"TV no longer commands our full attention": Effects of second-screen viewing and task relevance on cognitive load and learning from news

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ABSTRACT

Second-screen viewing—the use of smartphones, tablets, and laptops while watching television—has increased dramatically in the last few years. Using multiple resource theory and threaded cognition theory, this study investigated the effects of second-screen viewing on cognitive load, factual recall and comprehension of news. Second, we examined the effects of relevant (i.e., looking up information related to the news story) and irrelevant (i.e., looking up information unrelated to the story) second-screen viewing on learning from news. Results from an experiment ($N = 85$) showed that second-screen viewing led to lower factual recall and comprehension of news content than single-screen viewing. These effects were mediated by cognitive load: second-screen viewing led to a higher cognitive load than single-screen viewing, with higher cognitive load, in turn, leading towards lower factual recall and comprehension of news content. Contrary to our expectations, we found no statistically significant differences between effects of relevant and irrelevant second-screen viewing.

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1. Introduction

Second-screen viewing—the use of smartphones, tablets, and laptops while watching television—has increased dramatically in the last few years. The latest Nielsen survey of connected device owners reported that in 2013 nearly half of U.S. smartphone owners (46%) and tablet owners (43%) said they use their devices *daily* as second screens while watching TV (Nielsen Company, 2013). Accordingly, the much-cited New Multi-screen World report from Google, which took a closer look at cross platform consumer behavior, warned the TV industry that "TV no longer commands our full attention as it has become one of the most common devices that is used simultaneously with other screens" (Google, 2012).

The question that has kept television producers and advertisers busy is: what do multi-screen viewers use their second screen for? Do they follow up on something relating to the television program they are watching, or are they pursuing other activities? The Nielsen report shows it is both. Among tablet and smartphone owners, looking up general information (76% and 63%, respectively), web surfing (68% and 55%), and visiting social network sites (53% and 52%) are the most popular second-screen activities. However, almost one in two tablet owners also use their device to look up

information about what they are watching, and one in five read conversations about the program on social network sites (Nielsen, 2013).

The latest State of the News Media report from the Pew Research Center (Sasseen, Olmstead, & Mitchell, 2013) noted that second-screen viewing has become especially popular around news events such as the 2012 U.S. presidential debates, election night, and the State of the Union address. The report found that one in four who watched election night used both internet and television simultaneously to follow up on the results. In addition, a study from Verizon (2012) found that of the 65% adults saying they would watch the 2012 U.S. presidential debate on TV with a second device in hand, 46% planned to use this device for monitoring broadcast media reactions, 41% for fact checking candidate's claims, 39% for following the live reactions of political reporter(s), and 32% for monitoring social media reactions.

These emerging news viewing trends offer tremendous opportunities for news producers who want to strengthen bonds with their audiences by providing supplementary digital content, or by offering online tools allowing viewers to share and engage with news content more actively. Still, despite the increasing use of second-screens to follow the *same* news event, indications are that viewers are far more likely to split their attention between *distinct* activities on each device (Verizon, 2012). As news is not only a commodity, but also has a pivotal role as a source of public affairs information and a tool for fostering citizenship, this raises questions about the

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best way forward in news makers' utilization of second-screen technology. How to design second-screens in terms of content and formal features to ensure informational effectiveness?

The present study sets out to examine the consequences of second-screen viewing on news learning. First, we investigate the effects of second-screen viewing—in this study defined as watching a newscast while simultaneously looking up information online—on cognitive load, factual recall and comprehension of news. Second, we take a closer look at the effects of related (i.e., looking up information related to the news story) and unrelated (i.e., looking up information unrelated to the story) second-screen viewing on learning from news. Results from this study may be of relevance to information producers such as news makers, instructional designers, or public service message producers looking into enhancing the effectiveness of second-screen usage.

Several studies across a wide range of contexts have examined effects of media multitasking on complex memory and learning outcomes such as reading comprehension tasks (Bowman, Levine, Waite, & Gendron, 2010; Fox, Rosen, & Crawford, 2009; Lee, Lin, & Robertson, 2012, 2011; Srivastava, 2013), recall of podcast (Srivastava, 2013) and television news content (Bergen, Grimes, & Potter, 2005), and classroom learning tests (Fried, 2008; Hembrooke & Gay, 2003; Rosen, Lim, Carrier, & Cheever, 2011; Sana, Weston, & Cepeda, 2013; Wood et al., 2012). Most of these studies found that media multitasking reduces memory performance. For example, the use of social media (Wood et al., 2012) and laptops (Fried, 2008; Hembrooke & Gay, 2003; Sana et al., 2013) during class, reading an online news story while simultaneously listening to a podcast (Srivastava, 2013), or reading a text while at the same time being engaged in instant messaging (Bowman et al., 2010; Fox et al., 2009) or video viewing (Lee et al., 2012; Lin et al., 2011), have all been found to negatively influence learning outcomes of the primary task at hand.

Few studies, however, examined effects of concurrent television viewing along with other tasks on memory for television content. In most cases, research has focused on the detrimental effects of television exposure for other tasks. For example, some studies reported interfering effects of background television on reading comprehension (Armstrong & Chung, 2000) and homework performance (Pool, Koolstra, & Voort, 2003; Pool, Van der Voort, Beentjes, & Koolstra, 2000). Others showed a negative influence of concurrent video exposure on reading comprehension (Jeong & Hwang, 2012; Lee et al., 2012; Lin et al., 2011), with news video affecting reading comprehension more severely than comedy video (Lin et al., 2011). One study did examine effects of simultaneous message presentations in a television news program on viewers' attentional capacity and story fact recognition (Bergen et al., 2005). The researchers found that a multimessage format (i.e., the presentation of a news anchor, together with lexical news crawls, graphics, sports scores, weather icons, etc.) lead to lower recognition test scores than a simple format (i.e., the presentation of only a news anchor). These findings were attributed to the visual complexity of the multiple and conflicting message presentations which exceeded viewers' attentional capacities, resulting in an inefficient allocation of attentional resources (Bergen et al., 2005).

Although Bergen et al.'s study (2005) indicated that watching television news while simultaneously attending other visuals on the same screen hampers cognitive processing and memory performance, it is hitherto unknown to what extent a cognitively more demanding activity such as the concurrent use of second screens affects learning from television news. The present study addresses this gap in the literature by examining news recall and comprehension for student participants who watched a newscast while simultaneously looking up information online (i.e., the media multitask condition) and student participants who watched a newscast without receiving a second task (i.e., single task condition). As far

as we know, our study is the first to examine effects of second-screen viewing.

A second contribution of the current study is that it considers the relationship between tasks. More specifically, we seek to understand the role of task relevance in facilitating efficient cognitive resource allocation during multitasking. According to Wang, Irwin, Cooper, and Srivastava (2013, p. 6), task relevance refers to "whether the tasks involved in media multitasking serve closely related goals (or overall, a single goal)." Previous research most commonly defines media multitasking as the concurrent engagement in multiple tasks with different goals (e.g. Jeong & Fishbein, 2007; Ophir, Nass, & Wagner, 2009; Wang & Tchernev, 2012), reporting on the deleterious effects of media multitasking on cognitive functions (e.g., Ophir et al., 2009) and task performance (Wang et al., 2012). These findings led to the conclusion that the human brain is ill-equipped to handle multiple tasks simultaneously. However, recent studies found that under certain circumstances, depending on combinations of different individual and task related factors (for an overview see Wang et al., 2013), media multitasking performance may be more successful (David, Xu, Srivastava, & Kim, 2013; Srivastava, 2013; Wang et al., 2012, 2013). Especially in complex multitask situations, individuals tend to allocate their finite cognitive resources more strategically between tasks, seeking an optimal balance between the supply and demand of their resources to achieve the best outcomes (David et al., 2013; Wang et al., 2012, 2013). One way of doing so, it has been suggested, is by combining tasks that share a common goal (Wang et al., 2013).

Following this argument, it might be assumed that second-screen viewing is cognitively disruptive when the second screen is used to pursue activities that are irrelevant to the news program one is watching (e.g., checking email), whereas relevant use of the second screen (e.g., looking up additional information on the news story) might be less disruptive or even beneficial, because both tasks share a common goal, that is, information acquisition on a particular news issue. To our knowledge, no study to date has investigated the role of task relevance in the context of media multitasking. There is some evidence in the multimedia learning literature that the simultaneous presentation of corresponding visual (animation) and auditory (narration) material reduces cognitive load and enhances meaningful learning compared to a successive presentation of the same materials (Mayer & Moreno, 2003; Moreno & Mayer, 1999). However, these studies examined the role of temporal contiguity in multimedia learning and did not concern questions of task relevance. Therefore, in this study we focus on the role of task relevance by investigating news recall and comprehension for student participants who watched a newscast while simultaneously looking up relevant information online (i.e., information about the news story) and student participants who watched a newscast while simultaneously looking up irrelevant information online.

2. Predicting effects of second-screen viewing on recall and comprehension of news: multiple resource theory and threaded cognition

This study uses two theories of concurrent multitask performance to predict effects of second-screen viewing on recall and comprehension of news: multiple resource theory (Wickens, 1984, 2002) and threaded cognition (Salvucci & Taatgen, 2008).

2.1. Multiple resource theory

Resource theories of information processing offer a widely accepted explanation for the fact that performing two tasks