Universiteit Antwerpen

This item is the archived peer-reviewed author-version of:

Can't see the forest for the trees? The effect of media multitasking on cognitive processing style

Reference:

Kazakova Snezhanka, Cauberghe Veroline, Pandelaere Mario, De Pelsmacker Patrick.- Can't see the forest for the trees? The effect of media multitasking on cognitive processing style
Media psychology - ISSN 1521-3269 - 18:4(2015), p. 425-450
Full text (Publishers DOI): http://dx.doi.org/doi:10.1080/15213269.2015.1006789
To cite this reference: http://hdl.handle.net/10067/1274350151162165141

uantwerpen.be

Institutional repository IRUA

Can't See the Forest for the Trees? The Effect of Media multitasking on Cognitive Processing Style

SNEZHANKA KAZAKOVA
Department of Communication Science, Ghent University, Ghent, Belgium

VEROLINE CAUBERGHE
Department of Communication Science, Ghent University, Ghent, Belgium

MARIO PANDELAERE
Department of Marketing, Ghent University, Ghent, Belgium

PATRICK DE PELSMACKER
Department of Marketing, University of Antwerp, Antwerp, Belgium

Abstract

Media multitasking represents an important aspect of the recent evolution in media consumption habits. While some experimental research exists, it has primarily focused on the detrimental effects of multitasking on task performance. We go a step further by examining the impact of media multitasking on information processing style. Study I demonstrates that media multitasking, compared to sequential media consumption, leads to a more local perceptual processing style. Furthermore, the frequency of media switching predicts the level of perceptual processing. Study II extends these findings by showing that media multitasking also affects conceptual processing style. Specifically, media multitasking leads to lower-level (or more concrete) construal of behavior in a subsequent task. It further shows that conceptual rather than visual switching between media drives the observed differences in conceptual processing. These findings suggest that, as a growing phenomenon, media multitasking behavior may substantially alter how media viewers process media content.

Keywords: media multitasking, perceptual processing, construal level, task switching, abstract vs. concrete processing

Can't See the Forest for the Trees? The effect of Media Multitasking on Cognitive Processing Style

Beyond the invention of the Internet, technological innovation has led to the emergence of various new types of media devices and formats, increasing the opportunities for media exposure. Media viewers are adapting to this boundless media landscape, which has led to a fundamental change in their media consumption habits. A reflection of this change is viewers' tendency to consume more than one medium at the same time: a phenomenon referred to as *media multitasking* or *simultaneous media exposure* (Roberts, Foehr, & Rideout, 2005).

Media multitasking is truly ubiquitous today and is quickly becoming a standard behavioral pattern in everyday media consumption. It is most evident among the younger generations: individuals under 30 report that over one third of their television and Internet usage occurs simultaneously (Armbruster, 2008). A recent survey in the United States reports that the percentage of media multitasking behavior as a proportion of total media exposure has grown substantially since 2004 (Rideout, Foehr, & Roberts, 2010). The actual change is that, while

media multitasking leaves young people's media use time relatively unchanged, it leads to significantly more saturated exposure to media content – more content is viewed within the same timeframe (Foehr, 2006). It seems that viewers continuously adapt to the changing media landscape by surrounding themselves with a myriad of information streams (Roberts, Foehr, & Rideout, 2005). A number of recent studies have stressed the increased prevalence of media multitasking behavior and the growing need for empirical research on the potential consequences for the cognitive processing of media content (Ophir, Nass & Wagner, 2009; Lin, 2009; Cain & Mitroff, 2010). Experimental research on media multitasking, which is still rather scarce, has focused primarily on its detrimental effects on learning, memory, and general cognitive processing (Armstrong & Chung, 2000; Pool, Koolstra, & van der Voort, 2003; Brasel & Gips, 2011). For example, students' memory for lecture content suffered significantly, when they were permitted to use laptops with Internet access during their classes (Hembrooke & Gay, 2003). Furthermore, Wang and Tchernev (2012) found that while cognitive needs drive media multitasking behavior, media viewers obtain emotional but not cognitive gratifications from media multitasking.

From a cognitive psychology perspective, the above findings are hardly surprising. For over a century, researchers have documented the human (in)ability to multitask, revealing significant performance deficits when two or more tasks are performed concurrently (Pashler, 1994). These cognitive deficits suggest that viewers' ability to process media content is likely to be compromised in a media multitasking context. Thus, the new media consumption context viewers choose to create certainly affects *their ability* to process information. Still, how about *the level* at which information is processed? In a pioneering study, Ophir, Nass and Wagner (2009) explored the difference in cognitive processing mechanisms of high (frequent) and low

(infrequent) media multitaskers by letting them perform several executive control tasks. High media multitaskers exhibited greater difficulty in filtering out irrelevant stimuli, were less likely to ignore irrelevant representations in memory, and less effective at task switching. These findings suggest that individuals who media multitask regularly have a fundamentally *different cognitive approach* to processing information. However, the design of this study precludes causal inferences. It is unclear whether people who choose to engage or not engage in media multitasking differ in their cognitive approach to information processing. It is possible that media multitasking behavior changes their information processing style over time. The present paper contributes to this stream of research by studying the impact of media multitasking experimentally. Rather than looking at individual differences in multitasking behavior, we explore how a media multitasking *context* affects the level at which media viewers process information, both perceptually and conceptually.

People can attend to information in different ways. For example, a physical object can be processed visually either by focusing on the object's overall shape (like zooming out an optical lens) or by focusing on the details that make up the overall shape (equivalent to zooming in an optical lens). Psychologists refer to this distinction between global and local processing style as *the level of perceptual processing.* Similarly, people may conceptually process information at a concrete (i.e. low-level) or at an abstract (i.e. high-level). This distinction in *level of conceptual processing* refers to how objects or behaviors are mentally categorized. Compared to low-level construals, high-level construals are considered to be broader, more abstract, and more elaborate mental representations of reality. Thus, both perceptual and conceptual processing can vary from a lower to a higher level of processing. While processing information perceptually requires using

the senses, processing it conceptually demands the use of pre-existing cognitive schemas or mental categorizations.

Our primary goal is to identify the implications of consuming more than one medium simultaneously for viewers' perceptual and conceptual information processing style. The theoretical insights we use to predict these effects are derived from both social (information processing style) and cognitive (task interference and task switching) psychology paradigms. We bring these distinct streams of research together and apply them to media contexts. In two experiments, we compare a media multitasking context to a traditional (sequential) media consumption context, providing an initial account of their effects on viewers' perceptual and conceptual processing style. Study I explores the effect of a media multitasking context on the level of perceptual processing. It also investigates the role of media switching and perceptual load. Study II extends these findings to the level of conceptual processing by looking at the effect of media multitasking on concrete versus abstract construals of subsequent behaviors. Furthermore, it attempts to investigate more in-depth the mechanism that drives the observed effects by comparing visual attention switching (gaze shifting) to conceptual switching between *different* media content streams.

In the following paragraphs, we introduce two cognitive paradigms of multitasking performance (dual-task interference and task switching) that demonstrate the limits of our information processing ability in multitasking contexts. They also provide insights on how coping with these limitations can affect the level at which information is processed. Next, we elaborate on the differences between a media multitasking context and the simple stimulus-response tasks used in cognitive studies. Lastly, we summarize social psychology models of

perceptual and conceptual information processing, which allow predicting the level of information processing in a multitasking context.

Task Interference and Task Switching

A proper investigation of the media multitasking phenomenon and its effects on information processing style demands an overview of existing research on multitasking performance. Task interference studies have demonstrated that even very simple tasks performed simultaneously drastically interfere with one another, resulting in significant task response delays (For a review, see Pashler, 1994). Another prominent stream of cognitive research has approached the subject of multitasking ability by looking at the efficiency with which people switch between tasks (For a review, see Monsell, 2003). Two competing theoretical explanations have been proposed for the detrimental effects of multitasking on performance: mental resources that represent our limited processing capacity are shared (capacity-sharing) among the different tasks being performed or distinct mental processes require a single mechanism to operate (bottleneck models) and these processes compete for access to the mechanism, leading to performance deficits. The two approaches are often complementary in accounting for various dual-task interference findings, although the structural bottleneck model has been more closely associated with observed differences in single versus dual-task performance (Roediger, Knight, & Kantowitz, 1977). Structural bottleneck models assume a specific structural limitation in the cognitive architecture, defining competition between tasks as an all-or-none process (Kahneman, 1973; Ruthruff, Pashler, & Klaassen, 2001). Similarly, *task switching models* assume that there is a limit to the human capacity for engaging in mental activities, which forces processes to occur sequentially rather than simultaneously while multitasking (Byrne & Anderson, 2001). While switching between tasks, a process referred to as ‘task-set reconfiguration’ occurs with the

purpose of adapting to the new set of rules inherent to the new task at hand. Another complementary explanation for switching costs is 'task-set inertia', which refers to the resources needed to inhibit the previous task-set with its different rules, goals, and stimulus attributes.

Media Multitasking Contexts

While cognitive models of multitasking focus primarily on the performance deficit evident in simple Stimulus-Response tasks (cf. S-R tasks), a media consumption context differs from this situation considerably in two ways. First, most traditional media are *passive* and do not require an actual, physical response/action from the viewer. Two primary examples are watching television and listening to the radio. Still, even new media formats that are highly interactive, such as social media websites and various software applications allow for delayed responses. In fact, while considerably more complex than S-R tasks, video games represent the only medium that resembles an S-R task environment, where active and timely responses are required. Precisely because most media do not require such responses, it seems easy to surround oneself with several media simultaneously.

The second difference concerns the flow of information in S-R tasks compared to media contexts. The majority of media formats, regardless of the content modality (visual, auditory, or both) represent a *continuous* flow of content fighting for viewers' attention. Taking into account the information processing constraints inherent to simple S-R environments, the interference is likely to be even stronger in media contexts, where attending to such complex, continuous streams of information is required. Therefore, the performance problem faced by media multitaskers is how to efficiently distribute their limited perceptual and cognitive resources among the multiple streams of information they choose to surround themselves with.

The present paper applies task switching models to complex media contexts in order to hypothesize the effect of media multitasking on cognitive processing style. The idea of sequential processing inherent to task switching implies that coping with information processing constraints would require quick and efficient switches of attention between different media. Thus, media viewers are likely to adopt an attention switching strategy in a media multitasking context, making it considerably more fragmented than single media contexts.

According to task switching models, the reconfiguration of mental resources that occurs immediately after a task switch results in consistently slower responses and higher error rates. These costs persist, albeit to a lesser degree, even when additional time is allocated to prepare for a task switch. Apparently, resource reconfiguration leads to a high cognitive load immediately after a switch, which results in processing costs. This high use of resources while switching between tasks could have detrimental effects not only on how *efficiently* information is processed but also on the *level* at which is it processed.

Task switching has also been studied using neuroimaging techniques (Dux, Ivanoff, Asplund & Marois, 2006). Studies reveal additional activation in several regions of the brain before and immediately after a task switch, which explains the findings from task switching experiments (Dove et al., 2000; Mecklinger, Von Cramon, Springer, Matthes-von Cramon, 1999). Activation is especially strong in the pre-frontal cortex, which is responsible for executive control functions.

Brasel and Gips (2011) recently conducted a naturalistic experiment, which clearly demonstrates viewers switching strategy and the fragmented nature of media multitasking. The researchers let participants use the Internet in combination with a television at their own will for approximately half an hour. On average, multitaskers switched between the two media types four times per minute, while the average gaze duration lasted only 2.6 seconds. Indeed, the shortness

of gaze durations for both media types suggests a highly fragmented environment, where attention needs to be constantly reoriented. Task switching models posit that the more one switches between tasks, the higher the costs are for cognitive processing and, therefore, for task performance. Apart from these cognitive deficits, the rapid attentional shifts reported in this naturalistic study indicate shallow cognitive processing, due to imminent task switching costs. Furthermore, participants considerably underestimated the frequency with which they switched their attention between the computer and the television, which also suggests a primarily automatic consumption of media content in a multitasking context. While previous studies focus on the effect of task switching on performance, we go a step further by looking into its implications for the level of information processing.

Perceptual Processing

Throughout this paper, we use the term *level of perceptual processing* to refer to the distinction between global and local perceptual processing style. The saying "Can't see the forest for the trees", serves well as a metaphor, exemplifying the difference between global and local perceptual processing: seeing trees would indicate a local perceptual processing style while seeing a forest would indicate a broader, global perceptual processing style. Navon (1977) was the first to study the precedence of global over local perceptual processing – the question whether perception occurs in a sequence from a global (wholes) to a local (parts that make up the wholes) perceptual style. Since his pioneering work, many researchers have investigated the determinants of perceptual processing style (Kimchi, 1992; Love, Rouder, & Wisniewski, 1999). Förster and Dannenberg (2010) integrated existing theory and research findings on the topic by developing a systems account of GLObal and LOcal processing MOdel (GLOMO^{sys}). GLOMO^{sys} makes several important assumptions regarding perceptual processing style. Our

predictions regarding the effects of media multitasking contexts on subsequent perceptual processing are partially based on three of these assumptions: 1) a number of real-world variables can affect the level of perceptual processing (e.g., mood, regulatory focus, novelty, power etc.), 2) the level of perceptual processing carries over to subsequent tasks, and 3) there is a clear link between perceptual and conceptual processing style.

Conceptual Processing (Construal Levels)

The forest versus trees metaphor used to exemplify the distinction between global and local perceptual processing can also be applied to conceptual processing style. Describing what we see as a forest would represent a higher-level, more abstract mental categorization (construal), while describing it as a 'situational grouping of trees' would represent a lower-level, more concrete construal. In order to move from a low-level (concrete) to a high-level (abstract) construal of an object, for example, one needs to exclude certain characteristics of that object that are secondary to its broader purpose. Thus, a high-level construal of a "television" as an "entertainment device" would require excluding features such as its color and size, while a high-level representation of the act of "playing basketball" as "having fun" would require omitting the type of sport and the ball altogether. A prominent theory concerned with conceptual processing and the mental construction reality is Construal Level Theory (CLT: Trope and Liberman, 2010). CLT is partly based on Action Identification Theory (AIT: Vallacher & Wegner, 1987), which is more narrowly focused on the mental representations of human *behaviors* and factors that influence these representations. AIT has provided a robust measure of construal levels through behavior identification (Vallacher & Wegner, 1989). It posits that difficult tasks require the action at hand to be encoded at a lower level of abstraction, where attention is highly focused on task details. This notion that successful performance of challenging tasks is associated with a local, more

concrete focus should hold for media multitasking contexts, where viewers' attention constantly shifts between complex, continuous streams of information.

Combining insights from the social and cognitive psychology frameworks presented above, we investigate how a media multitasking context affects the level of perceptual (Study I) and conceptual (Study II) processing during a subsequent task and the mechanism that drives these effects.

STUDY I: Media Multitasking and Global versus Local Perceptual Processing

Based on dual-task interference and task switching models, a media multitasking context is likely to be more perceptually demanding compared to a traditional, single or sequential media context. Therefore, due to interference between the different types of content a media viewer is exposed to, perceptual load should be generally higher in a multitasking context, compared to a traditional media context. Additional activation in the prefrontal cortex (linked to executive control) and other regions of the brain has been observed in neuroimaging studies during task switching and supports this prediction (Dove et al., 2000)

H1: Participants will report higher perceptual load when they are exposed to two media simultaneously compared to a condition where they are exposed to two media sequentially.

As stated above, Action Identification Theory assumes that successful performance of difficult tasks demands a low level of mental categorization of one's behavior. It requires that one's attention is focused on specific task elements rather than the general goal of the task at hand. This suggests that more local perceptual processing during a complex task (such as media multitasking) is most beneficial for performance. Thus, according to AIT, in order to successfully process a complex media environment, viewers' need to narrow their attentional scope and focus on perceptual details, which can induce a more local perceptual processing style.

Apart from increased complexity, frequent switching behavior is another major distinguishing factor between a sequential and a multitasking media context, since viewers' attention is frequently shifted between different perceptual streams. In a recent study, Hamilton, Vohs, Sellier, and Meyvis (2011) demonstrated that mindset switching depletes self-regulatory resources and impairs decision-making in subsequent tasks. Self-regulatory resources refer to an exhaustible supply of willpower that allows us to inhibit undesired behaviors and overcome temptation (Hamilton, Vohs, Sellier, and Meyvis, 2011; Rubinstein, Meyer, and Evans, 2001). Self-regulatory depletion has been linked to both perceptual (Bruyneel & Dewitte, 2012) and conceptual (Wan & Agrawal, 2011) processing style. More specifically, a state of self-regulatory depletion is characterized by local perceptual processing. Based on the assumptions of AIT concerning task complexity and the potential for self-regulatory depletion associated with frequent switching between content streams, we predict that perceptual processing will differ within a media multitasking context compared to a sequential media context. Specifically, we expect that task switching while media multitasking will deplete self-regulatory resources, and induce a more local perceptual processing style. Furthermore, according to GLOMO^{sys}, this local perceptual processing style should carry over to subsequent tasks.

H2: Participants exposed to two media simultaneously will exhibit a more local perceptual processing style during a subsequent task, compared to participants who are exposed to two media sequentially.

In line with AIT, difficult tasks tend to prompt a more local perceptual processing style and dual-task interference models suggest that multitasking falls into the category of difficult tasks because of the amount of cognitive resources required. Since perceptual load is an indicator of the amount of mental resources required by a task, and task difficulty is positively related to

local perceptual processing, we propose that perceived perceptual load will account for differences in perceptual processing style between a media multitasking and a sequential media context.

H3: Perceptual load will mediate the effect of media multitasking on levels of perceptual processing during a subsequent task.

The frequency of switching between two media streams is also an important factor to consider as a potential driver of the predicted differences in perceptual processing style. According to task switching models, each switch between two tasks is associated with processing costs. These costs are due to the need to reconfigure the task-set, defined as the set of rules inherent to the task and operations required by the task (Monsell, 2003). If 1) mindset switching depletes self-regulatory resources and 2) constant switching is indeed necessary for effectively navigating a media multitasking environment, then the amount of switching between media content streams should affect perceptual processing in a media multitasking context. Since switching frequency can only be measured in the media multitasking condition, our predictions about the relationship between switching frequency and perceptual processing cannot be tested across conditions but only within the multitasking condition.

H4: The higher the switching frequency between two media, the more local the perceptual processing style during simultaneous media exposure.

Method and Procedure

We conducted a laboratory experiment using a between subjects design to compare media consumption in a traditional, sequential media context to a media multitasking context. A total of seventy-seven (34 male) undergraduate students at a large European university took part in the experiment as fulfillment of a partial course credit requirement. They were randomly assigned to

one of the two experimental conditions. The average age within the sample was 21.4 years. In the traditional media condition (n=35) media exposure was *sequential* (in a randomized order), while in the media multitasking condition (n=42) media exposure was *simultaneous*. Due to the nature of a media multitasking context all sessions were conducted individually. Each participant was exposed to two types of media: a website (the official website of National Geographic for Belgium) and two short animated films (pre-selected from a DVD collection by Disney/Pixar). Exposure to each media type lasted approximately 8 minutes. In the sequential condition, the sessions lasted approximately 16 minutes while in the multitasking condition they lasted approximately 8 minutes. Despite the overall longer duration of the sequential condition sessions, the design of the study ensured that participants were exposed to identical types of media and content throughout all sessions. In both conditions, the website was viewed on a 15.6 inch laptop computer, while the short films were presented on a 40 inch flat screen TV. The two screens were placed at a 30 degrees viewing angle from each other, respective the spot where participants were seated. In the sequential condition, the order in which the two media types were viewed was randomized across participants in order to control for potential order effects. In the sequential condition participants were instructed to give their full attention to the presented media ("Please try to pay as much attention as possible to *each* medium"). In the media multitasking condition, where the two media types were presented simultaneously, participants were instructed to allocate their attention equally between the two media types ("Please try to pay as much attention as possible to *both* media."). The instructions to divide attention equally between the two media were given in order to prompt participants to switch between the short films and the website, rather than focusing only on their preferred medium. Video data on the frequency of switching between media revealed that most participants in the multitasking

condition followed the experimenter's instructions. Two participants who focused only on one medium were excluded from further analyses.

Measures

Global versus local perceptual processing. Immediately after the individual media sessions the level of perceptual processing was measured by a geometric figure comparison task originally developed by Kimchi and Palmer (1982). This task has been used standardly as a measure of global versus local perceptual processing style (e.g. Gasper & Clore, 2002). Participants were presented with triads of global geometric figures (triangles or squares) made up of smaller geometric figures (again, triangles or squares). On each trial they had to decide which of two geometric figures at the bottom was more similar to the comparison figure presented at the top (For an example, see FIG.1). They completed a total of 16 consecutive trials, randomized across participants. The similarity was arbitrary, based either on the global geometric configuration (a triangle or a square) or the local elements within the global configuration (also triangles or squares). Averaged scores ranged from 0 to 16; one point was given for each trial in which the global configuration was chosen as more similar (a zero was given otherwise). A high score, therefore, indicates predominately global perceptual processing, while a low score indicate predominantly local perceptual processing. If a media multitasking context indeed leads to more local perceptual processing, participants in the multitasking condition will be less likely than participants in the sequential condition to match the geometric figures based on their global configuration and more likely to match them based on the local elements that make up the global configuration.

Task switching. All sessions were recorded with an unobtrusive high-definition camera, recording the head and eye movements of participants in the media multitasking condition, in

order to estimate the frequency with which participants switched between the two media. Two independent judges counted the number of switches in each video. In case of discrepancies in the final score, both judges evaluated the video simultaneously and an agreement was reached. The flat screen TV was positioned approximately 3.5 meters away at a 30 degree viewing angle, which ensured the precise recording and estimation of gaze switches.

Perceptual load. Perceptual load was measured by a 7-point Likert scale (α=.74) adopted from the NASA Task Load Index (Hart & Staveland, 1988). In line with the design of the study, we used only one dimension from the Task Load Index that taps into 'mental demand'.

Mood. In previous studies positive mood has been linked to global perceptual processing and abstract construals, while negative mood has been associated with local processing and concrete construals (Gasper 2004; Gasper & Clore, 2002). To control for mood effects, we measured mood using the PANAS mood scale (Watson, Clark, and Tellegen, 1988).

Results

As predicted, an independent samples t-test revealed that self-reported perceptual load was significantly higher in the media multitasking condition (M = 2.60, SD = .70) compared to the sequential media condition (M = 2.17, SD = .62; $t(74) = -2.82$, $p < .01$), supporting H1. Furthermore, as hypothesized, participants in the media multitasking condition exhibited a more local perceptual processing style (M = 8.29, SD = 4.61) compared to those in the sequential condition (M = 10.5, SD = 4.93; $t(74) = -1.99$, $p < .05$). H2 is thus also supported by the data. To test H4, a linear regression analysis was conducted after selecting only data from the multitasking condition. In line with our predictions, switching frequency significantly predicted the level of perceptual processing ($\beta = -.51$, $t(40) = -3.747$, $p = .001$), such that higher switching frequency is associated with a more local perceptual processing. However, a Bootstrap analysis

revealed that perceived perceptual load does not mediate the effect of media context (multitasking versus sequential) on levels of perceptual processing (b = -.38, 95% CI = -1.717 to .619). H3 is not supported by our data. Last, t-tests revealed no significant differences in mood between the two media conditions ($t(74) = .23$, $p > .05$), confirming that differences in mood do not explain the observed effects on perceptual processing. Finally, no media order effects were found for levels of perceptual processing in the simultaneous condition ($t(74) = .58$. $p>.05$).

Discussion

In support of our predictions, participants who were exposed to two media simultaneously exhibited a more local perceptual processing style during the figure-comparison task compared to participants who were exposed to the same two media sequentially. These results indicate that a media multitasking context prompts a local perceptual processing style where visual attention is focused on local perceptual elements rather than their global configuration. The observed effect on perceptual processing style cannot be attributed to differences in affect since participants' mood did not differ between conditions. As expected, perceptual load was significantly higher in the multitasking condition. However, it did not mediate the effect of media multitasking on levels of perceptual processing. We used perceptual load as an indicator of the level of interference (task difficulty), which determines the amount of cognitive resources necessary to perform a task. The lack of a significant mediating effect could be attributed partly to the subjective nature of the perceptual load scale used. In fact, the frequency of media switching may better reflect perceptual load than the subjective perceptual load measure we used (no correlation was observed between switching frequency and perceptual load). However, since by design we only have media switching scores in the media multitasking condition, this precludes any test of mediation. Still, in support of the idea that frequency of media switching

represents the aspect of perceptual load that is most relevant to induce a local perceptual processing style, the frequency with which viewers switched between the two media in the multitasking condition predicted their level of perceptual processing during the figure-comparison task, explaining 26% of the variance in perceptual processing. A dual-tasking context has also been shown to impair elaborative encoding, by engaging *working memory* resources and thus forcing a more automatic processing style that does not require effortful attention (Naveh-Benjamin, Craik, Guez, & Kreuger, 2000; Foerde, Knowlton & Poldrack, 2006). This premise is also in line with the finding that mindset switching is linked to self-regulatory depletion, since working memory taps the same executive function resources as self-regulation and task switching (Miyake et al., 2000). While a media multitasking context forces viewers to process media content sequentially, our findings support the premise that it is the scattered, fragmented nature of a media multitasking environment is what prompts more local perceptual processing.

STUDY II: Media Multitasking and Abstract versus Concrete Construals

GLOMO^{sys} proposes that a direct link exists between perceptual processing and construal levels. Indeed, although perceptual and conceptual processing are distinct, abundant evidence exists for a relationship between perceptual processes and conceptual processes within a range of dependent measures, such as creativity, psychological distance, and contrast/similarity effects (Förster, Liberman, and Kuschel, 2008). Accordingly, global processing facilitates tasks, which benefit from broad or abstract construals, while local processing improves performance on tasks that benefit from narrow or more concrete construals (Förster, Liberman, and Kuschel, 2008). As such, we expect to find similar effects of media multitasking on perceptual and conceptual tasks, as far as these effects pertain to information processing style.

The purpose of Study II is two-fold. We do not only explore the effect of media multitasking contexts on construal levels, extending the findings of Study I to conceptual processing, but also pay closer attention to the type of switching responsible for driving the observed effects on processing style. In particular we distinguish between two types of switching: attention switches that represent simple shifts in perceptual focus versus attention switches that represent more complex shifts between different media content streams. We term the former *visual attention switching* and the latter *conceptual attention switching* and use these terms for the remainder of the paper.

As already stated, AIT posits that the *difficulty* of an action is a direct determinant of the level of abstraction at which the action is described. Thus, difficult tasks require more concrete construals of information. Furthermore, due to frequent task switching, less content deliberation occurs in a media multitasking environment, which should lead to information being encoded at lower levels of abstraction compared to a traditional, sequential media environment. Additionally, as already stated, mindset switching depletes self-regulatory resources, and self-regulatory depletion is associated with more concrete conceptual processing style (Wan & Agrawal, 2011). In line with these theoretical assumptions, we propose that a media multitasking context should be processed at a lower level of abstraction compared to a traditional, sequential media context. Specifically, based on the link between switching, self-regulatory depletion and construal levels, a media multitasking context should lead to more concrete construals compared to a sequential media context.

H5: Participants exposed to two media simultaneously will construe behaviors more concretely during a subsequent task, compared to participants who are exposed to two media sequentially.

Switching frequency during media multitasking was negatively correlated with levels of perceptual processing during a subsequent task in Study I, which indicates that switching might play a significant role in driving the observed effects. However, switching frequency was measured simply by observing participants' head and eye movements. In reality, this measure cannot distinguish between visual attention switches and conceptual attention switches as defined above, since visual switches represent simple gaze shifts, while conceptual switches represent shifts between different media content streams. For example, a participant could rapidly shift her gaze from the TV to the computer screen and back, without actually processing any information available on the computer screen for the brief duration of her gaze. The latter is an example of a visual attention switch, where no conceptual switching takes place. Indeed, in the context of dual-task interference, attention has been defined in terms of context-specific performance costs. Studies suggest that *attention*, as a process controlling perceptual selection, operates independently from the central bottleneck responsible for performance deficits in multitasking (Pashler, 1991). This notion of visual attention as separate from mindful processing is in line with research that demonstrates that mindset switching leads to self-regulatory depletion. No such link has been shown between visual switching (or gaze shifting) and self-regulatory depletion (Hamilton, Vohs, Sellier & Meyvis, 2011). We assume that switching between two different media streams increases the conceptual (mindset) switching, while switching between two identical media streams indicates perceptual switching only. Therefore we propose that *conceptual* rather than *visual* attention switching drive the effect of media multitasking on the level of information processing.

H6: Participants exposed to two different media streams simultaneously will construe behaviors more concretely during a subsequent task, compared to participants who are exposed to two identical media streams simultaneously.

Method and Procedure

The sample consisted of seventy-three undergraduate students (21 male) from a large European university who participated in the experiment in exchange for partial course credit. The average age within the sample was 23.6 years (range between 18 and 50). A between-subjects design with 3 conditions was used. The sequential (n=24) and media multitasking (n=27) conditions were identical to those used in Study I. In order to rule out attention switching as the potential driver of the observed effects, a third condition (n=22) was designed to require visual but not conceptual switching. In the conceptual switching condition participants watched two short films (an animated film by Disney/Pixar and an excerpt from the extreme sports documentary “Life Cycles”) simultaneously on two identical 20” LCD displays. Thus, they were exposed to two different video streams at the same time, which requires switching between the different content of the two films, manipulating conceptual switching. In the visual switching condition, participants saw the films sequentially but each film was shown on both displays. Therefore, they were exposed to two identical video streams at the same time, which only requires gaze shifts, manipulating visual switching. In order to make sure participants engaged in visual as well as conceptual switching, they were instructed to pay attention to both displays in both switching conditions (identical to Study I). The researcher stressed the importance following these instructions had for the purpose of the experiment since visual switching between two identical streams of information might appear meaningless to participants in the visual switching condition.

Measures

Immediately after media exposure, construal levels were measured using the Behavior Identification Form (BIF; Vallacher & Wegner, 1989). BIF measures the degree to which people construe certain behaviors as concrete or abstract. It has been used in studies investigating mental representations as defined by Construal Level Theory. Each of twenty-five behaviors is represented by a descriptive statement, which is followed by two statements, describing the behavior as concrete (the *how* aspect) or abstract (the *why* aspect). For example, the statement "making a list" is followed by two alternative representations that describe the behavior: (a) "getting organized" is the abstract representation and (b) "writing things down" is the concrete representation. Each abstract representation choice is given one point and each concrete choice is given zero points. Therefore, the range of BIF scores falls between zero to twenty-five: the higher the BIF score, the more abstract the level at which behaviors are construed. In addition, as in Study I, mood was measured using the PANAS scale.

Results

We conducted a one-way ANOVA to test *H5* and *H6.* The test confirmed that construal levels differed between the three conditions ($F(2, 70) = 4.42$, $p <. 05$). In line with our expectations, post-hoc comparisons confirmed that participants who conceptually switched between the two films (M = 9.89, *SD* = 5.34) construed behaviors more concretely than participants in both the sequential media condition ($M = 14.08$, $SD = 5.70$; $t(47) = -1.95$, $p < .05$) and the visual switching condition ($M = 13.00$, $SD = 4.68$; $t(49) = -2.99$, $p < .01$). No significant difference in construal level was observed between the sequential and visual switching conditions ($t(44) = .71$, $p = .48$). An additional one-way ANOVA confirmed that participants' mood did not differ significantly between the three conditions ($F(2, 70) = 1.57$, $p = .21$).

Discussion

In Study II we focus on construal levels in order to demonstrate the effect of media multitasking on conceptual processing style. We expected the effect of a media multitasking context that we observed for perceptual processing to extend to conceptual processing, leading to more concrete construal of behaviors during a subsequent task. As predicted, participants who were exposed to two short films simultaneously construed everyday behaviors more concretely in a subsequent task, compared to participants who watched two short films sequentially. These results are indicative of the strength of the impact of media multitasking behavior on high-level cognitive processing of information in media contexts and during subsequent tasks. We also incorporated an additional experimental condition in order to extend our understanding of the role of switching in driving the observed effects. As expected, participants who switched between two identical media streams (visual switching) construed behaviors more abstractly compared to participants who switched between two different media streams (conceptual switching). Since it is challenging to distinguish between the exact frequencies of visual versus conceptual switches by using an objective measure, these observed differences in construal levels provide further support for our hypothesis that conceptual switching at least partially drives the effect of media multitasking on processing style.

General Discussion

The present article investigates the effect of a media multitasking context on how media viewers process information. In Study I, participants in the multitasking condition processed information more locally compared to those in the sequential condition, relying more on the local elements rather than the global configuration in geometric figure comparisons. Furthermore, the number of visual switches between media was negatively correlated with the level of perceptual

processing, indicating that it is the high fragmentation of the media context that induces a more local style of perceptual processing. Study II showed that a multitasking context induces a more concrete mindset, which also carries over to subsequent tasks, extending our findings to conceptual processing style. The observed differences in perceptual and conceptual processing style suggest that media multitasking contexts require a narrow attentional focus and more concrete construals of information. Any further implications this difference in the level of perceptual and conceptual processing might have can be applied to all facets of media consumption, which takes place in a multitasking context.

Theoretical Implications and Future Research

Ophir, Nass, and Wagner (2009) used executive control measures to test the cognitive processing approach of high versus low media multitaskers. Their findings indicate that high media multitaskers have less executive resources at their disposal compared to low media multitaskers. Thus, high media multitaskers are more likely to be distracted by (or are less able to resist) the multiple streams of media they frequently consume (Lin 2009). Cain and Mitroff (2011) replicated these effects even under low working memory load, confirming the idea that attentional factors are their primary drivers. It still remains to be explored whether these differences are the result of stable individual differences between types of media users or simply a consequence of prolonged exposure to media multitasking contexts. While our findings provide support for the latter hypothesis, it is tentative since we document short-term effects only. An interesting future research direction might involve longitudinal studies that look at the potential long-term effect of prolonged media multitasking behavior on *individual differences* in cognitive processing style.

Jeong and Fishbein (2007) investigated the phenomenon's antecedents reporting that both the availability of media devices at home as well as individual audience factors, such as sensation-seeking tendencies, have contributed to the rise in media multitasking behavior over the past decade. The above findings seem to be in line with the finding that individual differences in sensation seeking tendencies are significant predictors of media multitasking behavior, since people higher in sensation seeking enjoy higher environmental stimulation levels. Longitudinal studies would also benefit from controlling for changes in sensation seeking tendencies in order to better enable researchers to attribute changes in processing style to changes in media multitasking behavior.

The current studies would have benefited from a measure of individual differences in media multitasking behavior (e.g. Media Multitasking Index, Ophir, Nass, and Wagner, 2009). It would have been interesting to examine whether the short-term changes in processing style we observed affect high versus low media multitaskers differently. For example, high media multitaskers might be more susceptible to the contextual effects of media multitasking on processing style compared to low media multitaskers.

Derryberry and Tucker (1994) demonstrated that arousal narrows the scope of perceptual attention, which indicates a more local perceptual processing style, a tendency to focus upon peripheral rather than central and local rather than global details. Positive mood has also been shown to prime a more global perceptual focus (Gasper & Clore, 2002; Gasper, 2004). In the current experiments we found no differences in mood between multitasking and sequential or single media contexts. Despite the differences in perceptual load, it did not explain the observed effects on perceptual processing. However, Wang and Tchernev (2012) showed that engaging media multitasking behavior is associated with emotional gratifications, despite the fact that

cognitive gratifications are sought by engaging in this behavior. If media multitasking is indeed likely to lead to higher affect through emotional gratifications, the effect on perceptual processing could be eliminated in a realistic multitasking context because positive mood is associated with global perceptual processing. Future research could explore this possibility by studying the effects of media multitasking on processing style in non-laboratory settings. For example, the Experience Sampling Method (Csikszentmihalyi & Larson, 1987) is an interesting methodological tool that could be used to study media multitasking and information processing in naturalistic environments.

Practical Implications

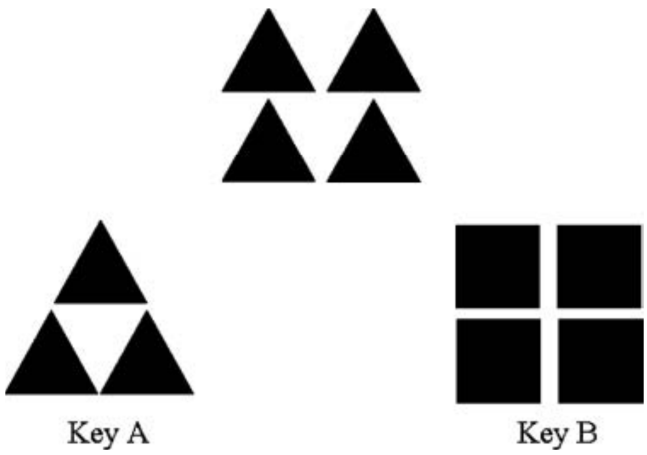
The observed effects could also have implications for the affective and cognitive processing of media content and persuasive messages and, consequently, for media planning strategies (Pilotta, Schultz, & Drenik, 2004; Voorveld, 2011). We show that the fragmented nature of media multitasking, and especially the frequent switching between distinct information streams can lead to a more local processing style and a more concrete mindset that *carry over* to subsequent tasks. Construal level has been studied in the context of various facets of consumer behavior: evaluating product attributes, making purchasing choices, resisting temptation etc. (Trope, Liberman, and Wakslak, 2007). Furthermore, since self-regulatory resource depletion appears to be the driving mechanism of the observed effects on construal levels, media multitasking represents a consumption context where viewers rely on heuristic, automatic processing, which decreases critical evaluation of the persuasive message (Persuasion Knowledge Model, Friestad and Wright, 1994) but also decreases the depth of cognitive processing of advertising messages. These characteristics of a media multitasking context are important to consider when establishing the goals of an advertising campaign. For example, a

media multitasking context would be detrimental to a strategy that aims to increase brand awareness or brand knowledge, because of its negative effect of cognitive processing. As media consumption habits continue to evolve, marketing and advertising practitioners could benefit from more experimental research on both the contextual and carryover effects of media multitasking behavior.

Conclusion

The global shift from scarcity to abundance of media content, coupled with the immediate availability that new technologies provide have led to a distinct shift in media consumption habits. In his recent book titled “The Shallows: What the Internet is Doing to Our Brains”, technology writer Nicholas Carr discusses the Internet’s potentially detrimental long-term effect on human cognition. Carr’s main argument is that prolonged, habitual Internet use diminishes the human capacity for concentration and contemplation because of the unprecedented abundance of instantly accessible content it provides. Certainly, the scientific merit of Carr’s argument is unclear, as he bases his reasoning on a mix of introspection, historical analogies, and existing empirical research. If approached scientifically, however, the idea could provide a relevant and gripping research direction. We found that when multitasking with media, viewers “can’t see the forest for the trees”, as focusing on details (both perceptually and conceptually) prevents them from processing information at a global, more abstract level. In line with Carr’s argument, studying the short-term carryover effects of media multitasking contexts on the way media viewers attend and process information might be the first step to theorizing the phenomenon’s long-term implications for human cognition.

FIG.1 A sample comparison trial from the Kimchi and Palmer (1982) geometric figures-comparison task.



References

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*, 327–352

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

Bruyneel, S. D., Dewitte, S. (2012). Engaging in self-regulation results in low-level construals. *European Journal of Social Psychology.*

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

Csikszentmihalyi, M., Larson, R. (1987). Validity and reliability of the experience sampling method. *Journal of Nervous and Mental Disease*, 775,526-536.

Derryberry, D., & Tucker, D. (1994). Motivating the focus of attention. In P. Niedenthal & P. Kitayama (Eds.), The heart's eye: Emotional influences in perception and attention (pp. 167–196). New York: Academic Press.

Dove A., Pollman S., Schubert T., Wiggins C.J., Von Cramon D.Y. (2000). Prefrontal cortex activation in task switching: An event related fMRI study. Brain Research, *Cognition and Brain Research*, 9:103–109.

Dux, P. E., Ivanoff, J. G., Asplund, C. L., Marois, R. (2006). Isolation of a central bottleneck of information processing with time-resolved fMRI. *Neuron*, 52(6), 1109-1120.

EIAA Media multitasking report (2009), European Interactive Advertising Association (EIAA), June.

Foehr, U.G. (2006). Media Multitasking Among American Youth: Prevalence, Predictors and Pairings. Menlo Park, CA: *Kaiser Family Foundation.*

Foerde K, Knowlton BJ, Poldrack RA. (2006). Modulation of competing memory systems by distraction. *Proceedings of the National Academy of Sciences*, 103, 11778–11783.

Förster, J., & Dannenberg, L. (2010). GLOMO sys: A systems account of global versus local processing. *Psychological Inquiry*, 21, 175−197.

Förster J., Liberman N., Kuschel S. (2008). The effect of global versus local processing styles on assimilation versus contrast in social judgment. *Journal of Personality and Social Psychology*, 94, 579–599.

Friestad, M., Wright, P. (1994). The Persuasion Knowledge Model: How People Cope with Persuasion Attempts, *Journal of Consumer Research*, 21(6), 1–31.

Gasper, K. (2004). Do you see what I see? Affect and visual information processing. *Cognition and Emotion, 18*, 405–421

Gasper, K., & Clore, G. L. (2002). Attending to the big picture: Mood and global versus local processing of visual information. *Psychological Science, 13*, 34–40..

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

Hart, S.G., Staveland, L.E., (1988). Development of NASA-TLX: results of empirial and theoretical research. In: Hancock, P.A., Meshkati, P. (Eds.), *Human Mental Workload*. Elsevier, Amsterdam, pp. 139–183.

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.

Jeong, S.H., Fishbein, M. (2007). Predictors of multitasking with media: media factors and audience factors, *Media Psychology*, 10, 364-384.

Kahneman, D. (1973). Attention and effort. Englewood Cliffs, NJ: Prentice-Hall.

Kimchi R. (1992). Primacy of wholistic processing and global/local paradigm. A critical review. *Psychological Bulletin*, 112, 24–38.

Kimchi, R., Palmer, S. E. (1982). Form and texture in hierarchically constructed patterns. *Journal of Experimental Psychology: Human Perception and Performance, 8* (4), 521-535.

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

Love, B. C., Rouder, J. N., Wisniewski, E. J. (1999). A structural account of global and local processing. *Cognitive Psychology*, 38, 291-316.

Mecklinger, A.D., Von Cramon, D.Y., Springer, A., Matthes-von Cramon G. (1999). Executive control functions in task switching: Evidence from brain injured patients. *Journal of Clinical and Experimental Neuropsychology*, 21, 606–619.

Miyake, A., Friedman, N., Emerson, M., Wizki, A., Howerter, A., Wager, T. (2000) The unity and diversity of executive functions and their contributions to complex 'frontal lobe' tasks: a latent variable analysis. *Cognitive Psychology*, 41, 49–100.

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

Naveh-Benjamin M., Craik, F. I. M., Guez J., Kreuger, S. (2000). Effects of Divided Attention on Encoding and Retrieval Processes: Assessment of Attentional Costs and a Componential Analysis. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 26(6), 1461-1482.

Navon, D. (1977). Forest before trees: The precedence of global features in visual perception. *Cognitive Psychology, 9*, 353–383.

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

Pashler, H. (1991). Shifting visual attention and selecting motor responses: Distinct attentional mechanisms. Journal of Experimental Psychology: *Human Perception and Performance*, 17, 1023–1040.

Pashler, H. (1994). Dual-task interference in simple tasks: Data and theory, *Psychological Bulletin*, 116 (2), 220–244.

Pilotta, J.J., Schultz, D., Drenik, G. (2004). Simultaneous Media Usage: A Critical Consumer Orientation To Media Planning, *Journal of Consumer Behavior*, 30 (3), 285-292.

Pool, M.M., Koolstra, C.M., van der Voort T.H. (2003). Background media and homework performance, *Journal of Communication*, 53, 74–87.

Rideout, V.J., Foehr, U.G., Roberts, D.F. (2010). Generation M2: Media in the lives of 8- to 18-year-olds. A Kaiser Family Foundation Study. Henry J. Kaiser Family Foundation. Menlo Park, Calif., USA.

Roberts, D.F., Foehr, U.G. (2008). Trends in media use, *The Future of Children*, 18(1), 11–3

Roberts, D.F., Foehr, U.G., Rideout, V. (2005). Generation M: Media in the lives of 8–18 year-olds, *Henry J. Kaiser Family Foundation*. Menlo Park, California, USA.

Rubinstein, J. S., Meyer, D. E., Evans, J. E. (2001). Executive Control of Cognitive Processes in Task Switching. *Journal of Experimental Psychology: Human Perception and Performance*, 27(4), 763-797.

Ruthruff, E., Pashler, H. E., Klaassen, A. (2001). Processing bottlenecks in dual-task performance: Structural limitation or strategic postponement? *Psychological Bulletin and Review*, 8, 73-80.

Schumacher, E. H., Seymour, T. L., Glass, J. M., Fencsik, D. E., Lauber, E. J., Kieras, D. E., Meyer, D. E. (2001). Virtually perfect time sharing dual-task performance: Uncorking the central cognitive bottleneck. *Psychological Science*, 121, 101-108.

Trope, Y., Liberman, N. (2010). Construal level theory of psychological distance. *Psychological Review*, *117*, 440-463.

Trope, Y., Liberman, N., Wakslak, C. J. (2007). Construal levels and psychological distance: Effects on representation, prediction, evaluation, and behavior. *Journal of Consumer Psychology*. *17*, 83–95.

Vallacher, R. R., Wegner, D. M. (1987). What Do People Think They Are Doing? Action Identification and Human Behavior. *Psychological Review, 94* (1), 3-15.

Vallacher, R. R., Wegner, D. M. (1989). Levels of personal agency: Individual variation in action identification. *Journal of Personality and Social Psychology, 57,* 660–671.

Voorveld, H. (2011). Media multitasking and the effectiveness of combining online and radio advertising, *Computers in human behavior*, 27 (6), 2200-2206.

Wan, E. W., Agrawal, N. (2011). Carryover Effects of Self-Control on Decision Making: A Construal-Level Perspective. *Journal of Consumer Research, 38* (1), 199-214.

Wang, Z., Tchernev, J. (2012). The ‘‘myth’’ of media multitasking: Reciprocal dynamics of media multitasking, personal needs, and gratifications. *Journal of Communication,* 62(3), 493-513.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology,* 54, 1063-1070.

Wickens, C.D. (2002). Multiple resources and performance prediction. *Theoretical Issues in Ergonomics Science,* 3(2), 159-177.

Wood, J.N., Grafman, J. (2003). Human prefrontal cortex: processing and representational perspectives. *Nature Reviews Neuroscience*, 4, 139-147.