Open access • Journal Article • DOI:10.1108/EJM-09-2017-0588

Freedom makes you lose control: Executive control deficits for heavy versus light media multitaskers and the implications for advertising effectiveness

Emma Beuckels, Snezhanka Kazakova, Veroline Cauberghe, Liselot Hudders ...+1 more authors

Published on: 13 May 2019 - European Journal of Marketing (Emerald Publishing Limited)

Topics: Human multitasking

Freedom makes you lose control Executive control deficits for heavy versus light media multitaskers and the implications for advertising effectiveness

Freedom Makes you Lose Control: Executive Control Deficits for Heavy Versus Light Media Multitaskers and the Implications for Advertising Effectiveness

Emma Beuckels, Snezhanka Kazakova and Veroline Cauberghe
Communication Sciences Department, Universiteit Gent, Ghent, Belgium

Liselot Hudders
Department of Communication Sciences/Marketing, Ghent University, Ghent, Belgium

Patrick De Pelsmacker
Department of Marketing, University of Antwerp, Antwerp, Belgium

STRUCTURED ABSTRACT

Purpose

Past research suggests that heavy media multitaskers (HMMs) perform worse on tasks that require executive control, compared to light media multitaskers (LMMs). This paper investigates whether individual differences between HMMs and LMMs makes them respond differently to advertising in a media multitasking context and whether this stems from differences in the ability versus the motivation to regulate one's attention. This is investigated by manipulating participants' autonomy over attention allocation.

Design/methodology/approach

For the first study (n = 85), a between subjects design with three conditions was used: sequential, multitasking under low autonomy over attention allocation, and multitasking under high autonomy over attention allocation. This study investigated the inhibitory control of HMMs vs. LMMs in a very controlled multitasking setting. The second study (n = 91)

replicated the design of study one in a more naturalistic media multitasking setting and investigated the driving role of motivation vs. ability for cognitive load differences between HMMs and LMMs and the consequent impact on advertising effectiveness.

Findings

Study one suggests that HMMs perform worse on a response inhibition task than LMMs after multitasking freely (in which case motivation to regulate attention determines the process), but not after their attention was guided externally by the experimenter (in which case their motivation could no longer determine the process). Study two argues that when motivation to switch attention is at play, cognitive load differences occur between HMMs and LMMs. This study additionally reveals that under these circumstances, HMMs are more persuaded by advertisements (report higher purchase intentions) compared to LMMs, while no differences appear when only ability is at play.

Originality/value

Our two experimental studies confirm and add value to previous academic findings about the negative relation between media multitasking frequency and tasks that demand executive control. Our study contributed to the previous by investigating whether individual differences between heavy and light media multitaskers makes them respond differently towards advertising and whether the driving mechanism of these differences is a lack of motivation or ability to efficiently shift attention.

INTRODUCTION

Due to the increasing accessibility and portability of technologies, a trend that has been rising over the past decade, is media multitasking. According to Deloitte Development LLC (2015), 92% of their respondents are reporting use of another medium while watching television. This major behavioral change in media consumption behavior implies that individuals have to process different streams of information simultaneously. Therefore, it comes as no surprise that the divided attention of media-users raises some concerns amongst researchers, policy makers and also advertisers, as it may constrain a proper processing of the media content and the advertisements embedded in this content (e.g. Garaus et al., 2017; Hwang and Jeong, 2018). The concept media multitasking is broadly defined as the performance of two or more tasks simultaneously, of which at least one involves media (Jeong & Hwang, 2016; Lang & Chrzan, 2015). Both the combined use of media with non-media tasks, as the use of plural media tasks at the same time (either on distinct or on the same device(s)), are considered media multitasking behavior (Jeong & Hwang, 2016). Recent studies have shown that people differ in how often they engage in media multitasking, distinguishing heavy (HMMs) from light (LMMs) media multitaskers. These variations in media multitasking frequency are argued to be related to individual differences concerning executive control, which is necessary for the cognitive control of thoughts and behavior (Baumgartner, Weeda, van der Heijden, & Huizinga, 2014; Cain, Leonard, Gabrieli, & Finn, 2016; Ophir, Nass, & Wagner, 2009). Ophir and colleagues (2009) concluded that HMMs experience a higher interference from irrelevant stimuli and are less efficient at task switching than LMMs. Although it seems counterintuitive that people who often engage in media multitasking are more distracted by their environment and less efficient at navigating it, these studies suggest that HMMs may be less good at controlling and allocating their attention when engaging in media multitasking. Essentially, HMMs appear to apply less executive control compared to

LMMs. Since executive control functions are used to regulate aspirations and to reduce desire (Hoch & Loewenstein, 1991), this study aims to investigate individual differences between HMMs and LMMs and the consequent effectiveness of advertising embedded in a media multitasking context. Because media content very often abounds with persuasive messages, there is a definite need to obtain better insights in the relationship between media multitasking frequency and advertising effectiveness. Several studies have already addressed the link between media multitasking and the effectiveness of persuasive messages (e.g. Angell, Gorton, Sauer, Bottomley, & White, 2016; Garaus et al., 2017; Jeong & Hwang, 2012, 2015). While the differences between HMMs and LMMs have been researched in the past (Minear, Brasher, McCurdy, Lewis, & Younggren, 2013; Ophir et al., 2009; Sanbonmatsu, Strayer, Medeiros-Ward, & Watson, 2013), however, to the best of our knowledge, the implications of their differences for advertising outcomes have not been investigated before.

To resist advertising and to effectively allocate ones attention between different media streams while ignoring others, one needs inhibitory control, which is a component of executive control (e.g. Miyake et al., 2000; Rozendaal et al., 2011). However, media multitasking contexts are characterized by higher cognitive load than sequential media contexts (Jeong & Hwang, 2012; Kazakova, 2014), and research has been shown that inhibitory control can be impaired by a high cognitive load (Wegner, 1994), and by a prior act of high intensity executive control (Hofmann, Schmeichel, & Baddeley, 2012). Therefore, we believe that the difference in response inhibition between HMMs and LMMs is very relevant to be investigated in this research and we expect as for overall executive control (e.g. Ophir et al., 2009), that HMMs would perform worse on inhibitory control tasks when media multitasking than LMMs. Cognitive psychology argues that true multitasking does not exist as people cannot actually engage in two tasks simultaneously (Monsell, 2003). Instead, people constantly shift their attention between the different tasks (Taatgen & Lee, 2003). Interestingly, it is suggested that

inefficiency in attention shifting lies at heart of the performance deficits of HMMs. Based on dual processing theories such as the Elaboration Likelihood Model (ELM; (Petty & Cacioppo, 1986), the present paper aims to explore first whether the individual differences between HMMs and LMMs is caused by a lower *ability* (i.e., capacity to perform a task) or a lower *motivation* (i.e., willingness to perform a task) to optimally control their attention during media multitasking. Because, if motivation would be driving individual differences between HMMs and LMMs, this would suggest that there might be a way to motivate HMMs to perform as well as LMMs. Hence, the underlying mechanism of ability versus motivation in explaining the above-mentioned differences was investigated in both studies. This was done by manipulating autonomy while media multitasking. In the multitasking contexts, we manipulated the autonomy with which respondents could allocate their attention between two tasks. In one condition they could freely switch their attention across both media tasks (as internally motivated), whereas in the other condition respondents were forced to switch their attention guided by the sign of the researcher (motivation to switch thus no longer plays a role). If a motivational aspect is indeed at play, then HMMs should show more deficiencies compared to LMMs when attention switching is internally driven. When attention switching is externally driven, respondents do not have to make the choice themselves, so motivation would no longer play a role in driving the revealed effect.

Previous research additionally revealed that elevated levels of cognitive load encourage impulsive behavior (Vohs & Faber, 2007) and make people more susceptible towards advertising (e.g. Jeong and Hwang, 2012). Furthermore, studies have been indicating that there is a clear negative relation between cognitive load and response inhibition (e.g. Chmielewski et al., 2015; Weidacker et al., 2017). Therefore, further building on the first study, the second study aims to investigate whether differences in cognitive load can be observed between HMMs and LMMs after engaging in media multitasking and whether these make them respond

differently to advertising. Similarly to the first study, study two will also investigate whether a lack of motivation or ability is driving the differences between HMMs and LMMs in the way they perceive cognitive load. Additionally, this study examines how the previous affects their responses to the advertising embedded in the media content.

In the first study, the impact of media multitasking frequency on response inhibition and the moderating role of autonomy is investigated in a very controlled multitasking setting with non-media tasks. This was done in order to control for influences stemming from media characteristics (e.g. media involvement). In the second study, the effect of media multitasking frequency on cognitive load and the moderating role of autonomy is investigated in a naturalistic media multitasking setting, where the respondents were asked to media multitask by simultaneously engaging in computer use and television watching. Additionally, the consequent effect of cognitive load on purchase intention towards the advertised product was measured.

CONCEPTUAL BACKGROUND

Executive control

One's executive control functions are a set of abilities used to regulate thoughts and actions and to modify and control cognition and behavior (Baddeley, 1996). Executive control mechanisms monitor various cognitive sub processes and thereby the dynamics of human cognition (Miyake et al., 2000). These functions are essential for general functioning, as failures in executive control are abundant and often at the core of both individual and social issues in modern life, such as crime, drug addiction, and gambling (Baumeister & Heatherton, 1996; Baumeister, Vohs, & Tice, 2007). Based on the most important postulated functions in academic literature (Baddeley, 1996; Lyon & Krasnegor, 1996), Miyake et al. (2000) distinguished three separable executive functions, namely (1) the shifting of mental sets, (2)

the monitoring and updating of working memory representations, and (3) the inhibition of prepotent responses. The main goal of the current paper is to investigate whether differences in executive control and cognitive load exist between HMMs and LMMs, and whether the latter affects advertising effectiveness. Firstly, as inhibitory control is particularly necessary to resist persuasive messages (Burkley, 2008), and is needed to successfully cope with the complex nature of media multitasking, the first study will focus on this sub dimension of executive control. Secondly, neuropsychological research suggests that executive functions and cognitive capacity are functionally equivalent (Chmielewski et al., 2015) and affect impulsive behavior in similar ways (Friese, Hofmann, & Wänke, 2008). Therefore, the second study will focus on the effect of media multitasking frequency on cognitive load and the consequent impact on advertising effectiveness.

Inhibitory control

Inhibitory control is the ability to inhibit behavioral responses (Norman & Shallice, 1986). Inhibitory control is a component of executive functioning and it allows us to overcome automatic or routine behaviors. For instance, when an error in behavior has occurred, efficient inhibitory control would demand inhibition of this exact behavior in the future.

Theoretically, executive control has been viewed as a resource that gets used up or depleted in different contexts and then replenished over time. An increasing body of research shows that after continuous acts of executive control (e.g. inhibiting emotional responses), one's ability of executive functioning diminishes in the short term, leading to failures. For instance, after controlling their attention or regulating their emotions in one task, people perform worse on a subsequent, unrelated task that requires executive functioning (for a review see Muraven and Baumeister, 2000). Evidence for the depletion hypothesis has been gathered in a variety of contexts indicating that after exercising executive control, people are worse at

performing sequential difficult cognitive tasks (Schmeichel, Vohs, & Baumeister, 2003), more impulsive in spending money (Vohs & Faber, 2007) and more prone to drink when expecting a driving test (Muraven, Collins, & Neinhaus, 2002). The first experimental study of this paper, investigates how media multitasking affects an individual's executive functioning, and more particularly, response inhibitory control in the short term.

Cognitive Load

According to neuropsychological research, both the inhibition of behavior as working memory processes, rely on the prefrontal cortex (e.g. Chmielewski et al., 2015). This is the front part of the brain and is argued to show similar activity when people experience a high cognitive load due to performing simultaneous tasks (Braver et al., 1997) as when people have to exert inhibitory control (Ridderinkhof, Van Den Wildenberg, Segalowitz, & Carter, 2004). Furthermore, the limitation of cognitive capacity or inhibitory control has been shown to similarly affect impulsive choice behavior in three distinct behavioral domains: choice behavior of fruit versus chocolate, potato crisps consumption, and beer drinking (Friese et al., 2008). As media multitasking contexts are typically characterized by a cognitive overload (Jeong & Hwang, 2016; Kazakova, 2014), and the depletion of cognitive resources have been shown to positively affect the acceptance of persuasive communication (Keating & Brock, 1974), advertising effectiveness (Jeong & Hwang, 2012; Segijn, Voorveld, & Smit, 2016) and impulsive behavior (Vohs & Faber, 2007) we believe it is especially relevant to investigate the concept of cognitive load in relation to media multitasking and advertising effectiveness. Therefore, the second experimental study of this paper will investigate the impact of media multitasking on cognitive load and the consequences for advertising effectiveness.

STUDY I: HOW MULTITASKING AFFECTS EXECUTIVE CONTROL OF HMMs VERSUS LMMs? THE MODERATING ROLE OF AUTONOMY

How Media Multitasking Frequency Affects Response inhibition

Recent studies have shown that people differ in how often they engage in media multitasking, distinguishing heavy (HMMs) from light (LMMs) media multitaskers (Ophir et al., 2009). As practice often leads to better performances, one might expect that HMMs would outperform LMMs in multitasking with media. However, several studies indicate the opposite to be true (Cardoso-Leite et al., 2016). These studies found frequent media multitasking to be related to high interference from irrelevant stimuli (Ophir et al., 2009), higher levels of attentional impulsiveness and sensation seeking (Uncapher, Thieu, & Wagner, 2016), working memory limitations and poor cognitive performance (Cardoso-Leite et al., 2016). Ophir and colleagues (2009) were the first to examine differences between heavy and light media multitaskers on a number of cognitive control tasks that require executive control. They reported that HMMs differ from LMMs in the way they attend to environmental stimuli and in their ability to control their responses towards these stimuli. Hereby, they concluded that HMMs are more susceptible to interference from irrelevant stimuli and stimulus representations in memory and, therefore, less efficient at task switching and attention allocation. The findings of these studies suggest that HMMs may have a deficit in the way they control and allocate their attention. The act of switching, focusing and controlling attention is considered a part of one's executive control functions. Lin (2009) therefore argues that people who media multitask frequently have lower executive control resources, making them more easily distracted by irrelevant stimuli in their environment. Following these insights, the study of Baumgartner and colleagues (2014) found a negative effect of media multitasking frequency on executive control. The pioneering study of Ophir and colleagues (2009) has been replicated

quite often, with a large and mixed set of conclusions as a result. Even though the results of numerous studies (e.g. Cain et al., 2016; Cain & Mitroff, 2011; Minear et al., 2013; Sanbonmatsu et al., 2013) supported the premises of Ophir et al. (2009), others failed to replicate some of the original effects (e.g. Baumgartner et al., 2014; Cardoso-Leite et al., 2016; Minear et al., 2013). In order to provide more scrutiny regarding these findings, Wiradhany and Nieuwenstein (2017) set up two replication studies and conducted a meta-analysis investigating 39 studies probing the existence of a relationship between media multitasking and distractibility. The results of these two replication studies generally exposed effects in the same direction as found by Ophir et al. (2009), but markedly smaller. Their meta-analysis revealed that 25 studies found that HMMs had more difficulties inhibiting responses to distractors compared to LMMs, 11 studies revealed results in the opposite direction and three studies found no significant differences in distractibility based on media multitasking frequency. They therefore concluded that there is a weak but significant overall relationship between media multitasking frequency and distractibility.

How Engaging in Multitasking Affects Response Inhibition

Cognitive psychologists agree that multitasking in its truest form is difficult to achieve (Monsell, 2003). Due to cognitive processing constraints, it is close to impossible to engage in two or more tasks simultaneously. Rather than parallel processing, multitasking requires the coordination of different tasks by quickly switching between them (Taatgen & Lee, 2003). Studies have shown that this switching or serial processing principle is also valid when multitasking with media (Yeykelis, Cummings, & Reeves, 2014). Because of the complex nature of media multitasking contexts, the control and regulation of thoughts and actions is essential during media multitasking. As such, executive control is necessary in order to keep one's focus on one medium's content while ignoring the other as a distraction (Brasel & Gips,

2011). Considering the nature of multitasking, it is not surprising that multitasking contexts have been shown to deplete executive control, decreasing performance on subsequent tasks that also require executive control resources (Zyphur, Warren, Landis, & Thoresen, 2007).

When multitasking, constant information monitoring and updating is required to keep track of different content streams as attention wanders between them. At the moment of each switch, processing the content of the medium one switches away from needs to be repressed or inhibited (Hamilton, Vohs, Sellier, & Meyvis, 2011). Without inhibitory control, media multitaskers would not be able to process information optimally. In the context of this study investigating media multitasking and advertising exposure, we believe response inhibition is the most relevant sub dimension of executive control to investigate as it is necessary every time one switches attention between different media sources and to resist to persuasive messages (Hamilton et al., 2011; Rozendaal et al., 2011). Shifting focus from one to another task, also referred to as 'shifting mindsets', is an important characteristic of media multitasking and it has already been shown to deplete one's executive control in the short term (Hamilton et al., 2011). Hence, we expect that this would affect the component response inhibition similarly and therefore hypothesize the following:

H1: Engaging in a multitasking compared to a non-multitasking context will negatively affect response inhibition

The Moderating Role of Autonomy over Attention Allocation

If multitasking impedes inhibitory control, are HMMs more likely to be negatively affected in a multitasking context compared to LMMs, or are HMMs trained to deal with these challenges and perform better than LMMs? In the current section, we discuss whether the depleting effect of multitasking behavior, as predicted in hypothesis one, affects HMMs and

LMMs differently. Furthermore, we predict the potential role of motivation versus ability in driving HMMs' performance deficit in tasks that require self-regulation. According to dual processing theories, optimally processing information depends on both one's *ability* and *motivation* (Chaiken & Eagly, 1989; Petty & Cacioppo, 1986). If ability is present, performance depends on one's *motivation* to optimally apply their ability (Petty & Cacioppo, 1986). Even if HMMs perform worse than LMMs on tasks that require executive control (Ophir et al., 2009; Wiradhany & Nieuwenstein, 2017), this performance deficit could stem either from their lack of *ability* or lack of *motivation* to effectively execute control.

There is converging evidence suggesting that HMMs' observed deficit in executive control stems from differences in attention allocation. In particular, HMMs appear to lack control over their attention, making them more susceptible to distraction by the different media streams they consume. According to Ophir and colleagues (2009), the observed differences in executive control suggest that HMMs have a more *breadth-based* approach to processing information, while LMMs focus their attention more narrowly. Similarly, Cain and Mitroff (2011) found differences in the way they allocate attention and Yap and Lim (2013) reported that HMMs exhibit a higher flexibility in attention allocation compared to LMMs. Lui and Wong (2012) argue that HMMs are better able to integrate and capture information from seemingly irrelevant sources. This broader, more flexible way of allocating attention suggests that HMMs exert less strict control over what they see as their primary task and what they see as distractions (Lin, 2009). Going beyond simple cognitive paradigms, Ralph and colleagues (2014) used self-reports of real life experiences to investigate the link between media multitasking frequency, attention failures, and mind wandering. They found no correlation with actual cognitive errors (long-term memory failures) in support of the premise that HMMs' deficits are not the result of inability. This might indicate that HMMs have more difficulties to ignore distraction by other media streams when media multitasking. The above mentioned

studies suggest that HMMs would have more difficulties than LMMs to inhibit prepotent behavior and that this difference stem from attentional rather than cognitive factors. We explore in more detail the role of attention allocation in driving the expected differences in response inhibition, by experimentally manipulating the autonomy over attention allocation.

The allocation of attention may be driven by both external (e.g. Facebook pop-up notification) and internal (e.g. the personal need to seek for additional information online) factors (Lang, 2000). In some contexts, the opportunity to freely allocate one's attention is high. Media multitasking contexts fit well into this category. For example, a media multitasker can freely decide when to switch from one media source to another (high autonomy). In situations where perceived autonomy is high, attention allocation is not only driven by one's ability but also by internal factors such as goals or motivation. For example, differences in one's intrinsic motivation to avoid distractions (e.g. vivid media stimuli) might result in high or low control over attention allocation even if the ability to control attention is present. If attention allocation is driven by external factors (e.g. an experimenter who tells participants exactly when to switch between tasks), the autonomy over attention allocation is limited. In this case, allocation should be driven primarily by one's ability. Thus, taking away the autonomy one has over their attention in a given context would mean taking away internal factors, such as motivation, that could play an important role in how much control they exert over attention allocation.

Therefore, under low autonomy conditions of attention allocation, we assume that only the ability to exert control would drive any differences in executive control. Under high autonomy conditions, however, it would be both the ability and the motivation to exert control that could drive these differences. Manipulating the level of autonomy over one's attention would, therefore, allow us to determine the role of motivation vs. ability to exert attentional

control in driving the before mentioned executive control differences between HMMs and LMMs.

If an inherently lower motivation to inhibit prepotent behavior indeed drives the assumed differences, HMMs would not be as motivated as LMMs to execute inhibitory control when given high autonomy over their attention allocation. Thus, if motivation rather than ability is the underlying cause of the expected differences in response inhibition, we hypothesize that the level of autonomy over attention allocation will moderate the effect on the level of response inhibition for HMMs and LMMs.

H2: When multitasking with high (vs. low) autonomy over attention allocation, media multitasking frequency will have a negative effect on response inhibition. This effect will be less apparent when multitasking with low autonomy over attention allocation.

METHOD

Participants, Design and Procedure

We conducted a laboratory experiment in which 85 respondents of which 26 were male, participated individually. Following numerous other media multitasking experimental studies (Fox, Rosen, & Crawford, 2009; Xu, Wang, & David, 2016; Yeykelis et al., 2014) and due to the knowledge that media multitasking behavior is specifically popular and prevalent amongst students (David, Kim, Brickman, Ran, & Curtis, 2015), all of our respondents were undergraduate students at a large European university, aged between 20 and 30 years old (M = 21.93, SD = 1.72). A between subjects design with three conditions was used: sequential, multitasking under low autonomy over attention allocation, and multitasking under high autonomy over attention allocation. Participants were randomly assigned to one of these three experimental conditions. Media multitasking frequency was used as an independent continuous

variable in the analyses. It was therefore not manipulated, but measured among participants using a self-developed short version of the Media Multitasking Index (MMI; Ophir, Nass, and Wagner 2009; for more information, see 'Measures' section and appendix 1). The mean MMI score was 2.81 (SD = .80), which is similar to the mean of the original MMI by Ophir and colleagues (2009) when considering the full number of media types included.

First, respondents had to complete three tasks, either sequentially or simultaneously (with or without autonomy over attention allocation). Immediately after completion of these tasks, they were asked to complete a paper version of the Stroop task (Stroop, 1992), measuring their ability to inhibit prepotent responses. Afterwards, they were asked to fill in a short self-reported questionnaire consisting of a short version of the MMI , perceived autonomy in the multitasking context, and demographic variables.

Stimuli

In the first study we wanted to investigate the hypothesized relation between media multitasking, response inhibition and the role of motivation vs. ability to inhibit control. In order to control for media-related effects, the first study investigated the hypothesized effects in a very controlled setting. Therefore, based on the laboratory study of Hecht and Allen (2005), three non-media tasks were selected to manipulate the multitasking conditions: an arithmetic task, a sorting task, and a letter-circling task. Just as for television watching and computer use (cf. study II), these tasks are text-based and demand one's ability to extract and comprehend relevant information. Participants were given brief trial blocks in order to familiarize themselves with the tasks they were about to complete during step two. When performing the tasks in the multitasking context, people were required to switch their attention between the three tasks and had to suppress thoughts about one task, when conducting another. Therefore,

executive control as well as inhibitory control was needed just as in a media multitasking context.

In the control condition (n = 28), participants were asked to complete the three tasks sequentially (one after the completion of the other) in an order that was randomized between participants. In the multitasking condition, participants had to complete these tasks simultaneously, in which the switching between tasks was either instructed (representing low autonomy over attention allocation) or a free choice (representing high autonomy over attention allocation). As such, in the low autonomy over attention allocation condition (n = 28), participants were asked by the experimenter to switch between tasks in clockwise fashion. Switching instructions were based on a pattern of predefined intervals of 20, 30, or 40 seconds (Hecht & Allen, 2005). This made it impossible for the experimenter to influence the results even though she was not naïve to the hypothesis. The experimenter was present during all experiments, regardless of the conditions. In the high autonomy over attention allocation multitasking condition (n = 29), participants were told they had full control over how they spread their attention between the three tasks within the 12 minutes time frame. Still, they were encouraged to multitask through instructions.

Measures

Response inhibition was measured by a verbal version of the Stroop task (Stroop, 1992). Participants were presented a list with a multitude of six color words, written in corresponding or non-corresponding colors. Participants' task was to verbally name the color in which every word was printed, while ignoring the word's actual meaning. The total time (in seconds) it took participants to name every color on the list was used to measure the amount of self-regulatory resources available.

Media multitasking frequency was measured by a short version of the MMI (Ophir et al., 2009). However, as this index requires individuals to rate up to 121 media combinations in total, the length of the MMI has been identified as its main practical problem (Baumgartner, Lemmens, Weeda, & Huizinga, 2017). Based on previous research we shortened the media multitasking index significantly (Baumgartner et al., 2017). We composed and validated a shorter version of the index which significantly correlated, $r = .454$, $p < .001$ with the original, long version of the MMI (for more information, see appendix 1).

Perceived autonomy was measured with 5 items on a 7 point Likert scale: I felt like it was not my own choice whether to multitask or not, I didn't really have a choice in what order to perform the tasks, I felt like I had to switch between tasks, I multitasked because I had no choice, I switched between tasks because I had to. These items were recoded and summed ($\alpha = .74$) so that a higher score on the perceived autonomy scale indicates a higher perceived autonomy in attention allocation.

RESULTS

Manipulation Check

The manipulation check was significant for perceived autonomy between the two media multitasking conditions. An independent t-test showed that the participants of the low autonomy condition reported to have less choice over the switching ($M = 2.02$, SD = .633) than the participants in the high autonomy condition ($M = 4.50$, SD = 1.05); $t(55) = -10.75$, $p < .001$.

Hypotheses testing

An independent t-test, indicated that the participants of the sequential condition ($M = 94.18$, SD = 13.43) needed significantly less time to perform the Stroop Task than the participants of the multitasking conditions ($M = 107.79$, SD = 15.46), $t(83) = -3.98$, $p = .000$.

As more time needed to perform the Stroop Task implies more difficulties to inhibit prepotent behavior, hypothesis one is supported and we can infer that engaging in multitasking negatively affects response inhibition.

Further, we examined whether the interaction effect of media multitasking frequency and level of autonomy on response inhibition was significant. This was done by a moderation analysis (Hayes 2013; model 1, 5,000 bootstraps; 95% bias-corrected confidence intervals). The variable media multitasking frequency, measured by the MMI, was used as a continuous variable in all following analyses in both study I and II. The interaction term was statistically significant indicating that the effect of media multitasking frequency on the Stroop performance changes across different levels of autonomy, $B = 14.29$,$SE = 5.94$, $t(48) = 2.41$, $p = .02$. Next, as illustrated in figure 1, we conducted a spotlight analysis to decompose the interaction term and examined the effect of media multitasking frequency at different levels of autonomy. First and as expected, the effect of media multitasking frequency on the total time it took to complete the Stroop task was significant when autonomy was high, $B = 10.84$,$SE = 4.39$, $t(48) = 2.47$, $p = .017$. In contrast, the effect of media multitasking frequency on the Stroop completion time was not significant when autonomy was low, $B = -3.45$,$SE = 4.00$, $t(48) = -.86$, $p > .38$. The more time needed to complete the Stroop Task, suggests that HMMs had less inhibitory control than LMMs *only* under conditions of high autonomy, thus when motivation is at play. Under low autonomy conditions, so when only ability is expected to be at play, there is no significant difference between HMMs and LMMs in response inhibition (hypothesis two).

PLACE FIGURE ONE ABOUT HERE

DISCUSSION

The expectation that engaging in a multitasking context obstructs inhibitory control in the short run was confirmed by this experimental study. As expected, frequently shifting ones mindset between different tasks resulted into depleted inhibitory control, compared to performing tasks sequentially, without shifting attention away before completion. The results additionally indicate that only when attention allocation of the participants was guided internally (when motivation should factor into one's performance), HMMs had less self-regulatory resources left than LMMs. This difference was not observed when the motivational aspect was removed from the participants by externally deciding when they had to switch their attention. This supports the assumption that individual differences in motivation rather than ability is driving the differences between HMMs and LMMs to execute inhibitory control.

The impairment of response inhibition is often considered as a risk factor for various negative behavioral and impulse-control outcomes such as binge eating, unhealthy food choices, alcohol and drug use (Baumeister et al., 2007; Friese et al., 2008; Heatherton & Baumeister, 1991). The results of this study argue that simply engaging in multitasking depletes inhibitory control, which raises some concern about the wellbeing of HMMs. Future research should however investigate whether this depletion of inhibitory control is lasting and cumulative in the long run. Furthermore, the current study reveals that motivation rather than ability is driving the differences in depletion between heavy and light media multitaskers. This is a promising finding, as it suggests that that heavy media multitaskers could possibly be motivated to allocate their attention more efficiently. To conclude, one could expect that HMMs have a specific interest in media tasks, causing them to allocate their attention inefficiently when multitasking freely. However, the respondents of this study multitasked with regular, non-media related tasks, which enabled us to exclude influences stemming from media involvement. The second study will further investigate the moderating role of autonomy over attention allocation in a more naturalistic media multitasking setting.

STUDY II: HOW MEDIA MULTITASKING FREQUENCY AFFECTS ADVERTISING EFFECTIVENESS: THE MEDIATING ROLE OF COGNITIVE LOAD

As explained before, neuropsychological research has been arguing that executive functions and cognitive capacity are functionally equivalent. The purpose of Study II was therefore twofold. Following the insights of study I, we wanted to investigate whether individual differences in cognitive load between HMMs and LMMs exist as well, and whether these consequently affect advertising effectiveness, and more specifically purchase intention towards an advertised product.

How Media Multitasking Frequency Affects Cognitive Load

As every media type abounds with persuasive messages, the relationship between media multitasking and advertising effectiveness received increasing attention over the past years (Angell et al., 2016; Chinchanachokchai, Duff, & Sar, 2015; Jeong & Hwang, 2012). Pilotta and Schultz (2005) emphasize that all media content, but particularly advertising content might be affected by media multitasking behavior. Early studies investigating the impact of media multitasking on advertising effectiveness mostly focused on its deleterious effect on outcomes such as ad recognition and recall, due to depleted cognitive resources of the media users (e.g. Zhang, Jeong, and Fishbein 2010; Armstrong and Chung 2000). Though, the depletion of these exact resources has recently been shown to lead to lower abilities to counterargue and consequently to more positive attitudes towards advertising embedded in multitasking contexts (Jeong & Hwang, 2012; Segijn et al., 2016). The consideration of personal traits such as media

multitasking frequency could, however, offer clearer directions for advertisers on how to efficiently target consumers in today's media landscape.

The perceived cognitive load consists of the total amount of mental resources required to perform a certain task (Paas & Van Merriënboer, 1994). Previous studies already confirmed that media multitasking contexts are typically characterized by a cognitive overload (Jeong & Hwang, 2016; Kazakova, 2014). Additionally, it is argued that HMMs are more distracted than irrelevant stimuli (Ophir et al., 2009; Wiradhany & Nieuwenstein, 2017). This makes it reasonable to expect that the cognitive task load would be higher for them (compared to LMMs) due to frequent reconfiguration between resources, which is followed by switching costs according to Monsell (2003). We thus expect that HMMs (vs. LMMs) would experience a higher cognitive load when media multitasking due to lower attentional control. In line with the first study, we wanted to investigate whether this expected difference in cognitive load would be driven by a lack of motivation or ability to control their attention.

An experimental study of Kononova, Joo, & Yuan (2016) revealed that media multitasking with high autonomy was cognitively more depleting for low, compared to high polychronics (people with a preference to multitask). However, their respondents multitasked with Facebook and an online article on a laptop. This implies that the media content of one task was not visible anymore when switching to the other. This is however not always the case, as people often multitask with media that are not being paused when switching to another medium (e.g. television watching, radio listening, video gaming). When switching away from these types of media tasks, their content does not stop streaming and has to be ignored in order to successfully process the other. As argued in study I, it is expected that HMMs have more difficulty to ignore other media streams, as they have been shown to be more easily distracted by irrelevant stimuli than LMMs (Ophir et al., 2009; Wiradhany & Nieuwenstein, 2017). Following the reasoning of study I, we believe this to be a result of differences in motivation

rather than ability. Therefore we believe that, when autonomy is high (and motivation is thus at play), HMMs would experience a higher cognitive load than LMMs. When autonomy is low however (and only ability is at play) we expect no difference to occur as the attention allocation in this case is externally driven and HMMs would not switch their attention more than LMMs.

H3: When media multitasking with high (vs. low) autonomy over attention allocation, media multitasking frequency will positively affect cognitive load.

How Cognitive Load Affects Persuasion

People with few cognitive resources have been shown to be more likely to yield to temptation and to buy impulsively. Shiv and Fedorikhin (1999) argued that when cognitive resources are highly assessed, people will more easily make emotional rather than thoughtful choices. Experimental studies of Vohs and Faber (2007) confirm this by revealing that people increasingly reported impulsive buying behavior under conditions of cognitive depletion. In order to resist the persuasive attempt of advertising, one needs to inhibit one's natural instinct and has to come up with counterarguments. Two other laboratory studies argued that a cognitive load when media multitasking, makes it harder for media users to counterargue the advertising content (Jeong & Hwang, 2012; Segijn et al., 2016). Consequently, these studies illustrated that a lower ability to counterargue, and thus to resist persuasive attempts, resulted into higher brand attitudes, advertising attitudes and purchase intentions. Hence, as we expect HMMs (vs. LMMs) to be more cognitively depleted when media multitasking with high autonomy, we believe that it would be harder for them to resist advertising. As illustrated in figure two and as hypothesized before (cf. hypothesis three), we believe that autonomy over attention allocation will moderate the effect of media multitasking frequency on cognitive load. As argued above, we additionally expect that the high cognitive load for HMMs will make

them more susceptible to advertisements, resulting into higher purchase intention. Accordingly, we composed the following hypothesis:

H4: When multitasking with high (vs. low) autonomy over attention allocation, media multitasking frequency will positively affect cognitive load, which consequently will lead to higher purchase intentions for the advertised brand.

PLACE FIGURE TWO ABOUT HERE

METHOD

Participants, Design and Procedure

As for study I, we conducted a laboratory experiment in which 91 respondents participated. Unlike for study I, we did not recruit respondents at the University (undergraduate students), but respondents were invited by email or Facebook to join the experiment (snowball sampling procedure). Accordingly, the sample of this study did not entirely consist of undergraduate students, although the average age of the participants (22.64; SD = 1.81) was similar to the one of study I and 56% of the participants were women. All experiments were conducted individually to avoid additional distractions by other participants. No incentives were provided.

The same between subjects design with three conditions (sequential; n = 31, multitasking under low autonomy over attention allocation; n = 30, and multitasking under high autonomy over attention allocation; n = 30) as for study I was used. The variables autonomy and media multitasking were manipulated. In the sequential condition, participants were exposed to one medium after the completion of the other.. Participants were randomly assigned to one of the three experimental conditions and the order of the media exposure was

randomized between participants. In the multitasking conditions, the participants were exposed to the two media at the same time. The media multitasking frequency was measured per participant and used as a continuous variable in the analyses. As for study I, the mean MMI score (M= 2.43, SD= .70) was similar to the mean of the original MMI by Ophir et al. (2009) when considering the full number of media types included.

Stimuli

In the second study we wanted to approximate a naturalistic media multitasking environment. Therefore, we provided both a television and a portable computer, representing a very popular media multitasking combination (Oviedo, Tornquist, Cameron, & Chiappe, 2015). On the television screen, a six minute fragment of a neutral television show was presented. On the computer, participants were asked to surf on a website, consisting of several informational articles. These articles were originally retrieved from the Greenpeace website, but incorporated in a self-created website from the non-existing organization *'Planet'*. The original name was not used, to control for preconceptions towards the organization Greenpeace. Within this website, a self-designed advertising banner (see figure three) was included, promoting the non-existing tea brand, '*Fruitea'* with the tagline '*Invite nature at your table everyday'*.

PLACE FIGURE THREE ABOUT HERE

The level of autonomy was manipulated exactly as in study I. In the condition with low autonomy we wanted to create a scenario where only ability could drive the effects. Therefore, participants were asked to switch between tasks by the experimenter, based on predefined intervals (Hecht & Allen, 2005). In the media multitasking condition with high autonomy,

participants were again told to have full control over their division of attention between the two media, within the six minutes time frame. In this condition, their motivation to allocate and switch their attention as well as their ability was at play.

Measures

The perceived cognitive load was measured with a six-item seven-point Likert scale, adopted from the NASA Task Load Index (Hart & Staveland, 1988) (α =.71). Purchase intention was measured by a three-item seven-point Likert scale by Putrevu and Lord (1994) (α =.95). Participants had to indicate to which extent they agreed with statements such as "It is very likely that I would buy the brand Fruitea". In addition, we included the variable 'product involvement' as covariate as this can largely predetermine purchase intentions regardless of conditions. This was measured by a five-item seven point Likert scale (Zaichkowsky, 1985). Consequently, media multitasking frequency and the demographic variables were measured exactly the same as in study I.

RESULTS

Hypotheses Testing

An independent t-test indicated that the participants of the sequential condition (M = 3.01, SD = 1.09) perceived less cognitive load than the participants of the media multitasking condition (M = 3.78, SD = 1.32), $t(88) = -2.76$, p = .007. To test hypothesis three, the moderating impact of autonomy over attention allocation on the impact of media multitasking frequency on cognitive load was examined (Hayes 2013; Model 1, 5,000 bootstraps; 95% bias-corrected confidence intervals). As shown in figure four, the results reveal that the interaction term was statistically significant, indicating that the effect of media multitasking frequency on the cognitive load changes across different levels of autonomy, $B = 1.36$,$SE = .44$, $t(56) = 3.09$,

p = .003. Next, we conducted a spotlight analysis to decompose the interaction term and examined the effect of media multitasking frequency at different levels of autonomy. As expected, the effect of media multitasking frequency on the cognitive load was not significant when autonomy was low, B = -.50 ,SE = .31, t(56) = -1.60, p > .12. In contrast, the effect of media multitasking frequency was significant when autonomy was high, B = .86 ,SE = .31, t(56) = 2.78, p = .007.

PLACE FIGURE FOUR ABOUT HERE

Further on, to test hypothesis four, we examined whether the indirect effect of media multitasking frequency on purchase intention through cognitive load was moderated by autonomy. The moderated mediation analysis (Hayes 2013, Model 8, 5,000 bootstraps; 95% bias-corrected confidence intervals) revealed that the index was significant, *ab* = .266, SE = .18, 95% LLCI = .013, 95% ULCI = .752. Based on this result, and as illustrated in figure five, we can infer that, even though the direct effect of media multitasking frequency on purchase intentions is not significant, *c'* = -.51, SE = .32, 95% LLCI = .115, 95% ULCI = -1.149, the indirect effect through cognitive load, does significantly differ, depending on the level of autonomy. When autonomy was high, we found a significant positive indirect effect of media multitasking frequency on purchase intentions through cognitive load, *ab* =.166, SE = .125, 95% LLCI: = .003, 95% ULCI = .516. This means that when the respondents had high autonomy over attention allocation, HMMs perceived higher levels of cognitive load compared to LMMs, resulting into higher purchase intentions towards the advertised product. On the contrary, when autonomy was low, this indirect effect was eliminated, *ab* = -.100, SE= .089, 95% LLCI: = -.347, 95% ULCI = .022. From the latter we can infer that, when the respondents had low autonomy over attention allocation, the difference in cognitive load and consequently

purchase intention, did not significantly differ for HMMs compared to LMMs. As shown in figure five, our data suggests that heavy (vs. light) media multitaskers experience a higher cognitive load under conditions of high autonomy, which, in turn, increases purchase intention. However, this is only the case under conditions of high autonomy: when the media users can freely allocate their attention. Thus, when motivation is at play, heavy media multitaskers have higher purchase intentions compared to light media multitaskers. This process is not significant under conditions of low autonomy, when only ability is expected to be at play.

PLACE FIGURE FIVE ABOUT HERE

DISCUSSION

The results of study II (for an overview of all results, see table one) suggest that individual differences between heavy and light media multitaskers also occur in naturalistic media multitasking setting. As for the inhibitory control in study one, HMMs also were more cognitively depleted than LMMs, when they had the freedom to switch their attention between the tasks. As similar effects were found cognitive load and inhibitory control regardless of whether respondents multitasked with media or regular tasks, we can infer that the identified effects were not driven by media related characteristics.

The high cognitive load for HMMs, compared to LMMs when media multitasking with high autonomy over attention allocation, resulted into higher purchase intentions towards the advertised brand. We can thus infer that a cognitive load, due to inefficient task switching behavior of HMMs, makes them more susceptible to advertisements. These findings can be of great interest of both advertisers and media-users. The latter group may not be aware of the fact that frequently multitasking makes them more susceptible towards advertising. Providing more information on the consequences of media multitasking may motivate them to allocate their attention more efficiently, which could make them preserve inhibitory control and resist

advertisements better. The results of the second study also provide relevant information for marketeers, whose main goals are to encourage people to purchase their products. If they have information about the media use behavior of their targets, which is quite achievable nowadays, they could aim to specifically target HMMs when they are engaging in media multitasking.

PLACE TABLE ONE ABOUT HERE

GENERAL DISCUSSION

Media multitasking has received widespread attention from different research fields over the last decade. Socio-demographic studies have stressed its rapid increase and prevalence, especially among young people (Deloitte Development LLC, 2015; Rideout, Foehr, & Roberts, 2010). In response to this fast changing media landscape, experimental research has explored a variety of topics: from its detrimental effects for learning and memory (Hembrooke & Gay, 2003; Pool, Koolstra, & Van der Voort, 2003), to its underlying motivations and obtained gratifications (Wang & Tchernev, 2012) and its implications for the effectiveness of persuasive communication (e.g. (Beuckels, Cauberghe, & Hudders, 2017; Chinchanachokchai et al., 2015; Hwang & Jeong, 2018; Segijn, Voorveld, & Smit, 2017). Our study contributed to the previous by identifying the underlying mechanism driving the previously revealed individual differences between HMMs and LMMs and by investigating its implications for advertising effectiveness.

Building up on the negative link between media multitasking frequency and various outcomes as is shown in many previous studies, both of our laboratory studies reveal that individual differences between HMMs and LMMs occur when performing tasks simultaneously with high autonomy. The first study revealed that, only when participants had

the freedom to switch their attention between the tasks (based on their motivation), HMMs performed worse on a Stroop task. When they were however instructed to switch between the tasks and their own motivation to switch no longer was at play, there were no significant performance differences on the Stroop task between HMMs and LMMs. This means that HMMs were worse than LMMs at inhibiting prepotent behavior when they were not directed when to switch attention. The second study similarly revealed that when respondents could internally decide when to switch attention between media tasks, it was cognitively more demanding for HMMs compared to LMMs. The fact that these differences were only established when the respondents could freely choose when to switch attention from one task to another, implies that it is their switching behavior, rather than a personal trait, that creates deficits for HMMs. If they were inherently worse at switching than LMMs, the differences would have also occurred when they were instructed to switch. An interesting finding that can be derived from both studies, is that LMMs were more depleted both in inhibitory control and cognitive resources under condition of low autonomy over attention allocation. This suggests that LMMs were more efficiently processing the media content when they could freely allocate their attention, than when they were forced to switch based on the predefined intervals. This could mean that LMMs switched less when they had the freedom to allocate their attention compared to when they were forced to do so. However, whether LMMs truly switch their attention less frequently under conditions of high autonomy should be investigated in future research.

It has to be noted that Kononova and colleagues (2016) similarly investigated the impact of autonomy over attention switching for HMMs and LMMS when media multitasking. Their study made people multitask with an online website and Facebook and indicates that HMMs (vs. LMMs) remembered the online content better when media multitasking with low autonomy over attention allocation. This is however a very different conclusion compared to

the ones of our study. Therefore, we want to discuss the probable drivers of these divergent outcomes. First of all, our studies used different media types and research has been arguing that different media combinations and their specific characteristics can drive media-effects. A study of Beuckels and colleagues (2017) specifically found that the exact same media multitasking situation with altered media types (Facebook versus an online website) resulted in different outcomes. As the manipulation of media types is also different from the study of Kononova and colleagues (2016) and ours, media related characteristics could be a possible explanation for our divergent results. A second difference between our studies and the one of Kononova and colleagues (2016), is the different manipulation of autonomy over attention switching. In the low autonomy condition, Kononova and colleagues (2016) asked the respondents to switch only four times. This was based on a pretest, where the respondents reported to switch between the media four times on average. However, when a task is complex, as is the case in a media multitasking context, less resources are available to process temporal cues, which could lead to misinterpretations. In a laboratory study, Brasel and Gips (2011) filmed each of their participants for 45 min when media multitasking and consequently asked them to estimate their switching rate. This revealed that participants had little insight into their switching activity, and reported their switching behavior at an average rate of only 12 percent of their actual switching. Therefore, we believe that the manipulation of four switches between the different media streams rather represents a sequential media use than a media multitasking situation. The last difference between our studies can be found in the fact that they measured polychronicity (a person's preference to perform different tasks simultaneously) while we measured media multitasking frequency. Even though there is a probable overlap between the two, a polychronic person does not necessarily have to be a heavy multitasker and vice versa. The difference between them is most probably driven by media involvement, which would imply that a high polychronic person might not be as willing to switch between media tasks as

a heavy media multitasker is. This might be a possible explanation for the fact that half of the respondents of Kononova and colleagues (2016) did not switch away from the online website, which might have in turn affect their content recognition results and led to different outcomes compared to our study.

Practical Implications

From a practical point of view, understanding the mechanisms that are driving the effects of media multitasking on advertising effectiveness for different groups of media-consumers could make it easier for practitioners to efficiently plan their media campaigns. Based on the findings of our study we can derive that HMMs will be more depleted in cognitive resources and inhibitory control when media multitasking, which makes them more prone to advertising compared to LMMs. This knowledge is of great importance for advertisers, who could, based on this, aim to target HMMs more often than LMMs. It could consequently be recommended for advertisers to increasingly focus on younger media-users, as they are known to media multitask more frequently than older ones (Carrier, Cheever, Rosen, Benitez, & Chang, 2009), Previous empirical evidence additionally indicates that media multitasking behavior is more common in the early part of the day (Voorveld & Viswanathan, 2015), which would make it more appropriate for advertisers to strategically target heavy media multitaskers at these moments, compared to evenings.

As argued above, younger people are media multitasking more often than older ones. Combined with the fact that their advertising literacy is not as well developed as for older people (De Jans, Hudders, & Cauberghe, 2017), it might make them particularly susceptible to advertising in a media multitasking context. It might therefore be important for policy makers to inform (young) media-users about their increased susceptibility towards advertising when media multitasking frequently.

Limitations and Future Research

In our second study, it would have been interesting to discover whether the findings of study I remain constant in a more naturalistic setting. However, as argued before, performing a Stroop task is effortful and demands a lot of executive control (Stroop, 1992). As argued by Hofmann and colleagues (2012), response inhibitory control can be negatively affected as a consequence of prior high intensity engagement of executive control functions. It would therefore be impossible to distinguish whether the advertising effectiveness would be mostly affected by the performance of the Stroop task or of the engagement in media multitasking, which are both actions that deplete the executive control functions in the short term.

Furthermore, by manipulating the autonomy over attention allocation, the experimental studies I and II revealed that the driving mechanism of the difference in inhibitory control and cognitive load between HMMs and LMMs is a lack of motivation. However, future research should consider measuring response inhibition or cognitive resources after repeatedly engaging in media multitasking contexts, in order to test whether this depletion is cumulative and lasting in the long-term. This might be the reason for the baseline difference between HMMs and LMMs in executive control and would make it easier to argue about the causality of the phenomena.

As argued in the literature review, executive control exists of different components (Miyake et al., 2000). The current study focused on the impact of media multitasking frequency on response inhibition, but it would be interesting for future research to investigate whether media multitasking frequency equally affects the other sub dimensions. It was not possible to measure inhibitory control and advertising effectiveness in the same study, as performing a Stroop task is effortful and the accompanied cognitive depletion would most likely affect the advertising effectiveness if measured in the same study. However, we relied on

neuropsychological research arguing that inhibitory control and cognitive capacity are functionally equivalent in predicting impulsive behavior. The fact that both variables were equally affected over the two studies, supports this assumption. Additionally, the impairment of response inhibition has been shown to predict a large number of other behavioral and impulse-control outcomes such as binge eating, unhealthy food choices, alcohol and drug use (Baumeister et al., 2007; Friese et al., 2008; Heatherton & Baumeister, 1991). However, the current study only focused on one particular advertising outcome, namely purchase intention. Future research should consider investigating other consequences of heavy media multitasking behavior, both advertising related and unrelated.

To conclude, the finding that a lack of motivation rather than ability drives the differences in inhibitory control and cognitive load between heavy versus light media multitaskers, suggests that HMMs could possibly be motivated when considered desirable by the advertiser. This argument might be an interesting starting point for future research, seeking how HMMs could be possibly motivated to allocate their attention. The current knowledge about the response inhibition, task load and the driving role of motivation may also aid the ad creation and formats. Based on the elaboration likelihood model (ELM; Petty & Cacioppo, 1986), we know that a lower ability or motivation demands altered advertising cues in order to persuade media users. Based hereon, it might be interesting for future research to investigate whether heavy versus light media multitaskers should be approached differently by advertisers, depending on the aimed for advertising effects (e.g. long term awareness versus short term sales). In the same line, future research should investigate how advertisement formats and content should be manipulated within this research context. Even though many subtle advertising forms exist nowadays, the current research used a relatively showy online banner. It could be interesting to investigate whether the same results can be found for other types of advertising. Furthermore, as the scope of this study was not to investigate the content of the

advertising but rather to reveal the underlying processes of advertising effectiveness, only a single message advertising has been used, which clearly imposes some limitations. Therefore, future research should investigate the impact of the incorporation of multiple banners on one or on both media.

REFERENCES

Angell, R., Gorton, M., Sauer, J., Bottomley, P., & White, J. (2016). Don't Distract Me When I'm Media Multitasking: Toward a Theory for Raising Advertising Recall and Recognition. *Journal of Advertising*, 1–13.

Armstrong, G. B., & Chung, L. (2000). Background Television and Reading Memory in Context Assessing TV Interference and Facilitative Context Effects on Encoding Versus Retrieval Processes. *Communication Research*, *27*(3), 327–352.

Baddeley, A. (1996). Exploring the central executive. *The Quarterly Journal of Experimental Psychology: Section A*, *49*(1), 5–28.

Baumeister, R. F., & Heatherton, T. F. (1996). Self-regulation failure: An overview. *Psychological Inquiry*, *7*(1), 1–15.

Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science*, *16*(6), 351–355.

Baumgartner, S. E., Lemmens, J. S., Weeda, W. D., & Huizinga, M. (2017). Measuring media multitasking: Development of a short measure of media multitasking for adolescents. *Journal of Media Psychology: Theories, Methods, and Applications*, *29*(2), 92.

Baumgartner, S. E., Weeda, W. D., van der Heijden, L. L., & Huizinga, M. (2014). The relationship between media multitasking and executive function in early adolescents. *The Journal of Early Adolescence*, *34*(8), 1120–1144.

Beuckels, E., Cauberghe, V., & Hudders, L. (2017). How media multitasking reduces advertising irritation: The moderating role of the Facebook wall. *Computers in Human Behavior*, *73*, 413–419.

Brasel, S. A., & Gips, J. (2011). Media multitasking behavior: Concurrent television and computer usage. *Cyberpsychology, Behavior, and Social Networking*, *14*(9), 527–534.

Braver, T. S., Cohen, J. D., Nystrom, L. E., Jonides, J., Smith, E. E., & Noll, D. C. (1997). A parametric study of prefrontal cortex involvement in human working memory. *Neuroimage*, *5*(1), 49–62.

Burkley, E. (2008). The role of self-control in resistance to persuasion. *Personality and Social Psychology Bulletin*, *34*(3), 419–431.

Cain, M. S., Leonard, J. A., Gabrieli, J. D., & Finn, A. S. (2016). Media multitasking in adolescence. *Psychonomic Bulletin & Review*, *23*(6), 1932–1941.

Cain, M. S., & Mitroff, S. R. (2011). Distractor filtering in media multitaskers. *Perception*, *40*(10), 1183–1192.

Cardoso-Leite, P., Kludt, R., Vignola, G., Ma, W. J., Green, C. S., & Bavelier, D. (2016). Technology consumption and cognitive control: Contrasting action video game experience with media multitasking. *Attention, Perception, & Psychophysics*, *78*(1), 218–241.

Carrier, L. M., Cheever, N. A., Rosen, L. D., Benitez, S., & Chang, J. (2009). Multitasking across generations: Multitasking choices and difficulty ratings in three generations of Americans. *Computers in Human Behavior*, *25*(2), 483–489.

Chaiken, S., & Eagly, A. H. (1989). Heuristic and systematic information processing within and. *Unintended Thought*, *212*, 212–252.

Chinchanachokchai, S., Duff, B. R., & Sar, S. (2015). The effect of multitasking on time perception, enjoyment, and ad evaluation. *Computers in Human Behavior*, *45*, 185–191.

Chmielewski, W. X., Mückschel, M., Stock, A.-K., & Beste, C. (2015). The impact of mental workload on inhibitory control subprocesses. *NeuroImage*, *112*, 96–104.

David, P., Kim, J.-H., Brickman, J. S., Ran, W., & Curtis, C. M. (2015). Mobile phone distraction while studying. *New Media & Society*, *17*(10), 1661–1679.

De Jans, S., Hudders, L., & Cauberghe, V. (2017). Advertising literacy training: The immediate versus delayed effects on children's responses to product placement. *European Journal of Marketing*, *51*(11/12), 2156–2174. https://doi.org/10.1108/EJM-08-2016-0472

Deloitte Development LLC. (2015). *Digital Democracy Survey. A multi-generational view of consumer technology, media and telecom trends.* Retrieved from https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Technology-Media-Telecommunications/gx-tmt-deloitte-democracy-survey.pdf

Fox, A. B., Rosen, J., & Crawford, M. (2009). Distractions, distractions: does instant messaging affect college students' performance on a concurrent reading comprehension task? *CyberPsychology & Behavior*, *12*(1), 51–53.

Friese, M., Hofmann, W., & Wänke, M. (2008). When impulses take over: Moderated predictive validity of explicit and implicit attitude measures in predicting food choice and consumption behaviour. *British Journal of Social Psychology*, *47*(3), 397–419.

Garaus, M., Wagner, U., & Bäck, A.-M. (2017). The effect of media multitasking on advertising message effectiveness. *Psychology & Marketing*, *34*(2), 138–156.

Hamilton, R., Vohs, K. D., Sellier, A.-L., & Meyvis, T. (2011). Being of two minds: Switching mindsets exhausts self-regulatory resources. *Organizational Behavior and Human Decision Processes*, *115*(1), 13–24.

Hart, S. G., & Staveland, L. E. (1988). Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. *Advances in Psychology*, *52*, 139–183.

Hayes, A. F. (2013). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. Guilford Press. Retrieved from http://www.guilford.com/books/Introduction-to-Mediation-Moderation-and-Conditional-Process-Analysis/Andrew-Hayes/9781609182304

Heatherton, T. F., & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin*, *110*(1), 86.

Hecht, T. D., & Allen, N. J. (2005). Exploring links between polychronicity and well-being from the perspective of person–job fit: Does it matter if you prefer to do only one thing at a time? *Organizational Behavior and Human Decision Processes*, *98*(2), 155–178.

Hembrooke, H., & Gay, G. (2003). The laptop and the lecture: The effects of multitasking in learning environments. *Journal of Computing in Higher Education*, *15*(1), 46–64.

Hoch, S. J., & Loewenstein, G. F. (1991). Time-inconsistent preferences and consumer self-control. *Journal of Consumer Research*, *17*(4), 492–507.

Hofmann, W., Schmeichel, B. J., & Baddeley, A. D. (2012). Executive functions and self-regulation. *Trends in Cognitive Sciences*, *16*(3), 174–180.

Hwang, Y., & Jeong, S.-H. (2018). Multitasking and task performance: Roles of task hierarchy, sensory interference, and behavioral response. *Computers in Human Behavior*, *81*, 161–167.

Jeong, S.-H., & Hwang, Y. (2012). Does multitasking increase or decrease persuasion? Effects of multitasking on comprehension and counterarguing. *Journal of Communication*, *62*(4), 571–587.

Jeong, S.-H., & Hwang, Y. (2015). Multitasking and persuasion: the role of structural interference. *Media Psychology*, *18*(4), 451–474.

Jeong, S.-H., & Hwang, Y. (2016). Media Multitasking Effects on Cognitive vs. Attitudinal Outcomes: A Meta-Analysis. *Human Communication Research*, *42*(4), 599–618.

Kazakova, S. (2014). *The Fragmented Mind - Exploring the Measurement and Consequences of Media Multitasking Behavior*. Ghent University.

Keating, J. P., & Brock, T. C. (1974). Acceptance of persuasion and the inhibition of counterargumentation under various distraction tasks. *Journal of Experimental Social Psychology*, *10*(4), 301–309.

Kononova, A., Joo, E., & Yuan, S. (2016). If I choose when to switch: Heavy multitaskers remember online content better than light multitaskers when they have the freedom to multitask. *Computers in Human Behavior*, *65*, 567–575.

Lang, A. (2000). The limited capacity model of mediated message processing. *Journal of Communication*, *50*(1), 46–70.

Lang, A., & Chrzan, J. (2015). Media Multitasking: Good, Bad, or Ugly? *Annals of the International Communication Association*, *39*(1), 99–128. https://doi.org/10.1080/23808985.2015.11679173

Lin, L. (2009). Breadth-biased versus focused cognitive control in media multitasking behaviors. *Proceedings of the National Academy of Sciences*, *106*(37), 15521–15522.

Lui, K. F., & Wong, A. C.-N. (2012). Does media multitasking always hurt? A positive correlation between multitasking and multisensory integration. *Psychonomic Bulletin & Review*, *19*(4), 647–653.

Lyon, G., & Krasnegor, N. A. (1996). *Attention, memory, and executive function.* Paul H Brookes Publishing.

Minear, M., Brasher, F., McCurdy, M., Lewis, J., & Younggren, A. (2013). Working memory, fluid intelligence, and impulsiveness in heavy media multitaskers. *Psychonomic Bulletin & Review*, *20*(6), 1274–1281.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology*, *41*(1), 49–100.

Monsell, S. (2003). Task switching. *Trends in Cognitive Sciences*, *7*(3), 134–140.

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin*, *126*(2), 247.

Muraven, M., Collins, R. L., & Neinhaus, K. (2002). Self-control and alcohol restraint: an initial application of the self-control strength model. *Psychology of Addictive Behaviors*, *16*(2), 113.

Norman, D. A., & Shallice, T. (1986). Attention to action. In *Consciousness and self-regulation* (pp. 1–18). Springer. Retrieved from http://link.springer.com/chapter/10.1007/978-1-4757-0629-1_1

Ophir, E., Nass, C., & Wagner, A. D. (2009). Cognitive control in media multitaskers. *Proceedings of the National Academy of Sciences*, *106*(37), 15583–15587.

Oviedo, V., Tornquist, M., Cameron, T., & Chiappe, D. (2015). Effects of media multi-tasking with Facebook on the enjoyment and encoding of TV episodes. *Computers in Human Behavior*, *51*, *Part A*, 407–417.

Paas, F. G., & Van Merriënboer, J. J. (1994). Instructional control of cognitive load in the training of complex cognitive tasks. *Educational Psychology Review*, *6*(4), 351–371.

Petty, R. E., & Cacioppo, J. T. (1986). *The elaboration likelihood model of persuasion*. Springer. Retrieved from http://link.springer.com/chapter/10.1007/978-1-4612-4964-1_1

Pilotta, J. J., & Schultz, D. (2005). Simultaneous media experience and synesthesia. *Journal of Advertising Research*, *45*(01), 19–26.

Pool, M. M., Koolstra, C. M., & Van der Voort, T. H. (2003). Distraction effects of background soap operas on homework performance: An experimental study enriched with observational data. *Educational Psychology*, *23*(4), 361–380.

Putrevu, S., & Lord, K. R. (1994). Comparative and noncomparative advertising: Attitudinal effects under cognitive and affective involvement conditions. *Journal of Advertising*, *23*(2), 77–91.

Ralph, B. C., Thomson, D. R., Cheyne, J. A., & Smilek, D. (2014). Media multitasking and failures of attention in everyday life. *Psychological Research*, *78*(5), 661–669.

Ridderinkhof, K. R., Van Den Wildenberg, W. P., Segalowitz, S. J., & Carter, C. S. (2004). Neurocognitive mechanisms of cognitive control: the role of prefrontal cortex in action selection, response inhibition, performance monitoring, and reward-based learning. *Brain and Cognition*, *56*(2), 129–140.

Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010). Generation M [superscript 2]: Media in the Lives of 8-to 18-Year-Olds. *Henry J. Kaiser Family Foundation*. Retrieved from http://eric.ed.gov/?id=ED527859

Rozendaal, E., Lapierre, M. A., Van Reijmersdal, E. A., & Buijzen, M. (2011). Reconsidering advertising literacy as a defense against advertising effects. *Media Psychology*, *14*(4), 333–354.

Sanbonmatsu, D. M., Strayer, D. L., Medeiros-Ward, N., & Watson, J. M. (2013). Who multi-tasks and why? Multi-tasking ability, perceived multi-tasking ability, impulsivity, and sensation seeking. *PloS One*, *8*(1), e54402.

Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology*, *85*(1), 33.

Segijn, C. M., Voorveld, H. A. M., & Smit, E. G. (2016). The Underlying Mechanisms of Multiscreening Effects. *Journal of Advertising*, 1–12. https://doi.org/10.1080/00913367.2016.1172386

Segijn, C. M., Voorveld, H. A., & Smit, E. G. (2017). How Related Multiscreening Could Positively Affect Advertising Outcomes. *Journal of Advertising*, 1–18.

Shiv, B., & Fedorikhin, A. (1999). Heart and mind in conflict: The interplay of affect and cognition in consumer decision making. *Journal of Consumer Research*, *26*(3), 278–292.

Stroop, J. R. (1992). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology: General*, *121*(1), 15.

Taatgen, N. A., & Lee, F. J. (2003). Production compilation: A simple mechanism to model complex skill acquisition. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *45*(1), 61–76.

Uncapher, M. R., Thieu, M. K., & Wagner, A. D. (2016). Media multitasking and memory: Differences in working memory and long-term memory. *Psychonomic Bulletin & Review*, *23*(2), 483–490.

Vohs, K. D., & Faber, R. J. (2007). Spent resources: Self-regulatory resource availability affects impulse buying. *Journal of Consumer Research*, *33*(4), 537–547.

Voorveld, H. A., & Viswanathan, V. (2015). An observational study on how situational factors influence media multitasking with TV: The role of genres, dayparts, and social viewing. *Media Psychology*, *18*(4), 499–526.

Wang, Z., & Tchernev, J. M. (2012). The "Myth" of Media Multitasking: Reciprocal Dynamics of Media Multitasking, Personal Needs, and Gratifications. *Journal of Communication*, *62*(3). https://doi.org/10.1111/j.1460-2466.2012.01641.x

Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review*, *101*(1), 34.

Weidacker, K., Whiteford, S., Boy, F., & Johnston, S. J. (2017). Response inhibition in the parametric go/no-go task and its relation to impulsivity and subclinical psychopathy.

Quarterly Journal of Experimental Psychology (2006), *70*(3), 473–487. https://doi.org/10.1080/17470218.2015.1135350

Wiradhany, W., & Nieuwenstein, M. R. (2017). Cognitive control in media multitaskers: Two replication studies and a meta-Analysis. *Attention, Perception, & Psychophysics*, *79*(8), 2620–2641.

Xu, S., Wang, Z. J., & David, P. (2016). Media multitasking and well-being of university students. *Computers in Human Behavior*, *55*, 242–250.

Yap, J. Y., & Lim, S. W. H. (2013). Media multitasking predicts unitary versus splitting visual focal attention. *Journal of Cognitive Psychology*, *25*(7), 889–902.

Yeykelis, L., Cummings, J. J., & Reeves, B. (2014). Multitasking on a single device: Arousal and the frequency, anticipation, and prediction of switching between media content on a computer. *Journal of Communication*, *64*(1), 167–192.

Zaichkowsky, J. L. (1985). Measuring the involvement construct. *Journal of Consumer Research*, *12*(3), 341–352.

Zhang, W., Jeong, S.-H., & Fishbein, M. (2010). Effects of multitasking and arousal on television content recall and secondary task performance. *Journal of Media Psychology*, *22*, 2–13.

Zyphur, M. J., Warren, C. R., Landis, R. S., & Thoresen, C. J. (2007). Self-regulation and performance in high-fidelity simulations: An extension of ego-depletion research. *Human Performance*, *20*(2), 103–118.