



# Mobile phone distraction while studying

new media & society

1–19

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DOI: 10.1177/1461444814531692

nms.sagepub.com



**Prabu David**

Washington State University, USA

**Jung-Hyun Kim**

Sogang University, Korea

**Jared S Brickman, Weina Ran and  
Christine M Curtis**

Washington State University, USA

## Abstract

The mobile phone is a breakthrough advance for human communication. But with the plethora of choices available via smartphone, individuals who are deficient in self-regulation or with a propensity for addiction may face challenges in managing these choices strategically. To examine this potential dysfunctional aspect, we examined the effect of multitasking when studying or doing homework and found that both frequency and attention to texting and social media were positively related to mobile phone interference in life (MPIL). However, frequency of music use during study was not associated with MPIL, although allocated attention to music while studying was positively associated with MPIL. Ownership of a smartphone and the number of Facebook friends were positively associated with MPIL and women reported more MPIL than men.

## Keywords

Attention, deficient self-regulation, media use, mobile phone, multitasking, smartphone, task switching

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## Corresponding author:

Jung-Hyun Kim, School of Communication, Sogang University, K328, 35 Baekbeom-ro (Sinsu-dong), Mapo-gu, Seoul 121-742, Korea.

Email: [junghyunk@sogang.ac.kr](mailto:junghyunk@sogang.ac.kr)

## Introduction

Multitasking is pervasive in everyday life and is spurred in part by mobile technologies such as smartphone that are widely used for work-related communication as well as interpersonal interactions. These days, mobile phone can be used to listen to music and play games, and users can download applications for activities such as online banking, booking airline tickets, shopping, making vacation plans, or tracking diet and physical activity. The versatility of mobile phone allows for seamless integration of work, play, and social interaction and enriches life in many ways. However, constant use of the mobile phone may also interfere with work. For example, an observational study of a small sample of information workers found that task switching occurred every 3 minutes and voluntary interruptions were as likely as external interruptions to cause switching (González and Mark, 2004). In another study that employed biometrics and embedded cameras during non-working time, task switching occurred 27 times per hour among digital natives and 17 times per hour among those who grew up with older technologies (Marci, 2012).

Multitasking is also common among students (Carrier et al., 2009; Ophir et al., 2009; Pea et al., 2012; Rosen et al., 2013; Srivastava, 2013; Wang and Tchernev, 2012) and associated with lower academic or test performance (Junco, 2012; Junco and Cotten, 2012; Wood et al., 2012). However, the emphasis on academic performance as the key outcome fails to account for emotional or social functions of multitasking (Wang and Tchernev, 2012) and the willingness among students to trade off performance on the academic task for entertainment, emotional or social gains. Various features available via mobile phone, including music, texting, social media, and games, offer a rich mix of multitasking options to address these needs.

In this study, we examine three popular options available via mobile phone—music, texting and social media—and their interference while studying or doing homework. A recent investigation found that ongoing brief visual inspections of 30 seconds or less spread throughout the day is typical among mobile phone users (Oulasvirta et al., 2012). Such ongoing use of the mobile phone when coupled with deficient self-regulation can evolve into an addiction, resulting in poor academic performance. Therefore, our primary aim is to examine the relationship between mobile phone-related multitasking activities that interfere with studying and self-reported “loss of control behaviors” stemming from deficient self-regulation (Kim & LaRose, 2004; LaRose et al., 2003). Furthermore, given the paucity of established measures of multitasking, we develop and test three measures of multitasking: *frequency of bundled multitasking*, *frequency of pairwise multitasking*, and *attention allocation within a multitasking bundle*.

## Literature review

### *Media multitasking and theoretical approaches*

Related, yet different, theoretical approaches apply to multitasking and task switching, two terms that are used interchangeably in the literature. Strictly speaking, multitasking involves simultaneous involvement in two or more tasks without disengagement or a

temporary break from either task. For example, singing and playing a guitar or driving a car and conversing with a friend co-occur in real time without a break in either task. However, both in the real world and the academic literature, multitasking also refers to task switching, which requires temporary disengagement from one task to attend to the other. For example, texting while doing homework requires temporary halting of one to attend to the other (task switching), whereas listening to music while studying can co-occur without a break in either activity (multitasking).

Most youth participate in a bundle of activities that include multitasking and task switching. For example, consider a common activity bundle that includes studying, listening to music, exchanging text messages, and updating Facebook. Although listening to music can co-occur with studying, texting and social media require a temporary hold on studying to free up cognitive and motor resources required for typing messages. To account for such media behaviors that occur in bundles, frequency should be assessed for clusters of activities, which is a departure from pairwise assessment currently reported in the literature. One popular measure is the Media Multitasking Index (Ophir et al., 2009), which consists of pairwise assessments of 12 types of media. Although this measure has been shown to have good scale properties, it has two drawbacks: it does not address attention to each task and multitasking is limited to two concurrent activities.

Instead of relying on a matrix of  $n \times n$  media activities, which can cause respondent fatigue, some authors have opted for a list of pairings that are strategically chosen for a given research context (e.g. Jeong et al., 2010). While this approach reduces respondent fatigue, it does not account for multitasking situations that involve more than two activities. Hence, in this study we examine multitasking involving common *pairings* of activities while doing homework and compare this to common *clusters* of more than two concurrent activities, such as studying, listening to music, and texting. Furthermore, we examine frequency and attention as distinct measures of media multitasking.

### *Limited capacity model*

To account for division of attention within a bundle of multitasking activities, communication researchers have relied on the limited capacity theory of media processing, which is based on the premise that human cognitive resource is finite and as the demand on this resource increases, task performance will decrease (Basil, 1994; Lang, 2000). For instance, watching a television soap opera while doing homework can hurt homework performance because of cognitive overload (Pool et al., 2000, 2003). Likewise, loss in performance on a primary task has been noted for multitasking interference from an audio advertisement (Voorveld, 2011), podcast (Srivastava, 2013), or television news crawls (Bergen et al., 2005). Furthermore, when attention is divided during media multitasking, messages become less persuasive perhaps because of limited availability of cognitive resources for the more persuasive, but attention-demanding central route processing (Jeong et al., 2010; Jeong and Hwang, 2012; Voorveld, 2011). Interestingly, when music has been introduced as distraction, no significant drop in performance has been observed (Pool et al., 2000, 2003). A plausible explanation for the benign effect of music on primary task performance may be that it can be ignored as background noise.

### *Threaded cognition model*

In addition to the limited capacity model, threaded cognition (Salvucci and Taatgen, 2008, 2010) offers another suitable framework for the study of multitasking and task switching. Three distinct pools of resources—cognitive, perceptual, and motor—are identified in threaded cognition, and it is posited that these resources are assigned to various tasks. Furthermore, each task is instantiated as a separate thread with options for switching between threads. Managing threads and switching between threads is handled by the procedural component of the cognitive resource (Salvucci and Taatgen, 2008).

Maintaining multiple threads and switching between threads, however, comes with a cost. When a task thread is temporarily set aside to attend to another, inevitably delays and errors occur (Altmann and Gray, 2008). The preparation cost associated with switching to a new task thread and the dissipation cost when a task is placed on hold can contribute to loss in performance during task switching (Meiran et al., 2000). Nonetheless, a moderate level of task switching is associated with increased productivity, although errors build up proportionally, as well. The onus is on the user to determine the trade-off between productivity and errors, which is likely dependent on the seriousness of the task and tolerance for errors (Adler and Benbunan-Fich, 2012), though there is evidence that errors can be minimized through practice (Dux et al., 2009).

In limited capacity and threaded cognition, attention is the key resource. Moreover, in both approaches, attention is a limited or finite resource that explains performance deterioration in multitasking. Therefore, in this study, we decided to examine attention to different multitasking activities separately from frequency of multitasking. Furthermore, to simulate the finite attentional capacity, a *constant-sum estimation task* was used to constrain attention allotted to different activities to 100%.

### *Motivated cognition model*

Lang (2006) has advanced a model of attentional resource allocation that is guided by motivation. In Lang's model, motivation is explained as a strategic activation of appetitive and aversive systems. While the appetitive systems seek to maximize positive affect through new experiences, the aversive system, which is built on the flight response, seeks to avoid negative affect (Cacioppo and Berntson, 1994).

Applying motivated cognition to task switching can offer fruitful insights into why distractions are irresistible during studying. For some students, homework is an inherently boring or moderately aversive activity. On the other hand, an ongoing text exchange with a friend can be an appetitive activity that can induce positive affect that offsets the boredom of homework. Recent studies offer empirical evidence that such emotional and social goals drive multitasking, rather than cognitive or performance goals (Wang and Tchernev, 2012).

In short, multitasking or task switching can be examined simply as cognitive overload that interferes with a primary task. However, threaded cognition offers a more nuanced perspective by describing each activity in a multitasking bundle as a separate thread with its own demands for perceptual, cognitive, and motor resources. Motivated cognition offers another extension by casting resource allocation among threads as a

volitional function, with appetitive activities like interactions with friends receiving more attention than less appetitive or aversive activities like homework. Therefore, despite self-reports that multitasking is driven by concerns about productivity and cognitive needs, it appears that multitasking among students might be motivated by social and emotional fulfillment (Wang and Tchernev, 2012). To account for such volitional control of attention to multitasking activities, a measure of individual preference of multitasking was introduced.

## **Deficient self-regulation and mobile phone interference in life**

The purpose of this study is to examine how multitasking while studying is associated with deficient self-regulation (LaRose et al., 2003) behaviors in mobile phone use, which is labeled in this study as mobile phone interference in life (MPIL). Unregulated media use behaviors have been examined for media such as television (Griffiths, 1999) and Internet (Brenner, 1997) as an addiction (McIlwraith, 1998) or dependence (Kubey, 1996). It has been suggested that unregulated media use is believed to be less consequential than a drug or alcohol addiction. Still, unregulated media use behaviors, which are usually benign, can evolve over time into behaviors that are compulsive, uncontrolled and indulgent, and interfere with life (LaRose et al., 2003; Marlatt et al., 1988).

Given that media addiction starts as a benign habit, we adopt a definition of addiction as a “repetitive habit pattern that increases the risk of diverse and/or associated personal or social problems” (Marlatt et al., 1988: 224). Frequent multitasking can become self-reinforcing and eventually become a habit (Olson and Fazio, 2001; Wang and Tchernev, 2012), which is the repetition of behavior without active self-regulation. Habits that go beyond healthy behavioral patterns can interfere with studying and other required activities of everyday life. In essence, we contend that deficient self-regulation of mobile phone use during required activities can lead to interference in daily life.

Loss of volitional control to abstain or moderate mobile phone use can have long-term effects and deserves the attention of communication scholars. For example, heavy multitasking among youth has been associated with fewer interpersonal interactions and lower well-being (Pea et al., 2012). Also, lasting cognitive effects have been identified with multitasking. For instance, students who reported heavy multitasking were found to have limited ability to ignore peripheral distractions, which led to poor performance on the primary task (Ophir et al., 2009). Furthermore, there is mounting evidence that media multitasking during studying is associated with shallower processing (Carr, 2010), poor performance in the classroom (Junco, 2012; Rosen et al., 2013; Wood et al., 2012), and lower grade point average (Junco, 2012), which can collectively hinder success and well-being in life. In light of these deleterious effects on life, deficient self-regulation in mobile phone use deserves scrutiny.

For the purpose of this article, we look at some common behavioral manifestations of deficient self-regulation in mobile phone use, which include using mobile phone longer than intended, inability to cut down on mobile phone use, and continued use of mobile phone at the expense of not completing other required tasks. MPIL, as conceptualized in

**Table 1.** Minutes per day for studying, media, and communication activities ( $N = 992$ ).

	Mean	SD
Studying	198.8	101.2
<i>Communication and media activities</i>		
Face-to-face interaction	310.4	214.2
Texting	180.3	190.5
Music	160.7	142.0
Social media	133.9	112.0
Video	116.6	95.6
Browsing	81.1	86.4
Email	37.3	50.9
Voice	36.3	53.9
Video games	31.5	63.7
Books	31.4	47.5
Total	1119.6	523.4

**Table 2.** Frequency of engaging in other activities when studying (0 = Never, 100 = Always) ( $N = 992$ ).

	Mean	SD
Music	62.24	30.56
Texting	57.13	28.31
Social media	49.74	26.74
Face-to-face interaction	43.72	25.81
Browsing	37.24	26.34
Video	32.88	26.12
Email	24.96	22.77
Voice	20.12	21.30
Books	16.82	22.09
Video games	10.88	17.73

this article, is more than nuisance incursions into daily life via mobile phone, but the inability to curb the use of the mobile phone despite one's better judgment.

### Interference from music, texting, and social media

As already noted, recent findings among youth suggest that music, texting, and social networking are among the most common elements of multitasking activities (Moreno et al., 2012), which also bears out in our sample of college students (see Tables 1 and 2) and corroborated through a pilot study.<sup>1</sup>

While Facebook use and texting allow for social interaction, music use stems from different motivations. Although music can be engaging and evoke strong emotional responses, with practice it also can be ignored as background noise. In fact, music

through headphones is often used as a buffer to block out ambient noises in a dorm room or coffee shop. Texting and social media, on the other hand, are interactive and require active engagement and have stronger potential for interfering with studying.

Findings suggest that music and music videos have little or no effect as distractions while studying (Pool et al., 2000, 2003). Motivated cognition may offer an explanation for the minimal harm from music. When music is used out of habit or to filter out ambient noise, the listener exercises volitional control to limit attention to music. Furthermore, multitasking research shows that with practice individuals become adept with some types of multitasking and listening to music as a secondary activity may be such an acquired skill that requires very little attention. Based on the null findings in the extant literature buttressed by motivated cognition, we predict that listening to music when studying will not be significantly associated with MPIL.

Furthermore, motivated cognition suggests individuals pursue appetitive responses (Lang, 2006), and Wang and Tchernev (2012) have shown that entertainment, social and emotional needs are the primary motivations of multitasking among students. If multitasking meets social and emotional needs, Facebook and texting are ideal platforms to satiate these needs during studying, though from a threaded cognition perspective performance deterioration can be expected in turn resulting in a positive correlation with MPIL.

Hypothesis 1 (H1): Facebook use during studying will be positively associated with MPIL.

Hypothesis 2 (H2): Texting during studying will be positively associated with MPIL.

## Media multitasking and measurement

Measurement of media use is a challenging task because of reliance on self-reports (Chaffee and Schleuder, 1986; Pinkleton and Austin, 2002), which suffer both from motivational biases, such as the social desirability bias, and cognitive biases, such as errors in recalling media use episodes within a prescribed period of time. The cognitive complexity of retrospective self-reports is compounded by the pervasive nature of media and media multitasking.

The complexity can be reduced to some extent by imposing context and boundary conditions on retrospective recall. For example, it is much easier to respond to the question, "How much do you text when studying?" than to the question "How much do you text in a typical day?" In addition, time spent on texting is correlated and constrained by other multitasking activities that occur within the context of a primary activity. If the primary activity is studying or doing homework, multitasking can be examined within a limited set of activities that co-occur while studying.

Until now, multitasking researchers have focused mainly on frequency as the key measure of multitasking. Earlier research on television use suggests that attention is a better predictor of media effects than frequency (Chaffee and Schleuder, 1986). Likewise, attention to music might be a more effective measure than the frequency or duration that



music is on. Furthermore, given the important role of attention in the theoretical frameworks applied to media multitasking, attention deserves examination as a separate measure of multitasking, which led to the following research question.

Research Question 1 (RQ1): Is there a difference between frequency and attention as measures of multitasking for listening to music, using Facebook, and texting while studying?

Also, in keeping with the basic premise of limited capacity, participants were given a constant-sum task to allocate 100% points of their attention to the different multitasking activities within a bundle, which forces a compensatory allocation model. That is, higher allocation of attention to one activity reduces attention resources available for other activities in the bundle, and the constant-sum estimation task simulates this psychological process.

Measurement models of multitasking should also consider individual preference for multitasking as a covariate. Human factors researchers have differentiated between monochronicity, preference for doing one task at a time, and polychronicity, preference for doing more than one task at a time (Zhang et al., 2005), and demonstrated that preference for multitasking is related to multitasking performance (Poposki and Oswald, 2010). These scales, however, were designed to examine multitasking and task switching in work contexts. Therefore, a new scale that emphasizes *media multitasking* was developed by integrating constructs from earlier research. In addition, gender, relationship status, number of friends, number of Facebook friends, and ownership of a smartphone are included as covariates.

## Method

Undergraduate students from different majors participated in the survey for extra credit. The survey was approved by Institutional Review Board (IRB) and conducted during November–December 2012. Students had 2 weeks to fill out the online survey. Links to the survey were distributed by instructors and posted on course websites. In all, 1053 students started the survey. Participants whose communication and media-related times were more than 3 *SD* (standard deviation) from the mean were coded as outliers. After dropping outliers and incompletes, 992 participants were retained. Average age of participants was 19.7 (*SD* = 1.9). The sample consisted of freshmen (29.4%), sophomores (36.9%), juniors (18.3%), and seniors (15.5%). Females (60.2%) outnumbered males (39.8%) and 75% of the sample was made up of Caucasians. Two out of five participants (39.4%) reported that they were in a relationship. An overwhelming majority (85.4%) reported owning a smartphone. Key variables used in the analysis are described below.

## MPIL

Four items were used to create the MPIL scale: (1) “Use my mobile phone longer than I intended,” (2) “Would be more productive if I didn’t use my mobile phone so much,” (3)



“I have tried to cut down the amount of time spent with my mobile phone, but failed,” and (4) “Even when I have other things to do, I find myself saying ‘Just a few more minutes’ and continue to use my mobile phone.” These items, rated on 5-point scale ( $1 = \text{Never}$ ;  $5 = \text{Always}$ ), were significantly correlated and had good internal consistency ( $M = 2.89$ ,  $SD = 0.89$ ,  $\alpha = .81$ ).

### *Time spent on activities*

Time spent on diverse activities of daily life, including sleeping, working, exercising, and studying, and activities involving communication or media were assessed. Participants entered time for each activity in hours and minutes, which was transformed to minutes before analysis. Summary of time spent on various activities that are relevant to this article are summarized in Table 1.

This study was limited to the three most common task switching activities while studying or doing homework that were reported in a pilot study (see Footnote 1). Given the lack of consensus on operational definitions, three measures were examined—frequency of bundled multitasking, frequency of pairwise multitasking, and attention allocation to activities within a bundle.

### *Frequency of bundled multitasking*

Multitasking or task switching happens within a bundle or cluster of activities. Based on a qualitative pilot study and the descriptive statistics presented in Table 1, the following combinations or bundles of activities were identified and rated on a 5-point scale ( $1 = \text{Never}$ ;  $5 = \text{Always}$ ): How often do you engage in the following group of activities (1) homework, music, social media; (2) homework, texting/instant messaging (IM), social media; and (3) homework, music, texting/IM. This 3-item measure had acceptable reliability and was averaged to create a composite score for bundled multitasking while studying ( $M = 3.70$ ,  $SD = 0.87$ ,  $\alpha = .81$ ).

### *Frequency of pairwise multitasking*

This measure included pairwise assessment of frequency of doing another activity when studying or doing homework. Participants provided ratings on a 100-point frequency scale ( $0 = \text{Never}$ ;  $100 = \text{Always}$ ) for co-occurrence of the following activities: studying and texting/IM ( $M = 56.5$ ,  $SD = 28.2$ ), studying and social media ( $M = 49.2$ ,  $SD = 26.5$ ), and studying and music ( $M = 61.5$ ,  $SD = 30.7$ ). Pairwise assessment of a variety of other media activities when studying was evaluated and a summary is presented in Table 2.

### *Attention allocation within a multitasking bundle*

A third measure of multitasking focused on allocation of attention to various activities within a bundle through a constant-sum estimation task. Participants were asked how much attention they allocated to each activity in a multitasking bundle that included studying, texting/IM, social media and music. Total attention allocated to the four tasks

**Table 3.** Distribution of percentage of attention between studying and other multitasking activities ( $N = 992$ ).

	Studying (%)	Music (%)	Texting (%)	Social media (%)
Studying + music	79	21	–	–
Studying + texting	77	–	23	–
Studying + social media	74	–	–	26
Studying + music + texting	69	13	18	–
Studying + music + social media	67	14	–	19
Studying + texting + social media	67	–	16	17
Studying + music + texting + social media	60	12	14	14

was constrained to 100%. Attention allocated to studying ( $M = 60.6$ ,  $SD = 20.8$ ) was significantly higher than attention allocated to the sum of the other activities, including texting/IM ( $M = 14.1$ ,  $SD = 9.8$ ), social media ( $M = 14.1$ ,  $SD = 11.3$ ), and music ( $M = 11.3$ ,  $SD = 9.4$ ) (see Table 3).

### Multitasking preference

A new multitasking preference scale with 14 items was introduced (Appendix 1). All items were rated on a 7-point scale ( $1 = Strongly disagree$ ,  $7 = Strongly agree$ ). Exploratory factor analysis revealed a single-factor structure. After reverse coding negatively worded items, the scale had good reliability, and the items were averaged to create a composite score for multitasking preference ( $M = 5.23$ ,  $SD = 0.90$ ,  $\alpha = .88$ ). Correlations between the multitasking preference scale and the aforementioned measures can be found in Table 4.

## Results

### Descriptive analysis of multitasking when studying

We begin with descriptive statistics of time spent on communication and media activities, followed by descriptive statistics for the measures of multitasking and an examination of correlations among these measures. Table 1 shows time in minutes spent on texting ( $M = 180$ ,  $SD = 190$ ), music ( $M = 161$ ,  $SD = 142$ ), and social media ( $M = 134$ ,  $SD = 112$ ), which adds to 8 hours when summed. Furthermore, when texting, social media, music, and other media activities were added to face-to-face communication ( $M = 310$ ,  $SD = 214$ ), total was more than 18 hours ( $M = 1120$ ,  $SD = 523$ ). When time spent on studying ( $M = 199$ ,  $SD = 101$ ) and other activities of daily life, such as sleeping, attending classes, and working were taken into account, the total exceeded 24 hours.

Next, frequency of engaging in multitasking when studying was examined. Music was the most frequent media activity that students combined with studying (Table 2). On a 100-point scale ( $0 = Never$ ,  $100 = Always$ ), frequency of music use was highest

**Table 4.** Correlations among popular multitasking activities when studying and self-reported mobile phone interference in life (MPIL).

	1	2	3	4	5	6	7	8
1. MPIL	—							
2. B_Freq	.26***	—						
3. P_Freq_Text	.23***	.35***	—					
4. Atten_Text	.28***	.10**	.31***	—				
5. P_Freq_FB	.21***	.34***	.61***	.16***	—			
6. Atten_FB	.21***	.16**	.18***	.33***	.35***	—		
7. P_Freq_Music	.03	.43***	.25***	-.07*	.26***	.01	—	
8. Atten_Music	.09**	.18***	.00	.10**	.08*	.13***	.18***	—
9. MT Pref Scale	.11***	.30***	.16***	.03	.17***	.04	.27***	.04
M	2.89	3.70	56.5	14.1	49.2	14.0	61.5	11.3
SD	0.89	0.87	28.2	9.8	26.5	11.3	30.7	9.4

MPIL: mobile phone interference in life, B\_Freq: bundled frequency, P\_Freq\_Text: pairwise frequency for texting, Atten\_Text: attention allocated to texting, P\_Freq\_FB: pairwise frequency for Facebook and social media, Atten\_FB: attention to Facebook and social media, P\_Freq\_Music: pairwise frequency for music, Atten\_Music: attention to music, MT Pref Scale: multitasking preference scale.

N varied from 894 to 992.

\*  $p \leq .05$ , \*\*  $p \leq .01$ , \*\*\*  $p \leq .001$ .

(60,  $M = 62.24$ ,  $SD = 30.56$ ), followed by texting ( $M = 57.13$ ,  $SD = 28.31$ ) and social media ( $M = 49.74$ ,  $SD = 26.74$ ). In addition to frequency, attention allocated to various activities within a multitasking bundle was examined. Common multitasking scenarios were generated in a pilot study, and allocation of attention within each scenario is presented in Table 3. Across scenarios, attention to studying ranged from 60% to 79% and decreased as the number of activities in a multitasking bundle increased. For instance, in the multitasking scenario that included listening to music, texting, and social media, attention to studying was 60%. Whereas when music was the only concurrent activity while studying, attention to studying was 79%.

In the next step, correlations among the three measures of multitasking—frequency of bundled multitasking, frequency of pairwise multitasking, attention allocation within a multitasking bundle—and multitasking preference were examined (Table 4). The frequency of bundled multitasking was significantly correlated with both the frequency of pairwise multitasking and attention within a multitasking bundle. However, the correlations between bundled frequency and pairwise frequency for texting ( $r = .35$ ), Facebook ( $r = .34$ ), and music ( $r = .43$ ) were higher than correlations between bundled frequency and attention to texting ( $r = .10$ ), Facebook ( $r = .16$ ), and music ( $r = .18$ ) (see Column 2, Table 4). Also, the correlations between pairwise frequency and attention to texting ( $r = .31$ ), social media ( $r = .35$ ), and music ( $r = .27$ ) were statistically significant. The highest pairwise correlation was between frequency of texting and frequency of social media use ( $r = .61$ ) (Table 4).

Except for the frequency of listening to music when studying, all measures of multitasking were significantly correlated with MPIL (see Column 1, Table 4). Multitasking

preference was significantly correlated with multitasking frequency (both bundled and pairwise), but not with attention to texting, Facebook, or music (see Row 9, Table 4). MPIL and multitasking preference were also significantly correlated ( $r = .11$ ).

*Relationship between multitasking while studying and MPIL.* Although respondents reported that more than 60% of their attention was allocated to studying, the focus of this article is the interference caused from the allocation of the remaining attention to music, texting, and social media. Therefore, with self-reported MPIL as the outcome variable, three two-step hierarchical regression models were examined.

In the first step, control variables and covariates were introduced (gender, relationship status, smartphone ownership, number of Facebook friends, number of close friends, and preference for multitasking). In the second step, one of the multitasking measures was introduced and the relationship between that measure and MPIL was examined (see Table 5).

Ownership of smartphone and the number of Facebook friends were significant predictors of MPIL in all three models. Relationship status and the number of non-Facebook friends were not significant in any of the models, and gender was significant in two out of the three models. The standardized coefficients for smartphone ownership were between .23 and .25 (see Table 5), with higher MPIL among smartphone owners ( $M = 3.0$ ,  $SD = 0.84$ ) than non-owners ( $M = 2.27$ ,  $SD = 0.93$ ), and the difference was tested with an unequal variances t-test, which was significant,  $t = 8.84$ ,  $df = 190$ ,  $p < .001$ .

The effect of gender, which was significant in two out of the three models, was examined further using a t-test. Females ( $M = 3.01$ ,  $SD = 0.90$ ) reported higher MPIL than males ( $M = 2.71$ ,  $SD = .84$ ),  $t = 5.23$ ,  $df = 988$ ,  $p < .001$ . The number of Facebook friends had a positive relationship with MPIL, with standardized coefficients ranging from .10 to .13. Preference for multitasking, a new scale introduced in this study, was a significant predictor ( $\beta = 0.08$ ) of MPIL only in Model 3 that was based on the attention measure, but not in the other two models based on frequency measures.

After controlling for the variables explained above, bundled frequency was a significant predictor of MPIL ( $\beta = 0.18$ ) (Model 1) and pairwise frequency was significant (Model 2) for social media ( $\beta = 0.11$ ) and texting ( $\beta = 0.13$ ), but not for music. Attention (Model 3) to social media ( $\beta = 0.10$ ), texting ( $\beta = 0.18$ ), and music ( $\beta = 0.08$ ) were significant predictors of MPIL as well. In support of H1 and H2, findings based on pairwise frequency (Model 2, Table 5) confirm that Facebook use and texting are positively correlated with MPIL and significant predictors after controlling for other variables. For music, frequency was not a significant predictor, which is in line with findings reported in the literature, but attention to music was a significant predictor of MPIL. RQ1 focused on the difference between frequency and attention measures of media multitasking. The findings suggest that bundled frequency, pairwise frequency, and attention are significant predictors of MPIL for Facebook and texting (Models 1-3, Table 5). The exception was music, for which frequency was not predictive, whereas attention was.

In a follow-up analysis, bundled frequency, pairwise frequency, and attention (predictor variables from Columns 1-3 in Table 5) were entered simultaneously. While attention continued to be significant for texting, Facebook, and music, pairwise frequencies were no longer significant. Given that bundled frequency subsumed pairwise frequencies,

**Table 5.** Predicting mobile phone interference in life (MPLI) from measures of multitasking activities when studying or doing homework.

	Model 1		Model 2		Model 3	
	B (SE)	Std $\beta$	B (SE)	Std $\beta$	B (SE)	Std $\beta$
Gender	-.16** (.06)	-.09**	-.10 (.06)	-.06	-.14* (.06)	.08*
Relationship status	-.03 (.05)	-.02	-.09 (.05)	-.06	-.04 (.05)	-.03
Smartphone ownership	.60** (.08)	.25***	.56*** (.08)	.23***	.60*** (.07)	.24***
No. of Facebook friends	.01*** (.003)	.11***	.01*** (.004)	.13***	.01*** (.003)	.12***
No. of non-Facebook friends	.01 (.01)	.04	.01 (.01)	.04	.01 (.009)	.04
Frequency of bundled multitasking	.17*** (.03)	.17***				
Frequency of pairwise multitasking						
Social media/studying			.004** (.001)	.11**		
Texting/studying			.004** (.001)	.13**		
Music/studying			-.001 (.001)	-.05		
Attention allocation						
Social media					.01*** (.002)	.10**
Texting					.02*** (.003)	.18***
Music					.01* (.003)	.07*
Preference for multitasking	.04 (.03)	.04	.03 (.04)	.03	.07* (.03)	.08*
Adj R <sup>2</sup>	.14		.14		.184	
F	F(6, 921) = 26.6		F(8, 758) = 17.1		F(9, 918) = 23.2	

SE: standard error.

\*  $p \leq .05$ , \*\*  $p \leq .01$ , \*\*\*  $p \leq .001$ .

these findings are predictable. Furthermore, when interactions between bundled frequency and attention were added for texting, Facebook, and music, there was no significant increase in *R*-square and the interaction terms were not significant. Subsequently, all three interactions were tested with pairwise frequency and found to be not significant. Because attention to different multitasking activities were measured using constant-sum estimation, it is reasonable to assume that these measures were correlated and contributing to multicollinearity in the regression equation for attention (Model 3, Table 5). Potential autocorrelation and multicollinearity were examined for the attention model using the Durbin–Watson statistic (1.87) and average variance inflation factor (VIF) of the predictor variables (1.2) as diagnostics. Based on these statistics (Durbin–Watson tending toward 2; VIF tending toward 1), it is safe to assume that neither assumption was violated (Field, 2013).

## Discussion

The mobile phone is a breakthrough advance for human communication. But with the plethora of choices available via mobile phone, individuals who are deficient in self-regulation or with a propensity for addiction may face challenges in managing these choices strategically. To examine this potential dysfunctional aspect, we examined the effect of media multitasking when studying within a convenience sample and found that both frequency and attention to texting and social media were positively related to MPIL. However, frequency of music use during studying was not associated with MPIL, although attention to music when studying was positively associated with MPIL.

The difference between the effects of passive listening to music and active engagement in texting or social media highlights a major shift in the intrusion of media in everyday life. Traditional media, such as radio, television, or music, which can be ignored as background noise, are fundamentally different from human interactions via text messages or social media. These interactions need immediate and active participation that can disrupt work, cause disorientation, and result in loss of efficiency on the primary task of studying. Maintaining various conversation threads during studying is likely motivated by the desire for human interaction. While ongoing text and Facebook conversations can alleviate boredom and even serve as a form of social support when one is studying, overindulgence in social interactions and subsequent erosion in primary task performance can have dire consequences on psychological well-being.

That media multitasking can be overwhelming is borne out in our findings that suggest a dilation of the 24-hour day. When asked to offer free recall estimates of time spent on various activities in a typical day, including media and communication activities, participants' estimates of time spent was approximately 39 hours in a 24-hour day. These misperceptions or biases in estimating time spent on media-related activities can be attributed to multitasking. Attending to various activities at the same time perhaps leads to discordance between psychological time and physical time. While the perceived dilation of time is interesting in itself, it poses a key methodological challenge to researchers interested in the measurement of media use. The challenge is to design rigorous and yet user-friendly approaches to capture media use habits that accommodate ongoing

multitasking and task switching. We attempted to address this challenge by employing a number of methodological nuances.

First, measures of media use were tied to situational contexts to keep retrospective self-reports of media use manageable. Second, since multitasking is carried out as a cluster of activities, multitasking bundles were identified for the situational context of interest, namely, studying. Third, frequency of media use and attention to an activity within a multitasking bundle were examined separately. Fourth, participants were forced to allocate a constant sum of 100% attention to various activities in a multitasking bundle, which is in keeping with the theoretical model of limited capacity. Fifth, a new media multitasking preference scale was introduced, which could be used in future research.

While the multitasking preference scale was significantly correlated with frequency measures, it was not correlated with attention. Furthermore, while the correlation between frequency and attention of each of the three activities (music, texting, and Facebook) were significant, the correlations did not exceed  $r = 0.3$ , which suggests that frequency and attention tap different aspects of the media multitasking experience. Future work on measurement of multitasking should take into account both frequency and attention within a multitasking bundle.

Another contribution of this article is the introduction of the constant-sum allocation method to measure attention. When participants were forced to allocate a constant sum of 100% attention to various activities in a multitasking bundle, attention to studying decreased steadily, thus offering face validity to the measure. Further replication and examination of the constant-sum approach to attention might be a fruitful direction for future research on media multitasking measurement. Given the wide array of media multitasking activities, we believe that a measurement approach that consists of bundles of multitasking activities within a certain context offers much promise. This bundled approach contributes not only to ecological validity, but eliminates pairwise estimates of all conceivable media multitasking combinations, which can lead to respondent fatigue.

The multitasking preference scale offered paradoxical results in this study. Though multitasking preference was positively correlated with the frequency of multitasking activities, it was also positively correlated with MPIL. This finding suggests that with increasing preference for multitasking, a small but significant corresponding increase in perceived interference in life can be expected. Preference for multitasking and a concurrent perceived loss of control from multitasking might be emblematic of the inherent trade-off forced on users by mobile phone and other mobile technologies.

A number of differences by demographic variables deserve mention. While women reported higher MPIL than men and the number of Facebook friends was positively related to MPIL, smartphone ownership made a difference. Given the variety of potential distractions available through smartphones, it is not surprising that those with smartphones reported significantly higher MPIL than non-owners. Future studies are required on costs and benefits of media multitasking in other contexts and with other populations for a fuller understanding of the role of mobile media in everyday life.

The increasing penetration of the mobile phone raises interesting theoretical questions as well for future research. With the burgeoning affordances available in new media interfaces, what is the limit of human capacity for multitasking? More important perhaps is a better understanding of the motivations for task switching and the underlying



cognitive mechanisms used to coordinate media multitasking activities in real time. These fundamental theoretical questions naturally lead to obvious practical questions about gain and loss from multitasking.

A limitation of the study is reliance on a convenience sample of college students. Furthermore, with self-report measures, there is potential for social desirability bias, which could explain the greater than 60% attention to studying. Psychophysiological measures are less vulnerable to such biases and can be pursued in future studies. Also, findings reported in this study are correlational and causal claims cannot be made without appropriate replications using experimental designs, which offer numerous avenues for future research.

## Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## Note

1. To determine common bundles of multitasking activities, a pretest was conducted with 21 undergraduates in a multimedia design course. Participants were asked to list activities they typically engage in simultaneously when studying. The combination of music, texting, and Facebook was reported to be the most common activity bundle during studying.

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## Author biographies

Prabu David (PhD, University of North Carolina at Chapel Hill) is a Professor in the Edward R. Murrow College of Communication at Washington State University. His research focuses on the role of social and mobile media on health outcomes.

Jung-Hyun Kim (PhD, Michigan State University) is an Associate Professor at Sogang University, Seoul, Korea. Her research interests include social and psychological impacts of new media, new media and physical/psychological well-being, and social interaction and social influence in virtual world.

Jared S Brickman is a graduate student in the Edward R. Murrow College of Communication at Washington State University. His research interests include problematic use of new media, new communication technologies, and the cognitive effects of viral media content.

Weina Ran (MA) is a doctoral candidate in the Edward R. Murrow College of Communication at Washington State University. Her research interests include media effects on public health (e.g. sexual health, drug abuse, and nutrition), entertainment education, and new technology, social media, and multitasking.

Christine M Curtis (MA) is an academic advisor in the Edward R. Murrow College of Communication at Washington State University. Her research interests include environmental and crisis communication.

## Appendix I

### *Multitasking preference scale*

1. I am more efficient when I am multitasking.
2. I try to multitask whenever possible.
3. I enjoy multitasking.
4. I am in a state of flow when multitasking.
5. I multitask out of habit.
6. Before multitasking I deliberately think about specific tasks that I can do concurrently.
7. I lose track of time when multitasking.
8. I can do more through multitasking.
9. When I am on a computer or using my mobile phone, I am always drawn to do more than one thing at a time.
10. I am distracted when I have to focus on only one task.
11. I find it difficult to do more than one task at a time.
12. I am bored when I am not multitasking.
13. I find it entertaining and enjoyable when multitasking.
14. I find it distracting to engage in different activities concurrently.