Computers in Human Behavior 41 (2014) 236–244

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

What's going on? Age, distraction, and multitasking during online survey taking

Lara Zwarun *, Alice Hall [1]

Department of Communication, University of Missouri – St. Louis, 1 University Blvd., St. Louis, MO 63121, USA

ARTICLE INFO

Article history:
Available online 20 October 2014

Keywords:
Multitasking
Distraction
Computer
Survey
Data collection

ABSTRACT

Nearly 6000 adults from 7 countries participated in an online survey about what other activities they engaged in while taking the survey and how distracted they felt. Younger people were more likely than older ones to engage in electronic and non-electronic multitasking. Engaging in a wider range of tasks was associated with feeling more distracted. However, once the variety of tasks was taken into account, interruptions associated with checking or talking on one's phone made participants feel *less* distracted. The relationship between age, multitasking, and feeling distraction was curvilinear, with middle-aged respondents being more affected by multitasking than either younger or older survey takers. The findings suggest that people of all ages are often deliberate multitaskers who choose their distractions intentionally, at least some of the time. This bodes well for researchers seeking to administer online surveys, because it suggests that survey takers will set themselves up with the type and amount of distractions they are comfortable with. The finding that a high degree of electronic multitasking may decrease the perception of distraction should be followed by experiments verifying if this perception corresponds to actual task performance.

Published by Elsevier Ltd.

1. Introduction

As portable, network-connected devices such as tablet computers and smart phones become more prevalent, media multitasking has become a subject of increasing interest. Media multitasking refers to engaging in multiple tasks within the same time period, where at least one task involves a form of mediated communication. Devices like laptops, tablets, and smart phones make it easier for individuals to switch back and forth between tasks on one device (e.g., reading a text message while playing a video game on one's phone), across multiple media devices (e.g., watching a television while updating one's social networking status on a mobile phone), or between mediated and non-mediated environments (e.g., reading email while cooking dinner) (Jeong & Fishbein, 2007).

A commonly expressed concern, both in the academic literature (Bowman, Levin, Waite, & Gendon, 2010; Waite, Levine, & Bowman, 2009) and the popular press (e.g., Richtel, 2010; Stross, 2012) is that multitasking negatively affects concentration, engagement, and task performance. Individuals who are multitasking are thought to be less efficient and less thorough in completing the tasks that they are engaged in, although there is some speculation that these effects may affect different age groups unequally (e.g., Carrier, Cheever, Rosen, Benitez, & Chang, 2009). This possibility has wide-ranging implications for contexts where the ability to focus matters, such as education, where multitasking could inhibit academic success (Levine, Waite, & Bowman, 2007; Waite et al., 2009), or consumption of entertainment media, where it could interfere with the ability to become involved.

Another context in which the effects of multitasking might be consequential is in the case of online survey-taking. This form of research administration has become increasingly popular in both industry and academia (Groves, 2011). Yet little attention has been given to how often research participants combine computer-based surveys with other activities, when such multitasking might be most common, or how participants' attention and performance might be affected by it. The current study therefore sought to address these questions. It investigated the relationship between the amount and type of multitasking computer users engage in while responding to a survey using a large, international sample. It examined the relationship between different forms of multitasking and the participants' subjective sense of being distracted from the task. It also examined the relationship between multitasking and the participants' age, given previous research suggesting possible differences across generations. In pursuing these objectives, it helps identify correlates of multitasking, provides valuable information for those interested in how individuals combine activities online,

* Corresponding author. Tel.: +1 314 516 6725.
E-mail addresses: zwarunl@umsl.edu (L. Zwarun), halla@umsl.edu (A. Hall).
[1] Tel.: +1 314 516 6662.

http://dx.doi.org/10.1016/j.chb.2014.09.041
0747-5632/Published by Elsevier Ltd.

and assists researchers in designing and interpreting their survey research.

2. Literature review

2.1. Multitasking

Combining media with each other and with other tasks is a fact of life for many people (e.g., Foehr, 2006; Jeong & Fishbein, 2007). Even when one's intention is to concentrate on one medium, such as by watching a television show or taking a survey on a computer, environmental distractions can intrude, as when people are chatting or music or a video is playing in the background. Having one's attention drawn from the task at hand to these types of environmental distractions represents a type of multitasking. The portability of the electronic devices such as smart phones, tablet computers, and laptops that are increasingly used to access both mass and interpersonal media may make some forms of environmental distractions more likely. Being able to watch entertainment programming or download files from a server while in a coffee shop or an airport lounge, for example, might increase the likelihood of environmental distractions compared to a time when devices like the telephone or the television were essentially tethered to a wall in one's home or office.

In addition, one can also multitask more intentionally without involving a second media activity. An example of non-media multitasking would be interrupting the media activity one is engaged in by having a conversation with someone in the room or going to the bathroom. Finally, a third type of multitasking does not necessarily entail leaving the device one is using at all: electronic media multitasking represents consuming two media at once. Examples include dividing one's attention by watching television and taking an online survey simultaneously or task-switching among different activities – such as checking email, word processing, updating one's social networking status, and taking an online survey – in a short time period. Like environmental distractions and non-media multitasking, electronic media multitasking is also common. In a study of 8–18 year-olds' media use, Rideout, Foehr, and Roberts (2010) found that about a quarter of the time the participants used media was spent with two or more media concurrently. Data released by Nielsen Company (2009) found that, on average, 28% of U.S. users' time on the internet at home was spent in front of a television set as well. Moreover, this type of media multitasking is a global phenomenon. For example, in a study of Korean smart-phone users, Park (2013) found that almost three-fourths used some sort of second screen (e.g., a tablet, a smart phone, or a laptop) while watching television. A study of Dutch teens and adults reported that 22% of the time spent with media was spent with two or more media concurrently (Voorveld & van der Goot, 2013). There is also evidence that media multitasking in the form of task-switching is common. One recent study that tracked how often a sample of U.S. college students changed tasks while at their laptop computers found that the median time spent on one application was only 19 s (Yeykelis, Cummings, & Reeves, 2014). Clearly, many people around the world are engaged in more than one thing at a time as they consume electronic media.

2.2. Multitasking and distraction

While many appear resigned to the inevitability of multitasking, it may come at the price of impairing performance on some types of tasks. Common sense suggests that environmental distractions, like background music or conversation, might distract attention from the task at hand and cause people to feel more distracted from it. If this were true, one would expect people using technology in public spaces to report feeling more distracted than those in private, who presumably can control background interruptions to a greater extent. However, at least one recent study found the opposite. Zwarun and Hall (2011) asked a sample of participants to watch an online video in a place of their own choosing and then complete measures of the amount of multitasking they did and how distracted they felt. Participants reported being more distracted in a private versus a public setting. The researchers suggest that those who watched in public, who typically used headphones, were able to create a private "bubble" and isolate themselves from their surroundings in a way that was more difficult in private, where they may have felt more of an obligation to respond to their environment. One can ignore a stranger sitting at the next café table. It is more difficult to ignore one's spouse or partner on the sofa. We sought, therefore, to see whether this finding holds with a larger, more representative sample and with a different kind of activity, online survey taking, leading to the following question:

RQ1: Is there a relationship between setting and distraction?

It also seems logical that engaging in electronic multitasking might increase one's sense of distraction while taking an online survey, given the dispersion of one's attention across activities. However, not all types of secondary media are likely to be equally distracting. In a qualitative study of young people's motives and strategies for multitasking, Bardhi, Rohm, and Sultan (2010) found that they reported seeking to leverage media "synergies" in ways that limited their demand on cognitive resources by, for example, pairing media that required a relatively large number of cognitive resources, such as studying, with those that did not, such as listening to music. Furthermore, multiple studies (Carrier et al., 2009; Foehr, 2006; Wang, 2013) have found that media differ in how likely they are to be combined, suggesting that some seem to complement each other more than others. Wang (2013), for example, found users were relatively unlikely to pair two media that gave the user relatively little control over the rate of information flow and that shared information modalities (e.g., both were visual). She argued that combining media that present the same forms of information, particularly when the user has little control over the pacing, increases the demands on cognitive resources, making combining them less appealing. This leads us to question which types of activities are most likely to contribute to a subjective sense of distraction when combined with completing an online survey.

RQ2: Which types of electronic multitasking activities are most closely associated with feeling distracted?

When individuals switch between one task and another, the tasks take longer to complete than if they were done sequentially (Bowman et al., 2010; Monsell, 2003). One explanation for this is that each time someone changes tasks, they have to invest time and mental resources to re-orient themselves to the task immediately at hand (Monsell, 2003). Carrying out two tasks simultaneously (e.g., doing homework while watching TV) may also negatively affect performance. The secondary task increases the cognitive demands placed on an individual. If the combined demand exceeds the cognitive resources available, it can reduce the individual's subjective sense of being able to attend to the task as well as the depth or thoroughness with which the information is processed. Multitasking while watching an online video, for example, has consistently been found to be associated with a greater sense of distraction and less engagement with the narrative (Zwarun & Hall, 2011, 2014). This leads to our prediction that the more demands one places on oneself by engaging in multiple activities, the less ability one will have to concentrate on any one of

those activities, such as taking an online survey. This will contribute to the participants' subjective sense that they are distracted from the task.

H1. Amount of multitasking will be positively associated with self-reported distraction.

2.2.1. Age

It has frequently been suggested that multitasking, and thus any potential cognitive effects of the practice, is particularly prevalent among younger people (e.g., Prensky, 2001; Richtel, 2010). However, the evidence regarding the relationship between age and media multitasking has been mixed. Carrier et al. (2009) compared the multitasking patterns of adults of different generational cohorts, and found that younger participants reported combining a wider range of activities and found multitasking to be less difficult than those who were older. However, a diary study by Voorveld and van der Goot (2013) of Dutch teens and adults did not find a linear relationship between age and time spent multitasking. Although the youngest participants (13–16) tended to spend the most time multitasking, the oldest participants also tended to be relatively heavy multitaskers. Those between the ages of 50 and 65 reported spending more time media multitasking in terms of total hours than any age group other than the teenagers. McDonald and Meng's (2009) analysis of the prevalence of multitasking while watching television indicated a relatively small increase in multitasking among younger viewers, with all age groups being within about 10% of each other in terms of the proportion of viewing sessions in which they did something else.

While multitasking in general does not necessarily occur at higher rates among younger people, there is stronger evidence that multitasking involving computers and mobile devices *is* more common among young people than older ones. McDonald and Meng (2009) report that using the internet while watching TV decreased with user age. Park (2013) found age to be negatively associated with the use of second screens while watching television. Helsper and Eynon (2010) found that younger people reported multitasking more when using the internet, and Voorveld and van der Goot (2013) found that teens combined music with online activities like using social media more than other age groups. Since the current study focused on multitasking while engaged in an online activity, specifically survey-taking, we hypothesized that:

H2. Age will be negatively associated with amount of multitasking.

However, the effects of multitasking on distraction may not be uniform. Generation and age has been argued to be associated not only with the prevalence or amount of multitasking, but also with how an individual responds to its demands. As noted above, Carrier et al. (2009) found that younger adults rated multitasking as less difficult than older ones, suggesting that younger participants might tend to feel less distracted when engaged in multiple activities.

One line of reasoning that is often used to support this perspective is that individuals who've grown up multitasking with computerized devices, often referred to as "digital natives," have learned to cope with distractions better than previous cohorts. The greater experience that young people have with computer-based multitasking, and their lack of memory for an environment or context in which it was not prevalent, suggests that they may be more likely to see multitasking as natural and normal, and thus be less likely to register it as a distraction. Furthermore, their greater familiarity with multitasking could make today's young adults better at managing multiple tasks and with coping with the cognitive demands of switching between them.

This idea of a cohort effect, with the "Millennial" generation that grew up with computers showing a jump in their level of ease and facility with multitasking as compared to older cohorts, is not universally accepted. Helsper and Eynon (2010), for example, argue that despite the popularity of phrases such as 'digital native' (Prensky, 2001) the year of one's birth may not be the best predictor of the ease with which one uses technology or switches between it and other tasks. They found that the length of experience one has with digital technology and the variety of activities for which one uses it were stronger predictors of multitasking and of other measures of facility with technology than age. They argue that differences within generational cohorts can be least as important as difference across them.

However, others have suggested that individuals of different ages might respond to multitasking differently for reasons that have to do with neurological changes that occur as adults age, rather than the foundational experiences of particular generational cohorts. For example, older adults tend to find it more difficult to suppress distractions (Campbell, Grady, Ng, & Hasher, 2012; Gazzaley, Cooney, Rissman, & D'esposito, 2005; Hasher, Stoltzful, Zacks, & Rypma, 1991; Malmstrom & LaVoie, 2002; Yang & Hasher, 2007). Much of this research has sought to understand memory deficits in healthily aging older adults by contrasting college-age participants against seniors in their sixties or older. For example, in an often-cited pair of studies, Connelly, Hasher, and Zacks (1991) compared the ability of adults in their late teens and twenties to ignore distracter words in a written text and focus on the central message to that of adults in their late sixties. The older adults' performance was more negatively affected than that of the younger participants. Similarly, reports from the market research company Nielsen NeuroScience claim that "Boomer" adults – those now in their 50s and 60s – have more difficulty with visually complex messages (Neff, 2012; Nielsen, 2013). This work suggests that older adults will find it more challenging to maintain performance levels in the face of at least certain types of multitasking.

Both the argument regarding the "digital native" cohort effect and the evidence of differences in cognitive processing among older adults suggest that individuals of different ages respond to multitasking differently. However, most of the work investigating the relationship between media multitasking and task performance has involved teens or college students (e.g., Baumgartner, Weeda, van der Heijden, & Huizinga, 2013; Levine et al., 2007; Waite et al., 2009). Without more data from individuals from a wider age range, one cannot address how young adults' responses to the demands of multitasking might compare to that of their elders, or change as they age. What's more, as noted earlier, there is evidence that individual traits such as length and depth of technology experience may be important factors in people's multitasking (Helsper & Eynon, 2010), calling into question how meaningful generational distinctions are in understanding this behavior. This study sought to address this gap in the literature by investigating the relationship between the participants' age and the strength of the association between multitasking and perceived distraction. Based on the findings that young adults have more experience with computer-based media multitasking and tend to be better able to suppress distraction, we predicted that the relationship would be stronger among older participants.

H3. The participants' age will moderate the relationship between amount of multitasking and self-reported distraction, such that multitasking will be more strongly correlated with distraction among older viewers than among younger ones.

By exploring these research questions and hypotheses with data from a large, diverse sample, we will be able to develop a clearer understanding of the type of behavior people engage in

when participating in online research; to what extent their time is also spent on activities besides completing the survey; how distracting they find those other activities to be; and what the relationships are between their age, the amount and type of multitasking they engage in, and how distracted they feel. These findings will contribute to what is known about multitasking in general and any drawbacks associated with it, as well as provide descriptive information about research participants that will be useful to the many scholars and practitioners who make use of online survey data.

3. Methodology

3.1. Procedure

The measures analyzed in the current study were appended to a longer survey that was administered by a professional marketing research firm specializing in online survey research. Approval to include questions on the survey and to analyze de-identified data was sought and obtained from the University's human subject review board.

Participants were recruited from a panel of people who had indicated their willingness to occasionally participate in internet-administered surveys. Email invitations with a link to the survey were sent to eligible panel members in seven countries: Australia, China, France, Germany, Norway, the United Kingdom, and the United States. Participation was voluntary, and responses were not associated with personally identifying information. The survey was available for seven days, and a reminder email was sent during the middle of this time period. Panel members who agreed to participate and complete the survey were rewarded with a small payment as incentive, as is typical for participating in surveys as part of this panel. Response rates ranged from 2% to 7%, depending on the country.

The bulk of the survey consisted of a series of Likert scales asking the participants to indicate how much they felt a series of statements described the policies, economy, facilities, culture and society of five different countries. This somewhat lengthy, repetitive series of questions served as an appropriate approximation of what participants do in a typical online survey. After completing these questions, the participants completed the variables of interest, which dealt with their experience of participating in the preceding survey and the other tasks they were engaged in while completing the survey questions.

The survey as a whole took approximately half an hour to complete. The survey was fielded on the marketing research company's servers and a data file was shared with the study's authors once the survey closed.

3.2. Participants

A total of 6381 people from seven countries completed the online survey. We excluded participants who reported that they were younger than 18, as well as participants who completed the survey in less than half of the median response time for all participants in their country. These participants were moving through the survey so quickly, it was thought unlikely that they were able to read the questions and answer them meaningfully. The number of participants who were excluded from the analysis ranged from 6% to 11%, depending on the country. After this data cleaning, the sample size was 5853. The demographic characteristics of the sample are reported in Table 1. Most participants reported completing the survey on either a desktop (48%) or a laptop (46%) computer as opposed to a tablet or smart phone.

Table 1
Demographic characteristics of the sample.

	N	Percentage
Gender		
Female	3120	53
Male	2733	47
Age		
18–24	515	9
25–34	1061	18
35–44	1191	20
45–54	1136	19
55–64	1100	19
65+	850	15
Country		
Australia	1090	19
China	790	14
France	855	18
Germany	925	16
Norway	271	5
United Kingdom	1038	18
United States	884	15

3.3. Measures

3.3.1. Age

Participants were asked to select what category their age fell into. As noted in Table 1, the age ranges of 25–34, 35–44, 45–54, and 55–64 each represented about a fifth of the sample. About 15% of the participants indicated that they were 65 or older, and 9% of the sample reported being between 18 and 24.

3.3.2. Multitasking

We considered three types of multitasking. One type was exposure to "environmental distractions" that would not have required participants to task-switch by shifting their primary attention from the survey, but had the potential to take up cognitive processing capacity. Participants were asked to report whether there was music or a video playing where they were "right now," and whether there was background conversation in the form of people talking to each other but not directly to them.

A second type of multitasking was "non-media multitasking," a pair of non-electronic activities that would have required the participants to task-switch. Participants were asked whether or not someone was talking to them during the survey. They were also asked to indicate how many times they "physically left or put down the device or computer I was taking the survey on to complete another task." The response options were "0," "1–2 times," "3–4 times," and "5 or more times," coded on a four-point scale ranging from 0 to 3.

The third type of multitasking measured was "electronic media multitasking," consisting of a series of activities that were carried out while the survey was being taken, either on the same device or on another electronic device. The activities were having "read some sort of written message, such as a text, tweet, social networking update, or email, on my computer, tablet, or phone," "heard a noise notifying me that I had received an instant message, voice mail, text, or email," "wrote or responded to a written message, such as a text, tweet, status update, or email," "talked on the phone or participated in a video chat," and "left the browser screen the survey is on to do another task on my computer, tablet, or phone." Using the same four-point frequency scale described above, participants indicated whether these things did not occur at all (0), occurred one or two times (1), occurred three or four times (2), or occurred five or more times (3) during the survey.

The number of different tasks the participants engaged in was calculated by counting how many of each of the five tasks the par-

ticipant reported engaging in at least once, producing a "multitasking variety" scale that ranged from zero to five. A large portion of the participants (71.2%) did not report engaging in any electronic media multitasking at all.

A more comprehensive measure encompassing both the variety and amount of electronic multitasking was calculated by adding up the participants' scores on the 0–3 frequency response choices for each of the five multitasking items to create a single scale with a range of 0–15. The scale had a Cronbach's alpha of .84.

3.3.3. Subjective distraction

Participants indicated how distracted they felt while taking the survey on a scale from one (not distracted at all) to ten (extremely distracted), as well as how much attention they were able to pay to the survey on a scale from one (a lot of attention) to ten (extremely close attention). The items were correlated significantly ($r = -.49$, $p < .001$). The attention item was reverse coded and scores for the two items were summed to create a 20-point "distraction" scale that ranged from 2 to 20, with higher numbers indicating greater distraction. The mean was 4.39 ($SD = 3.00$), suggesting that most participants did not feel extremely distracted and paid attention to the survey.

3.3.4. Setting

Participants were asked to indicate if they were taking the survey while in a private home; in their office or at work; in a public location, such as a restaurant or café, a library, or a train; or at another type of location. A vast majority of participants (86.2%) indicated they were in a private home at the time they completed the survey, with most of the rest (11.1%) at work.

4. Results

4.1. Preliminary analysis

The proportions of participants who reported taking part in each of the multitasking activities are reported in Table 2. Only a small percentage reported taking part in each one of the activities within the approximately 30 min that it took to complete the survey. Nevertheless, the numbers were not trivial. Almost one in four engaged in some sort of electronic multitasking. These tasks ranged from ones that might provide only minimal distraction, such as hearing a mobile phone ping to indicate a new message (reported by 17%), to those that are likely to be quite disruptive, such as moving away from the browser screen on the computer to complete another task (13%).

4.2. Setting and distraction

RQ1 asked whether there was a relationship between where the survey was completed and how distracted participants felt while taking it. There was a significant difference in the mean level of distraction among those who completed the survey at home, at work, or in a public place, $F(2, 5759) = 40.07$, $p < .001$, *partial* $\eta^2 = .01$. The means indicated that participants who completed the survey at home were the least distracted ($M = 4.25$, $SD = 2.93$), followed by those who completed it at work ($M = 5.15$, $SD = 3.20$), and those who completed it in some other public place like a library or café ($M = 6.21$, $SD = 3.82$).

4.3. Type of electronic multitasking and distraction

RQ2 asked about the kinds of electronic media multitasking that were most strongly associated with distraction. To answer this, we conducted a regression analysis with the five individual measures reflecting how much each electronic multitasking activity took place. A summary of these results is reported in Table 3. Switching away from the browser to complete another task had an increasing effect on distraction the more often it was done. However, increases in the frequency of the other activities, which tend to involve interacting with a mobile phone (e.g., being notified of an incoming text, responding to one, or talking), were associated with *decreases* in subjective distraction (see Table 4).

4.4. Amount of multitasking and distraction

H1 predicted that multitasking would be associated with the participants' self-reported distraction levels. A hierarchal regression analysis was carried out to investigate this. A set of dummy variables representing the respondents' age was entered in the first block, followed by a block containing the three potential environmental distractions (background music, video, conversation). The two measures of non-electronic multitasking were next, followed by the multitasking variety index, which measured how many forms of electronic multitasking were reported by the participant. As noted in Table 5, each form of multitasking explained additional variance in self-reported distraction. In step two, the presence of background music, video, and conversation were each indepen-

Table 2
Percentage of participants reporting different types of multitasking.

	Percentage
Environmental distractions	
Background music	17
Background video	7
Background conversation	9
Non-electronic multitasking	
Left computer	16
Direct conversation	6
Electronic multitasking	
At least one instance of electronic multitasking	29
Heard a noise notifying me that I had received an instant message, voice mail, text or email	17
I left the browser screen the survey is on to do another task on my computer, tablet, or phone	13
Read some sort of written message, such as a text, tweet, social networking update, or email	12
Wrote or responded to written message, such as text, tweet, status update or email	8
I talked on the phone or participated in a voice chat	8

Table 3
Standardized betas showing impact of number of electronic multitasking activities and frequency of individual electronic multitasking activities on self-reported distraction.[a]

	β
Range of tasks	.37[d]
Read some sort of written message, such as a text, tweet, social networking update, or email	−.04[b]
Heard a noise notifying me that I had received an instant message, voice mail, text or email	−.11[d]
Wrote or responded to written message, such as text, tweet, status update or email	−.06[c]
I talked on the phone or participated in a voice chat	−.04[b]
I left the browser screen the survey is on to do another task on my computer, tablet, or phone	.06[d]

[a] *Note:* Controlling for age, presence of environmental distractions, non-electronic multitasking.
[b] $p < .05$.
[c] $p < .01$.
[d] $p < .001$.

Table 4
Hierarchical regression of age and multitasking on self-reported distraction.

	Model 1 β	Model 2 β	Model 3 β	Model 4 β	Model 5 β	Model 6 β
Age[a]						
25–34	−.09[c]	−.08[c]	−.08[c]	−.08[c]	−.06[c]	−.06[b]
35–44	−.17[c]	−.15[c]	−.15[c]	−.14[c]	−.11[c]	−.11[c]
45–54	−.24 [c]	−.21[c]	−.21[c]	−.20[c]	−.15[c]	−.15[c]
54–65	−.30 [c]	−.27[c]	−.26[c]	−.24[c]	−.18[c]	−.18[c]
65 and over	−.30 [c]	−.26[c]	−.25[c]	−.24[c]	−.19[c]	−.19[c]
Environmental distractions						
Background music		.06[c]	.05[c]	.04[b]	.02	.02
Background video		.10[c]	.09[c]	.07[c]	.05[c]	.05[c]
Background conversation		.09[c]	.10[c]	.09[c]	.07[c]	.07[c]
Non-electronic multitasking						
Direct conversation			.13[c]	.10[c]	.07[c]	.07[c]
Left computer				.24[c]	.13[c]	.17[c]
Electronic multitasking						
Range of tasks					.23[c]	.37[c]
Frequency						−.16[c]
ΔR^2	.07[b]	.02[b]	.02[b]	.05[b]	.04[c]	.004[c]

[a] *Note:* The youngest age group, 18–24 year-olds, is the excluded, comparison variable.
[b] $p < .01$.
[c] $p < .001$.

Table 5
Proportion of participants in each age range engaged in different types of multitasking.

	18–24	25–34	35–44	45–54	55–64	65+
Background music[a]	23%	20%	16%	16%	16%	13%
Background video[a]	17%	11%	8%	5%	5%	3%
Background conversation[a]	16%	16%	17%	11%	7%	5%
Direct conversation[a]	9%	9%	8%	5%	4%	3%
Left computer (at least once)[a]	22%	21%	17%	15%	11%	13%
Any electronic multitasking[a]	52%	40%	33%	25%	16%	17%

[a] Differences between age groups significant at the $p < .001$ level according to chi-square analysis.

dently associated with an increase in feeling distracted, with video and conversation having the stronger relationships. Both engaging in conversation and leaving the computer to complete another task were associated with further increases in distraction. Most relevant to the debates about the implications of the increasing prevalence of smartphones and other personal electronic media, the analysis also indicated that the number of kinds of additional electronic tasks the participants reported was associated with an additional increase in self-reported distraction. These results provide support for H1.

We also investigated whether the amount of multitasking contributed to distraction levels above and beyond the variety of activities engaged in. To do this, we entered into the regression equation the index representing a rough count of the number of times the participants engaged in all the electronic media multitasking activities. This variable significantly increased the variance explained by the model, albeit by a very modest amount. Unexpectedly, however, the direction of the relationship changed, indicating that increases in the number of times individuals engage in these activities were associated with a decrease in distraction once the range of different activities the participant engaged in was taken into account.

4.5. Age and multitasking

H2 predicted that the age of the participants would be negatively associated with multitasking. Chi-square analyses were run examining the proportion of individuals in each age category who experienced distractions while taking the online survey. These analyses indicate that this hypothesis is supported.

We first considered the possibility that younger people would have more background distractions present than older people while taking an online survey in the form of music, video, or background conversation. As shown in Table 5, age was associated with each of these forms of multitasking, with the proportion of respondents indicating that these potential distractions were present tending to decline with age, background music, χ^2 (5,5853) = 33.57, $p < .001$, Cramer's $V = .08$; background video, χ^2 (5,5853) = 125.02, $p < .001$, Cramer's $V = .15$; background conversation, χ^2 (5,5853) = 118.55, $p < .001$, Cramer's $V = .14$.

Further chi-square analyses indicated that the participants' age was also related to their tendencies to report non-electronic multitasking (see Table 5), direct conversation, χ^2 (5,5853) = 56.44, $p < .001$, Cramer's $V = .10$; leaving the computer, χ^2 (5,5853) = 55.66, $p < .001$, Cramer's $V = .10$. Again, the percentage reporting these forms of multitasking showed a steady downward trend as the age category got older.

Finally, we tested whether age was associated with reports of engaging in electronic media multitasking. We conducted a final chi-square comparing the proportions of respondents in each age category who reported at least one instance of electronic multitasking. It was significant, χ^2 (5,5853) = 359.52, $p < .001$, Cramer's $V = .25$, with data suggesting it was less common among older participants (see Table 5). The proportions decreased steadily up to the "55–64" and "65 and over" age categories. We also carried out an ANOVA with the participants reporting at least one instance of electronic multitasking ($n = 1683$), which found age to be significantly associated with overall volume (range and frequency) of electronic multitasking they engaged in, F (5,1677) = 15.80, $p < .001$, *partial* $\eta^2 = .05$. Participants' scores on the scale tended

to decline with age, moving from a mean of 3.35 (*SD* = 2.81) among 18–24 year-olds, to 1.77 (*SD* = 2.01) among those over 64, lending additional support for H2.

4.6. Multitasking, distraction, and age

H3 predicted that age would moderate the relationship between multitasking and distraction, with multitasking more strongly related to distraction among older users than younger ones. However, there is reason to suspect this moderated relationship, if it exists, might not be linear. The "digital generation" cohort effect, which predicts that those who have grown up with computers will be particularly comfortable with multitasking, suggests a jump in the strength of the association between multitasking and distraction between "Millennials," who came of age beginning in the 90s, and older generations. Furthermore, research on cognitive changes in seniors indicates they differ from young adults, but provides little information about potential differences across adults who are between these age brackets. H3 was tested in a way that allowed us to identify non-linear patterns of moderation by first calculating the correlations between the amount of media multitasking and self-reported distraction within each age group, and then testing whether the correlations were significantly different from each other by converting them according to Fischer's procedure and calculating the *z*-score (Preacher, 2002).

Although the correlation was significant within all age groups, the size of the correlations suggests a curvilinear relationship, as shown in Table 6. The correlation coefficients for the three youngest age groups were not significantly different from each other. However, the trend suggests an increase with age, with 34–45 year olds showing the strongest correlation in the sample, $r = .38$, $p < .001$. The next oldest age group, 45–54 year-olds, $r = .23$, $p < .001$, showed a relatively precipitous decrease in the strength of the correlation that was significantly different from that of next youngest group. The size of the relationship dropped again among the oldest age group, those 65 and older, $r = .19$, $p < .001$. The correlation among these participants was lower than among any other cohort. H3 was not supported, and it is overly simplistic to say that younger people can multitask with less effect on their concentration than older people. Rather, it was middle-aged people who felt the most distracted by their multitasking.

Table 6
Correlations between amount of multitasking and self-reported distraction within age groups.[a]

	R
18–24	.29[b,c,d]
25–34	.33[b]
35–44	.38[b]
45–54	.23[c,d]
55–64	.28[c]
65+	.19[d,e]

[a] Rows that do not share a superscript are significantly different at $p = .05$.

Examining the mean distraction scores for the different levels of multitasking across the different age groups sheds more light on this relationship (see Table 7). In general, the older one is, the less distracted one reports being, a pattern that also holds for those who did not multitask at all, albeit at lower levels. As the amount of multitasking engaged in increases, distraction scores tend to increase for younger participants more than older ones, although at the heaviest levels of multitasking, younger participants' distraction scores often fall below those of their older high-multitasking counterparts. However, caution must be used in interpreting these findings given the relatively small number of participants in older age groups who were heavy multitaskers.

5. Discussion

5.1. Conclusions and implications

The ever-growing popularity of smartphones and tablet computers suggests that multitasking is a reality of modern life. Thus, understanding the effects of competing demands on computer users' attention is of interest from both a scholarly and a pragmatic perspective. We sought to consider both by examining multitasking in the context of online survey taking, with a large, international sample of all ages.

In fact, over 70% of the sample reported no multitasking during the survey. There may have been some social desirability at play, with participants not wanting to tell a market research company by whom they are paid to complete surveys that they do so distractedly. Furthermore, the surveys were completed voluntarily at the time and place of the participants' choosing. Many people may wait until they have a block of time they expect to be distraction-free to do so. Nevertheless, nearly 30% of the sample experienced one or more distractions or competing activities during the approximately 30 min survey, enough to merit consideration.

As predicted in H2, multitasking was more likely to occur among younger people, who were more likely to report having taken the survey with music or a video in the background. Completing the survey at home increased the likelihood of there being background conversation for these participants. Younger participants were more likely to report having had a conversation while completing the survey and leaving the computer mid-survey for another task. They were also more likely to carry out another activity on an electronic device. More than half (52%) of the 18–24 year-olds reported having done another electronic-based activity at least once during the survey, whereas about a third as many people over 55 did so. Furthermore, among those who were electronically multitasking, younger people tended to report doing so a greater number of times.

However, the difference in the amount of multitasking across the age groups was not as pronounced in relation to other secondary activities, such as listening to background music or having a conversation. It is clear from our data that all age groups multitask while online. Although our large sample size allowed us to discern even small differences between participants of different ages,

Table 7
Mean (standard deviations) of self-reported distraction scores[a] at select levels of electronic multitasking for different age groups.

	18–24	25–34	35–44	45–54	55–64	65+
Avg	5.91(3.33)	5.23(3.31)	4.65(3.00)	4.10(2.84)	3.64(2.58)	3.40(2.37)
0	5.06(2.97)	4.46(2.97)	3.98(.10)	3.67(2.55)	3.38 2.37)	3.23(2.14)
1	5.93(3.27)	4.94(2.96)	4.78(.20)	4.82(2.84)	4.17(2.71)	4.00(2.87)
6	7.27(3.00)	7.73(4.20)	8.33(.79)	8.33(2.87)	3.33(1.53)	4.00(2.83)
10	14.00(.00)	7.46(3.95)	10.00(1.58)	5.00(3.91)	11.00(.00)	–
15	4.00(.00)	7.75(4.43)	11.00(2.74)	2.00(.00)	–	6.50(6.36)

[a] A higher number represents feeling more distracted.

many of these effects were modest and their magnitude should not be overstated. Moreover, the findings suggest that people of all ages are often deliberate multitaskers, choosing their second activities and distractions intentionally, at least some of the time.

Despite this effort to control their environment, multitasking was associated with an increased sense of distraction. Environmental distraction and non-electronic multitasking were significantly associated with reports of being more distracted and less able to focus. The number of additional electronic-based tasks the participants engaged in beyond taking the survey was also associated with greater distraction. Thus, even if participants choose their additional activity, device, or distraction intentionally, it still can lead to them feeling less able to pay attention. The change in the R^2 suggests that the amount of additional variance in distraction that is explained by these variables is modest, but worthy of consideration given the prevalence of multitasking. Taking into account the number of additional activities that the participants completed on their phone or computer, for example, accounted for nearly 5% of the variance across participants in their self-reported distraction levels.

Interestingly, however, once the number of different electronic-based tasks the participant did was accounted for, the amount of multitasking engaged in was associated with a *reduction* in perceived distraction rather than a further increase. In other words, once people were doing a few different electronic things at once, the more frequently they did those things, the less distracted they felt. Regressing the electronic multitasking items individually enabled us to see that while additional instances of leaving the browser with the survey to complete another task increased the feeling of being distracted, engaging in the four other tasks more heavily decreased it. We can offer two potential explanations for this. One is that if people are doing multiple instances of the same thing at once (e.g., answering more than one text at the same time), they may be task-switching in larger "blocks," giving them more time to orient to the additional activity. This might leave them feeling less scattered and stressed. A second explanation has to do with the nature of the additional electronic multitasking activities. Many would be done on a smart phone, such as listening for a noise indicating a new message, writing texts, or reading social network updates. It is possible that these behaviors are so automatic for such a large portion of the sample that doing them makes them feel connected and "normal." A recent, small-scale study of young adults' media use in a leisure context found that they switched between media venues 27 times per hour (Steinberg, 2012), suggesting that electronic media multitasking can become habitual. This might contribute to feeling better able to concentrate on the survey than one would if that habit could not be fulfilled. Additionally, a recent study of college students' physiological reactions to task-switching on the same device (Yeykelis et al., 2014) found a significant increase in arousal in the 12 s preceding a switch from work to entertainment. To the extent that taking a survey is a task that requires finishing and checking one's phone for messages is often part of one's social life, it could be that monitoring communication while taking a survey is a perceived as an indulgence or a way to stay connected as opposed to a distraction. Neither of these possibilities can be verified from this study, but are worthy areas of future investigation, particularly given the prevalence of multitasking likely to be associated with the continued proliferation of personal electronic devices and developments like Google Glasses.

5.2. Limitations

It should be noted here that one limitation of the study is that we measured the participants' subjective sense of being distracted, not actual task performance. This means we were unable to ascertain directly whether the people who reported greater distraction actually performed more poorly. Some participants might feel distracted, but have the resources to meet the demands of the task satisfactorily and not show a measureable decrease in task performance, whereas others' performance might suffer objectively along with their subjective sense of being unable to focus. Future research would benefit from including an objective measure of performance. However, the self-report measure used here is worthy of consideration. In addition to its theory-based link to performance, in some cases, feeling distracted is meaningful in itself. It would hamper engagement in some types of stimuli material, such as audio-visual narratives. Furthermore, it might also affect the participants' mood, which might shape the valence of their evaluations. Distracted participants who are pre-testing commercials, for example, might be less likely to be transported by them. Distracted participants might be more likely to report negative evaluations of just about anything.

Although multitasking was related to age and the number of different multitasking activities was related to distraction, age was not found to moderate the relationship between multitasking and distraction in the manner expected. We predicted that older people, who are less likely to combine electronic media, would feel more distracted than young people when doing something else while taking the survey. In actuality, older participants felt less distracted than younger ones on average and when multitasking levels were light. Furthermore, the strength of the correlation between multitasking and distraction was roughly curvilinear, with participants who were 35–44 showing the strongest correlation. The correlation was also weaker for the oldest age group than the youngest one. This relatively complex pattern is not explained by the "digital generation" cohort effect, which would predict jump in the size of the correlation between distraction and multitasking as one moved from cohorts who had grown up with computers to those who had not. Nor is it adequately explained by the older adults' greater difficulty in suppressing distractions, which would suggest an increase in the strength of the correlation among older cohorts. The relationship among multitasking, distraction, and age is clearly a rich direction for further investigation, as it appears that these variables are linked in unexpected and nonlinear ways.

Setting, on the other hand, did not result in surprising findings. People were most distracted out in public and least at home, lending further support for the idea that people are deliberate multitaskers when they can be. This bodes well for researchers seeking to administer online surveys to volunteers, whether for scholarly research or business, because it suggests that survey takers will set themselves up with the type and amount of distractions they are comfortable with. Interestingly, it appears that a high degree of electronic multitasking may even decrease the perception of distraction for some survey takers, a finding that should be followed by experiments verifying if this perception corresponds to actual task performance.

This analysis provides a large comprehensive look at multitasking in a context with excellent ecological validity. By querying survey takers while they were in the midst of completing an online survey, we were able to ask about other activities and distractions in their environment as they were happening, increasing the likelihood of obtaining an accurate report. Moreover, our data came from people from seven countries and a wide range of ages, although the fact that all belong to a market research company's panel suggests they may be more technologically oriented than people overall. We also do not wish to overstate the statistical significance of findings from a sample this large; at the same time, we feel we have provided a valuable snapshot of a common behavior that is likely to grow in popularity and that has important implications for how people interact with media messages.

References

Bardhi, R., Rohm, A. J., & Sultan, F. (2010). Tuning in and tuning out: Media multitasking among young consumers. *Journal of Consumer Behavior, 9*, 316–332.

Baumgartner, S. E., Weeda, W., van der Heijden, L., & Huizinga, M. (2013). *The relationship between media multitasking and executive function in early adolescents*. Paper presented at the meeting of the international communication association, London, UK.

Bowman, L. L., Levin, E., Waite, B. M., & Gendon, M. (2010). Can students really multitask? An experimental study of instant messaging while reading. *Computers & Education, 54*, 927–931.

Campbell, K. L., Grady, C. L., Ng, C., & Hasher, L. (2012). Age differences in the frontoparietal cognitive control network: Implications for distractibility. *Neuropsychologia, 50*, 2212–2223.

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

Connelly, S. L., Hasher, L., & Zacks, R. T. (1991). Age and reading: The impact of distraction. *Psychology and Aging, 6*, 533–541.

Foehr, U. (2006, December). Media multitasking among youth: Prevalence, pairings, and predictors. *The Henry J. Kaiser Family Foundation.* <http://www.kff.org/entmedia/upload/7592.pdf>.

Gazzaley, A., Cooney, J. W., Rissman, J., & D'esposito, M. (2005). Top-down suppression deficit underlies working memory impairment in normal aging. *Nature Neuroscience, 8*, 1298–1300.

Groves, R. M. (2011). Three eras of survey research. *Public Opinion Quarterly, 75*, 861–871.

Hasher, L., Stoltzful, E. R., Zacks, R. T., & Rypma, B. (1991). Age and inhibition. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 17*, 163–169.

Helsper, E. J., & Eynon, R. (2010). Digital natives: Where is the evidence? *British Research Journal, 36*(3), 503–520. http://dx.doi.org/10.1080/01411920902989227.

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

Levine, L. E., Waite, B. M., & Bowman, L. L. (2007). Electronic media use, reading, and academic distractibility in college youth. *Cyberpsychology and Behavior, 10*, 560–566. http://dx.doi.org/10.1089/cpb.2007.9990.

Malmstrom, T., & LaVoie, D. (2002). Age differences in inhibition of schema-activated distractors. *Experimental Aging Research, 28*, 281–298.

McDonald, D. G., & Meng, J. (2009). The multitasking of entertainment. In S. Kleinman (Ed.), *The culture of efficiency: Technology in everyday life* (pp. 142–157). New York: Peter Lang.

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

Neff, J. (2012, September 12). Inside the brain of a boomer: Cash-rich demo does poorly with visual complexity. *Advertising Age*. <http://adage.com/article/news/inside-brain-a-boomer-cash-rich-demo-sees-ads/237089/>.

Nielsen Company (2009, December 18). *Television, Internet, and mobile usage in the U.S.: A2/M2 three screen report*. <http://www.nielsen.com/content/dam/corporate/us/en/newswire/uploads/2009/09/ThreeScreenReport_US_2Q09REV.pdf>.

Nielsen Company (2013, June 20). *The me generation meets generation me*. <http://www.nielsen.com/us/en/newswire/2013/the-me-generation-meets-generation-me.html>.

Park, Y. (2013). Changes in TV viewing habits: An empirical analysis of second screen usage. *Asian Journal of Information and Communications, 5*, 33–44.

Preacher, K. J. (2002, May). Calculation for the test of the difference between two independent correlation coefficients [Computer software]. <http://quantpsy.org>.

Prensky, M. (2001). Digital natives, digital immigrants. In *On the horizon, October 2001* (Vol. 9, issue no. 5). Lincoln: NCB University Press.

Richtel, M. (2010, November 21). Growing up digital, wired for distraction. *The New York Times* (pp. A1, A20).

Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010, January). Generation M^2: Media in the life of 8- to 18 year-olds. *The Henry J. Kaiser Family Foundation*. <http://www.kff.org/entmedia/8010.cfm>.

Steinberg, B. (2012, April 9). Study: Young consumers switch media 27 times an hour. *Advertising Age*. <http://adage.com/article/news/study-young-consumers-switch-media-27-times-hour/234008/?utm_source=daily_email&utm_medium=newsletter&utm_campaign=adage>.

Stross, R. (2012, March 3). The second screen, trying to complement the first. *The New York Times*. <http://www.nytimes.com>.

Voorveld, H. A. M., & van der Goot, M. (2013). Age differences in media multitasking: A diary study. *Journal of Broadcasting and Electronic Media, 57*, 392–408.

Waite, B. M., Levine, L. E., & Bowman, L. L. (2009). Instant messaging, multitasking and media use of college youth: Connections to impulsiveness and distractibility. *American Journal of Media Psychology, 2*, 126–146.

Wang, J. (2013, June). *Cognitive dimensions of multitasking*. Paper presented at the meeting of the international communication association, London.

Yang, L., & Hasher, L. (2007). The enhanced effects of pictorial distraction in older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 62*, 230–233.

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

Zwarun, L., & Hall, A. (2011, November). *Is public the new private? A first look at media multitasking and online video*. Paper presented at the meeting of the National Communication Asssociation, New Orleans, LA.

Zwarun, L., & Hall, A. (2014). Narrative persuasion, transportation, and the role of need for cognition in online viewing of fantastical films. *Media Psychology, 15*, 327–355.