Everyday multiscreening

How the simultaneous usage of multiple screens affects information processing and advertising effectiveness

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Chapter 4

Effects of Multiscreening on Cognitive Advertising Outcomes

ABSTRACT

Multiscreening, the simultaneous usage of multiple screens, is a relatively understudied phenomenon that may have a large impact on media effects. First, we explored people's viewing behavior while multiscreening by means of an eye-tracker. Second, we examined people's reporting of attention, by comparing eye-tracker and self-reported attention measures. Third, we assessed the effects of multiscreening on people's memory, by comparing people's memory for editorial and advertising content when multiscreening (TV/tablet) versus single screening. The results of the experiment (*N* = 177) show that 1) people switched between screens 2.5 times per minute, 2) people were well capable of reporting their own attention, and 3) multiscreeners remembered content just as well as single screeners, when they devoted sufficient attention to the content.

People spend more than a quarter of their media time using multiple media simultaneously (MediaTijd, 2014); this is known as 'media multitasking' (e.g., Voorveld, Segijn, Ketelaar, & Smit, 2014; Wang, Irwin, Cooper, & Srivastava, 2015). A relatively new form of media multitasking is multiscreening, that is, the simultaneous use of multiple screens, such as a TV and a tablet or smartphone (Segijn, 2016). A recent Nielsen survey showed that a quarter of tablet or smartphone owners use their devices daily while watching TV (Nielsen, 2013), making multiscreening a part of the daily routine. However, there is still a limited understanding of this phenomenon. Three important aspects of multiscreening are largely unknown, namely 1) people's objective viewing behavior in terms of number of switches, gaze duration and total viewing time, 2) whether people are capable of reporting this behavior, and 3) the effects that multiscreening has on people's memory of editorial content and advertising in the different media. Thus, the current study examines three important aspects of multiscreening that are driven by descriptive (i.e., viewing behavior), methodological (i.e., reporting), and theoretical motivations (i.e., memory effects).

Viewing behavior refers to how people's attention is distributed across media, including the number of switches between screens, as well as gaze durations, and total viewing time per screen. Because of the multiple screens, people have to divide their attention (Jeong, Hwang, & Fishbein, 2010; Salvucci & Taatgen, 2011). There is limited knowledge of the viewing behavior of people who are multiscreening, and insights into such behavior will contribute to our understanding of media use and benefit both media scholars and practitioners. The first aim of the current study is to objectively examine the viewing behavior of people who are multiscreening.

Another important aspect of multiscreening research is the way viewing behavior is measured and reported. Media exposure is a challenging concept to measure (e.g., de Vreese & Neijens, 2016; Slater, 2004). Because it is mostly assessed by self-reported measures, researchers have to rely on people's memory and they have to trust that people are able to accurately and reliably assess their media exposure (Slater, 2004). An objective measure of attention is data collection through an eye-tracker (Bol, Boerman, Romano Bergstrom, & Kruikemeier, 2016). Testing the correlation between eye-tracking and self-reported data provides insights into the validity of the self-reported attention measures. The results provide insight into people's ability to report their attention distribution, which benefits future research into media exposure and how it is measured. Thus, the second aim of the study is to examine the correlation between eye-tracker and self-reported measures of attention.

Finally, the study examines the effects of multiscreening on people's memory for the media content. In the literature, the general assumption is that multiscreening leads to a decrease in memory compared to single screening (e.g., Angell, Gorton, Sauer, Bottomley, & White, 2016; Kazakova, Cauberghe, Hudders, & Labyt, 2016; Oviedo Tornquist, Cameron, & Chiappe, 2015, Segijn, Voorveld, & Smit, 2016). Some scholars, however, argue that it is possible to remember media content just as well when multitasking as when single tasking, but only if the media user pays enough attention to the media content (Jeong, Hwang, & Fishbein, 2010; Jeong & Hwang, 2012). To our knowledge, this has not previously been examined for multiscreening. Thus, the third aim of the study is to examine the effects of multiscreening on people's memory.

Uses of Multiscreening

Multiscreening is the use of multiple screens simultaneously (Segijn, 2016). Because people's attention cannot simultaneously be divided among different tasks when both tasks require visual attention (Salvucci & Taatgen, 2011), multiscreening entails an interleaved strategy of attention distribution where one task is temporarily suspended to allocate visual attention to another task. Two different processes determine how visual attention is allocated among screens, namely bottom-up and top-down processes. Bottom-up processes of attention are stimulated by features of the media content (e.g., Pieters & Wedel, 2004; Smit, Neijens, & Heath, 2013). For example, camera changes, arousing content, and new information introduced could result in orienting responses (Lang, Park, Sanders-Jackson, Wilson & Wang, 2007). Bottom-up processes are characterized as being automatic processes (Pieters & Wiedel, 2004). Thus, even when people are not intentionally searching for certain information, these features could attract people's attention. Top-down processes of attention, on the other hand, are guided by personal factors, such as goals (e.g., Eysenck & Keane, 2005). Thus, viewing behavior when multiscreening could be both directed by bottom-up processes (e.g., features in editorial content) and top-down processes (e.g., instructions on how to divide attention).

Viewing behavior. Switching is a first component of viewing behavior when multiscreening. A substantial amount of time during multiscreening is devoted to dividing attention between the multiple screens by switching between them. Like media multitasking, multiscreening should be seen on a continuum that ranges from tasks that involve frequent attention switching to tasks that involve long time spans between switches. A study into the attention allocation of people who were multiscreening with a TV and a computer, found that people switched their attention between media on average more than four times per minute (Brasel & Gips, 2011). On a computer screen, it was found that people switched approximately three times per minute (Yeykelis, Cummings, & Reeves, 2014). These studies indicate that people often switch their attention to different media or different parts of the screen within a medium.

A second component of viewing behavior is gaze duration (defined here as the duration of a single gaze on specific medium content without switching to other content areas of interest). A study on single screening (TV only) showed that gazes mostly last around 1.5 seconds (Hawkins et al., 2005). Similar durations were found in the multiscreening study by Brasel and Gips (2011). In addition, they found that the gazes on the TV were shorter than the gazes on the computer. Both studies found that most gazes while using media are short in duration.

A third component of multiscreening viewing behavior is total viewing time, that is, the summed viewing duration of all fixations on a screen. There is limited knowledge of which screen receives the most attention. In their study, Brasel and Gips (2011) found that the computer dominated the TV in terms of viewing time. How viewing time is distributed may depend on several factors guided by bottom-up or top-down processes. For example, different types of content could lead to different attention allocation patterns. In addition, viewing behavior could be different when one or the other screen is the primary screen. It is therefore considered interesting to examine people's viewing behavior with other content and in a goal-directed versus a natural attention distribution setting. The first research question is:

RQ1: What does multiscreening viewing behavior look like in terms of a) number of switches, b) average gaze durations, and c) total viewing time?

Reporting of viewing behavior. In the media multitasking literature, scholars heavily rely on self-reported measures of media exposure (e.g., Duff & Sar, 2015; Jeong & Hwang, 2012; Voorveld, 2011), with some scarce exceptions (Wang et al., 2012). Therefore, researchers have to rely on people's memory and they have to trust that people are able to accurately and reliably assess their exposure to media. However, people have difficulty assessing their media exposure post-hoc, especially when their attention is limited (Slater, 2004). Despite this challenge, many inferences about the prevalence and effects of media use are based on these self-reported measures (de Vreese & Neijens, 2016).

Advances in technology, such as eye-tracking devices, make it possible to objectively record exposure and viewing behavior (Bol et al., 2016). This is an interesting addition to the commonly used self-reported measures in post-hoc questionnaires. In their multiscreening study, Brasel and Gips (2011) found, for example, that people seriously underestimate their switching behavior. This raises the question whether people are able to retrospectively report their own distribution of attention. Up until now it is not known whether people are able to report their viewing behavior in terms of attention to both screens. To this end, the following research question is formulated:

RQ2: To what extent are people able to report attention to media content?

Effects of Multiscreening

The third question of the study is about how multiscreening affects people's memory for editorial content and advertising on both screens. When people are multiscreening, their overall exposure to media content is increased. It is argued, however, that doing multiple tasks simultaneously diminishes the depth with which the information is being processed (Jeong & Fishbein, 2007; Wang et al., 2015). As a result, cognitive media effects such as memory are reduced when doing multiple things simultaneously compared to focusing on one task (e.g., Jeong & Hwang, 2016; Jeong et al., 2010; Segijn et al., 2016). However, the effect of multiscreening on cognitive outcomes may depend on different factors (Jeong & Hwang, 2016), such as the degree of structural and capacity interference (e.g. Jeong & Hwang, 2015; Pool, Koolstra, & van der Voort, 2003) and the amount of attention paid to the task (Jeong & Hwang, 2012).

Structural versus capacity interference. The dual-channel paradigm states that people have different sensory channels to process visual and auditory information (Baddeley, 1997; Paivio, 1986; Wickens, 2002). These channels are unique systems that function independently, but are interconnected (Paivio, 1986). Structural interference occurs when information from shared modalities is processed (Kahneman, 1973), which is the case with multiscreening (i.e., both screens are visual). It is harder (or even impossible) to process information from shared modalities (Salvucci & Taatgen, 2011), because it is processed through the same sensory channel rather than through different channels (Paivio, 1986; Wickens, 2002). As a consequence, people remember less of the messages when multitasking with different modalities (Jeong & Hwang, 2015; Wang et al., 2012). Thus, memory could be limited while multiscreening because people cannot allocate their visual attention to both screens simultaneously.

In addition, people who multiscreen also have to deal with capacity interference. According to the limited capacity model of mediated message processing (Lang, 2000), people are limited in the cognitive resources that they have for encoding, storing, or retrieving information. Thus, when people are multiscreening, they have to divide these cognitive resources among the tasks involved. Capacity interference occurs when people need more cognitive resources than are available. People are limited in the amount of resources they can divide among tasks. Thus, memory could be limited while multiscreening because people do not have enough cognitive resources to process both tasks.

Amount of attention paid. The multiscreening literature has mostly reported negative effects on memory (e.g., Angell et al., 2016; Kazakova et al., 2016; Oviedo et al., 2015; Segijn et al., 2016). However, there is an indication that multiscreening does not necessarily have to lead to a decline in memory compared to single tasking (Jeong & Hwang, 2012). It is argued that a sufficient amount of visual attention while media multitasking will help people overcome a potential memory deficit (Jeong et al., 2010; Jeong & Hwang, 2012). In this case, top-down processes of attention could help to improve processing the content of one of the two screens. The current study examines this argument and whether it applies to both screens involved in multiscreening. To do so, the following research question is formulated:

RQ3: To what extent does multiscreening affect people's memory in terms of editorial and advertising content?

METHOD

Sample

A total of 177 undergraduates participated in the experiment (M_{age} = 22.19, SD_{age} = 3.34, 68.4% female). They were recruited through an online subject pool at the University of Amsterdam. Eye-tracker data were logged for all participants during their media use. Technical issues led to the eye-tracker data of ten participants being discarded, resulting in ten missing cases in the eye-tracking data. The total duration of participation was approximately 30–45 minutes per participant. The participants were given 5 euro or research credits for participating.

Design and Procedure

A single factor between-subjects design with five media conditions was used. These media conditions were: 1) A multiscreening condition in which the participants were instructed to direct their primary attention to the TV (MS TV); 2) a multiscreening condition in which participants were instructed to direct their primary attention to the tablet (MS tablet); 3) a natural multiscreening condition (MS natural) in which the participants were free to choose how to divide their attention; 4) a single screening TV condition (SS TV); and 5) a single screening tablet condition (SS tablet). In all media conditions, participants' attention allocation was driven by bottom-up processes (i.e., media content that drives attention allocation). In addition, top-down processes played an important role in attention allocation in the MS TV and MS tablet condition because of the instructions on how to divide attention.

The experiment was conducted in a room that had been designed to simulate a living room, in order to create a multiscreening environment that was as natural as possible. Before the start of the experiment, the participants read and signed an informed consent form. They then put on the eye-tracker glasses and these were calibrated. After that, they received the instructions and the experiment started. The participants were told that the study was about how people experience, process, and evaluate TV programs. In the MS conditions and SS tablet condition, the participants were also told that some TV shows develop their own application (app). In the MS conditions the participants were told that they could use this app when the TV show was on. In the SS tablet condition the participants were asked to use the app for seven minutes and in the SS TV condition the participants were asked to watch a seven minute TV clip. All participants were also told that after media exposure they were asked to fill out a questionnaire about the media content (of TV, tablet or both), their experience, and their evaluation of the media content Furthermore, in the MS TV and MS tablet condition they were asked to direct most of their attention to the TV or tablet, respectively. All instructions were provided on paper to guarantee consistency. The participants were seated on a couch in front of a TV. A tablet was also provided in the MS conditions and SS tablet condition. After media exposure, the participants removed the eye-tracker glasses and completed a questionnaire on a computer.

Stimuli

Television. The TV show was played on a Samsung TV (3D-LED-TV, Full HD, 200 Hz, 40”). The editorial content consisted of a seven minute clip of an entertainment show (i.e., Survivor). It was a clip of episode 8 of season 13 of the Dutch version of Survivor which was originally broadcasted in 2012. This episode showed the merge, which is the point in the middle of the game in which the remaining contestants are merged into one group and start competing individually. The episode showed a barbecue to celebrate that the contestants made it to the next phase.

Tablet. The participants used a Samsung Galaxy Tab 3 10.1 P5210 Wi-Fi White tablet in the MS conditions and the ST tablet condition. The editorial content consisted of a magazine application (app) on the tablet that matched this TV show. The magazine consisted of a 15-page magazine with articles (e.g., interviews with contestants) that was specifically designed for the current study. Existing content of online media was used to create the content of the magazine. The magazine content was identical across all media conditions. The participants could only use the magazine in landscape orientation. The participants could scroll through the magazine back and forth as they wished. The banner ad would always appear as a second layer on the right upper corner of the magazine simultaneously with the banner on the TV, no matter which page of the magazine was displayed. The timeline of the stimulus material for each condition is shown in Figure 4.1.

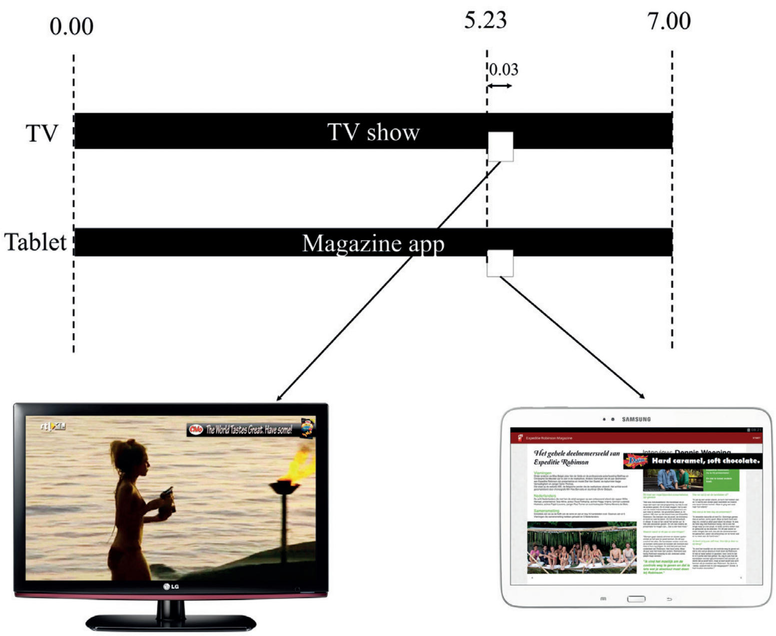

Figure 4.1. Timeline and stimulus material.
Note: The editorial content consists of a 7-minute clip of an entertainment show on television (TV) and a magazine application (app) on the tablet that matches this TV show. A banner ad appeared in the right upper corner on both the TV and the tablet after 5 minutes and 23 seconds, and disappeared 3 seconds later. The timeline is the same for all multiscreening conditions. In the single-screening conditions the participants are only exposed to the TV show or the magazine app.

4

Banner. An advertisement in the form of a banner was displayed simultaneously on the TV and tablet. The visibility of the TV banner ad was pretested in an online experiment (*N* = 62, M_{age} = 31.19, SD_{age} = 12.63, 67.7% female). This was necessary to make sure that the banner was at least sufficiently salient without distractions because it is assumed that the banner will be even less salient while multiscreening. In the pretest we compared three clips that all contained a banner. The banner included a brand logo and text, the banner was of three or six seconds of length (or both) and placed on 2.54 minutes or 5.23 minutes (or both) in the upper right corner. It was important that the banner wouldn't appear too early in the clip because of orienting responses (Lang, 2000). For the same reason a calm scene was selected in which the banner would appear. Participants were shown one of the three clips and after that different memory questions were proposed. The banner that led to the highest overall memory scores was chosen as stimulus material (Table 4.1). This banner was placed in a scene where one of the contestants was walking on the beach with calm background music.

A second pretest was conducted to find a brand for the ad on the tablet that was comparable to the brand on TV, to exclude the possibility that conclusions could be explained by differences in brands. In total, 58 participants (60.3% female, M_{age} = 30.98, SD_{age} = 12.89) were randomly exposed to the logos of three of six selected brands.
One of these six brands was the target brand of the TV ad. Only one brand was not significantly different from the TV brand on brand familiarity (Laroche, Kim, & Zhou, 1996), brand attitude (Chang & Thorson, 2004), involvement (Traylor & Joseph, 1984), and purchase intention (Spears & Singh, 2004). This brand was chosen as the comparable target brand for the banner on the tablet (Table 4.2).

Table 4.1 Memory scores of the three different clips.

	Banner conditions		
	Banner 6 sec - 2.54 min	Banner 3 sec – 5.23 min	Both banners
Product recall	29%	55%	52%
Brand recall	24%	35%	33%
Aided recall	24%	40%	43%
Brand cued recognition	33%	45%	48%
Banner recognition (6s)	14%	-	19%
Banner recognition (3s)	-	55%	43%

Table 4.2 Means (standard deviations) of different brands compared to TV brand.

	TV brand: Chio (n=30)	Daim (*n*=29)	Caramba's (*n*=33)	Hellema (*n*=27)	Punselie's (*n*=29)	Balisto (*n*=29)
Familiarity	3.90 (2.02)	3.39 (2.42)	1.47 (1.17)***	1.89 (1.43)***	1.41 (1.34)***	5.08 (1.86)***
Attitude	3.95 (1.39)	3.96 (1.30)	3.45 (1.11)	3.67 (1.26)	3.34 (1.25)*	3.84 (1.23)
Involvement	1.97 (0.94)	2.06 (1.12)	2.35 (1.26)*	1.89 (0.94)	2.02 (1.03)	2.02 (1.07)
Purchase intention	2.28 (1.31)	2.14 (1.58)	1.89 (1.34)	1.93 (1.10)	1.52 (0.97)***	2.16 (1.32)

Significance levels indicate differences with scores of TV brand. *** $p < .001$, ** $< .01$, * $p < .05$.

Variables

The questionnaire contained questions regarding memory, evaluation, and behavior. The variables were displayed in the following order to minimize cross-contamination between the various measures: memory about editorial content, implicit brand memory, unaided recall, aided recall, brand recognition, implicit brand attitude, explicit ad/brand attitude, purchase intention, variables about media use and possession, message recognition, self-reported attention, some demographics, and brand choice behavior. Only the cognitive variables are discussed in this paper.[2]

Eye-tracker data. To log eye-tracker data, eye-tracker glasses (SMI Eye Tracking Glasses 2 Wireless) were used because of the mobility and the possibility to log data related to both screens. The following variables of the eye-tracker data were coded: number of switches between media, average gaze duration in seconds for TV and tablet, prevalence of gaze duration per second, and total viewing time in seconds for TV and tablet. The eye-tracker videos were coded by two independent coders separately in Observer XT 11.5. The first coder coded 100% of the sample, and the second coder coded 25% of the sample. The Krippendorff's alpha of all measures was ≥ .74, indicating a good intercoder reliability.

Self-reported attention. Self-reported attention was measured with two items: 'How much attention did you pay to the [TV/tablet]?' (Jeong & Hwang, 2012) on a scale of 0-100, where 0 means no attention and 100 means full attention (M_{tv} = 77.84, SD_{tv} = 22.30, M_{tablet} = 48.19, SD_{tablet} = 31.59).

Memory of editorial content. Memory of editorial content (memory$_{ed}$) was measured by five multiple choice questions about both the TV and the tablet content (Oviedo, Tornquist, Cameron, & Chiappe, 2015). The questions were recoded into a dichotomous variable 1 = correct, 0 = incorrect. A sum score of the five questions was calculated, which resulted in two separate variables: memory$_{ed}$ TV content (0-5; *M* = 3.25, *SD* = 1.89) and memory$_{ed}$ tablet content (0-5; *M* = 2.03, *SD* = 1.79). This variable was not measured in the SS condition in which the participants were not exposed to the editorial content; for example, memory$_{ed}$ TV was not asked in the SS tablet condition. The questions were based on information that was only presented in the editorial content of one screen or the other. No memory$_{ed}$ TV questions were related to the part of the video in which the banner ad appeared. Three out of five of the memory$_{ed}$ TV questions were based on visual information (e.g., How many beds

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[2] No significant effects were found between the conditions for the affective and the implicit outcomes. We did find that the tablet brand was more favorable and that people had a higher purchase intention for this brand than for the TV brand.

were on the island?), one was based on auditory information (What was the message from the envelope that was read by one of the contestants?), and one question was based on audiovisual information (Which contestant made the following statement [statement]?). All memory$_{ed}$ tablet questions were based on visual information that was derived from different pages throughout the entire magazine (e.g., What is going to change in the next season of the show?).

Memory of ad. Memory of both the TV ad and the banner ad was calculated by a sum score of correct answers on four different memory questions. First, we asked people to list all the brands they could remember. Second, we asked people if they could remember a chips/chocolate brand. Third, we showed the participants a list of brands and asked if they could remember any of these brands from the clip. Finally, we showed a print screen of the clip where the brand was shown and asked them if they had seen this in the TV clip. On every item the participants scored a 1 when they remembered it correctly and a 0 when they remembered it incorrectly (0-4; M_{tv} = 1.58, SD_{tv} = 1.59, M_{tablet} = 1.11, SD_{tablet} = 1.61).

Table 4.3 Overview eye-tracker data per multiscreening condition.

			Multiscreening conditions		
	F [a]	p	MS natural	MS TV	MS tablet
Average number of switches	9.397	< .001	17.87 (12.71)$_b$	15.44 (10.28)$_b$	27.61 (12.62)$_a$
Number of switches per minute	9.379	< .001	2.50 (1.78)$_b$	2.16 (1.44)$_b$	3.86 (1.76)$_a$
Average gaze time TV (sec)	9.039	< .001	45.95 (39.36)$_a$	51.18 (36.33)$_a$	18.50 (17.25)$_b$
Average gaze time tablet (sec)	6.353	.003	12.29 (6.80)$_{ab}$	9.20 (8.27)$_b$	15.64 (6.67)$_a$
Average % viewing time TV	25.954	< .001	73.9% (16.81)$_a$	79.9% (18.93)$_a$	48.8% (19.76)$_b$
Average % viewing time tablet	25.549	< .001	25.3% (16.62)$_b$	19.6% (19.04)$_b$	50.1% (19.66)$_a$

Note. A different subscript indicates a significant difference between conditions.
The table shows means with the standard deviations in parentheses.
[a] the degrees of freedom of all analyses are 2, 103.

Control Variables

To check whether any control variables had to be included in the analyses, a chi-square test was conducted for gender and separate ANOVAs were conducted for the other variables. No control variables were included in the analyses, because no significant differences were found for gender (p = .094), age (p = .240), familiarity with the TV brand (p = .343) and the tablet brand (p = .046; Tukey's post-hoc test showed no significant differences between media conditions), tablet possession (p = .211), average TV use (p = .141), average tablet use (p = .946), tablet skills (p = .704) or whether participants had seen the video clip before (p = .732).

RESULTS

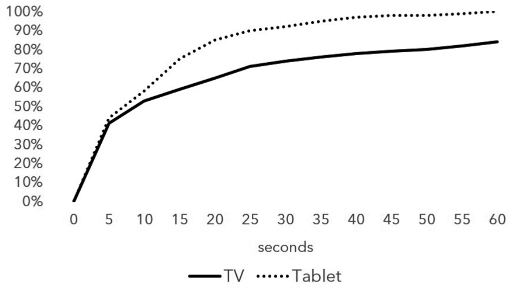
Viewing Behavior (RQ1)

The eye-tracker data were analyzed to obtain information on people's viewing behavior while multiscreening. The number of switches, gaze duration, and total viewing time of the natural multiscreening condition are discussed here (see Table 4.3 for an overview of all conditions).

Number of switches. Participants in the natural multiscreening condition switched between media on average 17.87 times (SD = 12.71) during media exposure. This is, on average, 2.50 switches per minute (SD = 1.78). The number of switches differed between multiscreening conditions, F (2, 103) = 9.38, p < .001, η^2 = .16. Tukey's post-hoc test revealed that participants in the MS natural condition and MS TV condition switched less than those in the MS tablet condition. In addition, the MS natural and MS TV participants were not significantly different in terms of number of switches (Table 4.3).

Gaze duration. In the MS natural condition, the gazes on the TV were significantly longer (M = 41.54, SD = 28.53) than those on the tablet (M = 12.29, SD = 6.80), t (37) = 5.92, p < .001, d = 1.41. Two separate ANOVAs showed that the different multiscreening conditions resulted in different average gaze times on the TV (F (2, 103) = 9.04, p < .001, η^2 = .15) and on the tablet (F (2, 102) = 6.35, p = .003, η^2 = .11). Tukey's post-hoc test revealed that the average gaze time was similar in the MS natural and MS TV conditions for both screens. However, the average gaze time on TV in the MS tablet condition was significantly shorter than in the other two MS conditions. Thus, when instructed to focus mainly on the tablet, participants had on average a shorter gaze duration toward the TV. Whereas the average gaze time on the tablet was significantly longer in the MS tablet condition compared to the MS TV condition, it did not differ from average in the MS natural condition (Table 4.3).

4.2.a



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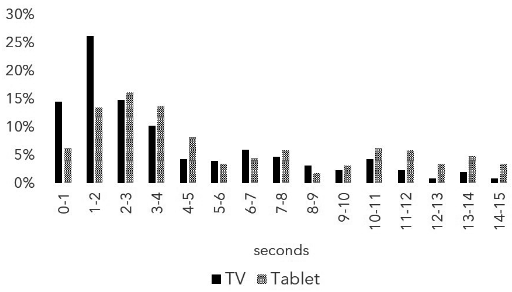

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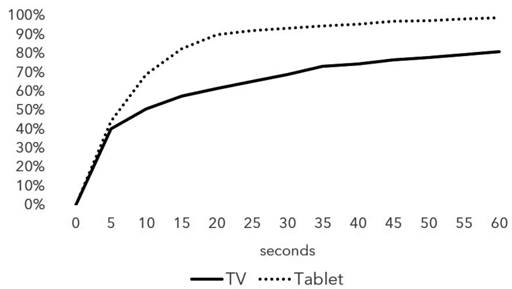

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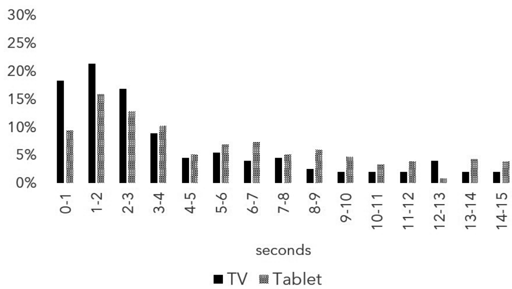

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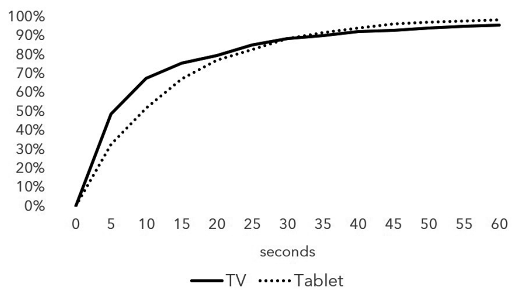

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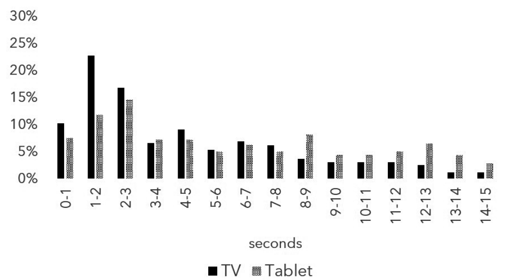

Figure 4.2. Gaze distributions presented as cumulative gaze distribution (left) and per duration (right) for the MS natural (a, b), the MS TV (c, d), and MS tablet (e, f) conditions.
Note: Gaze distributions presented as cumulative gaze distribution (left) and per duration (right) for the MS natural (a, b), the MS TV (c, d), and the MS tablet (e, f) conditions. Not all gazes are included in the figures. The cumulative figures (a, c, e) show all gazes up to 60 seconds and the gaze distribution figures (b, d, f) show all gazes up to 15 seconds.

However, drawing conclusions from the average gaze duration results should be done with caution, because longer gazes may result in skewed durations. It is therefore, important to also look at the gaze distribution. Figures 4.2a and 4.2b show the distribution of gaze durations in the MS natural condition. The results show that 50% of all gazes on both screens were shorter than 10 seconds (Figure 4.2a). Only a few gazes on the tablet in the MS natural condition lasted longer than 60 seconds, namely 0.5% (n_{gazes} = 2) of the gazes on the tablet compared to 6.4% (n_{gazes} = 28) of the gazes on the TV. Although the nature of the gazes on both media is characterized by mainly shorter gazes (Figure 4.2b), the gazes on the TV are more stretched (Figure 4.2a). The MS TV conditions follow roughly the same distribution as the MS natural condition in gaze duration (Figures 4.2c and 4.2d). The participants in the MS tablet condition had a more equal distribution of gazes on both media (Figures 4.2e and 4.2f).

Total viewing time. Participants in the MS natural condition spent, on average, 73.9% (SD = 16.81) of their total viewing time on the TV and 25.3% (SD = 16.62) on the tablet. When comparing the three multiscreening conditions, the results of two separate ANOVAs showed a significant difference between the groups in terms of viewing time toward the TV ($F(2, 103) = 25.95$, $p < .001$, $\eta^2 = .34$) and tablet ($F(2, 103) = 25.55$, $p < .001$, $\eta^2 = .34$). Tukey's post-hoc test showed that participants in the MS natural and MS TV conditions spent more time on the TV than participants in the MS tablet condition, and that participants in the MS tablet condition spent more time on the tablet than participants in the other two conditions (Table 4.3). Thus, participants in the instructed multiscreening conditions had their attention mostly directed toward the instructed medium, and the viewing behavior of the participants in the natural multiscreening condition was again similar to that of participants who were instructed to mainly focus on the TV.

Reporting: Comparison between Eye-Tracker Data and Self-Reported Data (RQ2)

The second research question was about the extent to which people are able to report attention to media content. Therefore, self-reported data was compared to eye-tracking data of attention. The measurements showed that the self-reported attention and the visual attention measured with the eye-tracker (i.e., total viewing durations transformed into percentages) were highly correlated for both media ($r_{tv} = .87$, $p < .001$; $r_{tablet} = .91$, $p < .001$). Thus, the participants were capable of reporting the attention they paid to a medium.

Multiscreening Effects on People's Memory (RQ3)

Separate ANOVAs were used to analyze the effects of multiscreening on people's memory of editorial and advertising content. All means, standard deviations, and correlations are presented in Table 4.4 and 4.5.

Table 4.4 Overview of memory variables per condition.

		MS TV	MS tablet	MS natural	SS TV[I]	SS tablet[II]
Memory_{ed}						
	TV	4.05_{ab} (1.14)	3.65_{b} (1.23)	4.08_{ab} (0.97)	4.56_{a} (0.56)	-
	Tablet	1.55_{b} (1.33)	3.29_{a} (1.53)	1.60_{b} (1.53)	-	3.72_{a} (0.97)
Memory_{ad}						
	TV	1.79_{a} (1.73)	1.32_{ab} (1.64)	1.85_{a} (1.56)	2.16_{a} (1.63)	0.78_{b} (1.05)[III]
	Tablet	0.66_{bc} (1.36)	1.61_{ab} (1.82)	1.05_{bc} (1.58)	0.09_{c} (0.39)[III]	2.11_{a} (1.69)

Note. The means are presented in the table with the standard deviations in parentheses. Different subscripts indicate significant differences. [I] SS TV condition is for the ad on the TV the full focus condition and for the ad on the tablet the no exposure condition. [II] SS tablet condition is for the ad on the tablet the full focus condition and for the ad on the TV the no exposure condition. [III] In the no exposure condition some participants indicated to 'remember' the brand, but this was caused by the task that they had to perform before answering the memory_{ad} items.

Table 4.5 Correlation matrix of memory.

	1	2	3	4
1. Memory_{ed} TV	x			
2. Memory_{ed} tablet	-.57***	x		
3. Memory_{ad} TV	.23**	-.19*	x	
4. Memory_{ad} tablet	-.35***	.41***	-.20**	x

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

Memory_{ed}. To analyze the effects on memory of the editorial content, four media conditions were compared (i.e., the three MS conditions and one SS condition). The analysis for memory_{ed} TV showed significant differences between the four (MS TV, MS Tablet, MS natural, SS TV) conditions, F (3, 140) = 4.36, p = .006, η^2 = .09. Tukey's post-hoc test revealed that the participants' memory of the editorial content on TV was equal in the SS TV, MS TV, and MS natural conditions, and that participants in the MS tablet condition remembered significantly less of the editorial content than participants in the SS TV condition (Table 4.4).

The analysis for the tablet also showed significant differences between the four media conditions (MS TV, MS Tablet, MS natural, SS tablet), F (3, 144) = 25.17, p <

.001, η^2 = .35. Tukey's post-hoc test revealed that the participants in the SS tablet and the MS tablet conditions remembered the editorial content of the tablet just as well and, even more importantly, they scored significantly higher on $memory_{ed}$ for the tablet than the participants in the MS TV and MS natural conditions (Table 4.4). This indicates that people remember the editorial content of the screen focused upon just as well when multiscreening as when single screening.

$Memory_{ad}$. To analyze the effects on memory of the ad, all five media conditions were compared. The SS conditions functioned as a full or no exposure condition, depending on which medium the ad appeared (e.g., the participants in the SS TV condition were fully exposed to the ad on the TV, but had no exposure to the ad on the tablet). The analysis of the TV banner showed a significant difference of memory for the ad between the media conditions, $F(4, 176) = 4.28$, $p = .003$, $\eta^2 = .09$. Tukey's post-hoc test revealed that the participants in the SS TV, MS TV, and the MS natural condition remembered the TV ad just as well, and significantly better than the participants in the SS tablet (no exposure) condition. Participants in the MS tablet condition did not remember the TV ad better than the participants in the SS tablet (no exposure) condition (Table 4.4).

The analysis for the tablet also showed significant differences between the media conditions, $F(4, 176) = 9.86$, $p < .001$, $\eta^2 = .19$. Tukey's post-hoc test revealed that participants in the MS tablet and SS tablet conditions remembered the tablet ad just as well, and better than the participants in the SS TV (no exposure) condition. Conversely, participants in the MS TV and MS natural conditions had significantly less memory for the tablet ad compared to the participants in the SS tablet (full exposure) condition, and there was no difference between these groups and the participants in the SS TV (no exposure) condition (Table 4.4). Overall, these findings indicate that people remember the ads on the screen that they focus upon just as well when multiscreening as they do when single screening, but not when they multiscreen and have their primary focus on the other screen.

DISCUSSION

In this study we examined 1) viewing behavior, in terms of number of switches, gaze duration, and total viewing time; 2) the correlation between eye-tracker and self-reported data on people's attention distribution across screens; and 3) the effect on people's memory of editorial content and advertising while multiscreening as compared to single screening. Overall, the results showed that people switched on average 2.5 times per minute and had greater average and total gaze durations on TV than tablet. In addition, the study showed that, overall, people were well capable of reporting their own attention distribution to both screens. Finally, the results showed that multiscreeners were able to remember editorial content and advertising just as well as single screeners, as long as they devoted sufficient visual attention to the screen.

First, the study examined viewing behavior of multiscreening and found that participants in the natural multiscreening condition switched 2.5 times per minute, had longer gazes on the TV than toward the tablet, and devoted their attention to the TV almost 75% of the time. There appeared to be fewer switches than found in earlier research (Brasel & Gips, 2011). This shows that viewing behavior is context-dependent (bottom-up), and may vary based on the characteristics of the media, content, and user (Wang et al., 2015). However, top-down processes could also guide attention as shown in the differences in viewing behavior between the MS TV and MS tablet condition. The results also showed that half of all gazes on media are shorter than 10 seconds. Finally, the gaze distribution pattern was remarkably similar to gaze distribution patterns found in other attention research that examined multiscreening with TV and computer (Brasel & Gips, 2011) and in studies on TV attention (Hawkins et al., 2005).

Second, people are capable of reporting post-hoc how much attention they paid to the screens, as demonstrated by the highly correlated eye-tracker and self-reported data. A previous study found that people are not capable of reporting how often they switch between media (Brasel & Gips, 2011). Synergizing these findings, it seems that people are not capable of reporting details of their behavior (e.g., number of switches), but are capable of reporting their behavior in more general terms (e.g., the total distribution of their attention). However, whether people will always report their attention correctly is another matter. Although they were not told beforehand that they would have to report their attention afterwards, it is possible that they followed the instructions more carefully because of the eye-tracker glasses. Whether people always report the distribution of their attention accurately can only be examined by collecting both self-reported and objective measures of attention. Future research should examine the correlation between self-reported and objective measures in other contexts (e.g., different media combinations, different media content, longer durations) to get a better understanding of the extent to which people are capable of reporting, and are willing to report, their media exposure accurately.

Third, the effects on people's memory of editorial and advertising content between multiscreening and single screening were compared. The multiscreening literature has generally found a memory deficit when people use multiple media simultaneously, compared to when they use one medium. However, there is some indication that this deficit might not be present when enough visual attention is devoted to the media content (Jeong et al., 2010; Jeong & Hwang, 2012). The current study confirmed this indication. Importantly, we found that memory was only impaired in multiscreening conditions when the focus of attention was on the medium that was not focused on in the single screening condition. The content of the medium focused upon in a multiscreening situation is remembered just as well as it is in a consecutive single screening condition.

The results of the study showed greater attention to and effects of TV compared to the tablet. There are at least three possible explanations for this difference. First, the found differences could be explained by a difference in screen size. Previous literature showed, for example, that bigger screens elicit more arousal than smaller screens and that more arousal could positively affect memory (e.g., Reeves, Lang, Kim, & Tatar, 1999). Second, TV is a more prevalent screen than the tablet (SKO, 2016). Thus, it is likely that people have more experiences with TV compared to tablet. Also, TV is more often used in combination with another screen when multiscreening. Therefore, people may have better skills to combine this screen with other screens. Third, in this study the content on TV was audiovisual, whereas the content of the tablet was only visual. Therefore, it is possible that people who were focusing on the tablet could still have paid attention to the information on the TV through their auditory senses, without directing visual attention to this medium. This is in line with previous research on multitasking and structural interference (e.g., Pool et al., 2003; Jeong & Hwang, 2015). However, it was not possible to direct visual attention towards the tablet when focusing on the TV. In addition, the results indicate that bottom-up processes are strong drivers of attention allocation towards the TV content. Even in the multiscreening condition where the participants were instructed to focus mainly on the tablet, they focused on the TV a large proportion of their time. Thus, bottom-up processes almost overruled the top-down process of the instruction to pay more attention towards the tablet in the MS tablet condition. Although these factors could be potential confounding factors, we believe our claims still hold, especially since the results showed both a decrease in participant's memory in the MS TV and MS tablet condition compared to the ST tablet and ST TV conditions respectively.

Limitations

It could be argued that the self-reported and eye-tracker measurements of attention are not measuring the same concept. Attention is more than just viewing time (Hawkins et al., 2005). The eye-tracker data reflect visual attention, however, the self-reported measure also reflects whether someone is mentally present. One can watch something without paying attention to it; for example, one can look at TV but not register what is happening. However, the difference in concepts is also seen as an advantage. Some studies only use eye-tracking data, which reflect only visual attention, and some studies measure attention with self-reports, which measures more than only visual attention. The current study shows that both measures are highly correlated, and this finding will benefit future research.

The focus of the study was to unravel people's visual viewing behaviors during multiscreening - and its consequences. Eye-tracker measurements of attention are ideal for this purpose. However, this focus on visual attention neglects the auditory component of television as an audiovisual medium. Future research could make use of other measures of attention that take into account all involved modalities, such as EEG, skin conductance, or heart rate, which are known to measure the orienting response or secondary reaction tasks (e.g., Lang et al., 2007).

Finally, as mentioned before bottom-up processes are important in guiding attention allocation of people (e.g., Pieters & Wedel, 2004). Therefore, using one kind of stimulus (e.g., one TV show and one type of advertising) could be seen as a limitation of the study. The current study is a first step in unraveling viewing behavior and its effect while multiscreening. Future research using different kinds of stimuli is necessary to further disentangle this phenomenon.

Research Implications

The current study has some major research implications. First of all, it has made an important contribution by comparing eye-tracker data with self-reported data. By showing the high correlation between these two measures, we showed that people are capable of reporting their distribution of attention in multiscreening conditions, and that post-hoc self-reported attention immediately after exposure is a valid measure in multiscreening research. This finding will benefit future research on media exposure and attention. The high correlation between the self-reported and eye-tracker measures of attention indicate that both could be used. We suggest that the decision about which of the two measures researchers should use depends on what kind of attention the researchers are interested in.

A second contribution is the additional knowledge of the effect of multiscreening on memory. We found that the participants who were multiscreening had equal memory of the media content as the participants who were single screening, provided that they paid sufficient attention to the assessed media content. Thus, compared to TV as the single screen there was a decrease in memory only for the participants in the MS tablet condition, whereas compared to tablet as the single screen there was a decrease in memory only for the participants in the multiscreening condition with most attention directed to the TV (i.e., MS TV and MS natural). Although less attention was paid to the content in the multiscreening conditions compared to the single screening conditions it was still sufficient to remember the content equally well. The memory deficit reported in earlier research seems to exist only when the main focus of attention is not on the assessed content. This means that not all types of multiscreening are the same. Effects might vary greatly by the type of multiscreening and how attention is divided. Therefore, future research should further look into differences between various multiscreening conditions.

Third, we have contributed to the knowledge on multiscreening by comparing natural (bottom-up) and instructed multiscreening (top-down). Thus, it was possible not only to make inferences about how people would normally behave while multiscreening, but also to actually examine rather natural multiscreening behavior and its effects on people's memory for media content. An important finding is the similarity in viewing behavior of the participants in the natural multiscreening condition and the multiscreening TV condition.

The current study also has important practical implications. First, the results with regard to viewing behavior provide important information for practitioners. The results showed, for example, that half of all gazes are shorter than 10 seconds. Thus, the attention paid to the screens is very short. This indicates that the main message of a media campaign must not take too long, because people will not pay enough attention to process longer messages. Second, by showing that a message can be processed just as well when people are multiscreening as when they are single screening, we showed that multiscreening does not have to be as bad for memory as believed. When the screen in focus is the same screen that is used when single screening, memory for the editorial and advertising content is unimpaired. This has implications for all kinds of parties who generate media content, such as advertisers, the government, program/app developers, etc. In a world where people are increasingly combining multiple media it is important to get the audience's attention. Attention is the key word when one wants to be remembered in a multiscreening environment.