Original Article

The Mere Presence of a Cell Phone May be Distracting

Implications for Attention and Task Performance

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Abstract. Research consistently demonstrates the active use of cell phones, whether talking or texting, to be distracting and contributes to diminished performance when multitasking (e.g., distracted driving or walking). Recent research also has indicated that simply the presence of a cell phone and what it might represent (i.e., social connections, broader social network, etc.) can be similarly distracting and have negative consequences in a social interaction. Results of two studies reported here provide further evidence that the ''mere presence'' of a cell phone may be sufficiently distracting to produce diminished attention and deficits in task-performance, especially for tasks with greater attentional and cognitive demands. The implications for such an unintended negative consequence may be quite wide-ranging (e.g., productivity in school and the work place).

Keywords: cell phone, distraction, attention, performance

Mobile cell phones are ubiquitous and ''smartphones'' in particular are becoming increasingly prevalent. Recent surveys indicate that at least 85% of people in the United States have cell phones, and that over 50% of these users now have smartphones (Duggan & Rainie, 2012; Nielsen, 2013; Smith, 2012; Time Mobility Poll, 2012). Overall, users note that mobile technology has changed their lives with most indicating it has helped them maintain or enhance their relationships with friends and family. Aside from calling, it is texting that has become the predominate use of the cell phone, followed by email and social networking. Indeed, in the 10 years since 2002, text messaging in the United States alone has gone from 31 million per day to 6 billion (Cellular Telecommunications Industry Association, 2012).

The ''constant connectivity'' afforded by mobile technology has contributed to a preoccupation with the cell phone – an overwhelming majority of users check their phone upon waking and as the last thing before bed, are continually checking for calls and texts, and report they could not go without their phone for one day (Perlow, 2012; Smith, 2012; Time, 2012).

Such ''cognitive salience,'' when the cell phone dominates one's thoughts or focus, along with ''behavioral salience,'' a preoccupation with checking/using the cell phone, are primary symptoms of behavioral addiction (Walsh, White, & Young, 2008). Moreover, this constant connectivity throughout the day provides for a continual source of interruptions and distractions and potentially diminishes our ability to maintain attention and to concentrate and think deeply about things (Carr, 2010; Wajcman & Rose, 2011). Yet, a majority of users report ''no problem'' with regard to being able to disconnect from work at home, give people undivided attention, or focus on a task without being distracted (Smith, 2012).

Distraction Associated With Cell Phone Use

Multitasking is very common with mobile technology (e.g., talking/texting while driving, walking, shopping, or watching television) and perhaps contributes to the users' belief that the cell phone makes it easier to stay in touch with people, helps coordinate daily activities, and contributes to greater productivity (Smith, 2012). Indeed, multitasking with the cell phone has the appearance of not taking up extra time; instead, it creates the illusion of ''giving you more time'' (Turkle, 2011).

Distracted Driving and Walking

However, multitasking with the cell phone has obvious negative consequences as is apparent with delayed detection and reaction times, inattentional blindness, and increased incidents of accidents associated with distracted driving (Caird, Willness, Steel, & Scialfa, 2008; Strayer,

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Drews, & Crouch, 2006; Strayer, Drews, & Johnston, 2003; Strayer & Johnston, 2001). And, at least for driving, performance deficits are not reduced with more experience (Cooper & Strayer, 2008) and are evident even with the use of hands-free cell phones (Caird et al., 2008; Strayer & Drews, 2007) or voice-to-text capability (Yager, 2013). Similarly, distracted walking is evident among pedestrians using their cell phones to talk or text. Research indicates such cell phone use results in diminished situational awareness, an increase in unsafe behaviors, and greater risk for accidents, injuries, and death (Hyman, Boss, Wise, McKenzie, & Caggiano, 2010; Nasar & Troyer, 2013; Neider, McCarley, Crowell, Kaczmarski, & Kramer, 2010; Stavrinos, Byington, & Schwebel, 2011).

Distracted Working

In business, there is growing concern with "distracted working" due to multitasking and the increasingly frequent electronic interruptions involving email, texting, and social networking. Not only does cell phone use have implications for accidents and "close calls" in the workplace (Korpinena & Pääkkönen, 2012), but the use and misuse of mobile technology has negatively impacted productivity both in quantity and quality of work output attributed in large part to the interruptions occurring every 15 min and the time it takes to regain concentration afterwards (harmon.ie, 2011; Spira & Feintuch, 2005). For instance, a 3-s distraction (the time it takes to reach out and silence a cell phone) while conducting a sequencing task is sufficient to disrupt attention and result in twice the number of errors made in the post-disruption phase of the task; longer the interruption, greater the error rate (Altmann, Trafton, & Hambrick, 2014). Ironically, the technologies that are envisioned to save time and enhance productivity through multitasking may actually be serving to waste time, cost money, and harm relationships at work and home (Crenshaw, 2008).

Distracted Learning

Among college students, there is evidence of "distracted learning" where academic performance is negatively impacted due to either conversing or texting (Froese et al., 2012; Smith, Isaak, Senette, & Abadie, 2011) and by the distraction associated with the ringing of a cell phone in the classroom (End, Worthman, Mathews, & Wetterau, 2010; Shelton, Elliott, Eaves, & Exner, 2009). Even if performance is not negatively affected, there may be other undesirable costs for cell phone use. For instance, performance on a reading comprehension task did not differ between students who responded to text messages while reading and students who did not text message; however, not counting texting time, it took texting students significantly longer to complete the reading task in order to achieve the same level of performance (Bowman, Levine, Waite, & Gendron, 2009; Fox, Rosen, & Crawford, 2009). And, students' text messaging frequency and other social networking use negatively correlates with their grade point average although the frequency of cell phone calls does not (Harman & Sato, 2011; Walsh, Fielder, Carey, & Carey, 2013).

Distraction Associated With Cell Phone Presence

As for interpersonal relationships, mobile technology indeed does have the potential to expand people's social connections and maintain or enhance their relationships with friends and family (Geser, 2002; Leung & Wei, 2000; Mathews, 2004; Srivastava, 2005; Wajcman, Bittman, & Brown, 2008; Wei & Lo, 2006). However, this technology actually may have unintended negative consequences for immediate social interactions as its presence may serve as a constant reminder of the broader social network that is potentially available. Thus, in social situations, people may often disengage from their present company to attend, either in thought or action, to other people or events elsewhere in cyberspace (Geser, 2002; Ling, 2004; Plant, 2000; Srivastava, 2005; Turkle, 2011); "Thumbs are stronger, attention shorter, temptation everywhere: we can always be, mentally, digitally, someplace other than where we are" (Time, 2012).

Indeed, recent research has demonstrated the potential for the "mere presence" of the cell phone to be a distraction in a social situation and have a detrimental effect on an interpersonal experience. Przybylski and Weinstein (2013) innocuously manipulated the presence or absence of a cell phone while two strangers took part in a relationship formation task, a 10-min face-to-face interaction discussing an assigned topic (e.g., most interesting event in the past month). Participants' evaluations of the relationship quality (i.e., "liking of their partner") and feelings associated with the other person (e.g., closeness, trust, and empathy) were significantly lower in the cell phone condition. These differences were most apparent when the discussion topic was personally meaningful (your most important event last year) rather than casual (attitudes about artificial holiday trees).

The Present Research

It is perhaps obvious that talking or texting while engaged in another task would have implications for distracted attention and diminished performance, especially when the task was one requiring undivided attention for successful completion. It is interesting that simply the presence of a cell phone may have the potential for an equivalent detrimental effect, at least with regard to an interpersonal social experience. As such, the present research was undertaken to consider further whether the presence of a cell phone itself would have the capacity for distraction and have a negative impact on attentional processes and task performance.

Study 1

Participants, Procedure, and Manipulation

Undergraduate students (37 women, 17 men, ranging in age from 18 to 46; $M_{age} = 23.8$) took part in this study in exchange for extra credit in their introductory psychology class. Scheduled to participate in random pairs, participants were brought into a laboratory where they were seated at separate tables (25″ × 45″) facing away from each other. While they could not observe each other while working, participants could both turn to attend to a female experimenter as she provided an explanation of the research and demonstrations of the tasks involved. It was explained that they would be working at a set of timed tasks that required attention and concentration for quick and accurate completion. It was further noted that these tasks were usually timed to see how long it took people to complete them and that the purpose of the present study was to establish baselines for task performance when specified time limits are imposed. Participants would complete two timed digit cancellation tasks and two trail-making tests, followed by two brief questionnaires. These materials were provided in an ordered set through which participants would be directed by the experimenter. Prior to each timed task, the experimenter explained what was to be done while demonstrating with an example task. While participants were doing each task, the experimenter remained out of sight behind a room divider.

Experimental Manipulation

When beginning to explain the nature of the research and the timed tasks to the two participants, the experimenter had innocuously placed her cell phone and a stopwatch on the edge of the table of one participant; a spiral notebook of similar size to the cell phone had previously been positioned on the table of the other subject (cf. Przybylski & Weinstein, 2013). Once the tasks had been explained and participants were provided the research materials and ready to begin, the experimenter picked up the stopwatch, but left the cell phone on the table. She then proceeded to have participants begin with the series of timed tasks. Students had not been asked to turn off their cell phones for the duration of the session so as to not bring explicit attention to cell phones, especially among those in the control (notebook) condition; however, there was no indication of an incoming call or text during any experimental session.

Materials

Digit Cancellation Task

Digit cancellation tasks are common in neuropsychological evaluations used to assess attention, cognitive capacity, and executive functioning (e.g., Della Sala, Laiacona, Spinnler, & Ubezio, 1992; Teuber, 1972). In this study, there were two cancellation tasks involved, one more challenging than the other. For both, participants were presented with a page of 20 rows of 50 single digit numbers singly spaced. The less challenging task was a simple "*digit cancellation*" task. Each row of digits was preceded by a "target number" that the subject was to circle and then proceed to cross off each occurrence of the number appearing in that row; then on to the next row with a different target number (e.g., 2: 38~~2~~16~~2~~75...). The more challenging task was an "*additive cancellation*" task. Again, each row of digits was preceded by a "target number" that the subject was to circle and then proceed to cross off any two adjacent numbers that "added up" to the target number (e.g., 3: 3~~21~~618~~30~~5...). Participants were told when to start and when to stop – 90 s (1.5 min) for the simple cancellation, and 180 s (3 min) for the additive cancellation. For both tasks, participants were permitted to complete cancellations in a row for which they had already circled the target number. Performance on both tasks was assessed by the number of lines completed and a cancellation score based on the total number of targets possible for the lines completed minus the number of errors made (failure to cancel a target or mistakenly cancelled an inappropriate number).

Trail Making Test

The Trail Making Test (TMT), often a component of neuropsychological evaluation, is a measure requiring a variety of abilities for successful performance, including attentional processes, mental flexibility, and motor function (Reitan, 1958, 1992; Reitan & Wolfson, 1985). The test is comprised of two components, one more challenging than the other. For the TMT-*Part A*, the task requires a person to draw a line (without lifting the pencil) as quickly as possible to connect sequentially 25 consecutively numbered circles displayed in a random order on a page (e.g., 1-2-3-4-...). As originally designed, an examiner would point out a mistake requiring the person to retrace the path to correct the sequencing, thus adding on to the time for completion. For the TMT-*Part B*, the task also requires a person to draw a path between 25 circles, but this time alternating sequentially between a number and letter (e.g., 1-A-2-B-3-C-4-...). A mistake in sequencing would be pointed out and the path retraced in order to correct, thus adding on to the time for completion. Part B is obviously the more difficult task with increased attentional and cognitive demands, more complex rules directing behavior, and visually interfering stimuli (Gaudino, Geisler, & Squires, 1995). In the present study, however, rather than timing how long it took to successfully complete a path, participants' performance would be based on *how far* they get on the path within a specified amount of time – 15 s for Part A and 30 s for Part B. Participants had been instructed that, should a mistake be made, they simply retrace their path to make a necessary correction. Scoring on both Part A and B was the number of circles sequentially connected; errors (retracing) would result in fewer connected circles. If a sequencing error was not self-corrected, then those errors would be subtracted from the participant's total circles connected.

Attentional Behavior Assessment

The Attentional Behavior Rating Scale (Ponsford & Kinsella, 1991) was adapted to provide for a self-report assessment of attentional difficulties. The original scale was intended for use by external observers to evaluate an individual's level of difficulty with memory, distractability, sustaining attention, and related behavioral problems and is a valid and reliable assessment of attentional behavior that correlates with neuropsychological measures of attention. The present self-assessment is a 14-item questionnaire with each item responded to along a five-point continuum, "never true of me" (1) to "always true of me" (5). Sample items include: "I am unable to stick to one task for very long," "I make mistakes due to not paying attention," and "I seldom need prompting to get on with things" (reverse-scored). Total scores could range from 14 to 70 with higher scores reflecting greater attentional behavior difficulties. The internal consistency of this scale in the present study was very good (Cronbach's $\alpha = .86$).

Cell Phone Usage and Possession Attachment Survey

The *Cell Phone Usage* survey considered the manner in which individuals use their cell phones with items similar to those used in other surveys (e.g., Nielsen, 2013; Time, 2012). Participants indicated how often they used their cell phone for six specific activities (e.g., talking, texting, email), use of their phone, excluding talking, in seven specific situations (e.g., idle time at school/work, waiting in line, while driving), and use of their phone, excluding talking, in conjunction with six other activities (e.g., watching television, walking, shopping). Each item was responded to using a five-point scale, "rarely or never" (1) to "most, or all the time" (5). Responses to the 19 items were summed to provide an overall assessment of cell phone use; total scores could range from 19 to 95 with higher scores associated with greater overall usage. The internal consistency of this composite measure in the present study was very good ($\alpha = .90$). *Possession Attachment* is a five-item assessment of participants' connection to, and dependence on, their cell phone (Weller, Dieckmann, Mauro, & Slovic, 2010; Weller, Schackleford, Dieckmann, & Slovic, 2013). Sample items include: "I would feel uncomfortable if I didn't have my phone with me" and "I would rather lose my wallet than my cell phone." These items were responded to using the same five-point scale; total scores could range from 5 to 25 with higher scores indicating greater possession attachment toward their cell phone. The internal consistency of this measure in the present study was very good ($\alpha = .85$).

Results and Discussion

Initially, a two-way multivariate analysis of variance (MANOVA) – gender-by-cell phone/notebook condition – was conducted with the digit and additive cancellation task performance scores and the TMT Part A and B scores serving as dependent measures. As there was no effect due to subject sex or any interaction (*F*s < 2), data were collapsed across gender and analyzed and reported on in the aggregate. Descriptive statistics are presented in Table 1.

Table 1. Descriptive statistics for task performance assessments and self-report measures cell phone presence (Study 1)

	Notebook		Cell phone	
	Mean	*SD*	Mean	*SD*
Digit cancellation				
Number of lines	10.79	2.06	11.23	2.36
Correct cancellations	61.46	11.69	62.46	12.85
Additive cancellation				
Number of lines	7.00	1.89	7.65	1.47
Correct cancellations	23.25	6.10	19.81	4.30
Trail making test				
Part A	17.17	5.31	16.77	4.12
Part B	15.46	4.35	12.42	3.88
Attentional behavior	41.33	7.92	39.46	8.09
Cell phone use	49.46	14.21	52.15	12.35
Possession attachment	14.42	5.02	14.65	4.96

Digit Cancellations

For the simple digit cancellation task, there were no differences as to the number of lines completed or the number of correct cancellations due to presence of a cell phone or notebook (*F*s < 1). Neither was there a difference with regard to the number of lines completed with the additive cancellation task ($F < 2$). However, the correct additive cancellations achieved did differ significantly as a function of the cell phone presence versus notebook, $F(1, 48) = 5.38$, $p < .05$, $\eta_p^2 = .10$. On this more demanding task, those with the cell phone had poorer performance than those with the notebook (*M*s = 19.81 and 23.25, respectively).

Trail Making Tests

Considering the performance on Part A of the TMT, the number of sequential circles successfully realized did not differ between the cell phone and notebook presence ($F < 1$). On the more difficult Part B task, however, those with the cell phone present achieved fewer circles ($M = 12.42$) than their counterparts with the notebook ($M = 15.46$), $F(1, 48) = 6.79$, $p < .05$, $\eta_p^2 = .12$.

Ancillary Analyses

A separate two-way MANOVA (gender-by-cell phone/notebook condition) was conducted to evaluate possible differences in age, self-reported attentional difficulties, cell

Table 2. Correlations among individual difference variables and task performance assessments (Study 1 above diagonal; Study 2 below diagonal)

	1	2	3	4	5	6	7	8	9	10
1. Age	–	−.14	−.37[b]	−.43[b]	−.09	−.12	−.01	−.07	.03	−.16
2. Attentional behavior	−.10	–	.07	.11	−.18	−.13	−.09	−.14	−.18	.01
3. Cell phone use	−.45[b]	.10	–	.71[c]	.08	.10	.01	.09	.21	−.02
4. Possession attachment	−.39[b]	.21	.57[c]	–	−.10	.08	−.06	−.02	.04	−.05
5. Digit – number of lines	.15	−.25	−.04	−.16	–	−.74[c]	.51[c]	.34[a]	.25	.20
6. Digit – correct cancellations	.12	−.24	−.05	−.18	.63[c]	–	.48[c]	.40[c]	.41[b]	.24
7. Additive – number of lines	.21	−.08	−.15	−.06	.52[c]	.52[c]	–	.41[b]	.42[b]	.24
8. Additive – correct cancellations	.11	−.17	−.04	−.03	.33[b]	.40[b]	.45[b]	–	.34[a]	.42[b]
9. Trail making – A	.08	.09	−.02	−.11	.19	.20	.23	.13	–	.48[b]
10. Trail making – B	−.14	.02	.20	.02	.15	.25	.22	.35[a]	.29[a]	–

Note. [a]$p < .05$; [b]$p < .01$; [c]$p < .001$.

phone usage, and cell phone attachment (as there were no missing data on the individual difference assessments, participants' summed scores served as the basis for analysis and reporting). For each of these, there were no significant differences by sex of subject, condition, or interaction (Fs $\leq$ 2). Descriptive statistics collapsed across gender are presented in Table 1 also. Correlations among these individual difference assessments and task performance measures are presented in Table 2 (above the diagonal). While attentional behavior was not related to age, older participants did report less cell phone use and less possession attachment. However, performances on either the cancellation tasks or trail making tests were not significantly related to age, attention, usage, or attachment in any systematic manner.

Moderataion Analysis

In consideration of possible moderators of the cell phone effect, moderated multiple regression analyses (Aiken & West, 1991) were conducted for both the additive cancellation and the TMT-B tasks with age and individual difference variables included along with cell phone experimental condition as predictors with task performance as the criterion. This provides not only for first-order effects, but also higher-order interaction effects between the categorical variable (dummy-coded 1 = phone, 0 = no phone) and the different continuous predictor variables (each having been centered prior to inclusion in the regression). Results of the overall regressions for the additive task and the TMT-B were not significant, Fs(9, 40) $\leq$ 1.5. The unstandardized regression coefficients for each of the predictor variables are presented in Table 3. For both regressions, phone condition provided the only significant contribution. Moreover, there were no significant interaction effects between phone condition and age or individual differences indicative of a moderating influence.

Results of this study provide support for a "mere presence" effect of the cell phone in reducing attentional capacity and performance, but only when the task was more attentionally and cognitively demanding. Interestingly, based on the number of lines completed, the quantity of work was comparable for cell phone and notebook groups;

Table 3. Regression analysis summaries predicting performance as a function of cell phone presence, age, and individual differences in attention, usage, and possessiveness

	Study 1				Study 2			
	Additive cancellation		Trail making part B		Additive cancellation		Trail making part B	
	b (SE_b)	t	b (SE_b)	t	b (SE_b)	t	b (SE_b)	t
Phone condition	−3.53 (1.56)	−2.27[a]	−3.29 (1.15)	−2.86[b]	−4.54 (2.18)	−2.08[a]	−2.88 (1.24)	−2.33[a]
Age	−0.12 (0.19)	0.66	−0.21 (0.14)	−1.49	−0.06 (0.23)	−0.27	−0.08 (0.12)	−0.68
Attention	−0.49 (0.15)	−0.34	−0.17 (0.11)	−1.53	−0.12 (0.22)	−0.54	−0.18 (0.12)	−1.53
Usage	0.17 (0.11)	1.51	0.11 (0.08)	1.33	−0.08 (0.21)	−0.37	0.10 (0.11)	0.87
Possesiveness	−0.47 (0.33)	−1.42	−0.41 (0.24)	−1.71	0.23 (0.53)	0.44	−0.03 (0.28)	0.11
Phone × Age	0.11 (0.26)	0.40	0.06 (0.19)	0.31	0.22 (0.34)	0.64	0.06 (0.18)	0.32
Phone × Attention	0.15 (0.21)	0.70	0.23 (0.15)	1.51	0.42 (0.28)	0.15	0.36 (0.22)	1.64
Phone × Usage	−0.26 (0.19)	−1.38	−0.18 (0.14)	−1.34	0.08 (0.28)	0.29	−0.09 (0.15)	−0.62
Phone × Possessiveness	0.79 (0.47)	1.68	0.46 (0.35)	1.31	−0.35 (0.67)	−0.53	−0.08 (0.35)	−0.23

Note. [a]$p < .05$; [b]$p < .01$.

it was the quality of the work (i.e., accuracy) that suffered. In addition, the results would suggest that gender or age differences, self-reported attentional difficulties, and cell phone usage or attachment are not likely moderating or mediating variables of this unintended negative consequence.

Study 2

A second study was conducted in an attempt to replicate the findings of the first study outside of a laboratory context. In particular, students in two separate statistics classes volunteered to take part in this study which considered the presence (not the use) of a cell phone on task performance in a group setting. Whereas the previous study relied on the presence of the experimenter's cell phone, this study utilized the presence of the students' own phones.

Participants, Procedure, and Manipulation

Participants were students in two different statistics classes who were in attendance on the day the study was conducted. In exchange for their participation, an extra credit point would be earned toward their course grade. Based on a coin toss, one class was selected to be the experimental group (cell phone presence) while the other class served as a control group (no cell phone presence). The experimental class consisted of 23 students (14 women, 9 men, ranging in age from 19 to 48; M_{age} = 24.6), whereas the control class consisted of 24 students (17 women, 7 men, ranging in age from 18 to 47; M_{age} = 24.2). As in the previous study, it was explained to both classes that they would be working at a set of timed tasks that required attention and concentration for quick and accurate completion. It was also noted that these tasks were usually timed to see how long it took people to complete them and that the purpose of the present study was to establish baselines for task performance when specified time limits are imposed. With the research materials provided in an ordered set, students would complete the digit cancellation tasks and trail-making tests, and then the attentional behavior and cell phone usage surveys, as directed by the instructor.

Experimental Manipulation

In the experimental class, the students were asked to get their cell phones out and place them on their desktops prior to starting (not surprising, everyone had one; and class policy was for phones to be turned off during class). It was explained that one survey they would be completing was concerned with cell phones (brands, models, features, etc.) and they were being asked to have their phones ready in order to avoid confusion and be expedient. In the control class, there was no mention of cell phones or cell phone survey; and class policy was to have phones turned off and put away during class. In either class, there was no indication of any incoming call or text while data collection was underway.

Materials

All research materials were the same as those previously described for Study 1. Considering the self-report measures in this second study, the overall internal consistency was very good for the Attentional Behavior Assessment (α = .89), Cell Phone Usage Survey (α = .88), and Possession Attachment (α = .81).

Results and Discussion

A two-way MANOVA (gender-by-experimental condition) was conducted with the two cancellations tasks and two trail making tests serving as dependent measures. Again, there was no significant main or interaction effect involving sex of participants (*F*s < 1.8). Data were subsequently collapsed across gender and analyzed and reported on in the aggregate. Descriptive statistics are presented in Table 4.

Digit Cancellations

For the simple digit cancellation task, neither the number of lines completed nor the number of correct cancellations achieved differed with the presence or not of a cell phone (*F*s < 1). For the additive cancellation, the number of lines completed also did not differ between experimental conditions ($F < 1$). However, the number of correct additive cancellations did differ significantly as a function of the cell phone presence manipulation, $F(1, 45) = 5.80$, $p < .05$, $\eta_p^2 = .11$. On the more demanding task, the performance

Table 4. Descriptive statistics for task performance assessments and self-report measures by cell phone presence (Study 2)

	No cell phone		Cell phone	
	Mean	*SD*	Mean	*SD*
Digit cancellation				
Number of lines	12.52	3.19	12.33	3.10
Correct cancellations	67.43	14.16	66.00	13.09
Additive cancellation				
Number of lines	8.39	3.06	9.17	3.27
Correct cancellations	26.17	6.30	21.29	7.51
Trail making test				
Part A	14.37	5.94	15.79	5.13
Part B	16.91	4.08	14.50	4.14
Attentional behavior	39.39	8.18	43.38	8.73
Cell phone use	52.22	12.57	48.46	11.88
Possession attachment	15.87	5.13	14.67	4.78

of those with the cell phone present (M = 21.29) was lower than those with no cell phone presence (M = 26.17).

Trail Making Tests

Performance on the easier Part A of the TMT – the number of sequential circles successfully realized – did not differ due to the manipulated presence of the cellphone ($F < 1$). However, performance on the more difficult Part B task did with fewer sequential circles achieved with the cell phone present (M = 14.50) compared to not present (M = 16.91), $F(1, 45) = 4.05$, $p = .05$, $\eta_p^2 = .08$.

Ancillary Analyses

An additional gender-by-experimental condition MANOVA was conducted in consideration of possible differences in age, self-reported attentional difficulties, cell phone usage, and cell phone attachment (with no missing data on the individual difference assessments, participants' summed scores served as the basis for analysis and reporting). For each of these, there were no significant differences by sex of subject, condition, or interaction (Fs ≤ 2.5). Descriptive statistics collapsed across gender also appear in Table 4. Correlations among these individual difference assessments and task performance measures are presented in Table 2 (below the diagonal). Again, attentional behavior was not related to age, but older participants did report less cell phone use and less possession attachment. However, performances on either the cancellation tasks or trail making tests were not significantly related to age, attention, usage, or attachment in any systematic manner.

Moderataion Analysis

As in the previous study, moderated multiple regression analyses were conducted with additive cancellation and TMT-B task performance serving as criterion with age and individual difference variables included along with cell phone experimental condition as predictors. Again, the overall regressions for the additive task and the TMT-B were not significant, Fs$(9, 37) \leq 1.7$. Unstandardized regression coefficients for each of the predictor variables are presented in Table 3. For both regressions, phone condition provided the only significant contribution; none of the interaction effects proved significant.

Results of this study provide convergent support for the presence of a cell phone having a negative impact on performance when the tasks are more attentionally and cognitively demanding. The correlational results and regression analyses again indicate that relatively little variance in task performance can be accounted for by gender, age, attentional differences, or varying degrees of cell phone use or attachment. And, while this study was quasi-experimental given the use of intact groups, there were no differences between the two classes with regard to these variables; the only difference observed between the two groups was with regard to task performance on the more demanding tasks.

General Discussion

As previously noted, there is considerable evidence of attention and performance deficits associated with the actual use of a cell phone while multitasking whether it be driving, walking, working, or learning, and perhaps not unexpectedly so. However, the potential that the presence of the cell phone itself, even if not being used, could serve as a distractor and result in attentional and performance deficits is interesting and possibly equally problematic. The present findings with task performance are consistent with, and expand upon, recent research demonstrating negative implications of the cell phone's presence for interpersonal relationships (Przybylski & Weinstein, 2013).

Interestingly, in the present studies, the distracting effect of the cell phone's "mere presence" was not observed on simple tasks, but was apparent on the more complex tasks. Relatedly, Przybylski and Weinstein (2013) reported less magnitude of this effect with a casual discussion topic relative to a more meaningful one (i.e., simple vs. complex task). These findings parallel those observed for social facilitation where the presence of others has been shown to enhance or diminish a person's performance depending on task difficulty. Zajonc's (1965) drive theory posits that the "mere presence" of others produces arousal which contributes to enhanced performance on simple tasks but interferes with performance on complex ones. Alternatively, the presence of others may prove distracting and the conflict between attending to others and attending to the task is responsible for any arousal and subsequent enhanced or diminished performance (Baron, 1986). Social facilitation or inhibition indeed results from cognitive factors and attentional focus, not just heightened arousal (e.g., Huguet, Galvaing, Monteil, & Dumas, 1999). Whether the mere presence of a cell phone is capable of producing heightened arousal is not apparent, although that may be something further research might consider. However, the diminished performance observed with the cell phone's presence is indicative of attentional and cognitive deficits, just as it is with distracted driving (e.g., Strayer & Johnston, 2001). Considering attentional resources and cognitive capacity to be finite and utilized as a function of task demands, performance deficits due to multitasking may be minimal with simple tasks as they can be done with little or no attentional resources; more complex tasks, however, place a greater demand on attentional and cognitive resources and increase the potential for performance deficits (e.g., Kahneman, 1973; Schneider & Shiffrin, 1977).

Mobile technology indeed offers the ability to be constantly connected and the potential for contact with a very broad social and informational network (Plant, 2000; Srivastava, 2005; Turkle, 2011). These attributes are what likely contribute to the cell phone's conditioned stimulus properties whereby its simple presence is capable of creating a distraction from the immediate task or situation at hand and elicit awareness of that wider social network that one is not part of at the moment. This is analogous to other instances in which ''thoughts unrelated to task'' evoked by external stimuli may cause the mind to wander and potentially interfere with task performance, especially with more complex tasks dependent on attending to task-relevant stimuli (Smallwood & Schooler, 2006). It is easier to maintain task attention when there are fewer stimuli present that may evoke thoughts unrelated to task (McVay & Kane, 2010). The frequency of these unrelated thoughts is a function of task complexity and associated attentional/cognitive demands; with simple tasks, the mind is more likely to wander, and can afford to do so, without affecting task performance (Kane et al., 2007). And, less mind-wandering and greater ability to stay task-focused is evident among people with greater working memory capacity. While task performance did not covary much with self-reported differences in attentional difficulties in the present studies, perhaps working memory capacity may be an individual difference variable that would moderate the cell phone's mere presence effect.

The use of student samples in the present research may be a limitation, especially with regard to the potential for generational differences. For instance, whereas young people disproportionately have adopted the newer technology embodied in ''smartphones,'' their use has been increasing among older groups (Nielsen, 2013; Time, 2012). Ages of the students here ranged from 18 to mid-40 s (a positively skewed distribution) and there was evidence of cell use and possessiveness to be negatively correlated with age and suggestive of a generational issue. However, age, cell use, and possessiveness were essentially unrelated to self-reported attentional problems or task performances. This may not prove to be the case when older groups are considered in greater numbers. On the other hand, as older individuals become more enmeshed with mobile technology, any generational differences may diminish.

The subtle diversion introduced by the simple presence of a cell phone may have implications that could be quite wide-ranging with regard to impacting interpersonal interactions, driving, performance in school, and productivity in the work place. Although rules and regulations have been put in place to restrict cell phone use while driving, in classrooms, and in the workplace, if the mere presence of the cell phone has the potential to be distracting, then it may necessitate more of an ''out of sight, out of mind'' requirement in some instances. In addition, if the presence of a cell phone and what it may represent is sufficient to produce diminished attention and performance deficits under certain circumstances, then further research may consider whether other mobile technology with enhanced or expanded capabilities (e.g., smartphones and tablets) has the potential to do the same.

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