, 2004) as well as the dual-systems model by Hofmann et al. (2009), proposed that impulsive behavior is elicited by stimuli yielding to automatic reactions, neglecting other goals, or currently performed tasks (Hofmann et al., 2009). Prior

work has argued that social media use is mainly an impulsive process (e.g., van Koningsbruggen et al., 2018). According to the reflective-impulsive model (Hofmann et al., 2009), social media use potentially leads to affective behaviors that trigger automated and impulsive reactions (van Koningsbruggen et al., 2018). Instead of handling social media by ignoring the distraction, it might be argued that people often seem to respond to the notification due to habitual, impulsive reactions.

This work, however, has shown that social media distraction is not only impulsive, but can be reflective, guided by underlying motivations (see Paper 1, Koessmeier & Büttner, 2021). In addition, users seem to be able to control their behavior towards external distraction (i.e., the smartphone), so that users divert their attention towards the smartphone while they have attention to spare, which was during the transitions of the tasks in the experiment (see Paper 3, Koessmeier & Büttner, 2023). It suggests that users' reaction to social media distraction can also be controlled, based on thoughtful actions (e.g., Study 3, visual distraction only during breaks), because users were allowed themselves the visual distraction during the transitions. It indicates that people do not always react impulsively to social media distraction but can also regulate their distraction to some extent. Hence, this work may encourage to take also reflective and not only automatic processes into account.

5.7.2. Methodological Contributions

This dissertation has several methodological contributions. The studies extended previous established methodological approaches with new aspects. These methodological adaptations could be used in future research on social media distraction. In short, this work developed a new questionnaire to assess social media distraction, adapted a cognitive task to the social media context and investigated the mere smartphone presence using eye tracking and not only with cognitive tasks. The following discusses these methodological contributions in more detail.

Study 1 developed a new questionnaire that can be used to assess the main reasons for distraction (see Paper 1; Koessmeier & Büttner, 2021). Before, there had not been a scale or items that helps better understand the underlying reasons for user's social media distraction. This scale can be used in future work that is interested in user's reasons for distraction and could also extend the scale with new items. Future work can include the scale to investigate the reasons for distraction in further contexts. Moreover, future work can use these items to investigate which other individual differences or states might play a role for social media distraction.

Moreover, Study 1 created scales on distraction situation and strategies. These can help future work in deciding on research settings by identifying relevant situations that are prone for distraction and which strategies are mostly used. The scale used on social media strategies can help in identifying which strategies are the most pressing ones necessary to investigate. Lastly, the scales developed and used in Study 1 can be used in future work to find out more about the social media distraction patterns and behavior in a study's sample.

Study 2 used a cognitive task, the filter task, but adapted it by tailoring it to the phenomenon of investigation, social media distractions. The filter task was modified by including a new block focusing on social media (see Paper 2; Koessmeier & Büttner, 2023). Prior work on media multitasking had used the filter task before but had merely used the neutral rectangles as distractors and included the self-reported questionnaire on media multitasking (Ophir et al., 2009) to connect the filtering ability to daily media behavior. However, a direct connection to the ability to filter out social media distractions has not been made. In addition, while prior work had already adapted this cognitive task to include more complex, everyday objects (Uncapher et al., 2016), it again did not focus on social media distractions. However, this study showed that adapting the filter task with new objects is a viable methodological approach. This adaptation extends prior methods to focus it on social media cues.

Thus, Study 2 adapted the cognitive task, the filter task, to investigated how distracting visual cues of social media are. Similarly, prior research also had adapted a different cognitive task with social media symbols (Johannes, Dora, et al., 2019). While previous work has usually relied on cognitive tasks with neutral stimuli, this work extends the literature with a new method for assessing social media distraction. Now, not only the general ability to filter out distraction, but the specific ability to filter out social media distractions can be assessed.

Unique about Study 3 is that it included an objective measure, namely eye tracking, to investigate the underlying processes of distraction, and more specifically, to investigate how visually distracting smartphones are. Prior work exploring the smartphones' mere presence has not investigate the underlying mechanisms, and thus not how visually distracting the smartphones are. Eye tracking is a relevant method in this context since attentional shifts are precede by eye movements (Anderson, 2013). Hence, it is an appropriate measure of investigating the attention towards the distracting cue in the setting of the smartphone's mere presence.

In addition, using the mobile eye tracker, a more realistic study setting was possible since the smartphone could be present as the real distractor. As objective measure of attention, mobile eye tracking allowed to investigate visual social media in a more realistic setting, since

users could move more freely (compared to stationary eye tracking). To our knowledge, only few quantitative studies used stationary (Brasel & Gips, 2017; Vraga et al., 2016) or mobile (Segijn et al., 2017) eye tracking in the context of (social) media use thus far. For instance, prior research has used eye tracking to observe how often people switch between tasks or media, on average 2.5 switches a minute (Brasel & Gips, 2017; Segijn et al., 2017). Previous mobile eye tracking studies (Kätsyri et al., 2016; Segijn et al., 2017) examined how people devote attention to multiple media (TV and tablet for instance, Segjin et al., 2017) or TV and social media (e.g., Kätsyri et al., 2016). The settings resembled a living room with a TV and a table on which was a tablet (Kätsyri et al., 2016; Segijn et al., 2017). Thus, mobile eye tracking has been used before to create a more "realistic" study set up for investigating attention in a media environment in general. For a mobile eye tracking study, we collected many participants, given the effort in collecting the data and especially coding the videos.

While Study 3 used a paradigm that has been previously investigated in the context of the mere presence of smartphones (Thornton et al., 2014), this study design was extended with a further task that resembled a more realistic task. Previous work investigating the mere presence effect have used different merely cognitive tasks (e.g., Canale et al., 2019; Ward et al., 2017). Cognitive tasks, however, do not necessarily represent the distraction in daily live. Therefore, a further contribution is that Study 3 included not only cognitive tasks, but also included a reading task that is closer to the real life (compared to a cognitive task; see Paper 3, Koessmeier & Büttner, 2023.

5.8. Limitations

Even though this work has contributed to provide new insights, there are also drawbacks of this work, that are sometimes driven by certain practical limitations or due to decisions made in favor of certain aspects while thereby having to neglect others. Future work can address these limitations (see chapter 5.9.).

One limitation is that Study 1, focusing on the reasons for distraction, remained a purely descriptive study, without testing any actual distraction (see Paper 1, Koessmeier & Büttner). Hence, the study did not include any objective measure for social media distraction. However, the purpose of this study was to solely focus on the user's perspective of social media distraction. The following studies in this work then investigated objective distraction behavior. But with regards to the reasons for distraction, further work might be needed to verify the scale

for reasons for distraction more deeply. However, for getting a first understanding on user's reason for distraction, the study suffices.

Furthermore, the tasks that were used in the studies might have been too demanding which may have prevented a distraction to occur (see Paper 2, Koessmeier & Büttner, 2023; see Paper 3, Koessmeier & Büttner, 2022). The high perceptual load may have prevented to observe attentional biases (see Paper 2, Koessmeier & Büttner, 2023). Future work could focus on including different tasks that are less cognitively demanding which might allow to observe distraction better. Not all tasks that users regularly focus on are as demanding as the ones used in these studies. Hence, for understanding social media distraction in user's daily life, tasks would be needed to use that are closer to these settings. For instance, Study 3 also included a task that required participants to read a newspaper (see Paper 3, Koessmeier & Büttner, 2022). More research could focus on tasks like these.

Furthermore, while including an objective measure of distraction in Study 2, the visual attention towards social media cues remained unclear. This study still did not help in finding out more about the internal and external distraction of social media (see Paper 2, Koessmeier & Büttner, 2023). This limitation was tackled with Study 3, where visual attention as well as internal distraction were measured (see Paper 3, Koessmeier & Büttner, 2022). However, this study only focused on the smartphone's distraction potential and neglected the perspective of social media cues. But, as argued before (see chapter 2.3.1.), the smartphone brings the social media distraction closely to its users and thus may represent social media distraction.

In general, the phenomenon of social media distraction may closely relate to and have intersections with other concepts such as media multitasking, vigilance, mind wandering or procrastination. Future work could focus on understanding the relations to these concepts with social media distraction. Even though argued in this work (see chapter 2.1.1.), it remains the question whether there are any behavioral patterns specific to certain social media platforms. Moreover, social media are constantly changing, with added features or even entirely new social media. These changes could also change the distraction behaviors in the future.

Additionally, social media use is influenced by norms, expectations, and practices (e.g., Bayer, Campbell, et al., 2016) and habits as well as automatic behaviors (van Koningsbruggen et al., 2018) which might also apply for social media distraction. These underlying patterns might be difficult to compare, since it may be a very individual and hence diverse behavior.

Last, the probably ideal setting for a study would be to observe users' distractions in their environment and how users are behaving naturally. However, uncontrollable influences in a naturalistic setting would make it difficult to systematically uncover motivations, understand

underlying processes, and influencing factors. Investigating distractions in a (laboratory) study setting always reduces the naturalness of the situation and thus the observed distraction. These limitations also offer the opportunity for future research.

5.9. Future Research

Future research is needed to understand social media distraction even more comprehensively. For instance, future work could delve deeper into understanding what exactly drives distraction. This work has given first insights into the underlying reasons for distraction (see Paper 1, Koessmeier & Büttner, 2021), further research could extend these reasons.

Moreover, future research is needed for understanding further potential influencing factors. While this work could find factors such as self-control and FoMO to influence the distraction motivation (see Paper 1, Koessmeier & Büttner, 2021), these could not be found to influence the filtering ability (see Paper 2, Koessmeier & Büttner, 2023), or external distraction (see Paper 3, Koessmeier & Büttner, 2022). Future work needs to investigate further factors influencing a person's social media distraction and for which processes these play a role.

For instance, a person's mindfulness might play a role for distraction. Research has suggested that mindfulness might help control impulsive stimuli responses (Papies et al., 2011). In particular, research has shown that attention benefited from short mindfulness intervention for heavy media multitaskers having otherwise problems in controlling their attention (Gorman & Green, 2016). Prior work has shown that people thinking a lot about the online world (high in online vigilance) have a lower mindfulness (Johannes et al., 2018). Moreover, not being able to self-control one's social media use might negatively impact mindfulness over time (Du et al., 2021). Hence, mindfulness may help to control one's attention and behavior and thus, play a role for users' social media distraction.

Future work also needs to investigate the interplay of internal and external distraction. How is external distraction influencing internal distraction – and vice versa? For instance, this work showed that an internal distraction is increased by smartphone presence, but at the same time visual distraction seems to be under control and only happening during breaks (see Paper 3, Koessmeier & Büttner, 2022). Future work could also use eye tracking to examine internal versus external distraction; prior work has suggested that internal distraction can be observed in the form of pupil dilation and shows that the process of distraction takes time since the pupils dilate a moment before self-interrupting (Katidioti et al., 2014). More work is needed to focus on the internal distraction of social media. Previous research has suggested that internal

distractions may be more distracting compared to external distractions (Katidioti et al., 2016). In addition, people were slower when they were internally distracted compared to when they were externally distracted (Katidioti et al., 2014; Katidioti et al., 2016). Moreover, during these studies, participants could not interact with social media and not even receive notifications, albeit prior work suggested that receiving notifications increased the distraction (Mendoza et al., 2018). Thus, future work could focus on the effect of notifications on external and internal distraction, as well as on performance.

Future research could investigate when users react how to social media distractions. Future work is needed to investigate the role of reflective and impulsive processes of social media distraction. While this study proposed that reflective processes also play a role for social media distraction (see Paper 3, Koessmeier & Büttner, 2022), future research could investigate more deeply when users react impulsively versus reflectively. In particular, future work could look at situational or dispositional variables as moderators as prior work has suggested that time pressure, high cognitive load or low working memory capacity might be influencing factors (Hofmann et al., 2009).

Moreover, users have three options on handling social media distractions: 1) ignoring distraction, 2) starting to use social media, 3) starting multitasking, i.e., pursuing the task and interacting with social media (see Firgure3, 4; see Paper 1, Koessmeier & Büttner, 2021). It would be interesting to find out whether there are certain tasks more prone for one of the reactions than others. For instance, in social interactions, when will people start using social media instead of ignoring the distraction? Does it more depend on the situation (e.g., the social interaction) or on the distraction (e.g., urgency of the message) that one will follow the distraction instead of ignoring it.

Even though users also state that they try to limit their social media distraction by employing different strategies (e.g., silencing the smartphone, deactivating notifications), users also perceive the use of such strategies rather ineffective in helping them handle their social media distraction (see Paper 1, Koessmeier & Büttner, 2021). Hence, more research is necessary to test more effective strategies that can really help users become less distracted. The results indicated that placing the smartphone out of sight might be a viable strategy (see Paper 3, Koessmeier & Büttner, 2022), more research could test different strategies.

Last, future work needs to investigate how social media distraction behavior changes over time. On the one hand, it is important to investigate how the current distraction behavior is changing. On the other hand, it is also vital to compare how distraction now (within one age sample) compares to that for those a couple of years ago or in a couple of years. For instance,

age also negatively impacts the ability for sustained attention and distractibility (Clapp & Gazzaley, 2012). Future work needs to investigate how age differences influence distraction, especially regarding necessary strategies to help limit distraction.

5.10. Practical Implications

Working and reading on the topic of social media distraction undoubtedly stirs the question on how, in the end, users can limit social media distraction. The following section hence touches upon practical strategies that could help users to limit their distraction, based on this work's research, but also based on the state of the art of the current literature.

Paper 1 argued that social media strategies that users already employ can be defined in two categories, strategies limiting the access to social media and strategies aiming at reducing the awareness of social media distractions (see Paper 1, Koessmeier & Büttner, 2021). Research on strategies limiting the awareness of social media cues has suggested that turning off notifications (Kushlev et al., 2016), closing browser windows of social media pages (Carrier et al., 2015) or even delaying responses and communicating this to others (Birnholtz et al., 2017; Rosen et al., 2011) could reduce distractions. Batching notifications, i.e., receiving notifications in timed intervals instead of whenever they come in, has helped users a lot (Fitz et al., 2019). Furthermore, previous work discussed the effect of educating people on the negative effects of distractions which does not help reduce distractions (Loid et al., 2020; Parry & le Roux, 2019; Terry et al., 2016).

Previous research has also discussed strategies limiting the access to social media, and in particular has suggested that trying to put the smartphone out of direct reach reduces distractions (Carrier et al., 2015; Kushlev et al., 2016; Stothart et al., 2015). Such strategies have been applied in the work context to increase productivity (Mark, Czerwinski, & Iqbal, 2018) or while driving where advanced driver assistance systems which have shown to reduce driving mistakes s (Dumitru et al., 2018). This work also showed that placing the smartphone out of sight reduces vigilance (see Paper 3, Koessmeier & Büttner, 2022). Relatedly, prior research has indicated that being completely separated from the smartphone does not lead to better concentration (Markowitz et al., 2019) and that it could create anxiety (Kushlev et al., 2016).

This work showed that people tend to use strategies that keep social media easily accessible (see Paper 1, Koessmeier & Büttner, 2021). But, as this work also showed, people can be able to control their visual attention (see Paper 3, Koessmeier & Büttner, 2022).

However, reducing the temptation for visual attention, that is putting the smartphone out of sight, also reduces the potential for internal distraction. Thus, even though strategies that only limiting the awareness to social media might be enough for limiting distractions, limiting the access might be even more helpful. All this effort could be beneficial, since previous work has suggested that reducing smartphone use by one hour per week can improve well-being and a healthier lifestyle (Brailovskaia et al., 2022).

5.11. Conclusion

This work has intensively discussed the distraction potential of social media. Due to attentional capacity limits, it is not possible to work on a task and simultaneously direct attention to social media. Nonetheless, users are oftentimes getting distracted by social media, which might negatively impact their task performance. This work investigated why users are users are getting distracted by social media and the findings suggested that users' reasons are to engage in social and task-related distraction. Herewith, this work contributes to the understanding of social media distraction as an active behavior that is guided by its underlying motivations, and thus shows that the uses and gratifications approach can also be applied to social media distractions. Moreover, individual differences such as FoMO and problematic social media use can have an influence on users' reasons for distraction.

Since social media cues are tempting because users associate numerous rewards and gratifications with its use, social media cues are likely to receive value-driven attention. This work further contributes to the understanding of internal and external distraction by showing that external cues such as the smartphone can create an internal distraction. This work further investigated the underlying attentional processes and suggested in line with perceptual load theory, people are less susceptible for distractions, which might explain why social media cues were not particularly distracting.

Indeed, findings suggested that cues such as the smartphone can attract the visual attention of users, but only in moments of low cognitive load (i.e., the transitions between tasks). It shows on the one hand, that such cues are capturing user's attention, while on the other hand, users can also control their attention so that they were only visually distracted during these transitions. This suggested that social media distraction means that users not only impulsively react to stimuli but also can control their attention. Herewith, this work contributes to the discussion on reflective and impulsive processes that can impact social media distraction. However, the findings also suggested that placing the smartphone out of reach can help limit internal distractions.

Further, this work contributes to the discussion on the effects of social media distraction on performance. These studies did not find an effect of distracting social media stimuli on performance. Future work could investigate whether this might be only due to the shorter duration of the studies and whether this may further suggest that users can control their distraction for brief periods of time. Overall, this work provided several contributions but has also methodological contributions that arise due to the mix of studies used (survey, cognitive experiment, eye tracking) and the extensions made to established methodological approaches.

These contributions offer several opportunities for future work to build on for an even deeper understanding of social media distraction.

6. References

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Appendix

Appendix A – Supporting Material

Table A1

Study Overview of the Methods, Sample, and Investigated Concepts

	Study 1	Study 2			Study 3
		Experiment 1	Experiment 2	Experiment 3	
Method	Online survey	Cognitive experiment adapted from Vogel et al. (2005)			Experiment from Thronton et al. (2014)
Methodological Specialty	Scale reasons for distraction	Added new trial blocks focused with social media cues			Mobile eye tracking glasses
Sample	$N = 329$	$N = 64$	$N = 66$	$N = 116$	$N = 103$
Focus	Social media distraction	Ability to filter out distractions			Visual attention to smartphones
			Cyberostracism	FoMO	Smartphone presence
Individual differences					
General traits					
	Basic motives				
	Self-control	Self-control	Self-control		Self-control
	Impulsitvity	Impulsitvity			
			Mind wandering	Mind wandering (state)	
Social media-specific					
	Problematic social media use	Problematic social media use		Problematic social media use	Problematic social media use
	FoMO	FoMO	FoMO		FoMO
				Social media self-control failure	Social media self-control failure
				Smartphone craving	Smartphone craving
					Smartphone vigilance

Appendix B – Paper 1 (Study 1)

Koessmeier, C., & Büttner, O. B. (2021). Why are we distracted by social media? Distraction situations and strategies, reasons for distraction, and individual differences. *Frontiers in Psychology, 12*, 711416. https://doi.org/10.3389/fpsyg.2021.711416

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Why Are We Distracted by Social Media? Distraction Situations and Strategies, Reasons for Distraction, and Individual Differences

Christina Koessmeier and Oliver B. Büttner*

Economic and Consumer Psychology, Department of Computer Science and Applied Cognitive Science, University of Duisburg-Essen, Duisburg, Germany

Social media is a major source of distraction and thus can hinder users from successfully fulfilling certain tasks by tempting them to use social media instead. However, an understanding of why users get distracted by social media is still lacking. We examine the phenomenon of social media distraction by identifying reasons for, situations of, and strategies against social media distraction. The method adopted is a quantitative online survey (N = 329) with a demographically diverse sample. The results reveal two reasons for social media distraction: social (e.g., staying connected and being available) and task-related distraction (e.g., not wanting to pursue a task). We find individual differences in these reasons for distraction. For social distraction, affiliation motive and fear of missing out (FoMO) are significant predictors, while for task-related distraction, self-regulatory capabilities (self-control, problematic social media use) and FoMO are significant predictors. Additionally, typical distraction situations are non-interactive situations (e.g., watching movies, facing unpleasant tasks). Strategies used to reduce distractions mostly involved reducing external distractions (e.g., silencing the device). This paper contributes to the understanding of social media use by revealing insights into social media distraction from the user perspective.

Keywords: social media, distraction, situations, strategies, individual differences, fear of missing out, self-control

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****Correspondence:***
Christina Koessmeier
christina.koessmeier@uni-due.de

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INTRODUCTION

Internet and smartphones enable users to be permanently online and permanently connected (Vorderer et al., 2018). As a consequence, users can permanently be distracted by social media. Social media distraction refers to the process by which social media cues draw individuals' attention away from a task that they originally pursued (e.g., working). Due to especially mobile access to social media, distractions by social media can occur frequently. Previous studies on multitasking have consistently demonstrated negative effects of distraction on performance (Jeong and Hwang, 2016), on academic performance among students (Junco and Cotten, 2012; Giunchiglia et al., 2018) and on well-being (e.g., Brooks, 2015). By drawing away users' attention, distractions take up limited cognitive resources.

Given these negative consequences, it is important to understand users' underlying reasons for social media distraction. Understanding the reasons for social media distraction can help to

increase users' agency to deal with unwanted social media distractions. Therefore, our major goal is to identify the reasons that underlie users' distraction by social media. Furthermore, we examine how these reasons for distraction relate to individual differences in general (e.g., self-control) and social media-specific traits (e.g., problematic social media use). Additionally, to fully understand the phenomenon of social media distraction, we identify typical situations in which users are distracted, and we examine which strategies people use to handle social media distractions.

THE PROBLEM OF SOCIAL MEDIA DISTRACTIONS

Because of human's limited capacity to process information (Pashler, 1994; Lang, 2000), distraction is problematic. Thus, in order to fulfill specific tasks successfully, social media distractions should be minimized. *Distractions* are caused by task-irrelevant *stimuli* that interrupt goal-directed behavior (Clapp and Gazzaley, 2012). Such distractions should be ignored when people want to focus on a task that requires their undivided *attention* to fulfill a certain goal. For instance, when writing a paper or talking to someone, social media cues–as the irrelevant distractors in that situation–are distracting by drawing the attention away from the primary task.

We refer to *social media distraction* as the phenomenon of social media cues (the distractors) drawing the attention away from the task at hand and directing it instead toward social media. These cues can be external or internal (Wilmer et al., 2017). For instance, social media distraction can be external (i.e., from the environment), such as receiving a notification, or internal (i.e., from within a person), for example when a user starts thinking about social media (e.g., unanswered messages). While users are engaged in a task, mind wandering may lead to internal distraction (McVay and Kane, 2010). For instance, prior work showed that students' mind frequently wandered to social media when learning online (Hollis and Was, 2016). Mind wandering has been attributed to failed attentional control (McVay and Kane, 2010).

When faced with internal or external social media distractions, users can determine how to react and handle the distraction. There are three possible reactions to social media distractions: (a) *ignoring* the distraction and going on with the task; (b) *stopping* the task to use social media instead; or (c) starting to *multitask* (frequent switching between the task and social media). Social media cues distract from a task and offer the option of using social media. Starting to use social media as a reaction to distraction can have various reasons and how users handle this distraction can differ. The consequence of distraction can be that users start using social media (b or c). One explanation for why users engage in social media instead of ignoring it when engaged in a task, may be a failure of self-control. Research has found that social media self-control failure is related to high social media use (Du et al., 2018, p. 68). Moreover, users may engage in social media use after getting distracted in order to procrastinate. Research has indicated that procrastination–"voluntarily delay an intended course of action despite expecting to be worse off for the delay" (Steel, 2007, p. 66)–is related to high social media use (Reinecke et al., 2018; Rozgonjuk et al., 2018). The distraction may offer users an option to procrastinate instead of working on their tasks. Concluding, a user's reaction to distractions may be influenced by, for instance, a failure to control one's social media use or by the desire to procrastinate.

Situations Prone to and Strategies Against Social Media Distractions

Prior studies have usually focused on social media as a distraction in one specific situation. For instance, a review found that students frequently use social media while in a lecture, reading, or studying (Chen and Yan, 2016). Additionally, prior research has examined distractions while working (Brooks and Califf, 2017) or while actively participating in traffic (Gliklich et al., 2016). Moreover, previous research has investigated such effects in social situations, such as relationship formation (Przybylski and Weinstein, 2013) or romantic relationships (Roberts and David, 2016). To summarize, most previous studies have focused on one specific situation in which distraction is examined, but an overview of *typical distraction situations* is lacking in prior research. Therefore, the present study investigates which distraction situations are typical in users' daily lives.

Different strategies may be needed to successfully handle social media distraction, but so far it is unclear which strategies individuals already use. For instance, previous research has argued that closing social media tabs in the browser, turning off notifications, and trying to put the device out of sight might reduce distractions (Carrier et al., 2015; Kushlev et al., 2016). To empower social media users to avoid distractions, it is first necessary to understand the strategies that people use. Therefore, we investigate which *strategies* are used most frequently. In summary, we seek to identify distraction situations and strategies (RQ1).

Reasons for Social Media Distraction

Social media's strong pull factor–others have described it as "hedonic appeal" (Brooks, 2015, p. 26) or temptation (Hofmann et al., 2017)–makes users "drawn to distraction" (Aagaard, 2015, p. 93) and leads them to override their primary goals and tasks. This strong pull of social media has a high potential for distraction. For instance, research has found that students cannot focus for long on a task such as studying, and that, on average, they switch to social media after about six minutes of focused work (Rosen et al., 2013) and react to notifications shortly after their arrival (Pielot et al., 2014). In order to limit these distractions so that goals can be successfully accomplished, it is necessary to understand the underlying reasons for the distractions.

According to the uses and gratifications (U&G) approach (Katz et al., 1974), users actively seek media to fulfill certain needs and gratifications. From a variety of media choices, users select those that they expect to fulfill their needs. Social and psychological factors as well as the context influence media use and effects (Rubin, 2002). Accordingly, we argue that social media

distraction represents a user's *active* choice to fulfill certain needs. Even though external distractions can occur uncontrolled, it is a user's active choice how to handle these distractions. Similarly, users working on a task might be "hijacked by task-unrelated thought[s]" that may distract internally (McVay and Kane, 2010, p. 324). Relatedly, prior work indicated that being preoccupied with the online world increased mind wandering (Johannes et al., 2018a). Even though these internal distractions represent an attentional control failure, users can still choose how to handle such a brief moment of uncontrolled attention (i.e., how to react to an uncontrolled thought about social media that arises), similarly to a user's choice of how to handle external distractions. Users can choose whether to give in to the distraction (and start using social media) or to ignore the distraction.

In light of U&G, we propose that a user's *susceptibility* to social media distractions in a specific moment represents need satisfaction (e.g., to find out whether someone texted), even though this might conflict with the user's current goal-relevant task. Users' momentary needs might influence how susceptible they are to distractions since users' needs may influence attentional control. This may result in mind wandering (internal distractions) or, for instance, looking at the smartphone (external distractions). Hence, we argue that user's needs may influence how susceptible users are to distractions. Moreover, U&G has been widely used in previous research to investigate why people use media (Ruggiero, 2000). Similarly, we want to investigate why users get distracted by social media–that is, we are interested in the reasons for social media distraction.

Previous research has identified several motivations for using social media *in general*, such as to communicate (Whiting and Williams, 2013), to stay in touch (Papacharissi and Mendelson, 2010), to feel connected to others (Quan-Haase and Young, 2010), to escape (Papacharissi and Mendelson, 2010), or to pass time (Whiting and Williams, 2013). These motivations for social media use describe the overall reasons for signing up to and using social media. The present research, by contrast, focuses on the *reasons for social media distraction*. We examine the underlying motivation for users' increased susceptibility toward social media cues that draw the attention away from a task to which an individual originally attended. Motivations for social media use and reasons for distraction may overlap to a certain degree, but nevertheless reflect different aspects. For instance, most people do not sign up at a social media platform with the intention to procrastinate on their homework.

From a U&G perspective, it is relevant to examine the reasons for social media distraction. As Rubin (2002) argued, "to explain media effects, we must first understand the characteristics, motivations, selectivity, and involvement" (p. 526), because these can "have important implications for media effects" (p. 536). For example, research has found that users' motivation influences which social media features they use (Smock et al., 2011). Therefore, understanding the reasons for social media distraction is a first step that enables future research to investigate the possible influences of distraction on different behaviors. Hence, this study investigates why users react to rather than ignore distracting social media cues when they are working on a task. Our second research question seeks to identify users' reasons for distraction by social media (RQ2). In particular, we are exploring which different types of social media distraction exist.

Individual Differences and Social Media Distraction

According to U&G, individual differences influence media use and effects (Rubin, 2002; Sherry and Boyan, 2008). Similarly, we expect that users' traits contribute to individual differences in social media distraction. Based on the current literature, we identified a set of traits that we considered relevant for explaining why users are distracted by social media: basic motives, self-control, impulsivity, problematic social media use, and fear of missing out (FoMO). Our rationale was to include general traits, which are not exclusively related to social media, as well as traits that are specific to social media use. Given that we did not know in advance which factors of reasons for distraction by social media would emerge from the analysis, we could not formulate specific hypotheses regarding which of the trait variables correlated with which type of distraction. Therefore, we adopted an exploratory approach. Our third research question investigates how individual differences influence the reasons for social media distraction (RQ3).

We included *basic motives* to address general individual differences in motivations that underlie behavior. Motives refer to stable "predisposition[s] to approach a particular class of incentives... or to avoid a particular class of threats" (Trash et al., 2012, p. 141). Previous research has identified achievement, power, and affiliation/intimacy as basic motives (Emmons, 1997; Schönbrodt and Gerstenberg, 2012). Achievement refers to striving for adherence to excellence and mastering challenging tasks. Power describes the endeavor to impact others (regarding their attitudes or behaviors) and being concerned about status and prestige. Affiliation refers to the wish to have social relations, while intimacy refers to the motive of having strong social interactions and being close to others. For instance, research has shown that, of these motives, power and affiliation are related to a positive attitude toward social media (Sariyska et al., 2019). We included these explicit motives because they represent overarching motivations for users' behavior.

Self-control and *impulsivity* are indicators of users' self-regulatory abilities. Self-regulation–inhibiting or overriding impulses and temptations in order to achieve a higher-level goal (Baumeister and Heatherton, 1996)–is necessary for the ability to resist the temptation of social media distractions. Previous literature has discussed self-control as a predictor for media use (Reinecke and Hofmann, 2016; Hofmann et al., 2017), demonstrating that low self-control and high impulsivity relate to higher multitasking (Wang et al., 2012; Sanbonmatsu et al., 2013) or to a fast response to messages (Berger et al., 2018).

Fear of missing out refers to the FoMO on rewarding experiences others might have (Przybylski et al., 2013). Previous research has found that it is important for people to stay socially connected (Przybylski et al., 2013). In particular, FoMO is related to higher social media use (Przybylski et al., 2013), especially in situations when pursuing a task such as studying (Milyavskaya et al., 2018). Users might show an

increased susceptibility to social media distraction to avoid the feeling of missing out.

Problematic social media use might also influence social media distraction. In its extreme form as social media addiction, it is characterized by a preoccupation with social media, loss of control and problems in social interactions (Wegmann et al., 2017), and low self-control (Wegmann et al., 2015). This suggests that users with a tendency toward social media addiction are also more susceptible to social media distraction.

Overview of the Study

This study used an exploratory approach to address the three research questions. We explored social media distraction, in particular investigating in which situations people are most likely to be distracted and which strategies they use to regulate their distraction (RQ1). Second, we wanted to identify the reasons for social media distraction–that is, we investigated why people get distracted by social media (RQ2). Finally, we investigated if social media distraction depends on individual differences (RQ3) in trait variables (general motives, self-control, impulsivity) and social media-specific variables (FoMO, problematic social media use).

Our methodological approach consisted of two steps: First, in preliminary studies, we conducted qualitative interviews to uncover users' reasons for distraction, distraction situations, and strategies, which we then pre-tested as items in follow-up studies. Second, for our main study and the focus of this paper, we conducted a quantitative online survey with a large and heterogeneous sample. Data and supplementary material are available via the Open Science Framework (OSF): https://osf.io/5pvj6/.

MATERIALS AND METHODS

Preliminary Studies

The goal of the preliminary studies was to develop the items for the research focus (reasons for distraction, distraction situations, and strategies) used in the main study. In 15 semi-structured qualitative interviews (each with a duration of 15–20 min), we asked students questions relating to why they get distracted, in which situations this was most likely to happen, and what strategies they used to limit their distraction. We asked students since we assumed these are particularly prone to distraction. Five interviews each focused on one of the three topics (reasons for social media distraction, situations for social media distraction, strategies to reduce distraction). Questions started openly but included targeted questions to find out more about the three topics. Subsequently, we developed the items based on the insights gained from the interviews; namely, we extracted and aggregated the main reasons, situations, and strategies that interviewees pointed out and we refined these based on the literature. We developed these items without any potential underlying factors in mind. We then pre-tested and refined the items in two questionnaire studies (N_1 = 92; N_2 = 127) before including them in the main study to get a first impression of social media distractions and our items. This preliminary work resulted in the scales for reasons for distraction, distraction situations, and strategies used to limit distraction, which we then used and explored in the main study (see Measures section for a detailed description and **Tables 3–5** for the items). Further information on the preliminary material is available online in our OSF repository.

Main Study

The main study was a quantitative survey. To begin, the survey asked about social media use and social media distraction in general. The survey then focused on reasons for social media distraction, potential distraction situations, and strategies used to limit distractions. The survey looked into individual differences regarding FoMO, problematic social media use, explicit motives, self-control, and impulsivity. Lastly, the survey included socio-demographic variables. The study was approved by the department's ethics committee.

Sample

For the survey, we recruited social media users via an online access panel in Germany. The prerequisites for participation in the study were having at least one social media account and using social media at least once per week. Since the aim of our study was to investigate social media distraction, it is necessary that only those people participate that are familiar with social media. In order to reach a sample reflecting a broad selection of social media users, we recruited participants aged between 18 and 69 years.[1] Overall, 382 social media users from Germany participated in the study[2]. To ensure data quality, we excluded 53 participants from the analysis. Of those, 10 users were excluded for interrupting survey completion. We excluded the fastest and slowest 5% (40 respondents) to control for people not filling out the survey with attention. Three participants were excluded because of inappropriate responses to open questions. **Table 1** summarizes the socio-demographic details of the participants in our final data set used for the analysis.

Measures[3]

For descriptive purposes, we assessed frequency of *social media use* (a few times a day, daily, a few times a week, once a week, once a month or less), social media use in hours per day ("How many hours do you use social media in a regular day? I use social media for... hours per day"), and for which social media platforms participants held an account. We assessed different facets of *social media distraction* with three single items: (1) degree of distraction (1 = *not much distracted by social*

[1]We used a stratified sampling approach with specified subgroups regarding age (18–29; 30–39; 40–49; 50–59; and 60–69); at least 50 people were in each age group and there was a roughly equal gender distribution. We used this approach to ensure that the sample is demographically diverse and to avoid an unbalanced sample (e.g., younger persons might be more prone to participate in a study on social media).

[2]In line with the recommendation by Stevens (2009), we collected data on more than 300 people, which allowed us to focus on factor loadings of 0.4 or greater in our EFA.

[3]Measures are reported in order of appearance in the questionnaire. For exploratory purposes, we also assessed social media usage motivation and work-related self-efficacy. These are not further investigated here since a discussion exceeds the scope of this paper.

TABLE 1 | Socio-demographic details on sample.

	N	% of Sample	*M* (SD)
Age			42.58 (14.75)
Gender			
Female	168	51	
Male	161	49	
Education			
Not graduated from school	3	0.9	
Lower secondary school graduate	25	7.6	
Secondary school certificate	63	19.1	
Traineeship	73	22.2	
Higher education entrance qualification	91	27.7	
Bachelor (University degree)	23	7.0	
Master (University degree)	44	13.4	
Other	7	2.1	
Occupation			
Student (School)	2	0.6	
Student (University)	33	10.0	
In traineeship	8	2.4	
Employee	164	49.8	
Self-employed	21	6.4	
Homemaker	17	5.2	
Unemployed	15	4.6	
Retired	54	16.4	
Other	15	4.6	
Marital status			
Single	91	27.7	
In a relationship	80	24.3	
Married	126	38.3	
Divorced	27	8.2	
Widowed	5	1.5	

N = 329.

media; 5 = *very much distracted*); (2) reactivity to distraction (1 = *typically directly respond to notifications*; 5 = *rather take some time to react to a notification*); and (3) typical source of distraction (1 = *internally*–thinking about social media-related content; 5 = *externally*–receiving notifications). *Evaluation of distraction* measured how far participants perceive their social media distraction as problematic (**Table 2**; five items, scaled 1–5, α = 0.91). *Notification settings* assessed whether participants receive all, some, or no notifications, or never stay logged in.

To find typical *situations* of social media distraction, participants rated 10 situations based on how often they perceived social media distraction in these situations (**Table 3**), ranging from (1) *never/rarely* to (5) *very often*. This scale measured the extent to which people perceived themselves as being typically distracted in certain situations. Moreover, to assess *reasons for social media distraction* (**Table 5**), participants rated each of the 16 reasons by determining how much the reason related to their distraction behavior. Participants had to think back to the previously mentioned distraction situations, complete the sentence "I get distracted in these situations, because . . .," and rate each listed reason on a five-point rating scale ranging from (1) *totally disagree* to (5) *totally agree*. In order to discover people's most common *strategies* to limit social media distraction, the survey asked participants to indicate which strategies they already used to reduce social media distraction. Participants rated, from (1) *never* to (5) *always*, how often they would use each of these 15 strategies (**Table 4**). Additionally, participants rated their *evaluation of strategies* used (**Table 2**, four items, scaled 1–5, α = 0.96) to reduce distractions.

Problematic social media use was measured with the Internet addiction scale modified for social networking sites (s-IAT-SNS; Wegmann et al., 2015), with the two dimensions *loss of control* (six items, α = 0.89) and *craving* (six items, α = 0.91), rated on a five-point rating scale ranging from (1) *never* to (5) *very often*. *FoMO* (Przybylski et al., 2013) was measured with the revised FoMO scale (Wegmann et al., 2017), assessing *online* (seven items, α = 0.86) and *offline* (five items, α = 0.90) FoMO on a five-point rating scale ranging from (1) *totally disagree* to (5) *totally agree*.

We measured basic *explicit motives*–achievement (α = 0.88), power (α = 0.86), affiliation (α = 0.81), and intimacy (α = 0.80)–with the Unified Motivations Scale (UMS-6; Schönbrodt and Gerstenberg, 2012), using six items for each motive. We measured *self-control* using the German version of the Brief Self-Control Scale (Tangney et al., 2004; Bertrams and Dickhäuser, 2009; α = 0.84). We assessed *impulsivity* with the short form of the Barratt Impulsiveness Scale (BIS-15) in German (Meule et al., 2011; α = 0.81).

RESULTS

Descriptive Summary of Social Media Use and Distraction

Participants estimated using social media on average 2.2 h per day (SD = 2.3). The most frequently used social media platform[4] was WhatsApp (86%), followed by Facebook (82%), YouTube (67%), Facebook Messenger (49%), and Instagram (39%). Half of the participants (51%) reported having *some* notifications from social media activated, whereas 28% received *all* possible notifications, and 9% reported disabling all notifications.

Table 2 shows how participants perceived their distraction by social media. However, they reported that they experienced their distraction as rather negative. Participants stated that they generally took some time to respond to notifications instead of immediately reacting to them. The source of distraction seemed to be external rather than internal, that is, from notifications rather than from starting to think about social media.

Situations and Strategies Against Social Media Distraction

First, we identified situations and strategies (RQ1). Situations typical for social media distraction are presented in **Table 3**. The situations in which people reported getting distracted most often were while watching movies/series, when trying to avoid

[4]We used a broad definition of social media, including social networking sites and instant messaging apps.

TABLE 2 | Descriptive measures on distraction by social media.

	M	SD
Degree of distraction	2.50	1.20
Source of distraction	2.91	1.28
Reactivity to distraction	3.29	1.07
Evaluation of distraction behavior	3.07	1.03
Unproblematic (1)–very problematic (5)	2.94	1.21
Not stressful (1)–very stressful (5)	2.82	1.20
Not disturbing (1)–very disturbing (5)	3.09	1.23
Not much (1)–very much time-consuming (5)	3.45	1.15
Not critical (1)–very critical (5)	3.05	1.19
Evaluation of strategy use	3.76	1.04
Unhelpful (1)–helpful (5)	3.81	1.08
Ineffective (1)–effective (5)	3.76	1.11
Useless (1)–useful (5)	3.78	1.43
Unsuccessful (1)–successful (5)	3.71	1.10

N = 329.

TABLE 3 | Situations prone to social media distraction.

	M	SD
While watching a movie/series	2.85	1.30
When I do not want to start with my task after a break	2.47	1.24
When I want to delay the start of a task	2.22	1.21
When I have to do an unpleasant task	2.16	1.19
When I would have other, more important tasks to do	2.12	1.13
While studying/working	2.06	1.13
When talking to family/friends/others	1.86	1.02
When I am eating with others	1.64	0.92
When I actively participate in traffic	1.57	0.93
In a meeting	1.37	0.83

N = 329, English translation of the original German items used in this study, original items are in our OSF repository. We gave a brief description of distraction by social media: it was described as referring to situations in which people, while performing a task, are distracted by social media, either internally or externally. Introduction to these items: "When you are in one of the following situations, how often do you get distracted?".

returning back to a task, or when they wanted to delay the start of a task.

Strategies that were used to reduce distractions are presented in **Table 4**. The most common strategies were silencing the devices, leaving the devices somewhere else, or deactivating notifications. Overall, participants evaluated their use of strategies to limit social media distractions as moderately effective ($M = 3.76$, SD = 1.04).

Reasons for Social Media Distraction

Moreover, we investigated the reasons for social media distraction (RQ2). **Table 5** shows the descriptive statistics of the items measuring reasons for distraction. To find underlying types of reasons, we conducted an exploratory factor analysis (EFA). EFA is used when the underlying factor structure is not known, as it was the case in our study. We calculated the

TABLE 4 | Strategies used to reduce distractions by social media.

	M	SD
... silence my devices	3.51	1.45
... leave my device at a different location (e.g., other room, at home)	2.58	1.36
... deactivate notifications	2.55	1.48
... place the device out of reach	2.49	1.35
... turn my device around so that I cannot see any notifications	2.41	1.36
... turn off my device	2.33	1.36
... deactivate the Internet connection	2.25	1.35
... log off my social media accounts	2.22	1.41
... activate flight mode	2.10	1.30
... treat myself for successfully avoiding social media	1.64	1.03
... use apps/plug ins to control my social media use	1.59	1.06
... delete my social media apps (temporarily)	1.57	1.02
... lock my device away	1.55	1.00
... give my device to another person (e.g., spouse)	1.50	0.96
... delete my social media accounts	1.44	0.91

N = 329; English translation of the original German items used in this study, original items are in our OSF repository. Introduction to these items: "In order to be less distracted by social media, I..."; Device refers to all that are used for accessing social media.

EFA using oblimin rotation[5] and principal axis factoring.[6] With regard to sampling adequacy, the Kaiser–Meyer–Olkin (KMO) measure showed acceptable results: overall, KMO = 0.94 and all individual KMO values were >0.87. Bartlett's test of sphericity indicated that correlations were sufficiently large: $\chi^2(105) = 3259.72$, $p < 0.001$. The EFA yielded two factors with eigenvalues greater than 1 and the scree plot indicated that two factors were suitable. Overall, the two factors explained 58% of the variance.

Table 5 shows the rotated factor loadings of the structure matrix.[7] Factor loadings were >0.5; that is, they were well above the recommended threshold of >0.4 (Stevens, 2009; Field, 2013), and they showed no substantial cross-loadings on the other factor (<0.3; Stevens, 2009). Conceptually, Factor 1 relates to *task-related reasons* for distraction and indicates people being distracted by social media because they try to avoid tasks or do not want to do what they ought to, are bored, or cannot concentrate. Factor 2 relates to *social reasons* for distraction: people are distracted by social media because they want to feel connected, want to stay in touch, or feel the urge to reply. Hence, reasons for distraction comprised the two factors of social distraction and task-related distraction (each with eight items). The internal consistency of both factors was good (social: $\alpha = 0.91$; task-related: $\alpha = 0.90$). As expected, both factors significantly correlated with each other ($r = 0.67$, $p < 0.001$)

[5]We used an oblique rotation, since this is recommended when a correlation between factors is expected (Finch and French, 2015, p. 14) and considered reasonable (Stevens, 2009, p. 331). We assumed that the factors represent faces of distraction rather than clearly distinguishable dimensions and, hence, expected them to be correlated.

[6]We used in R the "fa" function from "psych" package.

[7]We excluded the item "I have nothing to do anyways" which had emerged from the interviews because we considered it to be conceptually different from distraction.

TABLE 5 | Exploratory factor analysis of reasons for distraction.

	M	SD	Factor loading	
			1	2
Factor 1: social reasons				
... It is important to me to directly reply	2.18	1.21	**0.86**	−0.14
... I always directly reply	2.21	1.23	**0.77**	−0.06
... I always want to be up to date	2.42	1.28	**0.77**	0.07
... I want to know what is happening	2.80	1.28	**0.74**	0.09
... I want to keep up with what others are doing	2.51	1.23	**0.73**	0.09
... I want to know what others are writing/posting/liking/sharing	2.72	1.30	**0.69**	0.06
... My friends expect me to react	2.46	1.23	**0.68**	0.02
... I want to stay in touch with friends	3.13	1.27	**0.65**	0.09
Factor 2: task-related reasons				
... I am not interested in pursuing my tasks	2.45	1.29	−0.10	**0.93**
... I want to escape an (unpleasant) situation	2.21	1.22	−0.03	**0.87**
... I want to get distracted	2.52	1.31	0.07	**0.71**
... I cannot concentrate	2.53	1.23	0.10	**0.67**
... I am bored	2.98	1.34	0.09	**0.63**
... I got interrupted by a notification while pursuing a task	2.34	1.22	0.21	**0.58**
... I am seeking entertainment and fun	2.86	1.28	0.29	**0.51**
Eigenvalue			4.82	3.91
Explained Variance			32%	26%

N = 329, EFA with principal axis factoring and oblimin rotation; factor loadings >0.50 in bold; English translation of the original German items used in this study, original items are in our OSF repository; Introduction to these items: "I get distracted by social media in these situations, because...".

which indicates that the two types of distractions are not independent from each other, but rather depict different facets of distraction. Overall, the scale assesses how strongly people are distracted by social media due to social and task-related reasons.

Individual Differences as Predictors of Social Media Distraction

We investigated which individual differences predicted users' social media distraction (RQ3). **Table 6** shows that all trait variables correlated with social distraction and task-related distraction. In order to analyze which of the traits are most important for each type of distraction, we calculated two hierarchical regressions, one with social distraction and one with task-related distraction as dependent variable.

In step 1 of the hierarchical regressions, we entered the general trait variables basic *motives* (achievement, power, affiliation, intimacy), *self-control*, and *impulsivity* as predictors. For *social distraction* (**Table 7**), these predictors accounted for about 20% of variance; power, affiliation, and self-control emerged as significant predictors. The stronger the power (β = 0.18) and affiliation (β = 0.21) motive, the higher was social distraction. Higher self-control (β = −0.25) reduced social distraction. For *task-related distraction* (**Table 8**), the model accounted for 25% of variance; achievement, self-control, and impulsivity emerged as significant predictors. The higher the achievement motive (β = 0.14) and impulsivity (β = 0.16), the higher was task-related distraction. Again, higher self-control (β = −0.32) was associated with reduced task-related distraction.

In step 2, we included the social media-specific variables *problematic social media use* (craving and loss of control) and *FoMO* (online and offline) as predictors. For *social distraction* (**Table 7**), these additional predictors increased the explained variance significantly to 49%. While affiliation was still a significant predictor (β = 0.11), power and self-control were no longer significant. In addition, online FoMO emerged as the strongest predictor of social distraction (β = 0.64). For *task-related distraction* (**Table 8**), the additional social media-specific predictors increased the explained variance significantly to 45%. None of the general trait variables remained significant; instead, all social media-specific variables significantly predicted task-related distraction. While loss of control (β = 0.41), offline FoMO (β = 0.13), and online FoMO (β = 0.24) were associated with higher task-related distraction, craving (β = −0.17) was associated with lower task-related distraction.

DISCUSSION

This research examined distraction by social media, and, more specifically, when, and why people are distracted, and what they do to reduce their distraction. We examined this with a larger German sample that is diverse in terms of demographic characteristics such as age, educational background, and occupation (see **Table 1**) and by investigating social media distraction in general, rather than focusing only on one social media platform. We identified typical distraction situations (e.g., when pursuing a task) and typical strategies users employ to be less distracted (e.g., silencing notifications). By focusing on reasons for distraction, we identified two types of social media distraction: social distraction and task-related distraction. These types of distraction differed in their association with individual differences in basic motives, self-regulatory abilities, problematic social media use, and FoMO.

Situations of and Strategies Against Social Media Distraction

According to U&G, the environment influences media use and effects (Ruggiero, 2000; Rubin, 2002). Against this backdrop, we identified typical situations in which participants were distracted by social media (RQ1). This extends previous research, which has focused on social media distraction only in one particular context (e.g., studying; Chen and Yan, 2016). An interesting finding is that social media distraction occurs not only in non-interactive situations (e.g., when working on a task or watching a movie), but also when users are interacting with other people (e.g., when talking to others or when in a meeting). Although participants indicated that distraction in interactive situations is less frequent than in non-interactive situations, previous research has revealed that

TABLE 6 | Descriptive statistics and correlations for reasons for distraction and traits.

Variable	*M*	SD	1	2	3	4	5	6	7	8	9	10	11
1. Self-control	3.28	0.67	–										
2. Impulsivity	2.11	0.43	−0.61***	–									
Fear of missing out													
3. Offline	2.02	0.94	−0.46***	0.30***	–								
4. Online	2.00	0.88	−0.33***	0.29***	0.70***	–							
Problematic social media use													
5. Loss of control	2.22	0.87	−0.43***	0.36***	0.54***	0.63***	–						
6. Craving	1.85	0.85	−0.36***	0.37***	0.56***	0.63***	0.83***	–					
Basic motives													
7. Achievement	3.12	0.90	0.10	−0.10	0.21***	0.29***	0.19***	0.18***	–				
8. Power	2.51	0.90	0.01	0.00	0.34***	0.40***	0.28***	0.33***	0.60***	–			
9. Affiliation	3.09	0.78	0.09	−0.10	0.16**	0.22***	0.05	0.01	0.45***	0.27***	–		
10. Intimacy	3.60	0.78	−0.03	−0.11*	0.08	0.04	0.06	−0.02	0.34***	0.07	0.47***	–	
Reasons for distraction													
11. Social	2.55	0.99	−0.26***	0.18***	0.47***	0.68***	0.47***	0.45***	0.24***	0.27***	0.26***	0.14*	–
12. Task-related	2.21	0.89	−0.40***	0.33***	0.52***	0.57***	0.60***	0.49***	0.22***	0.21***	0.18***	0.15**	0.67***

*N = 329. Pearson's r correlation coefficient; *p < 0.05, **p < 0.01, ***p < 0.001.*

TABLE 7 | Hierarchical regression examining the effect of traits on social distraction.

	b	SE	β	*p*	R^2	Δ R^2	*F*	*p*
Step 1					0.197			
Constant	1.93	0.64		0.003				
Basic motives								
Achievement	0.07	0.08	0.07	0.350				
Power	0.20	0.07	0.18	0.005				
Affiliation	0.26	0.08	0.21	<0.001				
Intimacy	0.01	0.08	0.01	0.914				
Self-control	−0.37	0.09	−0.25	<0.001				
Impulsivity	0.13	0.15	0.06	0.361				
Step 2					0.488	0.291	45.32	<0.001
Constant	1.04	0.55		0.057				
Basic motives								
Achievement	−0.01	0.06	−0.01	0.902				
Power	−0.02	0.06	−0.02	0.750				
Affiliation	0.14	0.06	0.11	0.027				
Intimacy	0.08	0.06	0.06	0.208				
Self-control	−0.12	0.08	−0.08	0.142				
Impulsivity	−0.10	0.12	−0.04	0.418				
Problematic social media use								
Loss of control	0.04	0.09	0.04	0.634				
Craving	0.05	0.09	0.04	0.595				
Fear of missing out								
Offline	−0.07	0.06	−0.06	0.291				
Online	0.72	0.07	0.64	<0.001				

N = 329.

distraction in interactive situations may have strong negative effects, for instance, during social interaction it can negatively affect well-being (Xu et al., 2016) or relationship formation (Przybylski and Weinstein, 2013). Previous research has also argued that social media is used to escape unpleasant situations (Reinecke et al., 2018).

In addition, our study identified strategies that people use to reduce social media distraction. The most popular strategies, such as silencing the device, deactivating notifications, or placing the device out of sight, address external distractions. These strategies tackle the problem that push notifications demand users' attention (Hofmann et al., 2017). Previous research

TABLE 8 | Hierarchical regression examining the effect of traits on task-related distraction.

	b	SE	β	*p*	R^2	Δ R^2	*F*	*p*
Step 1					0.252			
Constant	1.95	0.62		0.002				
Basic motives								
Achievement	0.15	0.07	0.14	0.036				
Power	0.11	0.07	0.10	0.116				
Affiliation	0.14	0.07	0.11	0.059				
Intimacy	0.07	0.07	0.05	0.368				
Self-control	−0.47	0.09	−0.32	<0.001				
Impulsivity	0.36	0.14	0.16	0.012				
Step 2					0.452	0.200	28.91	<0.001
Constant	0.49	0.56		0.388				
Basic motives								
Achievement	0.09	0.06	0.08	0.158				
Power	−0.06	0.06	−0.06	0.312				
Affiliation	0.07	0.07	0.05	0.309				
Intimacy	0.08	0.06	0.06	0.227				
Self-control	−0.13	0.09	−0.09	0.136				
Impulsivity	0.20	0.12	0.09	0.107				
Problematic social media use								
Loss of control	0.47	0.09	0.41	<0.001				
Craving	−0.19	0.09	−0.17	0.039				
Fear of missing out								
Offline	0.14	0.07	0.13	0.038				
Online	0.27	0.08	0.24	<0.001				

N = 329.

suggests that such strategies are indeed successful. Simply being able to see the device is already distracting (Johannes et al., 2018b). Along similar lines, Aagaard (2015) found that students close their laptops strategically to reduce in-class distractions. However, strategies reducing external distractors (e.g., silencing notifications, relocating the device) may not suffice in reducing distractions (Pielot et al., 2014), because these strategies still allow easy access to social media, rely on internal control capabilities, and people may still be distracted internally (e.g., thinking about unread messages or likes). Participants also reported more drastic strategies, such as deleting accounts or apps. Obviously, our findings suggest that more drastic (and probably more effective) strategies are less likely to be adopted.

Distraction Due to Social and Task-Related Reasons

By focusing on users' underlying reasons (RQ2), we identified two types of social media distraction: social distraction and task-related distraction. *Social distraction* refers to an increased susceptibility to social media distractions because of striving for social connection and fulfilling others' expectations. This corresponds to previous research arguing that social cravings motivate multitasking (Wang et al., 2012), problematic smartphone use (Seo et al., 2015), or distracting behavior (Clayson and Haley, 2013; Bayer et al., 2016), because social media use is socially rewarding (Bayer et al., 2016). Other studies have found that communicating with and being concerned about others are dominant reasons for in-class social media use (Clayson and Haley, 2013) and that social pressure is a main reason for quickly reacting to notifications (Pielot et al., 2014).

Task-related distraction, on the other hand, refers to an increased susceptibility to social media distractions in order to avoid unpleasant tasks, or to make uncomfortable situations more pleasant. This finding aligns with U&G research, which has often highlighted that people use media for entertainment or to avoid unpleasant thoughts (Ruggiero, 2000). Additionally, previous work has argued that people use (social) media to regulate their mood (Hofmann et al., 2017; Reinecke et al., 2018) or to make tasks more entertaining (Wang and Tchernev, 2012). For instance, previous research has suggested that students use social media during classes to procrastinate (Rozgonjuk et al., 2018) or out of boredom (Clayson and Haley, 2013). To summarize, the identified types of distraction indicate which possible gratifications make people more susceptible to social media distraction. From a U&G perspective, an investigation of these underlying reasons for social media distraction is important because, as Rubin (2002) argued, the motivations for media use influence the effects of media on its users.

Individual Differences and Distraction

Our research aim was to examine whether individual differences in general and social media-specific traits in particular explain social media distraction (RQ3). We investigated various predictors that differ substantially for social versus task-related distraction. This underlines that social and task-related distraction are indeed different types of distraction because

they are driven by different psychological processes. Thus, our results correspond to previous research on U&G stating that individual differences influence media use (Rubin, 2002; Sherry and Boyan, 2008).

When considering the general traits (hierarchical regression step 1), both types of distraction were predicted by lower self-control; in the case of task-related distraction, additionally by lower impulsivity. Importantly, social and task-related distraction differed in basic motives. Social distraction was predicted by strong affiliation and power motives. This indicates that social media distraction might be driven not only by the striving to connect with others but also by the exertion of power over others. For instance, previous research has argued that feeling socially excluded, in particular, makes users turn to social media (David and Roberts, 2017), indicating that a susceptibility to social media would be motivated by the need for social connection. Task-related distraction, by contrast, was predicted by a strong achievement motive. At first, this seems contrary to previous research arguing that people turn to media when faced with tasks that are "demanding, complex, unpleasant, boring or anxiety-inducing" (Reinecke et al., 2018, p. 864), and that students are susceptible to distractions in a difficult lecture (Aagaard, 2015). However, it fits well to research that has linked perfectionism as well as low self-control to procrastination (Ferrari, 1992; Przepiórka et al., 2019). Overall, the findings on the relationship between social media distraction and general traits provide two major insights. First, lower self-regulatory abilities contribute to social media distraction. This is in line with previous research that has conceptualized problematic social media use as a problem with self-control (Wegmann et al., 2015). In addition, it corresponds to the literature on mind wandering, identifying internal distractions as failed attentional control (McVay and Kane, 2010). Second, the findings show that, in addition to self-regulation, users' motivational dispositions have additional explanatory power for social media distraction. This suggests that taking users' motives into account, as suggested by U&G (Rubin, 2002), provides a more complete picture of social media distraction than the self-control perspective alone.

When including social media-specific variables (hierarchical regression step 2), the pattern of predictors changes, but substantial differences between social distraction and task-related distraction persist. For social distraction, the affiliation motive is still a significant predictor, but FoMO emerged as the most important predictor. This result is not surprising since FoMO refers to the striving to stay socially connected (Przybylski et al., 2013) and is related to higher social media use (Przybylski et al., 2013; Hunt et al., 2018). For task-related distraction, problematic social media use in the form of loss of control and craving are significant predictors. These refer to more social media-specific aspects of self-control and thus seem to replace the more general predictors–namely, self-control and impulsivity–identified in step 1. This corresponds to previous research showing that problematic social media use is associated with lower productivity (Duke and Montag, 2017). In addition, FoMO contributes to task-related distraction, which suggests that users neglect their tasks in favor of not missing out on things online as well as offline. Taken together, the findings show that users with low self-regulatory abilities and high FoMO are more prone to task-related distraction. For social distraction, FoMO is the most important predictor and users do not need to have low self-control to be susceptible to social media distractions.

Limitations

Our study has certain limitations, which, at the same time, point to opportunities for future research. First, this study focused on users' perception of distraction and thus is based on participants' self-reports to capture their perception. In order to expand this perspective, future research should relate these subjective perceptions to more objective measures of social media distraction. For instance, use eye-tracking could be used to examine whether self-reported social media distraction goes along with higher visual distractibility by social media cues (see Serfas et al., 2016).

Second, we identified individuals' use of strategies against distraction, but the effectiveness of these strategies remains unclear. By exploring users' popular strategies, we tackled the call to investigate strategies that are realistically used in everyday situations (Chen and Yan, 2016). The next step should be to empirically test which of these strategies really help in reducing distractions. Furthermore, the popular strategies found here focus on reducing external distractions. Thus, future research could investigate strategies against internal distractions because previous research has indicated that reducing internal distractions might require different strategies (Rosen et al., 2013).

Third, we chose an exploratory approach. Hence, it is up to future research to explore causal relations. In our study, we identified the two reasons for distraction, but it is thus far unclear how these affect the susceptibility to distractions either in particular situations or in relation to employing different strategies. This requires experimental research. Finally, our sample is demographically diverse, but limited to participants from Germany. Future research is needed to explore social media distraction in different cultural settings.

CONCLUSION

Social media distractions can easily become a threat to task performance and well-being. For increasing users' agency, future research should develop and test interventions that help users to reduce social media distractions. By identifying reasons for, situations of, and strategies against social media distraction, the present study provides an important step toward developing such interventions.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository and accession number can be found below: OSF: https://osf.io/5pvj6/.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the Department of

Computer Science and Applied Cognitive Science, University of Duisburg-Essen, Duisburg, Germany. The participants provided their informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CK and OB designed the study. CK organized data collection, performed the statistical analysis, and wrote the first draft of the manuscript. CK and OB revised the manuscript and approved the submitted version.

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Appendix C – Paper 2 (Study 2)

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Social Media Users' Ability to Filter Out Visual Distractions and Influencing Factors on Distractibility

Christina Koessmeier and Oliver B. Büttner

Economic and Consumer Psychology, Department of Computer Science and Applied Cognitive Science, University of Duisburg-Essen, Duisburg, Germany

Author Note

Christina Koessmeier https://orcid.org/0000-0002-7027-0714

Oliver B. Büttner https://orcid.org/0000-0001-5037-1895

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Correspondence concerning this article should be addressed to Universität Duisburg-Essen, Fachgebiet Wirtschaftspsychologie, Lotharstr. 65, D-47057 Duisburg, Germany. Email: christina.koessmeier@uni-due.de

Abstract

Distracting stimuli are everywhere, especially social media cues can distract people from working on intended tasks. Accordingly, in the context of social media, this study examines what influences a person's distractibility, specifically whether social media cues are more distracting than neutral cues. Across three experiments (*N* = 246), we measured user distractibility with the filter task paradigm, a measure of the ability to filter out distractions. The results showed that social media cues are not more distracting than complex neutral cues, but they are more distracting than simple neutral cues. In addition, distractibility increases with an increase in the number of distractors. Overall, the findings suggested that none of the stable investigated individual differences impact distractibility (Experiment 1). Results showed that state cyberostracism influenced distractibility whereby socially excluded participants were more distracted than those who felt included (Experiment 2) while state FoMO did not influence distractibility (Experiment 3). This study contributes to the understanding of social media distraction by showing first potential influencing factors. Future work is needed to find out more about differences in distractibility.

Social Media Users' Ability to Filter Out Visual Distractions and Influencing Factors on Distractibility

Social media is ubiquitous in daily life and acts as a potential distraction. Previous findings show that it is hard to resist this distraction. Social media cues have the potential to trigger cravings for and thoughts about social media (van Koningsbruggen et al., 2017; Wegmann, Stodt, et al., 2017). Due to the tempting hedonic rewards of using social media (Brooks, 2015; Hofmann et al., 2017), users are particularly susceptible to being distracted by social media cues. Distraction by social media occurs when social media cues draw the attention away from a task to social media (Koessmeier & Büttner, 2021).

Social media distraction is frequently triggered by visual cues such as incoming messages, notifications, or pop-up windows. Being able to ignore visual social media cues is thus crucial when performing intended tasks, as, due to limited attention (Anderson, 2013), thoughts about social media interfere with task performance. Previous reviews have consistently demonstrated that using social media while working on a task has negative effects on academic (Jeong & Hwang, 2016) and cognitive performance (Uncapher et al., 2017). Hence, managing (and shielding oneself against) distraction by social media cues has become an important competence for successful self-regulation.

In this study, we examine distraction by social media cues at the level of visual attention. We follow two main research aims. First, we examine the distractibility of social media cues at the visual level (i.e., whether perceiving visual social media cues is more distracting than perceiving neutral cues). Second, we aim to identify the influencing factors with respect to the ability to ignore distractions and attempt to explain why some people are better at dealing with social media distraction than others. Understanding the mechanisms underlying visual distraction is relevant with respect to reducing the negative distracting

effects of social media. Accordingly, in the present research, we examine whether individual differences, such as self-control, social media addiction, and fear of missing out (FoMO), influence the user's ability to filter out social media distractions.

In the following three experiments, we investigate visual distractibility by neutral and social media cues and examine whether stable individual factors (general traits and characteristics specific to social media in Experiment 1) as well as situational factors (cyberostracism in Experiment 2 and FoMO in Experiment 3) influence distractibility.

The Distraction Potential of Social Media

Distraction by social media refers to situations in which people want to focus on a task but are interrupted by social media. Distractions should be ignored in these moments because task-irrelevant stimuli interfere with goal fulfillment (Gupta & Irwin, 2016). Social media distractions occur when social media cues direct the attention away from a goal or task towards social media (Koessmeier & Büttner, 2021). *Distractors* are the cues or stimuli responsible for causing this distraction. In the context of this work, distractors are any social media cue; they can be *external* and triggered by the environment (e.g., by a notification) or *internal* and triggered within the user (e.g., upcoming thoughts about social media; Koessmeier & Büttner, 2021; Wilmer et al., 2017). *Visual* (e.g., seeing social media app symbols or notifications), *auditory* (e.g., hearing the sound of incoming notifications), or *haptic* (e.g., sensing vibrations of smartphones) cues constitute social media distractions. In this paper, we examine the distractibility of visual social media cues.

Being distracted by social media can hinder users from successfully completing their primary task. Therefore, it is relevant to investigate a person's distractibility. Possible reactions to social media distractions (besides ignoring the distraction) include stopping the

task to use social media or engaging in multitasking (Koessmeier & Büttner, 2021). However, cognitive capacity is limited (i.e., only one task can be performed at once), and switching between tasks imposes an extra burden on the cognitive system (Pashler, 1994). According to threaded cognition theory, impaired task performance occurs when two or more tasks performed at the same time require the same resources (Salvucci & Taatgen, 2008). For instance, receiving social media notifications while studying impairs performance because the same resources (i.e., reading) are needed (David, 2018). This finding suggests that attending to social media cues while also trying to focus on a task may result in performance decrements due to the limited capacities.

Attentional Processes and (Social Media) Distraction

Perceiving social media cues may elicit thoughts about and the desire to interact with social media. The perception of social media cues is dependent on visual attention and attentional patterns (Anderson, 2013; Kastner & Buschmann, 2017). Given that cognitive capacity is limited (Anderson, 2013), successful task completion requires the ability to filter out distractions. Distractibility describes how well a person can filter out irrelevant distractions (Forster & Lavie, 2016) and thus how susceptible they are to being distracted. Hence, our first research aim is to investigate people's general ability to filter out distracting social media cues.

In general, people preferably process information associated with previously experienced rewards (Anderson, 2016). People learn that attending to certain stimuli is rewarding, and, as a result, these stimuli habitually receive attention (Anderson, 2013, 2016). Hence, users' positive experiences with attending to social media cues (e.g., incoming notifications) and the consequential social media use (e.g., reading a message from a friend), can result in users especially susceptible to social media cues. Indeed, previous work has

suggested that social media imposes a stark temptation (Aagaard, 2015; Hofmann et al., 2017) or appeal (Brooks, 2015) for its users, pulling people in (Koessmeier & Büttner, 2021), and triggering hedonic reactions (van Koningsbruggen et al., 2017) as well as learned behaviors specific to social media (Hofmann et al., 2017).

Shielding oneself from competing goals, such as distracting stimuli, is an important feature of successful self-regulation (Shah et al., 2002). However, social media users might show attentional bias towards social media cues because of the rewards they associate with social media use. Attentional bias refers to cues that are preferably processed and are thus attention grabbing (Field & Cox, 2008). Usually, attentional biases have an adaptive function because, when pursuing a goal, increased attention towards goal-related stimuli is beneficial (Shah et al., 2002). However, via classical conditioning, attentional biases can also form to other reward-creating stimuli (Field & Cox, 2008), such as social media stimuli. In addition, craving for such rewarding stimuli can facilitate the formation and maintenance of attentional biases (Field & Cox, 2008). Research on attentional biases has demonstrated that visual attention plays an important role for addictive behaviors in different domains (see Field & Cox, 2008, for a review). For instance, research has shown that people with dieting goals have attentional bias in the form of increased visual attention towards cues of hedonic food (Papies et al., 2008). Moreover, impulsive buyers have attentional bias for distracting products when making purchase-related decisions (Büttner et al., 2014).

Prior work has suggested that social media stimuli can elicit automatic associations and impulsive behaviors due to learned gratifications from social media (van Koningsbruggen et al., 2018). Because of the learned positive associations of the stimuli (i.e., social media cues) and the multitude of rewards of using social media, users preferably process stimuli associated with social media. Previous research has shown that visual and

auditory social media cues increase cravings for social media (Wegmann, Stodt, et al., 2017) and that seeing those cues can create internal distraction (Koessmeier & Büttner, 2022). These internal distractions constitute a time-consuming effect (Katidioti et al., 2014).

Hence, we assume that social media users have attentional bias towards social media stimuli and preferably attend to and process social media cues. As a consequence, we expect that when performing a primary task, individuals are more distracted by visual social media cues than by neutral cues.

Influences on Visual Distractibility

Certain factors may make users more prone to distraction by influencing their ability to filter our visual distractors. For instance, prior work has suggested that individual differences in motivation help to explain attentional biases (Papies et al., 2008) and that traits concerning impulsive behaviors are important predictors of attending to attentional-bias cues (Field & Cox, 2008). Thus, we are interested in how general and specific social media factors may influence user susceptibility to distractors. In particular, we focus on factors identified by prior work as influencing users' reasons for social media distraction, specifically self-control, impulsivity, FoMO, and the tendency to be addicted to social media (Koessmeier & Büttner, 2021).

First, we expect that *general factors* may influence a person's distractibility caused by neutral and social media distractors. *Self-control*, the ability "to restrain or override one response, thereby making a different response possible," may be relevant for distraction insofar as it can enable users to disregard social media cues and instead follow through with their task (Baumeister et al., 2007, p. 351). Prior work has indicated that self-control is necessary for limiting task switching (Szumowska et al., 2018) and shielding oneself from distracting competing goals (Shah et al., 2002). Low self-control has been shown to be

associated with increased social media use (Du et al., 2018), social media procrastination (Sümer & Büttner, 2022), increased task-related distraction (Koessmeier & Büttner, 2021), and frequent media multitasking (Minear et al., 2013; Shin et al., 2019). In addition, impulsivity may also influence a person's distractibility. High impulsivity has also been found to be related to increased media multitasking (Minear et al., 2013; Sanbonmatsu et al., 2013; Schutten et al., 2017).

Mind wandering is another possible influencing factor of distractibility. While working on a task, users may experience upcoming thoughts that are irrelevant to the task and thus distract them from said task (McVay & Kane, 2010). Unsworth and Robison (2016) conducted experiments and demonstrated that 27% of participants conducted mind wandering, which reduced their cognitive performance.

Second, we expect that factors specific to *social media* may influence distractibility. Users showing *problematic social media use* might be especially susceptible to distractions. Research has indicated that social media addiction tendencies are related to attentional impulsivity (Wegmann et al., 2020). Moreover, loneliness or lacking social support can influence addictive tendencies (Wegmann & Brand, 2016). Research has shown that problematic social media use also increases socially motivated distraction (Koessmeier & Büttner, 2021). FoMO refers to people fearing missing out on gratifying experiences that other people might have without them (Przybylski et al., 2013). Because people use social media to stay socially connected online (Przybylski et al., 2013), FoMO can be seen as influencing susceptibility to social media cues. Previous research has shown that FoMO is related to increased social media use (Hunt et al., 2018; Oberst et al., 2017) and problematic social media use (Müller et al., 2020). In fact, FoMO has been shown to increase the overall motivation for becoming distracted (Koessmeier & Büttner, 2021).

Cyberostracism refers to people being excluded online (Williams et al., 2000). Research has found that cyberostracism has negative effects on emotional states, belongingness, self-esteem, and meaningful existence (Schneider et al., 2017). Research has shown that manipulating cyberostracism via chatting leads to negative effects on the basic needs of belonging, control, self-esteem, meaningful existence (Donate et al., 2017). Research has also shown that a lack of reactions on social media posts, such as likes, can make people feel excluded (Reich et al., 2018). Furthermore, the more likes people receive, the greater their self-esteem and feeling of belongingness (Reich et al., 2018). Hence, feeling ostracized may increase user susceptibility to distractions in the hope that their need to belong is fulfilled.

Overall, several individual differences may play an important role in filtering out social media distractions. In this study, we investigate how the general factors of self-control, impulsivity, and mind-wandering as well as the factors specific to social media use, such as problematic social media use, FoMO, and cyberostracism, influence distractibility.

Measurement of Distractibility

In our study, instead of relying on users' self-reported distraction, we used an objective measure of distractibility taken from cognitive psychology: the filter task developed by Vogel et al. (2005). The filter task is a paradigm measuring attentional filtering, that is, an individuals' ability to block out irrelevant distractors (Ophir et al., 2009; Uncapher et al., 2016). It is a well-established measure of visual working memory capacity (Vogel et al., 2005) and has been widely used to investigate the effects of media multitasking and filtering ability (Cardoso-Leite et al., 2016; Ophir et al., 2009; Uncapher et al., 2016; Wiradhany & Nieuwenstein, 2017). Working memory "involves mentally holding and updating information in order to perform a task" (Murphy et al., 2017, p. 667) and "enables the control of

distraction during task performance as well as switching between the tasks to be completed" (Pollard & Courage, 2017, p. 451). Visual working memory refers to the short-term storage of visual information, usually measured by storing objects in memory (Anderson, 2013). The filter task, as a measure of visual working memory, is an ideal measure to investigate visual distractibility because it requires participants to store visual cues and filter out irrelevant ones (Vogel et al., 2005). Distractibility in the filter task is measured by the ability to filter out distractors and focus on targets as indicated by task performance.

In the filter task paragidm, participants focus on target symbols while ignoring irrelevant distractor symbols. In the original version of the filter task (Vogel et al., 2005), participants needed to focus on and memorize the position of two red rectangles (the target symbols) and indicate whether a change of orientation occurred from one image to the next image while ignoring blue distractor rectangles. One study added a more complex distractor-type block to the filter task, specifically the neutral but more complex distractor type by including a block using common objects, such as pigeons or planes (Uncapher et al., 2016). This new distractor type showed consistent results compared with the original filter task, which used the rectangles block, but it revealed greater distractibility for the more complex distractors (Uncapher et al., 2016).

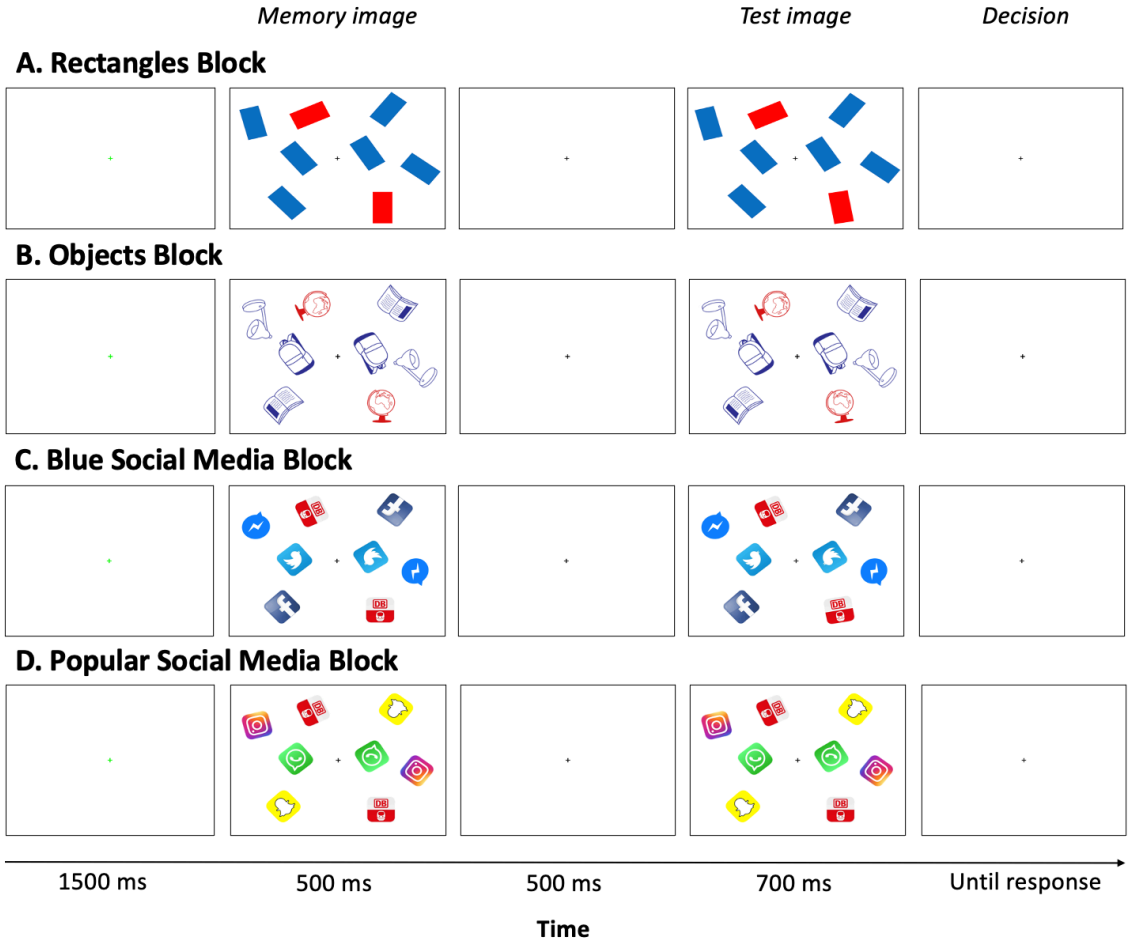
In our study, we make two changes to the filter task and transfer it to the context of social media. Because our research concerns social media distractions, we created a new block for the filter task by adding the distractor type of social media symbols, which allowed us to investigate not only general distractibility (as previous studies have done) but the ability to filter out visual social media cues. First, in line with the original filter task using blue distractors and red targets, we used blue social media symbols (Facebook, Facebook Messenger, and Twitter) as distractors and a red non-social-media app (German train app) as

the target (block: blue social media). Second, we created a further distractor type focusing on social media, but instead of relying on the original filter task's color scheme (i.e., blue distractors and red targets), we used popular social media symbols. Because the blue-colored social media symbols were not the most popular ones in our samples for Experiments 1 and 2, we created a second social media block with a different color scheme than the original filter task (red target, blue distractors). Instead, the second social media block used the popular social media symbols as distractors and another neutral symbol (unrelated to social media) as the target (block: colorful social media).

In this study, the filter task paradigm consists of three blocks of different distractor types per study. We included a rectangles block (Figure 1A, Experiments 1–3) as in the original version by Vogel et al. (2005) and an object block (Figure 1B, Experiments 1–2) following Uncapher et al. (2016), and we created a blue social media block (Figure 1C, Experiments 1–3) and a popular social media block (Figure 1D, Experiment 3). The filter task was programmed using Millisecond's Inquisit 5 software, a program that assess responses and response times. Figure 1 visualizes the filter task paradigm.

Figure 1

Visualization of the Filter Task Paradigm



Note. This image visualizes the procedure of the filter task in Experiments 1–3. Participants focused on the red target symbols and indicated a change of orientation over the first and second images shown. Zero, two, four, or six distractions were also presented and should have been ignored. After showing the second image, participants responded (indicated whether there was a change of orientation of one target or no change). Block A is follows Vogel et al. (2005); Block B follows Uncapher et al. (2016). Blocks C and D show our social media adaptation of the filter task. Block C represents the blue social media block, which follows the conventional color scheme of the original filter task. Block D represents the popular social media block.

Aim and Study Overview

In the present research, we are interested in understanding what influences distractibility and user ability to block out irrelevant distractors. We expect that both general

factors and factors specific to social media may increase a user distractibility. Thus, across three experiments (for an overview of the experiments and which constructs are included in which study, see Table A1 in Supplemental Material), we investigated users' ability to filter out neutral and social media stimuli as well as the influence of general and specific social media factors. In Experiment 1, we focused on *stable* factors that may impact distractibility, namely by measuring participants' self-control, impulsivity, problematic social media use, and FoMO. In subsequent experiments, we also investigated the *situational* influence of factors that may increase the drive for social media. For instance, in Experiment 2, we investigated the impact of momentary cyberostracism on distractibility, and, in Experiment 3, we investigated the impact of momentary FoMO on distractibility. Taken together, the point of three experiments is to identify the distractibility of social media cues as well as how general and specific social media factors influence user ability to filter out both neutral distractors and social media cues.

Experiment 1

In Experiment 1, we sought to answer two questions: (1) How distracted are people by social media cues, and (2) how does this distraction relate to individual differences? Accordingly, we investigated the distractibility of social media stimuli compared to neutral distractors. As agued above, social media cues are a major source of distraction due to the learned rewards of using social media (van Koningsbruggen et al., 2018); moreover, attentional biases towards social media cues might further enhance distractibility by social media stimuli. Correspondingly, previous work has shown that visual and auditory social media cues increase craving for social media (Wegmann, Stodt, et al., 2017), which indicates that social media cues draw attention. Thus, social media cues might receive preferential

attentional processing. Hence, we expect that social media cues are more distracting than neutral cues or everyday objects.

We also examined how stable trait-based factors may influence the ability to filter out neutral distractors and social media cues. Thus, we investigated how self-control, impulsivity, addictive tendencies, and FoMO influence distractibility. Self-control could lead to difficulties in filtering out distractions. Previous research has shown a relation between low self-control and high social media use (Du et al., 2018). Therefore, we expect people with low self-control to be worse at blocking out distractions. Conversely, research has indicated that impulsivity is related to stronger attentional bias (Coskunpinar & Cyders, 2013) and higher daily multitasking (Minear et al., 2013; Sanbonmatsu et al., 2013). Therefore, we expect individuals with high impulsivity to be worse at blocking out distractions compared with people with low impulsivity.

Some individual factors specific to social media users may also influence the ability to block out distractions. In particular, users showing a problematic social media use have increased susceptibility to distractions. Problematic social media use is characterized by users being preoccupied with social media (Wegmann, Stodt, et al., 2017) and is associated with attentional problems (Wegmann et al., 2020). Therefore, we expect that people with high problematic social media use are worse at blocking out distractions. FoMO is associated with increased social media use (Hunt et al., 2018; Oberst et al., 2017), and research has shown that people with higher FoMO are easily distracted and less focused (Milyavskaya et al., 2018). Therefore, we expect people with high FoMO to be worse at blocking out distractions.

Method

Procedure

The study used a three (distractor type: rectangles vs. objects vs. social media cue) x three (distractor loads: two, four, and six)[1] within-subjects design. We collected trait measures of self-control, impulsivity, problematic social media use, and FoMO via questionnaires. The study began with the filter task paradigm, which started with the *rectangles* block (Figure 1A) adapted from Vogel et al. (2005), followed by the objects (Figure 1B) and the social media (Figure 1C) blocks. We randomized the order of the objects and the social media blocks to control for possible influences of the block order.

The trials of the filter tasks started with a fixation cross, followed by an image that participants were required to memorize consisting of the two targets and various numbers of distractors. In the rectangles block, participants were told to focus on the two red target rectangles and memorize their orientation. Zero, two, four, or six distractors in the form of blue rectangles, which should have been ignored, were shown together with the red target rectangles, followed by a fixation cross. Thereafter, the image with targets and distractors was shown again. However, for half of the trials, one of the two target rectangles was rotated by 10 degrees (adapted from Uncapher et al., 2016). For the remaining trials, the image had the same orientation as the two red target rectangles. After this image was shown very briefly, the fixation cross appeared, and the participants were required to indicate whether a rotation change occurred in one of the two red targets. Once the decision was made, the next trail started.

The filter task consisted of 80 trials for each distractor-type block (i.e., rectangles, objects, and social media). Overall, 40 of the trials had changed target orientations and 40

[1] Similar to the original filter task, we included the condition of zero distractors. However, because we were only interested in the influence of distractors, we excluded trials with zero distractors from the analysis.

did not. We randomized the order of the trials. The three blocks followed one after another, and we introduced each target and distractor for the following block.

The *objects* block (Figure 1B) was adapted from Uncapher et al. (2016), who included a block using common objects (line drawings [2]) as more complex distractors. We created a new *social media block* to investigate the ability to filter out social media distractors. In our adaptation, we used a red non-social media symbol as the target and three blue social media symbols as distractors. After the filter task, we administered the questionnaires on individual factors and sociodemographic questions. Data of this study is available online via the Open Science Framework[3] and supplemental material online.

Measures

Visual distractibility (i.e., the ability to filter out distractors) was indicated by the performance in the filter task. Following Vogel et al. (2005 and Cowan (2001), we measured the working memory capacity (Ophir et al., 2009; Uncapher et al., 2016; Vogel et al., 2005) as follows: $k = S \times (H - F)$,

where S denotes the array size (i.e., the two targets), *H* denotes the hit rate (correctly indicated rotation of the target's orientation divided by 40, i.e., the total number of possible changes) and *F* denotes the false-alarm rate (incorrectly indicated rotation where none occurred divided by 40, i.e., the total number of non-rotated targets). Lower performance scores indicated a low ability to filter out distractors and hence greater distractibility.

We assessed *problematic social media use* via the with a short version of Young's Internet Addiction Test modified for social media communication (s-IAT-SNS, Wegmann et al., 2015), which consisted of the dimensions of loss of control (α = .87) and craving (α = .82)

[2] In the objects block, the red targets were line drawings of a globe while the blue distractors were line drawings of a notebook, backpack, and a desk lamp).

[3] https://osf.io/a4p2c/?view_only=76d4aa02a5d342fb9b46ddbcaf28537c

measured on a 5-point Likert scale ranging from 1 (*never*) to 5 (*very often*). *FoMO* was assessed using the revised FoMO scale (Wegmann, Oberst, et al., 2017). Based on a 5-point Likert scale ranging from 1 (*totally disagree*) to 5 (*totally agree*), participants rated 12 items in *online* (seven items; α = .86) and *offline* (five items; α = .78) FoMO. We measured *self-control* with the Brief Self-Control Scale (Bertrams & Dickhäuser, 2009; Tangney et al., 2004), and we assessed *impulsivity* with the Barrat Impulsiveness Scale (Meule et al., 2011). We asked for *social media use* ("How many hours do you spent in social media on average every day?") and included *sociodemographic* questions on age, gender, education, and current occupation[4].

Participants

We recruited participants from the campus of a German university; students received course credit for participation with the prerequisite of being a social media user. Sixty-five persons participated in the laboratory study. Criteria for data exclusion consisted of response time and hit and false-alarm rate. Furthermore, participants with 100% correct and 100% false responses or with 0% correct and 0% false responses in one block were excluded because this indicated that they pressed the same button throughout the whole experiment. We excluded one participant due to this criterion. The final data set consisted of 64 participants aged between 18 and 31 years (*M* = 23.07, *SD* = 3.51). About 69% (*N* = 44) of participants were female. Participants reported a daily average social media use of 3.29 hours per day (*SD* = 2.55).

Results

To investigate visual distractibility, we examined performance in the filter task via a three (distractor type: rectangles, objects, and social media) x three (distractor load: two,

[4] For exploratory purposes, we included questions on distraction by social media (active or passive use, source of distraction, and typical reaction to distraction), ADHS, reasons for distraction, and how participants evaluated their distraction (see Supplemental Material). These variables were not analyzed for this paper.

four, and six) ANOVA. Table 1 summarizes the ANOVA findings and shows the main effects and interaction effects. *Distractor type* had a significant main effect on performance ($p < .001$). Post-hoc pairwise comparisons[5] showed that performance with social media distractors ($M = 0.38$, $SD = 0.47$) was significantly lower compared to rectangles ($M = 0.57$, $SD = 0.49$), $t(63) = 4.29$, $p < .001$. Performance with object distractors ($M = 0.36$, $SD = 0.41$) was also significantly lower compared to rectangles, $t(63) = -4.44$, $p < .001$. Performance did not differ between social media distractors and the object distractors ($p > .999$).

Results showed a significant interaction effect of distractor type and distractor load, ($p = .006$). Post-hoc pairwise comparisons revealed that, with two distractors, performance was significantly lower for social media ($M = 0.52$, $SD = 0.45$) compared with objects ($M = 0.29$, $SD = 0.48$), $t(63) = -2.93$, $p = .013$, and it was significantly lower for objects compared with rectangles ($M = 0.61$, $SD = 0.53$), $t(63) = -3.96$, $p = .001$. Performance did not differ between social media distractors and rectangle distractors ($p = .383$). With four distractors, performance for social media distractors ($M = 0.28$, $SD = 0.50$) was significantly lower compared to rectangles ($M = 0.57$, $SD = 0.49$), $t(63) = 3.59$, $p = .004$. Object distractors did not differ from rectangle ($p = .058$) or social media distractors ($p = .231$). With six distractors, performance was significantly lower for social media distractors ($M = 0.34$, $SD = 0.43$) compared to rectangles ($M = 0.54$, $SD = 0.44$), $t(63) = 2.84$, $p = .034$. Again, object distractors did not differ from rectangle ($p = .091$) or social media distractors ($p = .677$). Figure 2 shows performance by distractor load and type and visualizes the described effects.

[5] For the post hoc analysis, we applied a Bejamini–Yekutieli (2001) correction, which controls for the false discovery rate in multiple tests. We only report values for significant post-hoc analyses.

Table 1

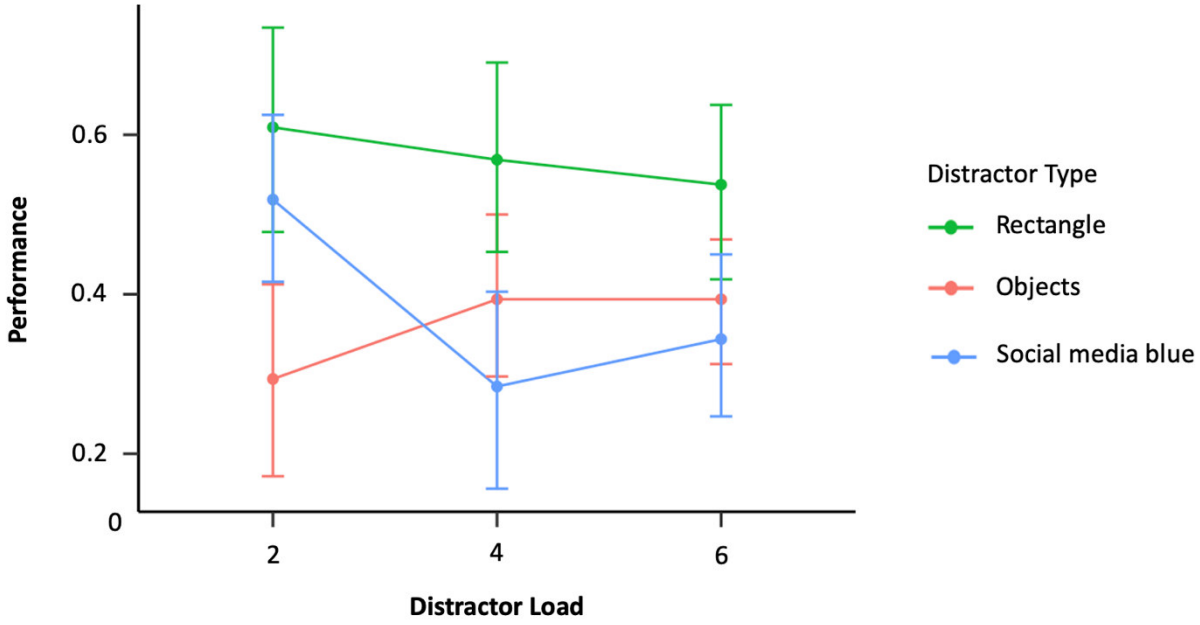
Within-Factor ANOVA Analyses of Distractor Type, Distractor Load, and the Interaction on Performance

	F	df	p	η^2
Distractor type	12.78	2, 126	**<.001**	.17
Distractor load	1.14	2, 126	.324	.02
Distractor type x Distractor load	3.66	4, 252	**.006**	.05

Note: Reported partial η^2

Figure 2

Performance by Distractor Load and Distractor Type



We also examined the effects of individual difference variables on performance. For this, we calculated correlations with the average performance per distractor type and the individual factors we had assessed, that is, self-control, impulsivity, tendency for social media addiction, and FoMO. The results showed no significant correlation between any of the individual difference variables and performance (Table 2).

Table 2

Correlation of performance in each block and individual difference variables

	Rectangles	Objects	Social media
Self-control	.071	-.019	.186
Impulsivity	-.063	.114	-.046
Fear of missing out			
Offline	-.127	-.001	-.107
Online	-.110	-.007	-.140
Social media addiction tendency			
Control	-.067	-.111	-.093
Craving	-.112	-.116	-.217

Note. ***p < .001, **p < .01, *p < .05.

Discussion

With Experiment 1, we investigated whether social media cues are more distracting than neutral cues as well as whether individual differences influence distractibility. Our results showed that, compared to the rectangle condition, performance was lower for both social media and neutral object distractors. However, performance for social media cues was not lower than for neutral objects, except in the two-distractor condition. These findings indicate that visual complexity, which is lower for the rectangles, was responsible for distractibility rather than meaning (social media vs. objects).

Regarding individual differences, our results showed no relation between visual distractibility and the general traits of self-control and impulsivity as well as between FoMO and problematic social media use. Previous studies have found a relation between higher social media use/media multitasking and lower self-control (Minear et al., 2013; Shin et al., 2019), higher impulsivity (Minear et al., 2013; Sanbonmatsu et al., 2013; Schutten et al., 2017), FoMO (Hunt et al., 2018; Oberst et al., 2017), and problematic social media use

(Wegmann et al., 2020). In light of these studies, our findings suggest that, even though these individual differences may enhance social media use, they do not necessarily increase distraction by social media cues.

Overall, this first experiment tested our adaptation of the filter task. We found greater distractibility by more complex distractors compared to neutral simple distractors. We focused on stable characteristics but found no relationship with the ability to filter out distractions. In the following experiments, we investigate how situational characteristics influence the ability to filter out distractions.

Experiment 2

In Experiment 1, we found that distractibility for social media cues was higher compared with visually simple cues but not for complex neutral cues. In Experiment 2, we were interested in whether the findings could be replicated or whether social media cues are more distracting than neutral cues as originally hypothesized. Experiment 1 focused on stable individual differences and their association with distractibility, whereas Experiment 2 focused on the *situational* aspects influencing users' distractibility.

We used cyberostracism to investigate situational influences on distractibility, which describes the feeling of being socially excluded online (Williams, 2009) and is especially problematic in the context of social media. For instance, people feel excluded when not receiving reactions, such as likes, on social media (Reich et al., 2018). The need to belong is a fundamental need (Baumeister & Leary, 1995) that people strive to fulfill, and this can be threatened by social media when people do not share or receive feedback (Tobin et al., 2015). According to the need-threat model by Williams (2009), ostracism creates a need threat whereby individuals, among other reactions, focus on social cues. Social media cues

can represent the social cues that ostracized people may especially attend to. Previous work has argued that social media can remined users of their social network (Tobin et al., 2015) and has found that people use social media to satisfy the need to belong when feeling ostracized (Iannone et al., 2018). Hence, social media cues may play a special role in ostracism and in making people more attentive to social cues. Therefore, we assume that people who feel ostracized are more likely to be distracted by social media cues.

Method

To examine the influence of cyberostracism on distractibility, we used our modified filter task described in Experiment 1. Moreover, we manipulated the concept of cyberostracism to understand how a feeling of exclusion might influence distractibility. We used a two (cyberostracism: exclusion vs. inclusion) x three (distractor type: rectangles vs. objects vs. social media cues) x three (distractor loads: two, four, and six) mixed design; cyberostracism was a between-subjects factor, whereas distractor type and distractor load were within-subject factors.

Procedure

We manipulated the feeling of social exclusion (vs. inclusion) using a vignette with a fictitious social network called neighborhood friends (manipulation similar to Wan et al., 2014). We told participants that they were to test this new network by imagining they moved to a new city and tried to make new friends in their new neighborhood. To do so, participants were required to write a few words about themselves in their profile and to send friend requests to people already registered in the network. Then, participants were told that all friends requests were accepted (inclusion group) or all were rejected (exclusion group). Participants were randomly assigned to these two experimental groups. After this

manipulation, we conducted the modified filter task described in Experiment 1. The experiment ended with sociodemographic questions.

Measures[6]

Visual distractibility was, similar to Experiment 1, measured by the working memory capacity, as indicated by the performance in the filter task. Again, similar to Experiment 1, we asked participants for an estimate of *social media use* per day, whether they use social media platforms, and whether they use social media in an actively or passive way. We included *sociodemographic* questions on age, gender, and education.

To assess whether the manipulation was successful, participants rated how they felt after receiving the feedback concerning friend requests: noticed—neglected/ignored, accepted—rejected, and belonging/included—excluded (bipolar items ranging from one to seven). For the manipulation check, we calculated the average of the three items and compared it for the two groups. Following the recommendation of Williams (2009) to include measures such as mood as a manipulation check in addition to feelings of inclusion/exclusion in the context of ostracism, we asked participants to indicate their mood immediately after the manipulation ("Please indicate how you feel in this moment," 5-point smiley scale).

Participants

Sixty-eight people participated in this laboratory study at a large German university. Due to technical problems, the data were missing for one person. Moreover, following the exclusion criteria described in Experiment 1, one participant was excluded due to a 0% hit rate and 0% false-alarm rate. The final data set used for the analysis consisted of 66

[6] Similar to Experiment 1, we included variables of individual differences, namely how self-control, impulsivity, and FoMO, and trait mind wandering influence the ability to filter out distractions. However, because these findings were, as in Experiment 1, all non-significant, they are only reported in the Supplemental Material.

participants. About 70% (*N* = 46) participants were female. Participants were aged between 18 and 31 (*M* = 22.62, *SD* = 3.77). Participants reported using social media 2.92 hours per day on average (*SD* = 1.56). Participants were randomly assigned to the social inclusion (*N* = 34) or social exclusion groups (*N* = 32).

Results

The manipulation was successful; a t-test showed that the feeling of exclusion was significantly higher in the exclusion group (*M* = 5.21, *SD* = 1.06) compared to the inclusion group (*M* = 1.72, *SD* = 0.77), *t*(65) = -15.51, *p* < .001. In addition, mood also served as an indicator of a successful ostracism manipulation (Williams, 2009). As expected, we found that mood was significantly lower in the exclusion group (*M* = 4.18, *SD* = 0.52) compared to the inclusion group (*M* = 2.58, *SD* = 0.79), *t*(65) = 9.81, *p* < .001.

We conducted two (cyberostracism: inclusion vs. exclusion) x three (distractor type: rectangles, object, and social media) x three (distractor load: two, four, six) mixed ANOVA to investigate the effect of the manipulation on performance depending on distractor load for each distractor type. Table 3 shows the ANOVA results, from which it is evident that distractor type (*p* <.001) and distractor load (*p* = .005) both had significant main effects. The main effect of cyberostracism, however, was not significant (*p* = .311).

Post-hoc analysis of the main effect of distractor type showed that performance for social media distractors (*M* = 0.45, *SD* = 0.48) was significantly lower compared with rectangles (*M* = 0.59, *SD* = 0.50), *t*(64) = 3.65, *p* = .002. Performance with object distractors (*M* = 0.37, *SD* = 0.38) was lower compared with rectangle distractors, *t*(64) = -6.18, *p* < .001. Performance did not differ significantly across social media distractors and object distractors (*p* = .062).

For the main effect of distractor load, post-hoc analysis revealed that performance was higher for two distractors (M = 0.55, SD = 0.47) compared to four distractors (M = 0.43, SD = 0.49), $t(64) = 2.96$, $p = .022$, and six distractors (M = 0.44, SD = 0.43), $t(64) = 2.74$, $p = .022$. Performance did not differ across four and six distractors ($p > .999$).

Our results revealed the significant interaction of both cyberostracism and distractor load ($p = .011$). Post-hoc analysis of manipulation by distractor load showed significantly lower performance for two distractors between the social exclusion (M = 0.44, SD = 0.47) and inclusion groups (M = 0.64, SD = 0.45), $t(64) = 2.24$, $p = .029$. There were no significant performance differences for both groups across four ($p = .469$) and six distractors ($p = .598$). Figure 3 shows performance by distractor type and load for the inclusion and exclusion group.

Table 3

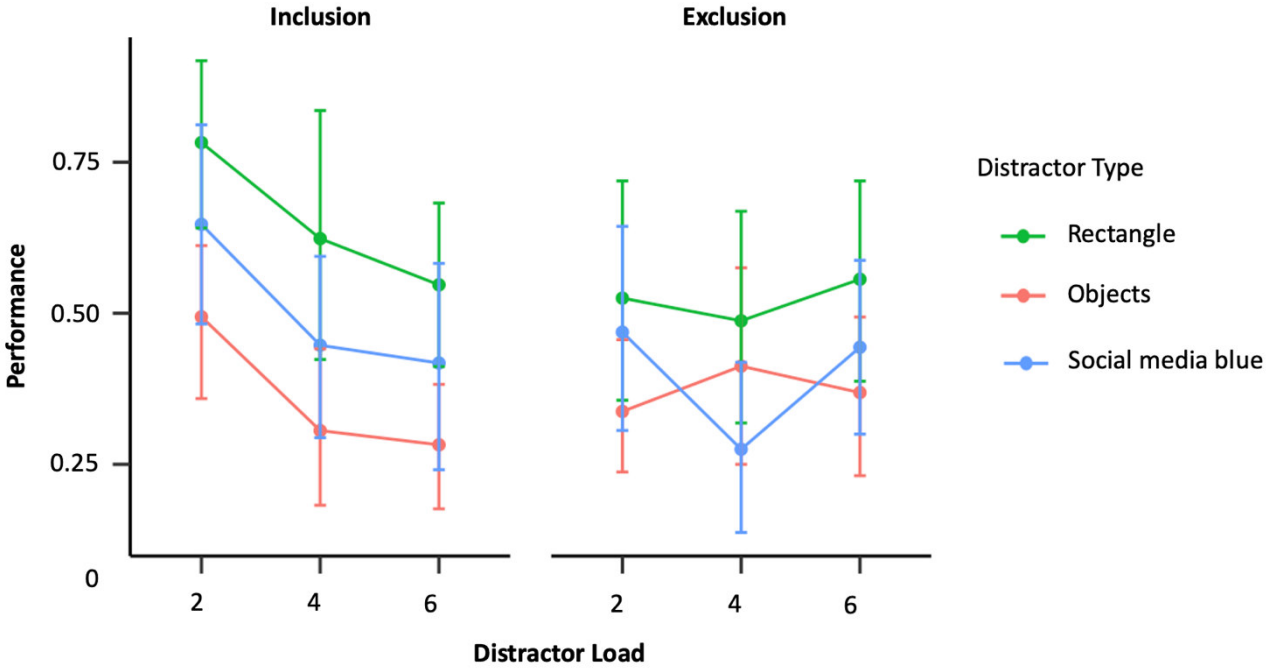
Mixed ANOVA Analyses of Cyberostracism, Distractor Type, Distractor Load, and their Interactions on Performance

	F ratio	df	p	η^2
Cyberostracism	1.04	1, 64	.311	.02
Distractor type	17.89	2, 128	**<.001**	.22
Distractor load	5.50	2, 128	**.005**	.08
Cyberostracism x Distractor type	2.08	2, 128	.129	.03
Cyberostracism x Distractor load	4.65	2, 128	**.011**	.07
Distractor type x Distractor load	0.78	4, 256	.538	.01
Cyberostracism x Type x Load	0.71	4, 256	.584	.01

Note: Reported partial η^2

Figure 3

Performance by Distractor Load and Distractor Type for Inclusion and Exclusion Groups



Discussion

Regarding distractor type, our results showed that performance was lower for both objects and social media distractors compared to rectangles. This finding corresponds to Experiment 1 and underlines the conclusion that it was the visual complexity and not meaning (social media vs. objects) of the stimuli that was responsible for distraction in the filter task. Regarding distractor load, our findings showed that distractibility was higher with greater distractor load (four and six distractors) compared to lower distractor load (two distractors). This corresponds to findings using the filter task: Prior work has indicated that distraction is enhanced with an increase in distractor number (Ophir et al., 2009; Uncapher et al., 2016).

We did not find any interaction effect of cyberostracism with distractor type, which is in contrast with our assumption that socially excluded individuals are more likely to be

distracted by social media cues. However, we found an interaction effect of social exclusion and distractor load on overall performance: Distractibility was greater for socially excluded (compared to included) participants when distractor load was low (two distractors), not high (four and six distractors). This is in line with perceptual load theory (Lavie & Dalton, 2014), stating that individuals are more likely to become distracted when the task does not occupy all cognitive capacities. Hence, with a reduced distractor load, socially excluded people might have shown greater distractibility because they were more distracted by being excluded. This finding corresponds to prior work showing negative effects on performance when being excluded (Cursan et al., 2017; Jamieson et al., 2010; Lustenberger & Jagacinski, 2010).

When faced with tasks requiring full attention, there is no room for distraction (Lavie & Dalton, 2014). With a higher distractor load, full attention was required for tasks. Thus, included and excluded people performed similarly because the higher distractor load required both groups to focus, which meant that there was no attention left to become distracted. In addition, prior work has indicated that ostracized people try to perform extra well (Jamieson et al., 2010). Although the socially excluded group did not outperform the socially included group, their performance increased with the highest distractor load (see Figure 3), which may suggest that they tried to perform extra well.

Overall, the findings suggested that social exclusion can negatively affect distractibility. With increasing distractor load, however, this effect diminished and performance between the inclusion and exclusion groups converged. As in Experiment 1, we did not find evidence that social media stimuli are more distracting, neither at the general level nor as an effect of social exclusion. One possible explanation is that the social media cues we used (in particular Facebook) have lost popularity among younger people who

participated in our study. Hence, in Experiment 3, we used social media cues that were more popular with younger users (e.g., Instagram).

Experiment 3

The purpose of Experiment 3 was threefold. First, we wanted to examine the influence of another social media-related situational factor, that is, FoMO, on distraction. As argued in Experiment 1, FoMO may increase users' interest in social media and thus make users susceptible to distraction by social media. Previous research has indicated that FoMO has negative effects on academic performance (Rosen et al., 2018) and that people specifically experience FoMO when performing tasks such as studying (Milyavskaya et al., 2018). Thus, FoMO appears to have the potential to distract people from their primary goal. Therefore, especially when working on a task, we assume that people are occupied with what they might miss out on online; thus, they are less focused and more likely to become distracted. We did not identify any FoMO effects in Experiment 1, but this can be attributed to using FoMO as a trait measure: FoMO might not have been activated and relevant during the task. Hence, in Experiment 3, we implemented FoMO manipulation in the expectation that people are worse at filtering out distractions when FoMO is activated.

Second, we extended the experiment by adding another social media block that includes popular social media cues (e.g., Instagram, Snapchat, and WhatsApp). As Experiments 1 and 2 consistently did not find a difference between the original social media block and the neutral objects block, we did not include the objects block in Experiment 3. We expect that the more popular social media cues are more distracting.

Third, we included mind wandering prompts to gain a deeper insight into the underlying mechanisms of the internal processes that may contribute to increased

distractibility. Because previous work has found that mind wandering negatively influenced the ability to filter out distractors during the filter task (Unsworth & Robison, 2016), we wanted to examine whether participants showed greater distractibility due to mind wandering. Research has shown that user mind wandering can become an internal distraction when working on a task (McVay & Kane, 2010). More importantly, we were interested in understanding whether this mind wandering would be general in nature or specific on social media. Prior work has indicated that mind wandering is related to online vigilance, a constant awareness of online communications (Johannes et al., 2018). Relatedly, research has shown that, when learning online, students mind wandering is often related to social media (Hollis & Was, 2016). In this context, mind wandering specific to social media can act as an internal distraction. Therefore, we expect that mind wandering occurs in the presence of social media cues and impacts performance.

Method

We used our modification of the filter task described in Experiment 1 but replaced the neutral objects block with a new block that had more popular social media cues. We manipulated FoMO in a vignette to examine its influence. To investigate mind wandering during the task, we included mind wandering prompts after each block. The experiment consisted of a two (FoMO vs. non-FoMO) x three (distractor type: rectangles vs. blue social media cues vs. popular social media cues) x three (distractor load: two, four, and six) mixed design; FoMO was a between-subjects factor, whereas distractor type and distractor number were within-subject factors.

Procedure

We manipulated FoMO following Milyavskaya et al. (2018). To induce FoMO, participants were required to imagine staying at home and finishing a task while a friend, wo

was celebrating their birthday, had just called and invited them to come. For the control group, we added a non-FoMO condition where participants were required to imagine going to the party and not finishing the task. Participants were randomly assigned to the FoMO group or control group. After going through this scenario, participants were asked to describe how they would feel in this situation.

In our first adaptation of the filter task for Experiments 1 and 2, we maintained the typical color scheme for the filter task and used a red app symbol as a target and only blue social media apps as distractors. However, because these apps did not necessarily represent the most popular social media apps in Germany at that time, we included a new social media block to include more popular social media apps. This meant we had to deviate from the color scheme of the filter task, as these social media apps were not blue. We did so because we assumed that more popular social media stimuli might create greater distraction.

The filter task used in Experiment 3 started either with the blue social media block used before or with our new popular social media block. The other block then followed, with the rectangles block being the last one. The mind wandering prompts were included after each block had finished. Lastly, we included sociodemographic questions.

Measures[7]

Similar to Experiments 1 and 2, *visual distractibility* was measured as the performance in the filter task indicated by the working memory capacity. *Mind wandering* was assessed by a mind wandering prompt (McVay & Kane, 2009), which was included after each block of the filter task was finished. The mind wandering prompt asked participants to record or indicate their thoughts at the given time. Participants could select one of eight

[7] Similar to Experiments 1 and 2, we included individual factors, namely smartphone craving and social media self-control failure. However, similar to Experiments 1 and 2, there were no significant relations, and, hence, we report these findings in the Supplemental Material.

response options. To indicate no mind wandering, responses included thinking about the current task or their performance in the task; to indicate mind wandering, responses included thinking about every everyday stuff, their current state of being, personal worries, daydreaming, or any other thoughts unrelated to the task (McVay & Kane, 2009; Rummel & Boywitt, 2014). We added the answer "at social media" to assess whether the tasks would trigger thoughts about social media. Lastly, as in Experiments 1 and 2, we asked for social media use per day and included sociodemographic questions on age, gender, and education.

To check whether the manipulation was successful, participants were required to write down their imagined feelings for the above scenario. Then, on a scale from 1 (*not at all*) to 5 (*extremely*), participants rated how much FoMO they would feel for missing out on the scenario (Milyavskaya et al., 2018). At the very end, we included the control variables whether participants perceived the scenario as realistic and whether they already knew the filter task experiment.

Participants

Participants were recruited from a German university; they were rewarded with a 5€ gift voucher or course credit for participation. Overall, 120 people participated in the experiment. Following the exclusion criteria described in Experiment 1, we excluded four participants from the analysis. Hence, 116 participants were used for the analysis. Participants were aged between 18 and 40 with a mean age of 22.47 (*SD* = 3.51). About 71% of participants were female (*n* = 82). Participants reported spending about 2.92 hours per day on social media (*SD* = 1.56). Participants were randomly assigned to either the FoMO group (*n* = 61) or non-FoMO group (*n* = 55).

Results

For the manipulation check, we conducted t-tests to compare both groups. We found that participants in the FoMO group (M = 3.92, SD = 0.85) indeed reported a significantly stronger feeling of missing out (experience of FoMO) compared to the control group (M = 3.26, SD = 1.16), t (118) = 3.57, p < .001, d = 0.653.

To investigate performance, we calculated two (manipulation: FoMO vs. non-FoMO) x three (distractor type: rectangles, blue social media, and popular social media) x four (distractor load: two, four, and six) ANOVA. Table 4 shows the results, from which it is evident that distractor type (p <.001) and distractor load (p <.001) had significant main effects. However, FoMO did not have a main effect on performance (p = .289).

For distractor type, post-hoc analysis showed that performance for blue social media distractors (M = 0.40, SD = 0.45), t(114) = 7.09, p <.001, and popular social media distractors (M = 0.36, SD = 0.45), t(114) = 8.17, p <.001, was significantly lower compared with the rectangles (M = 0.64, SD = 0.44). Performance for blue and popular social media distractors did not significantly differ (p = .388).

For distractor load, post-hoc analysis revealed that performance was significantly higher for two distractors (M = 0.55, SD = 0.47) compared with four (M = 0.43, SD = 0.48) distractors, t(114) = 4.70, p < .001, and six distractors (M = 0.42, SD = 0.43), t(114) = 4.53, p < .001. Performance did not differ for four and six distractors (p > .999).

None of the interaction effects were significant (see Table 4). Figure 4 visualizes the main effects on performance depending on distractor type and load for the FoMO and non-FoMO groups.

Table 4

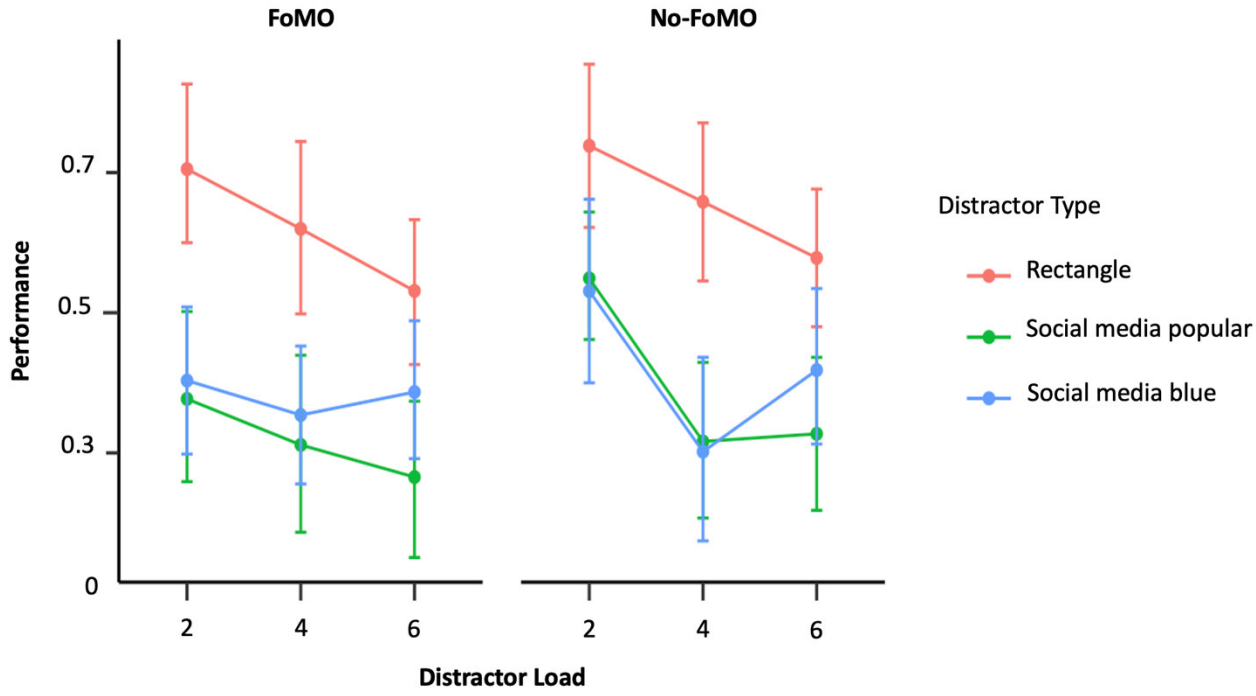
Mixed ANOVA Analyses of FoMO, Distractor Type, Distractor Load, and their Interactions on Performance

	F ratio	df	p	η^2
FoMO vs. no-FoMO	1.14	1, 114	.289	.01
Distractor type	40.47	2, 228	**<.001**	.26
Distractor load	13.76	2, 228	**<.001**	.11
FoMO x Distractor type	0.26	2, 228	.771	<.01
FoMO x Distractor load	2.04	2, 228	.132	.02
Block x Distractor	1.70	4, 456	.149	.01
FoMO x Type x Load	0.64	4, 456	.634	<.01

Note: Reported partial η^2

Figure 4

Performance by Distractor Load and Type for FoMO and Non-FoMO Groups



We investigated mind wandering with mind wandering prompts. With social media distractors, participants were mostly thinking about the task (blue social media: 75%,

popular social media: 72%), whereas with rectangle distractors, about half of the participants were thinking about the task (57%). Mind wandering mainly consisted of thoughts about general topics (rectangles: 43%, blue social media: 25%, popular social media: 28%), and no one indicated that their minds wandered to social media (for further details, see Table A9 in Supplemental Material). Hence, social media cues did not induce mind wandering to social media.

We exploratory investigated whether mind wandering influenced performance. We calculated t-tests and compared the performance for each distractor type between those participants who mind wandered and those who did not. The results showed that, for rectangle distractors, participants who conducted mind wandering (M = 0.70, SD = 0.33) performed significantly worse, t (114) = 2.25, p = .026, than those who did not (M = 0.55, SD = 0.36).

Discussion

Regarding distractor type, Experiment 3 investigated the distractibility by different types of social media and neutral symbols. The results showed that distractibility was greater for social media symbols than neutral distractors. These findings are in line with those of Experiments 1 and 2, where we also found greater distractibility for social media symbols. In Experiment 3, we additionally showed that popular social media symbols were not more distracting than the comparatively unpopular blue social media symbols, which we used to ensure consistency with the typical filter task color scheme.

Regarding distractor load, distractibility was lower for higher distractor loads (four and six distractors compared to two distractors). This again replicates our findings from Experiment 2.

This experiment also investigated the effects of situational FoMO on distractibility. Prior work has found that FoMO especially occurs when focusing on tasks (Milyavskaya et al., 2018), and thus we tested it in a situational context. Although we found heightened FoMO, it did not have an effect on distractibility. This is in line with Experiment 1, where trait FoMO did affect performance in the filter task. Although research has indicated that working on tasks might increase FoMO (Milyavskaya et al., 2018), our task may not have for FoMO effects to occur.

We also investigated mind wandering. Participants did not indicate mind wandering related to social media, suggesting that social media cues might not induce thoughts about social media. Our results also showed that, for those whose minds wandered in general, distractibility was greater compared with those who did not exhibit mind wandering but only for neutral distractors. However, prior work has shown that mind wandering leads to internal distraction (McVay & Kane, 2010) and can negatively affect performance (Unsworth & Robison, 2016). Accordingly, people might have to focus extra hard in the presence of social media distractors, and this has been indicated by previous work (Johannes et al., 2019).

General Discussion

Across three experiments with a total 246 participants, we investigated users' distractibility caused by neutral and social media cues. We did not find support for our assumption that individuals are more distracted by social media cues than by neutral ones. Rather, we found that complex neutral cues (common objects) and social media cues are more distracting than simple neutral distractors (rectangles).

In our three experiments, we found a main effect of distractor type on distractibility, and we demonstrated that complex distractors are more distracting than simple distractors. Although the results suggested that social media symbols are more distracting than simple neutral distractors (rectangles), we also found that more complex neutral cues (objects) have a similar level of distractibility as social media cues. Previous research has argued that distractors associated with rewards negatively impact performance in cognitive tasks (Rusz et al., 2018). In line with this reasoning, other studies have found that, in the presence of social media cues, hedonic reactions occurred as a response (van Koningsbruggen et al., 2017) as well as increased craving (Wegmann, Stodt, et al., 2017). However, prior work has shown that such cues are primarily visually distracting when users are not required to focus on a task (Koessmeier & Büttner, 2022). Hence, it is possible that we did not observe a more pronounced distracting effect of social media and neutral cues because the participants were preoccupied with the filter task and lacked the sufficient time to devote distracted by social media cues. With this work, we wanted to investigate users' ability to filter out distractions and the distractibility level of social media cues. The results showed distractibility to be associated with complex visual distractors rather than social media cues, which we can attribute to the zero difference across neutral complex (objects) and social media distractors.

We also investigated the influence of several general factors and factors specific to social media on visual distractibility. We found that none of the investigated stable individual differences influenced distractibility. Contrary to our expectations, individual differences such as self-control, impulsivity, FoMO, and social media addiction were not associated with distractibility. As an alternative explanation for differences in distractibility, prior research has argued that differences in distractibility may stem from general attentional problems

(Ralph et al., 2014) and that a greater attentional scope could be responsible for making some people being more easily distracted than others (Cain & Mitroff, 2011). Accordingly, the investigated individual factors might not have played an important role in distractibility measured via the filter task.

Our results further revealed that situational cyberostracism increased distractibility. People were worse at blocking out distractors when they felt socially excluded compared being socially included (Experiment 2) but only for low distractor loads. With higher distractor loads, this effect diminished with the socially included and excluded showing similar distractibility. This finding is in line with perceptual load theory, which suggests that people are more vulnerable to distractions when they do not use all capacities at their disposal to control their attention (Lavie & Dalton, 2014). Prior work has also found that the effects of distractors can diminish with increasing distractor load (Forster & Lavie, 2008). For tasks that do not require the totality of a person's cognitive capacities, susceptibility to distraction is enhanced, especially in the context of visual social media cues. Hence, for two distractors, people who felt excluded had the time to think about different things, but, for greater distractor loads, all cognitive capacities were needed.

We also investigated situational FoMO, and the results suggested that FoMO did not increase user distractibility. Although prior work has suggested that focusing on tasks increases FoMO (Milyavskaya et al., 2018), we could not replicate this finding, which might be due to our tasks not being sufficiently long to show any effects. However, we found that mind wandering negatively affects distractibility, but this was true only for simple neutral distractors. Moreover, although prior work has argued that social media cues might remind people of their social networks (Tobin et al., 2015), we found that they do not lead to thinking about social media.

In this set of experiments, we employed a previously used measure for filtering out distraction, that is, the filter task (Vogel et al., 2005). In particular, we found a similar pattern of distractibility with respect to previous studies for the neutral stimuli and also for complex versions with common objects as distractors (Uncapher et al., 2016). Our study also indicated that distractibility increases with an increase in distractor complexity (objects and our added social media). In Experiments 2 and 3, we found a main effect of distractor load, revealing that a higher distractor number increased distractibility. This is consistent with prior studies using the filter task, which showed problems in filtering out distractors for an increasing distractor load (Cardoso-Leite et al., 2016; Uncapher et al., 2016). Regardless of distractor type, more distractors appear to be more distracting.

We included a new distractor type (i.e., social media symbols) in two variations (blue and popular social media cues). We found effects consistently across all three studies, including our adaptations with social media distractors, indicating that both our social media adaptations adequately represented users' ability to filter out distractions. Hence, our adaptation is a viable extension of the filter task and could be used for further research.

With our second adaptation of the filter task using popular social media symbols, we deviated from the color scheme employed in the conventional filter task using blue distractors and a red target. Instead, our popular social media version included all kinds of colors (e.g., yellow, pinkish, and green). Still, we found the same patterns as the blue social media symbols and original filter task symbols (blue rectangles). Hence, with these experiments, we showed that the common color scheme of blue distractors is not necessary and can be extend even further. It is not only possible to extend the filter task using other cues, such as social media symbols, but also to deviate from the typical color scheme of

using blue distractors, such as by using colorful cues (not blue and not even the same color for all distractors), to obtain consistent results.

Limitations and Future Research

In our study, we could not identify stable influencing factors of distraction. One might think that our sample sizes could account for not finding stable differences. However, the filter task is a within-design measure for distractor load and distractor type, which accounts for smaller sample sizes. Future research could investigate other stable individual differences that might influence distractibility. For instance, prior work has shown that smartphone use during lectures is related to procrastination (Rozgonjuk et al., 2018) or that smartphone presence is particularly difficult for people being dependent on smartphones (Ward et al., 2017). Thus, future research could investigate smartphone dependency or procrastination.

We also found that situational cyberostracism influenced distractibility. Future research could investigate further situational influencing factors related to attentional processes and their influence on distractibility. For instance, research could investigate how a broad attentional focus (compared to a narrow attentional focus), which increases attention to peripheral cues (Streicher et al., 2021), might impact (social media-induced) distractibility.

Our findings suggested that visual social media cues are not more distracting compared to complex neutral cues. Future research could investigate the difference between general distractibility and distractibility specific to social media as well as whether any factors increase social media distraction (and not distraction in general). Future work could also explore whether people are perceiving the cues at all. It might be that people are not actually processing the social media cues and therefore are not in particular distracted

by them. In addition, it is unclear whether people are distracted by social media cues internally or externally. Previous research, however, has shown that internal distractions are more intrusive than external distractions (Katidioti et al., 2014). Thus, future work could delve deeper into investigating the nature of social media distraction.

Conclusion

We investigated user distractibility across three experiments, specifically how visually distracting social media cues are compared to neutral cues. Our findings suggested that visual social media cues are not more distracting than complex neutral cues. Moreover, complexity rather than meaning might impact distractibility, and distractibility increases with an increase in distractor load. The results also suggested that individual factors, such as self-control or problematic social media use, might not play a major role in distractibility. However, Experiment 2 showed that cyberostracism increased distractibility. Future work should further explore the situational factors that might impact distractibility. Our research highlights the importance of situational context for distraction and suggests that distractibility increases with an increase in distractor load, especially for complex distractors. The meaning of social media seems to not play such an important role for distractibility.

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Appendix D – Paper (Study 3)

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Beyond the smartphone's mere presence effect: A quantitative mobile eye tracking study on the visual and internal distraction potential of smartphones

Christina Koessmeier *, Oliver B. Büttner

Economic and Consumer Psychology, Department of Computer Science and Applied Cognitive Science, University of Duisburg-Essen, Germany

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ABSTRACT

Smartphones are a daily companion and ensure users' constant connectedness. In the context of focused work, however, smartphone presence may be problematic. Previous research has shown that even the mere presence of smartphones is distracting. The present study reexamined the smartphone's mere presence effect on performance. In addition, we investigated whether the mere presence of smartphones is visually distracting or creates smartphone-related thoughts. In a laboratory experiment, we compared participants (N = 103) with their smartphone present versus absent. Using mobile eye tracking glasses, we tracked how often people looked at their smartphone while performing cognitive and reading tasks. Our study could not replicate the negative effect of smartphone presence on performance. Results revealed that people rarely looked at their smartphones during the tasks. However, smartphones drew users' visual attention during breaks and transitions between tasks. We also showed that smartphone presence increased smartphone vigilance but had no effect on task performance. Our study contributes to understanding the underlying mechanisms of the smartphone's mere presence effects on performance. With this study, we extend previous research by showing that people can regulate their visual attention to smartphones.

1. Introduction

It has become completely normal for smartphones to be constantly with us, often lying next to us on the desk. For instance, in cafés when meeting friends, at the dinner table at home, but also at work or while studying, the smartphone is always there. However, in the context of focused work, even the mere presence of smartphones can be distracting. As such, previous research has shown that the mere presence of a smartphone negatively influences task performance (Canale et al., 2019; Thornton, Faires, Robbins, & Rollins, 2014; Ward, Duke, Gneezy, & Bos, 2017), even if it is not the participant's own smartphone (Thornton et al., 2014). Similarly, research has shown that people report being distracted by the presence of their smartphones (Johannes, Veling, Verwijmeren, & Buijzen, 2018). What is missing so far is a deeper investigation of the underlying processes of the smartphone's presence effect. It remains unclear why smartphones are distracting. Are smartphones distracting because they draw users' visual attention (i.e., because people to look at the smartphones)? Or are smartphones distracting because of users' internal attention (i.e., because people think about the smartphone)? Understanding the underlying process of smartphone distraction would ultimately help in identifying strategies that help individuals to become less distracted.

In this study, we investigated the distracting effect of the smartphone's mere presence. Even though previous work found an effect of the smartphone's mere presence (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017), others could not replicate these findings (Hartmann, Martarelli, Reber, & Rothen, 2020; Johannes et al., 2018). With this study, we build on these previous studies on the smartphone's mere presence effect but extend it in two ways. First, while previous research has mainly focused on standardized cognitive tasks, we additionally included a reading task to capture the smartphone's influence within a setting closer to real life. Second and more importantly, prior studies have not used objective measures, such as eye tracking, to understand the underlying processes leading to this distraction due to the smartphone's mere presence. Hence, we focused on the underlying processes and examined whether smartphones can be visually or internally distracting. Therefore, we conducted an experiment in which participants solved various tasks while their smartphone was lying next

* Corresponding author. Universität Duisburg-Essen, Fachgebiet Wirtschaftspsychologie, Lotharstr. 65, D-47057, Duisburg, Germany.
E-mail address: christina.koessmeier@uni-due.de (C. Koessmeier).

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to them. We concurrently monitored participants' gazes at the smartphone using mobile eye tracking glasses (ETG).

Our study provides three contributions. First, we found that smartphone presence had only limited effects on performance. Second, we found that individuals rarely looked at their smartphones while performing tasks; gazes at the smartphone occurred primarily during the breaks and transitions between tasks. Third, we found that smartphone presence increased internal attention in the form of smartphone vigilance. Overall, our results show that individuals are quite good at controlling their attention towards smartphones while performing tasks. This suggests that the effect of smartphones on performance is not as critical as initial studies implied. Specifically, our study gives insights into the mechanisms of smartphone distraction and shows that users can regulate their attention to smartphones.

2. The problem of smartphone distraction

The omnipresence and importance of smartphones in daily life (Ward et al., 2017) makes them so problematic. Smartphones might be distracting because of their ability to accessing social media, which are tempting (Hofmann, Reinecke, & Meier, 2017) and draw users to distraction (Aagaard, 2015). Prior work found that both social and task-related reasons drive distraction by social media (Koessmeier & Büttner, 2021). Distraction occurs when people are confronted with irrelevant stimuli that interrupt them while focusing on a specific task (Clapp & Gazzaley, 2012). For instance, in the context of focused work, smartphones, and especially their notifications, are irrelevant stimuli. Distraction by smartphones has been shown to have various negative effects. Research has shown that frequent smartphone notifications reduce attention, productivity, and mood (Fitz et al., 2019). For instance, activities were enjoyed less when reacting to notifications (Isikman, MacInnis, Ulkumen, & Cavanaugh, 2016), and students performed worse on a quiz following a lecture when their smartphones were present and received notifications (Mendoza, Pody, Lee, Kim, & McDonough, 2018). Furthermore, studies have shown that using a smartphone while driving (e.g., Ortiz, Ortiz-Peregrina, Castro, Casares-Lopez, & Salas, 2018) or walking (Thompson, Rivara, Ayyagari, & Ebel, 2013) negatively impacts safe behavior.

2.1. The smartphone's mere presence effect on performance

It is not only interacting with a smartphone and reacting to notifications that have negative effects, but the smartphone's mere presence can also be problematic. For instance, in prior studies people have reported feeling distracted by the presence of their smartphones (Johannes et al., 2018). On an interpersonal level, it has been shown that the mere presence of smartphones negatively impacts relationship formation (Przybylski & Weinstein, 2013) and can negatively impact daily social interactions (Allred & Crowley, 2016; Kushlev, Hunter, Proulx, Pressman, & Dunn, 2019).

The mere presence of smartphones can also affect users' task performance. The smartphone may lead to distraction, which in turn reduces cognitive capacity. People are constantly confronted with a huge amount of information, but they have a limited capacity to process it (Lang, 2000; Pashler, 1994). Attention determines the information that is cognitively processed, and stimuli with which users have learned to associate rewards are preferably attended to (Anderson, 2013, 2016). Therefore, smartphones are supposed to draw attention because users have learned that smartphones provide numerous rewards. Smartphone-related stimuli (i.e., visual cues) are then preferably processed, that is, attended to. Consequently, (visual) attentional processes based on learned rewards and their associated habits make smartphones potentially distracting. According to distraction-conflict theory, distracting stimuli create an attentional conflict that leads to impaired performance (Baron, 1986). These conflicts arise when the distraction is very tempting and difficult to ignore, but the user is under time and performance pressure, and concurrent processing of both task and distraction is impossible (Baron, 1986). Overall, the mere presence of smartphones could potentially reduce the user's cognitive capacity and thereby reduce task performance.

Previous studies examined the effects of having a smartphone present while performing several different tasks, and the results showed that having a smartphone lying next to participants had negative effects on their task performance (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017). The effect of the smartphone's mere presence on performance was found for a diverse set of cognitive tasks: cancellation tests and trail-making tests (Thornton et al., 2014), tasks assessing cognitive capacity (OSpan; Tanil & Yong, 2020; Ward et al., 2017), fluid intelligence (Raven's standard progressive metrics; Ward et al., 2017), sustained attention (go/no-go task; Ward et al., 2017), and visual working memory capacity (single-probe task; Canale et al., 2019). Studies showed that the effect occurred not only when the participant's own smartphone was present, but also when an unfamiliar phone was placed on the desk (Thornton et al., 2014).

However, prior studies' results are not yet fully consistent. Even though the above-mentioned studies used different tasks to investigate the mere presence effect, other research could not replicate these findings. For example, Johannes et al. (2018) investigated the effect of smartphone presence on the ability to control attention (ability to resist smartphone-related stimuli) and inhibit automatic responses (using a stop-signal task) and found no effect of smartphone presence. Similarly, another study investigating memory tasks (considering short-term and prospective memory) could not replicate the smartphone's mere presence effect (Hartmann et al., 2020). Thus, the smartphone's mere presence effect has not been consistently found and may not persist for different kinds of tasks. Therefore, we reinvestigated the effect of smartphone presence on performance. In our study, we used the tasks previously employed in other research (Thornton et al., 2014), but with a larger sample size. In addition, we included a further task (i.e., reading a text) that was more like tasks users perform in their daily lives than the cognitive tasks commonly employed in research. In the study, we expected that the presence of a smartphone (compared with the absence of a smartphone) would lead to poorer task performance (H1), which would be observed in cognitive tasks (H1a) and a reading task (H1b).

2.2. Visual and internal attention to smartphones and the effect on performance

Thus far, it largely remains unclear why the mere presence of smartphones is distracting and affects performance. Prior work discussed the mere presence effect as arising due to attentional limits, smartphone-related or task-irrelevant thoughts, and mind wandering (Stothart, Mitchum, & Yehnert, 2015; Ward et al., 2017). As notifications can arise anytime, perceived social pressure to respond that makes people react quickly to notifications (Pielot, Church, & de Oliveira, 2014) might increase distractiblity. Prior work argued that smartphones represent connection cues, "nonconscious triggers to check a mobile device" (Bayer, Campbell, & Ling, 2016, p. 128), for instance, thoughts, visual, or auditory cues. These cues attract users' attention and often result in smartphone use (Bayer et al., 2016). Internal distractions occur when "user's thoughts drift to a smartphone-related activity" (Wilmer, Sherman, & Chein, 2017, p. 4), while external distractions are caused by "environmental cues [that] capture the user's attention" (Wilmer et al., 2017, p. 4), such as the smartphone itself, or its notifications. Distraction–conflict theory states that both internal and external distraction can create the attentional conflict that impairs performance (Baron, 1986). Research has not yet investigated the possible explanations of this smartphone presence effect in detail; thus, it remains unclear whether people are rather visually or internally distracted by the smartphone's presence and how this relates to performance.

2.2.1. Visual distraction potential of smartphones

The mere presence of smartphones imposes a possible external visual distraction. One possible reason for people to look at their smartphone could be the constant expectation of incoming notifications. Previously learned behaviors based on rewards create attentional biases; that is, reward-associated visual stimuli capture attention and are processed preferentially (Field & Cox, 2008). As visual attention guides the selection of visual stimuli for cognitive processing (Kastner & Buschmann, 2017), the visual cue of a smartphone could distract users from their tasks. For instance, research showed that visual cues of smartphones elicited associations of social networks (Kardos, Unoka, Pléh, & Soltész, 2018), underlying the distracting potential of visual smartphones cues. This is not surprising as prior work showed that receiving notifications takes visual attention from the task to the smartphone, affecting performance (Mendoza et al., 2018). Therefore, we expect that smartphone presence leads to visual attention being given to smartphones (H2a), and that visual attention to smartphones negatively affects performance (H2b).

2.2.2. Internal distraction potential of smartphones

Non-visual internal distraction can also arise from the presence of a smartphone. Users' awareness of the smartphone might prompt them to think about their smartphones and what might be going on in their social networks. That is, un-cued thoughts of smartphones could create an internal distraction. This might be because smartphones have become a cue for social connection, which leads to preferential attention being given to the stimuli related to staying connected (Bayer et al., 2016). Hence, a smartphone's mere presence could prompt thoughts that are internally distracting. Because cognitive capacity is limited (Pashler, 1994), distraction supposedly impairs performance. Hence, when explaining the mere presence effect on task performance, it is important to consider the internal distraction potential of smartphones.

In the present study, we addressed internal distraction in the form of vigilance and craving. Smartphone vigilance refers to an "ongoing alertness" that is characterized as "being aware that one can always get connected with others or access information" and a "permanent readiness to respond to incoming smartphone stimuli" (Johannes et al., 2018, p. 2). Previous work indicated that people who were aware of a smartphone lying next to them during experiments, reported higher vigilance and perceived it as distracting (Johannes et al., 2018). Moreover, students reported greater distractibility when they had their smartphones present in a lecture and performed worse on a subsequent test (Mendoza et al., 2018). Taken together, these findings indicate that the smartphone's presence might make smartphones more salient in people's minds. Therefore, we expect that smartphone presence increases smartphone vigilance (H3a) and that higher smartphone vigilance negatively affects performance (H3b).

Furthermore, smartphone presence is likely to create a strong desire to use the smartphone. Prior work showed that visual and auditory social media cues trigger craving for social media (Wegmann, Stodt, & Brand, 2017). In the same way, the visual cues of smartphones could induce craving, that is, a strong desire to use the smartphone; similarly, research indicated that visual cues of rewarding activities or substances increase craving (Field & Cox, 2008; Wegmann et al., 2017)). As craving draws attention away from the task, it can negatively influence performance. Therefore, we expect that smartphone presence increases the craving to use the smartphone (H4a) and that craving negatively impacts performance (H4b).

2.3. Individual differences in distraction

As previous research did not consistently find the mere presence effect, we wanted to explore additional influences on performance. We included individual differences that prior work had identified as relevant to distraction as control variables: trait self-control and fear of missing out (FoMO).[1] Self-control, the ability to disregard impulses and resist temptations (Baumeister & Heatherton, 1996), plays an important role in (high) media use (Hofmann et al., 2017; Reinecke & Hofmann, 2016). Studies also showed that low self-control is associated with more task-switching (Szumowska, Popławska-Boruc, Kuś, Osowiecka, & Kramarczyk, 2018) and quicker (immediate) reactions to smartphone notifications (Berger, Wyss, & Knoch, 2018). Therefore, we expect that self-control influences attention and task performance. Moreover, FoMO refers to the fear of missing out on rewarding experiences that others might be having (Przybylski, Murayama, DeHaan, & Gladwell, 2013), and thus helps explain why people are drawn to their smartphones. For people with high FoMO, it is important to be socially connected (Przybylski et al., 2013). Research showed that FoMO is heightened when people are engaged in tasks, such as studying (Milyavskaya, Saffran, Hope, & Koestner, 2018), or when they are not receiving notifications (Fitz et al., 2019). Therefore, we assume that FoMO would lead to greater susceptibility to distractions and expect that FoMO influences attention and task performance.

2.4. Study overview

The present study addressed the underlying processes of the smartphone's mere presence effect that previous work had revealed. In this study, we explored whether people were distracted by the smartphone's presence because of *visual* attention (looking at the smartphone more often) and/or *internal* attention (higher smartphone vigilance and higher desire to use the smartphone) to smartphones. In addition, we examined how visual and internal attention to smartphones influenced performance. We expected that greater distraction (visual and internal) would help explain the negative effect of smartphone presence on performance.

Unlike previous studies investigating the smartphone's mere presence effect, we used a mobile eye tracker as an objective measure of participants' visual attention. The mobile eye tracker allowed us to understand the role of visual attention and distraction by measuring how much people actually looked at the smartphone. By using mobile eye tracking glasses (ETG), we could create an experimental situation that resembled a natural work/study setting. In contrast to using stationary eye trackers, with which participants are instructed to move as little as possible, the mobile ETG allow people to behave naturally (i.e., move their heads). For a study using ETG, which is a complex research method (in terms of both data collection and data analysis due to the manual coding of videos), we collected a comparatively large dataset ($N = 103$).

We used the cognitive tasks of Thornton et al. (2014). To find out more about the nature of smartphone distraction, we added a different type of task. It remained unclear whether there were any tasks particularly prone to distraction. Therefore, we included a reading task because, while reading, participants may easily become distracted as they could quite easily jump back to the content that they had previously been reading.

[1] In an exploratory approach, we had also included social media self-control failure, social media addiction tendencies, and smartphone dependency. As many of these interindividual difference variables were highly correlated (see Table A4 in the supplemental material), we focused on FoMO, which correlated highly with the other measures, and on self-control, which showed the lowest correlations with the other measures.

3. Method: experiment with mobile eye tracker

In this study, by using the ETG, we could create an experimental situation that resembled a natural work or study setting. The study setup was such that participants were seated at a desk that should resemble a normal work desk at home. Participants had to work on different tasks while wearing the ETG and had a smartphone (or a paper notebook for the control group) placed next to them in their peripheral field of vision. In our study, we used the participants' own smartphones to ensure that they were expecting notifications. Since some research has suggested turning the smartphone off might hinder the smartphone's mere presence effect (Canale et al., 2019), the smartphones stayed turned on. Additionally, we found it important that participants could still receive messages because knowing that notifications could come in would be more likely to create a temptation. In our study, participants first completed the cognitive tasks on paper and then worked on the reading task at the computer while the ETG tracked their gaze. Next, they completed questionnaires on internal attention to smartphones, individual differences, social media use, and demographics. This study was approved by the university's ethics committee. Data is available online via the Open Science Framework[2] and supplemental information is in the supplemental material.

3.1. Participants

Participants were recruited on the campus of a large European university. Data were collected from November 2019 to January 2020. Participants either received 10€ or course credit as compensation. This experiment was performed in the laboratory in individual sessions lasting about 1 h. To avoid problems with the ETG, only people who also could read without glasses were allowed to participate. We calculated power analyses using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) prior to data collection based on the means and standard deviations reported by Thornton et al. (2014). Power analysis revealed that at least 104 people were needed for an effect size $d = 0.65$ (correct cancellations in the additive cancellation task) or 82 people for an effect size $d = 0.74$ (trail making test part B) were needed to reach a power of 0.95. Therefore, we aimed to collect data from 104 people, but we followed through with any appointments already made before closing participant recruitment. In total, 105 participants showed up for the experiment. Two participants were excluded because they were not proficient enough in German to read the instructions and reading task, thus were not able to complete the experiment within the allotted time of 1 h. Hence, the final sample size of 103 participants (79 women) was used for further analysis. Participants were between 18 and 34 years old, with an average age of 22.25 ($SD = 3.13$) years. Nearly all participants were students (102 participants). Fifty-eight participants were in the smartphone group and 45 in the control group. The gender distribution, χ^2 (2) $= 1.84$, $p = .399$, age, t (98.76) $= 0.60$, $p = .549$, and social media use per day, t (77.59) $= -0.01$, $p = .992$, did not significantly differ between experimental and control group.

3.2. Research design and procedure

We used a between-subject experimental design with two groups (smartphone present vs. control group with smartphone absent). Participants in the *smartphone group* had their own smartphone present on the desk and in the do not disturb mode. In this mode, notifications can still arrive, but without causing the smartphone to light up or to make any noise (i.e., no vibration or ringtone). We chose this mode as we were interested in the effect of mere smartphone presence and wanted to control for incoming notifications or calls. In the *control group*, participants' smartphones were absent and there was a black paper notebook of a similar size to a smartphone lying where the smartphone would be (similar to Thornton et al., 2014). To answer our research questions, we investigated the effect of smartphone presence on (a) visual attention to the smartphone (compared to the notebook in the control group) measured by participants looking at the distractor, and (b) internal attention to the smartphone measured by self-reported smartphone vigilance and craving.

Upon arrival in the laboratory, participants turned off the sound on their smartphones and placed them either in their bags (control group) or at a marked position on the desk (smartphone group). As a cover story for placing the smartphone on the desk, we told participants that they would need the smartphone later in the experiment to look something up (similar to Ward et al., 2017). We asked participants in the smartphone group to activate the "do not disturb" mode[3] on their smartphones to limit any uncontrolled distractions from them. Then, we asked participants to place their smartphone on the desk in an exact location marked with transparent tape (similar to Thornton et al., 2014) near the computer screen (see Figure A1 in the supplemental material for an image of the experimental setup). Participants put on the ETG, and we checked that the ETG could detect their gaze without any problems. After the three-point calibration to ensure the ETG correctly captured participants' gazes, we started the recording. The experiment started with the cognitive tasks (digit cancellation task and trail making test) adapted from Thornton et al. (2014) as a paper and pencil tasks. Afterwards, participants were instructed to turn on the computer screen and started the reading task. After reading and answering all questions, we stopped the ETG recording. Participants took off the ETG and proceeded with the survey part of the study. Participants received the compensation and signed up for the debriefing e-mail that was sent out after data collection ended.

3.3. Mobile eye tracking equipment and data preparation

We used the SMI Eye Tracking Glasses 2 Wireless by SensoMotoric Instruments (SMI) for mobile eye tracking with a sampling rate of 60 Hz. The ETG monitored participants' eye movements with built-in infrared sensors. Additionally, the ETG recorded a video of participants' visual field with a HDR (high dynamic range) scene camera located between the eyes. The SMI analysis software BeGaze showed the video of participants' visual field and a gaze cursor that indicated exactly where participants were looking. These eye tracking data videos had to be manually coded. Since we were interested in where each participant looked, we manually coded the gaze points of each fixation by assigning them to areas of interest (AOIs). We defined the following AOIs: (1) task material (referring to the paper and pencil tasks), (2) screen (used for the reading task), (3) keyboard, (4) mouse, (5) distractor (the smartphone or notebook for the control group), and (6) white space (any gaze points not within any of our AOIs). We used BeGaze's Semantic Gaze Mapping function—an algorithm that automatically detects fixations in the video recordings (SMI SensoMotoric Instruments, 2016, 2017)—which allowed coders to go from fixation to fixation through the video and code each fixation. Two coders split the coding of the videos and assigned the appropriate AOI for each fixation during each step of the experiment. We collected the number of fixations on each AOI for each part of the experiment individually. These parts were the digit cancellation task, additive cancellation task, trail making tests A and B, the reading part of the reading and answering parts of the reading task, and the transitions between the tasks, which included the periods at the start, while participants read instructions, and at the end. Thus, we collected data on which AOIs participants looked at during each part of

[2] https://osf.io/g7a96/.

[3] We casually asked participants whether they were familiar with this setting. If participants were not familiar with this setting, we explained it and helped them find it. When participants asked why this setting was required, we simply stated that we needed conditions to be consistent for all participants.

the experiment. The ETG videos were on average 18.24 min long (*SD* = 2.47 min), ranging between 12.25 and 23.47 min. A third coder randomly coded 20% of participants (22 videos) to check whether the coders would provide the same results. The intraclass correlation showed a high inter-rater reliability, ICC = 0.986 (using the "irr" package in R).

3.4. Measures

3.4.1. Measures of attention to smartphones

3.4.1.1. Visual attention to the smartphone. We collected participants' gazes with the ETG and focused on fixations since these are markers for attention (Holmquist et al., 2011, p. 22). To determine visual attention to smartphones, we used the number of fixations, that is how often participants fixated on each grouped AOI. The AOI *tasks* included the task material used in the cognitive tasks and the screen used for the reading task; the AOI *distractor* included the smartphone and notebook; and the AOI *surroundings* included the keyboard, mouse, or white space. Hence, we measured where participants looked (task material, the distractor, or surroundings) during the tasks and transitions between tasks. For our analysis, we used the fixation counts on the distractor during each part of the experiment.

3.4.1.2. Internal attention to smartphones. Smartphone craving was assessed using the desire for alcohol questionnaire adapted for smartphones (Wegmann et al., 2017). This questionnaire was completed directly after the reading task to assess whether participants felt a heightened craving while their smartphone was lying next to them during the cognitive and reading tasks. The scale consists of 14 items (α = 0.89), such as "Using the smartphone now would make me feel less tense," rated on a scale from 1 (*complete disagreement*) to 6 (*complete agreement*). *Smartphone vigilance*, measuring how mentally present the smartphone was during the tasks, was measured by the smartphone vigilance scale (Johannes et al., 2018). Participants rated nine items, such as "During the task, my thoughts often drifted to my smartphone," on a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

3.4.2. Performance measures

We used a combination of tasks in the experiment to measure task performance. For the cognitive tasks, we used those employed by Thornton et al. (2014). The *digit cancellation task* consisted of 20 rows each with 50 numbers. Each row started with a target number and participants first had to circle this number and then cross off any occurrence of the target number in the row. In the more difficult version, the *additive cancellation task*, participants had to cross off any two consecutive numbers that added up to the target number. Participants had 1 min for the digit cancellation task and 3 min for the additive cancellation task. Performance was assessed by the number of lines completed and the cancellation score (number of possible targets minus the mistakes). The *trail making test* was also used by Thornton et al. (2014) and consisted of two parts, with the second being more difficult. Part A consisted of 25 circles spread across a sheet with the numbers from 1 to 25 placed randomly on it. Participants had to draw a line connecting the numbers in the correct order, starting at 1, without lifting the pen. In Part B, rather than containing only numbers, the circles were filled with numbers 1 to 13 and with letters A to L. Participants had to draw the line alternating between the numbers and letters (i.e., 1, A, 2, B, 3, C, etc.) in ascending order. Participants were given 30 s for part A and 45 s for part B. Performance of the trail making test was measured as the number of circles connected in the correct order, and the number of mistakes (incorrect connections) was subtracted). The experimenter recorded the time taken for all four cognitive tasks.

For the *reading task*, participants had to read an on-screen newspaper article on algorithms. The article had previously been tested and was in general perceived as interesting and neither too easy nor too difficult to understand. After reading the text, participants answered 15 questions about it. Participants also indicated whether they already knew the article, rated how interesting they perceived the article to be (1 = *not at all interesting*, 5 = *very interesting*), and what they estimated their prior knowledge on this topic to be (1 = *no prior knowledge*, 5 = *a lot of prior knowledge*). To assess performance in the reading tasks, the number of correct responses was summed and divided by the number of questions, yielding a percentage of correct responses. In addition, we calculated the time taken to read the text and to answer the questions (we used the time recorded by the survey program).

3.4.3. Individual difference measures

FoMO was assessed by participants rating, on a scale from 1 (*do not at all agree*) to 5 (*totally agree*), the two dimensions of offline FoMO, a general fear of missing out (five items, α = 0.70), and online FoMO, the fear of missing out on what happens online (seven items, α = 0.87; Wegmann, Oberst, Stodt, & Brand, 2017). We measured trait *self-control* with the Brief Self-Control Scale (Bertrams & Dickhäuser, 2009; Tangney, Baumeister, & Boone, 2004) in which participants rated 13 items on a scale from 1 (*not at all like me*) to 5 (*very much like me*).

3.4.4. Further survey scales

For descriptive purposes, we included questions on social media use and distraction, as well as socio-demographics. We asked participants to estimate their *daily social media use* in hours per day and which social media platforms they used. Participants indicated their social media notification settings (all, some, no notifications or not staying logged in). We assessed the *perceived glances at the smartphone* by asking people to estimate how often they had looked at the smartphone (smartphone group only). We included *socio-demographic* questions regarding age, gender, education, and occupation. Since we asked participants to not wear glasses during this study, we asked whether they usually needed a visual aid, and whether they could see and read everything without problems. At the end of the study, we asked participants in the smartphone group to check their smartphone in order to keep our promise that participants would need them in the experiment. Participants indicated the number of notifications and the number of social media notifications received during the experiment. Moreover, we asked them to indicate their smartphone screen time per week, if this feature was activated or an app was installed to measure this.

3.5. Data exclusion

For the performance tasks, we coded data as missing when participants did not perform the tasks according to the instructions. Moreover, for the additive cancellation task, we excluded data when participants crossed out more than the two numbers instructed, or when they made more mistakes than points (additive cancellation task: $n = 17$). For the trail making test, we excluded participants who crossed out numbers without following the instructions (some participants drew in visual patterns) or when participants did not draw the trail without interruption (part A: $n = 9$; part B: $n = 4$). In the reading task, we included a question about whether participants already knew the text (because it was a regular newspaper article and had been previously tested). Only two people indicated familiarity with this text, hence we coded this as missing data. Moreover, we checked whether participants had problems with vision during the study. If anyone had indicated serious problems, we would have removed this data from the analysis. No one reported having serious problems in reading/seeing. Regarding the eye tracking data, the ETG could not detect the eyes of some participants over short periods of time, and this was coded as missing data.

4. Results

4.1. Descriptive statistics on participants' smartphone and social media use

Participants reported using social media for about 3.15 h per day ($SD = 1.62$), with a range of 30 min to 8.5 h per day. The most frequently used social media platforms were WhatsApp (100%), YouTube (89%), Instagram (80%), and Facebook (64%). Participants reported that their smartphone notification settings were set to receive either all (17%), some (70%), or no (10%) notifications, while 3% stated that they never stayed logged in. Participants in the smartphone group ($N = 58$) reported they had received an average of 3.65 ($SD = 2.79$) notifications on their smartphones (range 0–12) at the end of the study. Of those, an average of 2.82 ($SD = 2.41$) were social media notifications (range 0–11). Twenty-six participants of these participants reported the screen time provided by their smartphone app, which was on average of 3.90 ($SD = 1.48$) hr per day, ranging from 1.89 to 7.91 h per day. The difference between self-reported and actual smartphone use was on average 0.50 h per day ($SD = 1.28$)(range −2.00–3.41). Self-reported use and actual use was significantly correlated, $r = 0.535$, $p < .005$, and paired t-tests indicated only a marginally significant difference between self-reported and actual use, $t(25) = 1.97$, $p = .059$, $d = 0.38$.

4.2. Effect of smartphone presence on performance

We examined the effect of smartphone presence on performance with two different kinds of task, the cognitive and reading tasks (H1). T-tests were calculated to compare the results of the performance tests for the smartphone and control groups (Table 1). We investigated performance for each of the task measures individually (like Thornton et al., 2014). However, we did not find that participants in the smartphone group performed worse in the cognitive tasks than the control group. Thus, we found no evidence to support H1a.

Regarding the reading task, we descriptively observed that people in the smartphone group performed worse and took longer to answer the questions on the reading task. Indeed, we found a significant difference ($p < .05$) for the time taken to answer the questions by participants in the smartphone group compared with those in the control group ($d = 0.34$). Thus, we found partial support for our hypothesis H1b. Taking the findings on H1a and H1b together, however, we observed no overall effect of mere smartphone presence on performance, and we only found hints of lower performance in the reading task.

4.3. Looking at the distractor and the effect on performance

Participants in the smartphone group estimated they had looked at the smartphone on average about once during the tasks ($M = 1.09$, $SD = 1.16$), ranging from 0 to 5 times. The actual eye tracking data revealed that participants in the smartphone group looked at the distractor up to 9 times in total (see Figure A2 in supplemental material) and on average 1.57 times ($SD = 2.01$) times. About 58% of the people in the smartphone group compared with 44% of the people in the control group looked at the distractor at least once.

In H2a, we expected that people in the smartphone group would look at the distractor (i.e., smartphone) more often than people in the control group would look at the distractor (i.e., notebook). Participants looked only very rarely at the distractor, and, for instance, not at all during the trail making tests (see supplemental material Table A1). Hence, we aggregated the number of fixations across the whole experiment as well as across relevant parts of the experiment, that is, the cognitive tasks, the reading task, and the transitions between tasks (Table 2). We calculated t-tests comparing the visual attention on the distractor using these aggregated measures. Table 2 shows the results of the t-tests calculated to compare the fixations on the distractors between smartphone and control group.

We observed a significant effect ($p < .05$) of smartphone presence during the whole experiment. People in the smartphone group looked at the distractor more often than people in the control group (on average 1.5 times and 1 time, respectively). However, we found no significant difference in attention during either the cognitive or reading tasks. Hence, we found no support for the hypothesis that participants looked more at the distractor during the tasks. However, we discovered a significant difference ($p < .05$) regarding visual attention to the distractor during the transitions. Participants looked at the smartphone ($M = 1.48$, $SD = 1.98$) significantly more than people in the control group looked at the notebook ($M = 0.84$, $SD = 1.09$) during the transitions and breaks in the experiment. In summary, we found that participants in the smartphone group looked more at the distractor overall in the experiment, and especially when they were between tasks rather than working on them. Thus, we found partial support for H2a as we showed that smartphone presence can lead to greater visual attention to the distractor, but only when people are not working on tasks.

Furthermore, we investigated the relation of visual attention to the smartphone and task performance and expected that more fixations at the distractor would result in lower performance (H2b). Since participants only looked very scarcely at the distractor during the task on an individual level, we had aggregated the eye tracking data as described above. Therefore, we needed the performance measures on an aggregated level as well to analyze H2b. To do so, we calculated performance on an aggregated level as well. For the cognitive tasks and reading task we used z-standardized scores of each performance measure. Correlations of the performance and number of fixations on the distractor showed no significant relations. Neither the correlations of cognitive task performance and distractor fixations during the cognitive tasks ($r = -0.133$, $p = .242$), nor the correlation of reading performance and distractor fixations during the reading tasks ($r = -0.161$, $p = .112$), were significant. Thus, we had to reject H2b.

4.4. Internal attention to smartphones and the effect on performance

We investigated internal distraction in the form of self-reported vigilance and craving. The measures of self-reported internal attention, that is, smartphone vigilance ($M = 1.16$, $SD = 0.34$) and craving ($M = 2.23$, $SD = 0.75$), significantly correlated $r = 0.44$, $p < .001$. Regarding *smartphone vigilance*, we expected that participants in the smartphone group would also have a higher self-reported smartphone vigilance (H3a). Results showed that people in the smartphone group reported a significantly higher smartphone vigilance ($M = 1.22$, $SD = 0.42$) than the control group ($M = 1.10$, $SD = 0.21$), $t(101) = 1.78$, $p = .039$, $d = 0.353$. Thus, we found support for our hypothesis that smartphone presence increased self-reported smartphone vigilance (H3a). Additionally, we expected that higher smartphone vigilance would be negatively related to task performance (H3b). We calculated correlations and found no relation between smartphone vigilance and task performance. Vigilance is neither related to cognitive performance ($r = 0.064$, $p = .573$), nor to reading task performance ($r = 0.008$, $p < .934$).[4] Therefore, we rejected hypothesis H3b.

Moreover, we investigated participants' smartphone *craving* as a form of internal attention to smartphones. We expected that people in the smartphone group would have higher craving for smartphones (H4a). However, t-tests showed that craving did not significantly differ between groups, $t(101) = 1.08$, $p = .142$, $d = 0.214$. People in the smartphone group did not report a significantly higher smartphone craving ($M = 2.30$, $SD = 0.80$) than those in the control group ($M = 2.14$, $SD = 0.69$). Moreover, we expected that craving would negatively impact task performance (H4b). We calculated correlations with craving

[4] See Table A3 in supplemental material for the correlation of both measures of internal attention to smartphones and each individual measure of performance.

Table 1
Means, Standard Deviations, and t-Tests Comparing the Performance of Each Task in the Experimental and Control Group.

	N	Smartphone		Notebook		*t*	*df*	*p*	Cohen's *d*
		M	*SD*	*M*	*SD*				
Digit cancellation									
Number of lines	103	12.12	2.12	11.84	1.95	0.68	101	.250	0.135
Cancellations	103	44.45	7.94	42.84	7.21	1.06	101	.147	0.210
Additive cancellation									
Number of lines	86	8.30	2.01	7.72	1.65	1.41	84	.081	0.301
Cancellations	86	17.96	6.89	17.22	7.33	0.47	84	.317	0.104
Trail making test									
Part A	94	9.75	2.71	9.86	2.43	−0.20	92	.421	0.041
Part B	99	12.21	3.33	11.60	3.18	0.92	97	.180	0.187
Reading task									
Correct answers (%)	101	70.99	11.37	73.94	11.58	−1.28	99	.102	0.257
Read Time (min)	101	5.79	1.43	5.95	1.35	−0.56	99	.290	0.112
Answer time (min)	101	2.57	0.62	2.38	0.50	1.71	99	.046	0.342

Note. Reported *t*-Test results refer to one-sided t-Tests.

Table 2
Means, Standard Deviations, and t-Tests Comparing the Fixation Counts in the Experimental and Control Group.

	Smartphone		Control		*t*	*df*	*p*	*Cohen's d*
	M	*SD*	*M*	*SD*				
In total during experiment	1.57	2.01	0.98	1.37	1.68	98	**.049**	0.338
Cognitive tasks overall	0.05	0.23	0.09	0.60	−0.42	100	.337	0.084
Reading tasks overall	0.00	0.00	0.07	0.45	−1.14	99	.129	0.229
Transitions	1.48	1.98	0.84	1.09	1.95	101	**.027**	.387

Note. Reported *t*-Test results refer to one-sided t-Tests.

and task performance and found no significant relation. Craving is neither related to cognitive performance ($r = -0.024$, $p = .832$), nor to reading task performance ($r = 0.033$, $p < .742$). Hence, we had to reject hypothesis (H4b).

4.5. Individual differences and performance

Given the inconsistent findings in previous research, we explored whether individual differences influence task performance and whether controlling for this influence would also show an effect of smartphone presence on performance. For each construct, we calculated multiple regression analyses to investigate the effect of group (smartphone vs. control) and individual differences on performance.[5] We found no significant influence of any individual difference variable and the group (smartphone vs control) on performance (Table 3). Thus, even controlling for individual differences yielded no effects of smartphone presence on performance.

Table 3
Regression analysis of the influence of smartphone presence and individual differences on performance.

	b	*SE*	*β*	*p*	R^2
Fear of Missing Out (FoMO)					
Cognitive tasks overall					.018
Group (smartphone vs. control)	0.80	0.83	.112	.336	
FoMO Online	−0.47	0.63	-.101	.459	
FoMO Offline	0.25	0.63	.054	.692	
Reading tasks overall					.016
Group (smartphone vs. control)	−0.30	0.29	-.107	.302	
FoMO Online	0.17	0.21	.100	.413	
FoMO Offline	−0.04	0.22	-.024	.845	
Self-Control					
Cognitive tasks overall					.020
Group (smartphone vs. control)	0.77	0.81	.107	.348	
Self-control	−0.55	0.63	-.098	.391	
Reading tasks overall					.011
Group (smartphone vs. control)	−0.26	0.29	-.092	.361	
Self-control	−0.12	0.22	-.051	.610	

5. Discussion

This study investigated the effect of the mere presence of smartphones on performance, as well as on visual and internal attention to smartphones. The study extends previous research in two ways. First, we used mobile eye tracking to directly investigate visual distraction. Second, we included a reading task in addition to the cognitive tasks from previous research. Overall, we could not replicate earlier findings that smartphone presence reduced task performance (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017). Eye tracking showed that participants looked at their smartphones, but this occurred only when participants were between tasks. Smartphone presence increased internal distraction, but internal distraction did not affect performance. Overall, our results indicate that the distraction potential of smartphones during task performance is less pronounced than previous research has suggested.

5.1. Smartphone's presence effects on performance

In general, we found no significant effects of smartphone's mere presence on performance. In line with our findings, other prior research also did not find an effect of smartphone presence (Hartmann et al., 2020; Johannes et al., 2018). Due to the smartphone's permanent connectivity, "users may have grown accustomed to being vigilant at all times to a degree that it does not affect executive control anymore" (Johannes et al., 2018, p. 9). Instead, smartphone presence might prompt participants to focus even more (Johannes et al., 2018) and make them try harder to perform well. This effect could even have been

[5] For detailed results of the other individual differences see supplemental material Table A5. We performed the same analysis as presented here and also found that none of the other individual differences had an impact on performance. More important, there was no significant effect of smartphone presence in any of these analyses.

reinforced in our study by the ETG and by setting smartphones to the do not disturb mode, which may have emphasized an artificial experimental setup and may have overridden potential effects of smartphone presence.

Moreover, we found that participants were able to perform equally well whether the smartphone was present or absent. This shows that individuals are not passive victims of smartphone distraction but can ignore their smartphone if the situation demands. An alternative explanation would be that participants in the control group rather suffered from a reduction in performance, because being separated from the smartphone leads to internal processes that distract from the task (Hartanto & Yang, 2016; Markowitz, Hancock, Bailenson, & Reeves, 2019). However, our results on internal distraction contradict this alternative explanation: Smartphone vigilance was higher in the smartphone condition than in the control group, even though both groups did not differ in smartphone craving.

Nonetheless, we found that people with their smartphone present took longer to answer the questions during the reading task. This might also be due to the very different nature and difficulty of the tasks. Previous work suggested that the smartphone's mere presence effects on performance depend on task difficulty (Thornton et al., 2014). Perceptual load theory (Lavie & Dalton, 2014) states that people are more likely to become distracted when a task does not occupy all of their available mental capacity, thus allowing people to devote some of their attention to a distraction. In line with perceptual load theory, the easier task, that is the reading task, may have made people more susceptible to distractions because their full mental capacities were not needed, contrary to the cognitive tasks. However, as the reading task was also the very last task, this may also suggest a decline in attention and control to resist smartphone distractions over time. This is in line with prior work noting that performance differences due to smartphone presence were most pronounced after about 10 min (Mendoza et al., 2018). However, this was the only effect of smartphone presence on performance that we found.

5.2. Visual attention to smartphones

We revealed that smartphones are visually distracting when people do not have to focus on a task. Our results showed that people with their smartphones present looked at them more often than the those with the control distractor (notebook), but only during the transitions (i.e., between tasks, during the instructions, and at the start and end of the experiment). This is in line with perceptual load theory and indicates that people used the time in which attentional capacity was free to let their visual attention go to the smartphone. However, our findings showed that smartphones were not visually distracting when people were required to focus on short, timed tasks.

This contradicts prior work where participants reported they were frequently checking their smartphones and were not able to stop even though they wished to (Johannes et al., 2018). However, another study that observed actual behavior (as our study did) is in line with our conclusion: even when students received messages during a lecture, only 20% looked at the smartphone (Mendoza et al., 2018). Thus, participants showed that they could resist smartphone distraction, if necessary. Our finding may also seem to contradict the literature on media multitasking which suggests that people frequently switch between media and tasks (e.g., Judd, 2014). However, our study differs from these studies in two ways. First, our tasks were rather short. Second, we investigated the effect of smartphone's mere presence, whereas media multitasking studies examined the interaction with media. Hence, in contrast to these studies, participants were not allowed to use the smartphone. Media multitasking requires task switching, which requires participants to disengage, switch, and reengage with their task (Allport & Wylie, 2000), and thus offers far greater potential impacts on performance.

Overall, our results on visual attention indicate that individuals are able to flexibly allocate their attention between task and smartphone according to the situational demands. This challenges the assumption that smartphones automatically distract users from their task and indicates that people are—at least when performing short and demanding tasks—capable of controlling their distraction.

5.3. Internal attention to smartphones

Our findings only showed limited internal self-reported attention to smartphones in the form of smartphone vigilance and craving. Smartphone vigilance increased due to the mere presence of the smartphone. This is in line with prior work finding that a visible smartphone suffices for creating vigilance and distraction in its users (Johannes et al., 2018). Furthermore, results showed that smartphone vigilance and task performance were not related. Similarly, prior work also found no effect of vigilance on performance but argued that smartphone presence may still affect attention (Johannes et al., 2018). Additionally, we found that smartphone craving was not related to performance. In summary, our results indicate that smartphone presence influenced self-reported internal attention to smartphones, but internal attention did not impact performance. Regarding individual differences, our findings indicate no influence of individual differences (self-control and FoMO) and smartphone presence on performance.

5.4. Limitations and future research

The present study is not free from limitations. One limitation is that the experimental setting and the use of the ETG may have influenced the ecological validity of the findings. In order to control for influences on task performance and attention, we used an experimental lab setting. As a result, participants may have worked on the tasks in a more focused way than during self-directed study or work. This, however, also applies to other studies that found an effect of smartphone presence and also used an artificial setup in the lab. Nevertheless, wearing the ETG might have strengthened the effect of the experimental setting, especially for participants who were not used to wearing glasses. Furthermore, since participants were aware that their eyes were being tracked, they might have tried to focus more on their tasks than during normal situations. However, this rigorous experimental setup provided insights into attentional processes that otherwise would not have been possible. A further limitation is that the cognitive tasks were rather short, especially the trail making tests. Therefore, participants may not have had time to look at the distractor. Research on smartphone use indicated that attentional problems emerge after about 10 min (Mendoza et al., 2018). Taken together, further research could extend our findings by investigating distraction in field situations, for instance, at the office or in a library while students are studying.

This study revealed that people looked only scarcely at their smartphone during the experiment. However, participants may not have looked at the smartphone because we predefined a location for the smartphone to control for internal reliability and people may have different preferences and usual locations for their smartphone. Furthermore, the ETG cannot track peripheral glances at the smartphone. It would be possible for people to perceive the smartphone in their peripheral visual field without directly looking at it. Finally, people might not have looked at the smartphone because of the "do not disturb" mode. Thus, participants were aware that there would be no notifications lighting up and, therefore, there would be no need to look at the smartphone. However, in previous studies that found an effect of mere presence, notifications were also turned off: participants had their smartphones turned off (Canale et al., 2019; Thornton et al., 2014; Ward et al., 2017) or in silent mode and facing down (Canale et al., 2019; Ward et al., 2017). Future research may include notifications to investigate the visual distraction potential.

Another limitation concerns the instructions. In the smartphone group, we needed a cover story to explain why participants would need

to place their smartphone on the desk and told them that they would need the smartphone later. In the control group, we did not use a cover story because the notebook that we used as control distractor was a plausible part of the workplace setting. We cannot rule out completely that these differences in instructions had additional effects on attention. However, if this were the case, we would expect that the instructions would magnify a potential distraction by the smartphone rather than reduce it. Given that we did not find differences in attention during task performance, we consider such an influence of the instructions as unlikely.

5.5. Conclusion

In conclusion, this study showed that people are not as bad as often expected in self-controlling smartphone distractions. Our results indicate that performance did not significantly decrease even though a smartphone was present. Moreover, the fact that people only looked at the smartphones during transitions, and not when they had to focus on a task, shows that they can suppress and control distractions if they need to. Smartphone presence increased internal attention to smartphones during the experiment and led to increased smartphone vigilance. However, this did not affect task performance. This study contributes to the understanding of the underlying processes of smartphone distractions. It shows that a smartphone's mere presence can be distracting, but the effect is rather limited. Users seem to be able to manage their distractions to some degree.

Credit author statement

Christina Koessmeier: Conceptualization, Methodology, Data Curation, Formal analysis, Writing – Original Draft, Review & Editing. **Oliver Büttner**: Conceptualization, Methodology, Writing – Review & Editing.

Data availability statement

Data and materials are available online via the Open Science Framework (OSF), doi:10.17605/OSF.IO/G7A96.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chb.2022.107333.

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