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The impact of engagement with social networking sites (SNSs) on cognitive skills

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ABSTRACT

The aim of the present study was to investigate the effect of social networking sites (SNSs) engagement on cognitive and social skills. We investigated the use of Facebook, Twitter, and YouTube in a group of young adults and tested their working memory, attentional skills, and reported levels of social connectedness. Results showed that certain activities in Facebook (such as checking friends' status updates) and YouTube (telling a friend to watch a video) predicted working memory test performance. The findings also indicated that Active and Passive SNS users had qualitatively different profiles of attentional control. The Active SNS users were more accurate and had fewer misses of the target stimuli in the first block of trials. They also did not discriminate their attentional resources exclusively to the target stimuli and were less likely to ignore distractor stimuli. Their engagement with SNS appeared to be exploratory and they assigned similar weight to incoming streams of information. With respect to social connectedness, participants' self-reports were significantly related to Facebook use, but not Twitter or YouTube use, possibly as the result of greater opportunity to share personal content in the former SNS.

1. Introduction

1.1. Social networking sites (SNSs)

In the last few years, there has been tremendous growth in the use of social networking sites (SNSs), with millions of users choosing to stay loosely connected through common interests, shared acquaintances, and even favorite video clips. In the present research, we focus on three highly popular SNS: Facebook, Twitter, and YouTube. Facebook's popularity has grown exponentially since its inception in 2004, to around 845 million Active users as of February 2012 (Protalinski, 2012).

Of the three SNS in the present study, Facebook offers the most flexibility to connect with long-lost friends, post updated information about yourself including photos, and even share news articles that you have been reading. In contrast, Twitter focuses more on the sharing of information (Kwak, Lee, Park, & Moon, 2010), rather than on reciprocal social interaction (Huberman, Romero, & Wu, 2009). 'Tweets' are restricted to 140 characters and anyone can follow these feeds. There is also less pressure to present details of yourself or to 'tell your life story' (Huberman et al., 2009), unlike Facebook's recent introduction of the Timeline. YouTube began as a video-sharing platform, but also offers its users the opportunity to create their own personal profile (a 'channel page') and befriend other YouTube users (Lange, 2007).

1.2. Working memory

With the exponential increase of SNS, there are even more demands on our cognitive resources. Recent technological innovations require many individuals to manage multiple digital technologies simultaneously or to switch attentional control between tasks (Poposki & Oswald, 2010). The ability to multitask with various SNS involves dividing attention, switching between tasks, and keeping track of multiple strands of information in working memory. Working memory comprises a higher-order skill related to the ability to allocate attentional resources, despite distraction or interference (e.g., Baddeley, 1996; Cowan, 2006; Engle, Tuholski, Laughlin, & Conway, 1999). Working memory involves updating information, shifting between mental sets, and inhibiting no-longer relevant information that was once activated in working memory (Lustig, May, & Hasher, 2001; Miyake, Friedman, Rettinger, Shah, & Hegarty, 2001). Working memory capacity has been found to mediate outcomes in reasoning tasks (Salthouse, 1995), IQ scores (Conway, Cowan, Bunting, Therriault, & Minkoff, 2002), academic attainment (Alloway & Alloway, 2010), reading (Siegel, 1994), and even building Lego blocks (Morrell & Park, 1993).

1.3. Attentional control

Multiple demands can also compromise the efficiency of attentional control (Watson & Strayer, 2010). There is abundant evidence that when an individual attempts two or more attentionally demanding activities at the same time, the allocation

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of attention to the tasks is limited and performance suffers as a result (Wickens, 1980). There are two competing theories to account for how multitasking impacts attentional control. One account is the bottleneck view where information is processed serially. As a result, attention can only be allocated to one task at a time and engaging in multiple tasks concurrently results in a bottleneck, which impairs cognitive performance (Pashler, 1994). An alternative account is a capacity-limited view where information is processed in parallel. However, there is a restricted scope in how attention can be allocated, which means that in order to do complete multiple tasks simultaneously, fewer demands must be made for each task (Navon & Miller, 2002; Tombu & Jolicoeur, 2002).

Previous research indicates that the frequency of multimedia use results in differing profiles of attentional control (Foerde, Knowlton, & Poldrack, 2006; Ophir, Nass, & Wagner, 2010). For example, individuals who were labeled as chronic media multitaskers adopted a more wide-ranging scope of assigning attention to tasks (Ophir et al., 2010). As a result, they failed to inhibit distracting information. In contrast, individuals who multitasked less frequently seemed to process information serially and thus, were able to allocate attentional resources fully on a single task. This approach allowed them to filter out irrelevant information while performing efficiently in a task.

1.4. Social connectedness and SNS

One potential bonus of engagement with SNS is that it can promote a sense of social connectedness. Lee, Draper, and Lee (2001) define social connectedness as an individual's sense of "enduring interpersonal closeness with the social world in toto". A strong sense of social connectedness can provide a foundation for goal-directed behavior, which can lead to the greater likelihood of achieving life goals (Kohut, 1984). In contrast, a low sense of social connectedness has been linked with loneliness, anxiety, and interpersonal problems (Lee et al., 2001; Lee & Robbins, 1995).

One way to foster a sense of social support is via social networking. Studies examining social networking in an offline setting have reported positive effects. For example, Tian, Yu, Vogel, and Kwok (2011) have reported that building and nurturing personal links leads to a support system. There are many benefits to this support system—for example, in business, individuals can gain an advantage in their career, achieving better job performance, as well as mobility through their corporate ladder (Podolny & Baron, 1997; Seibert, Kraimer, & Liden, 2001). Students also appear to benefit, as social networking behavior is also linked to higher academic achievement (Hwang, Kessler, & Francesco, 2004). Conversely, those who feel cut off from others often become isolated and may miss out on many life benefits within education and employment (Wei & Lo, 2006).

1.5. Present study

To date, the majority of research on SNS has focused on its relationship to aspects of personality (e.g., Nadkarni & Hoffman, 2012) or its impact on academic performance (Junco, 2012; Kirschner & Karpinski, 2010). Some studies have also looked at the effect of technology more broadly on multitasking skills (Ophir et al., 2010). The aim of the present study was to build on such research and extend previous lab-based research (Tombu & Jolicoeur, 2004) to look at real work engagement with SNS.

In the present study, we measured both working memory and attentional control. To date, there has been no research investigating the impact of SNS on working memory. Given the importance of working memory not just in educational (see Swanson & Alloway, 2012) and clinical settings (Alloway & Gathercole, 2006), but also in real-world settings such as driving (Watson & Strayer, 2010) and decision making (Fletcher, Marks, & Hine, 2011), it is relevant to explore the impact of the growing use of SNS in young adults.

Working memory was assessed using standardized measures involving both verbal and visuo-spatial stimuli (Alloway, 2007). The underlying theoretical structure for the tasks has been confirmed in studies of typically developing children (Alloway, Gathercole, & Pickering, 2006) and adults (Alloway & Alloway, 2012). These tasks have also been widely used in individuals with special needs, such as dyslexia, ADHD, and Autistic Spectrum Disorder (see Alloway & Gathercole, 2006, for a review). The tests have high test–retest reliability (Alloway et al., 2006) and good diagnostic validity (Alloway, Gathercole, Kirkwood, & Elliott, 2008). Given that this is the first study to investigate the relationship between SNS and working memory, it is unclear what the pattern of findings will be. It is possible that SNS engagement may have a positive effect on working memory, as the user may be challenged to engage in shifting and updating information, while ignoring distractors. Alternatively, the constant stream of information from SNS may overburden working memory.

Attentional control is part of a suite of executive function skills, requiring inhibiting, shifting, and updating information in working memory. Research from Miyake, Friedman, Rettinger, Shah, and Hegarty (2001) suggests that these skills are correlated, though they can make unique contributions to different complex tasks. One task that captures these different aspects is the Sustained Attention to Response Test (SART; Robertson, Manly, Andrade, Baddeley, & Yiend, 1997). The individual has to sustain their attention on a target stimulus (a letter, number, or an object), while ignoring salient but irrelevant incoming information. In the version used in the present study, the target stimulus was changed several times throughout the experiment, which required the individual to also update and shift their focus between different task requirements. Participants viewed a number on a screen and had to allocate attention to respond to a target stimulus (the number '5') while filtering out distracters (all other numbers). As a measure of task switching, another version was presented where the participant had to click on all other numbers except for the number 5. Switch costs were calculated as the accuracy of responses, a measure of false positives, omissions, and mean response times, across four trial blocks (Rubin & Meiran, 2005).

It is possible that the quantity and quality of SNS use makes a difference, and in order to explore this further, we identified Active and Passive SNS users. The Active/Passive index reflected the participant's interactions with the SNS in the present study (Facebook, Twitter, and YouTube). In line with previous research on technology usage (e.g., Junco, 2011, Ophir et al., 2010), the average number of hours a person spent engaged with these activities was calculated. Individuals were classified as Active SNS users if they scored one standard deviation or more above the sample mean and those who scored one standard deviation or less than the sample mean were classified as Passive SNS users. We then explored whether Active or Passive SNS users demonstrate a greater inability to focus on the target stimulus and inhibit distractions.

Finally, with respect social connectedness, it is worth exploring whether increased engagement with SNS also leads to a feeling of greater connectedness. According to researchers from the Pew Research Center's Internet and American Life Project, the average user of SNS has more close friends and confidantes and is 50% less likely to be socially isolated compared to non-Internet users (Hampton, Goulet, Rainie, & Purcell, 2011). In particular, Facebook users report more close ties than other internet users, such as Twitter, MySpace, and LinkedIn. But it is not clear whether individuals feel a higher level of social connectedness as a result. To date, there is no data on whether other SNS like Twitter and YouTube also promote a sense of connectedness. Thus, the present study investigated whether increased engagement with different SNS leads to greater reports of connectedness.

The research questions examined in the present study were:

- Question 1: Does engagement with different types of SNS impact working memory skills?
- Question 2: Is there a difference in how Active or Passive engagement with SNS affects attentional control?
- Question 3: Is increased engagement with different SNS is related to higher levels of social connectedness?

2. Material and methods

2.1. Participants

Data was collected from 284 university students, who received course credit in exchange for their participation. The average age was 22 years (SD = 6 years; range 18–58 years). The majority of the students fell in the 18–29 age range; the age distribution is as follows: 18–19 year olds: 30%; 20-year-olds: 62%; 30-year-olds: 4%; 40-year-olds: 2.5%; 50-year-olds: 1.5%. University students represent an excellent sample for Internet studies, as they are frequent users (Pornsakulvanich, Haridakis, & Rubin, 2008). The students were provided with an online link to the study, which included the Working Memory test, Attention test, and questionnaire. It took approximately 30–40 min in a single session to complete. Partial completions were not recorded.

2.2. Materials

2.2.1. Working memory

Two online tests taken from a standardized memory assessment, the Automated Working Memory Assessment (AWMA; Alloway, 2007), were administered to measure working memory. All test trials began with two items, and increased by one item in each block, until the participant was unable to recall three correct trials at a particular block. There were four trials in each block and the number of correct trials was scored for each participant. The move forward and discontinue rules, as well as the scoring, were automated by the program.

There was one verbal and one visuo-spatial working memory tests. In Processing Letter Recall, the participant views a letter in red that stays on the computer screen for 1 s. Another letter in black immediately follows this on the screen. Participants verify whether the black letter was the same as the red letter by clicking on a box marked either ‘Yes’ or ‘No’ on the screen. They then click on the red letters they saw in the correct sequence. The number of correct trials (remembering the red letters in the correct sequence) are recorded and then converted into standard scores (mean = 100, SD = 15) from a normative sample of the test.

Visual working memory was tested using a Shape Recall test. First, the participant views a colored shape in a 4×4 grid. Then another shape appears in the center of an empty computer screen. The participant has to verify whether those two shapes were the same color and shape by clicking on a box marked either ‘Yes’ or ‘No’ on the screen. Finally, they have to remember the location of the first shape on the 4×4 grid in the correct sequence. The number of correct trials (remembering the location of the shape on the grid in the correct sequence) are recorded and then converted into standard scores (mean = 100, SD = 15) from a normative sample of the test.

Test-reliability of the AWMA was established in a random selection of the normative sample tested on two separate occasions, 4 weeks apart. The reliability coefficient for the verbal working memory tests was .86 and for the visuo-spatial working memory test, it was .84 (Alloway, 2007).

2.2.2. Attention test

All 284 participants also completed an online assessment of Sustained Attention. There were two different versions. In one version, the participants responded to the computer screen by pressing the spacebar for every number presented except the number 5 (Version A). In the other version, participants responded to the computer screen by pressing the spacebar only for the number 5 (Version B). Participants responded to both versions, which were switched over the course of four blocks in the following sequence: Version A, Version B, Version A, and Version B. Each block consisted of 180 trials, with the target and distractor numbers randomly presented in the center of the screen for 500 ms. After the number presentation, there were three delay rates of 1000, 1500, or 2000 ms that were randomized across trials. Each block lasted for 3 min and the entire Attention test, which included practice sessions, took approximately 15 min to complete.

The following scores were recorded for each of the four blocks. First, the accuracy of responses was recorded as a percentage. A measure of false positives (errors of commission) and a measure of omissions errors were also recorded as a percentage. Finally, the average response time was recorded in milliseconds.

2.2.3. Social connectedness scale

We also included seven of the eight questions from the social connectedness scale (Lee & Robbins, 1995), which was used to assess how connected the participants felt with their family, friends, peers, or society. The scale items used in this present study represented two out of the three areas of belongingness: connectedness and affiliation. Participants responded to the statements using a Likert Scale (1 = agree very strongly to 6 = disagree very strongly). As the items were all phrased to represent a lack of social connectedness (e.g., ‘I feel so distant from people’ or ‘I do not feel I participate with anyone or any group’), a high score indicates a more reported sense of social connectedness. Model fit statistics and cross-validation data are reported in Lee and Robbins (1995).

2.2.4. Social Media Questionnaire

The questions assessed the following: the length of usage of the particular type of social media (Facebook, Twitter, and YouTube) and how often they used them for certain tasks. These tasks included activities such as playing games, quizzes, or writing on people’s walls (Facebook), checking tweets (Twitter), watching or posting videos online (YouTube). The questions reflected both Active engagement (‘How often do you comment on your friends’ photos or write on their wall on social networking sites?’) and Passive engagement (‘How often do you check tweets of famous people on Twitter?’). Participants reported the frequency in which they interacted with these SNS using a Likert Scale (0 = ‘Never’, 1 = ‘Once a month’, 2 = ‘Once a week’, 3 = ‘Once a day’, 4 = ‘1–3 h a day’ and 5 = ‘4–6 h a day’). Higher scores are representative of greater engagement with SNS.

In order to investigate the higher-order factor structure underpinning variations between the different questions, a principal-components analysis was conducted on the raw scores for all 15 questions, rotated to final solution with a Varimax rotation. Four factors emerged with eigen values in excess of 1.00, accounting for 67.5% of the variance, in total. Only factor loadings in excess of .40 on the rotated factor matrix are reported. The questions that loaded most highly on Factor 1 were all the Facebook questions (accounting for 31% of the total variance). The highest loading measures on Factor 2 were the Twitter questions (accounting for an additional 19% of the total variance). Factors 3 and 4 comprised the YouTube questions (10% and 7.5% of the total variance respectively). Factor 3 appears to relate to the frequency of Passive engagement, such as watching videos online, while Factor 4 corresponds to a more Active role in posting or commenting on online videos.

3. Results

The data indicated that 94% of the present sample had used Facebook for 6 months or longer; and only 8.5% had used Twitter for more than 6 months. This pattern of greater Facebook use compared to Twitter use corresponds with that reported in the Pew Research Center's Internet and American Life Project (Hampton et al., 2011): 92% of adults use Facebook, compared to 13% who use Twitter.

3.1. Working memory and SNS

- *Question 1: Does engagement with different types of SNS impact working memory skills?*

Descriptive statistics indicated that the present sample ($n = 284$) performed in the average range in verbal working memory (mean = 90.62, SD = 12.18) and visuo-spatial working memory (mean = 95.55, SD = 14.21). We wanted to find the best set of unique predictor variables of working memory scores as a result of social media, in the present sample. To that end, we conducted a series of stepwise regression analyses, with working memory standard scores as the dependent variable, and the respective SNS questions as the predictor variables. For example, we first examined which of the different Facebook activities best predicted working memory scores; then we conducted a separate stepwise regression analysis to explore which YouTube activities best predicted working memory scores; and in the final regression analysis, we investigated which Twitter activities best predicted working memory performance.

Model statistics, as well as standardized beta values and t-statistics, are provided in Table 1. Performance in both verbal and visuo-spatial working memory tests was best predicted by one activity in Facebook: checking friend's status updates. Among the YouTube activities, telling a friend to watch a video was the best predictor of verbal working memory scores; while watching videos online best predicted visuo-spatial working memory performance. None of the Twitter activities predicted either verbal or visuo-spatial working memory test scores.

3.2. Attention and SNS

- *Question 2: Is there a difference in how Active or Passive engagement with SNS affects attentional control?*

3.2.1. Index creation

In order to investigate whether Active engagement with social media improves attentional control, we first created an Active/Passive index by averaging participants' responses based on how often they engaged in various activities (e.g., posting status updates, commenting on friends' updates, etc.) included in the Social Media Questionnaire. We then subtracted the Passive composite from the Active composite to create the index. Thus, the index is an indication of participants' engagement with various social networking sites.

Table 1
Stepwise regression analyses predicting working memory scores.

	R^2	F Change	β	t	p Value
Outcome: Processing Letter Recall					
Facebook	.019	5.41[a]	.137	2.32	.02
YouTube	.018	5.24[a]	.136	2.29	.02
Twitter	–	1.60			
Outcome: Shape Recall					
Facebook	.017	4.84[a]	.13	2.20	.03
YouTube	.014	4.04[a]	.119	2.01	.05
Twitter	–	1.04			

[a] Significant at alpha level .05.

3.2.2. Index results

The Active/Passive index produced a normal distribution, with a mean of 1.84 and standard deviation of 1.09. This distribution suggests that there was not a bimodal distribution of 'Active' engagement or 'Passive' engagement. Based on the questionnaire, we identified participants with an Active/Passive index less than one standard deviation below the sample mean as 'Passive engagers'; and those with an Active/Passive index greater than one standard deviation above the sample mean as 'Active engagers'. On the basis of the Active/Passive index, data from 205 of the original 284 participants met the criteria for inclusion and were used in the subsequent statistical analyses.

3.2.3. Results

Descriptive statistics of attentional control performance across the four blocks in the Sustained Attention to Response Test, as a function of SNS engagement level, is shown in Table 2. Next, we conducted a repeated-measures ANOVA on accuracy rates across the four blocks. The findings indicated a significant difference across blocks, [$F(3609) = 24.14$; $p < .001$] and a significant interaction between accuracy and engagement level [$F(3609) = 3.71$; $p = .01$]. Post-hoc pairwise comparisons indicated that the Active users were significantly more accurate than the Passive group in Block 1 ($p = .01$).

The level of engagement with SNS also impacted the number of false positives across the blocks [$F(3609) = 213.82$; $p < .001$] and the Active users committed significantly more false positive errors compared to the Passive group [$F(1203) = 4.16$; $p = .04$], but the interaction was not significant [$F(3609) = 2.17$; $p = .09$]. Switching costs were measured using post hoc pairwise comparisons of the percentage of false positives between Block 1 and the subsequent blocks: both Active and Passive engagers performed significantly different across all comparisons ($p < .05$).

Inspection of omission errors revealed no significant group effects [errors across blocks: $F(1609) = 1.72$; $p = .16$; or engagement level: $F(1203) < 1$]; but a significant interaction [$F(3609) = 3.97$; $p = .008$]. The Passive group missed more target stimuli compared to the Active engagers in Block 1 ($p < .05$), but not in the subsequent blocks, which suggests that the Passive users were able to allocate their attentional resources effectively after Block 1. Switching costs as measured by the percentage of omission errors between Block 1 and the subsequent blocks indicated a significant difference in a linear fashion only for Active users ($p < .05$).

Finally, there was a significant difference in response times across the blocks [$F(3591) = 113.98$; $p < 001$], but not in engagement level [$F(1203) < 1$], nor interaction [$F(3591) < 1$]. There were significant switching costs in response times for both Active and Passive engagers across all comparisons ($p < .05$).

3.3. Social connectedness and SNS

- *Question 3: Is increased SNS engagement related to higher levels of social connectedness?*

The group scores for social connectedness were normally distributed, with a mean score of 3.85 (SD = .82). We were interested in the relationship between the frequency of social media use and the sense of social connectedness. Based on the exploratory factor analysis results of the Social Media Questionnaire, we created a composite score to reflect the frequency of use. For example, responses to all items relating to Facebook use were summed to create a Facebook composite, responses to all questions relating to

Table 2
Descriptive statistics of attentional control performance as a function of SNS engagement level.

	Engagement Level	Block 1 Mean	(Version A) SD	Block 2 Mean	(Version B) SD	Block 3 Mean	(Version A) SD	Block 4 Mean	(Version B) SD
Accuracy (%)	Passive	90.65	22	98.72	2.38	91.33	17.89	98.72	2.21
	Active	95.70	7.84	98.25	8.16	90.53	15.19	97.61	7.92
False positives (%)	Passive	22.95	21.26	.54	.67	34.54	22.98	.70	1.12
	Active	26.97	21.56	1.30	7.99	43.40	24.87	1.68	8.11
Omissions (%)	Passive	7.84	24.14	7.97	23.50	5.80	20.44	6.52	20.90
	Active	1.78	8.42	4.82	15.89	5.70	16.97	8.73	20.52
Mean hit rate (ms)	Passive	433.57	90.83	498.15	138.86	437.11	162.54	531.04	113.63
	Active	440.89	85.80	508.97	107.37	427.44	96.37	552.40	121.51

Twitter use were summed to create a Twitter composite, and the respective YouTube items were summed to create a YouTube Active (i.e., posting and commenting) and YouTube Passive (i.e., watching and telling friends to watch) composite.

The correlation coefficients between the composite social connectedness score and the SNS composites are shown in the lower triangle of Table 3. Partial correlations with age partialed out are shown in the upper triangle. Social connectedness was significantly correlated with Facebook use ($r = .13$), but not Twitter ($r = .07$) or YouTube Passive ($r = .09$) or YouTube Active use ($r = .01$). This pattern of relationships remained unchanged even with age partialed out: the relationship between social connectedness and Facebook use was still significant ($r = .13$).

4. Discussion

4.1. Working memory and SNS

The data suggest that some activities in Facebook and YouTube predicted higher scores in working memory performance. In particular, checking friend's status updates in Facebook was the best predictor of both verbal and visuo-spatial working memory. Telling a friend to watch a video in YouTube was the best predictors of verbal working memory scores; while watching videos online best predicted visuo-spatial working memory.

First, with respect to Facebook and working memory, the only activity that predicted both verbal and visuo-spatial working memory scores was checking friends' status updates. This would require the individual to hold this new information (status update) online, while discarding the previous known information about the friend's status, and finally update this with the current status information. These actions correspond closely with working memory skills (e.g., Miyake, Friedman, Rettinger, Shah, and Hegarty, 2001) and thus may explain why this activity in particular was the only predicator of working memory performance. However, there is a caveat—while this activity was a significant predictor of working memory scores, it only accounted for a small amount of performance variance (<2%). Thus, further research is necessary to replicate these findings. It would also be of interest to investigate whether some SNS activities may have longer-term benefits for cognitive skills.

The YouTube findings in the present study could be explained in light of how individuals construct their public persona on this SNS (Lange, 2008). It is possible that the act of recommending certain videos to friends involves goal-directed behavior associated with working memory, such as careful planning and keeping track of recommendations, in order to best represent their 'public face'. To our knowledge, no other studies to date have explored the interaction between SNS and working memory, thus this speculative explanation merits additional research.

4.2. Attentional control and SNS

Using real world engagement with SNS, we investigate whether Active and Passive SNS users have qualitatively different profiles of attentional control. There were two key findings. First, the Active SNS users were more accurate and had fewer misses of the target stimuli in Block 1. In subsequent blocks, the Passive engagers were able to allocate attentional resources efficiently and their performance matched the Active group.

The second key finding was based on the results from the errors of false positives. The data suggest that Active users did not discriminate their attentional resources exclusively to the target stimuli and were less likely to ignore distractor stimuli. It may be that they adopted a capacity-sharing approach where information was processed in parallel and they assigned similar levels of attentional control to the target and distractor stimuli. Their engagement with SNS could have been exploratory where they assigned similar weight to incoming streams of information.

In contrast, the Passive SNS users volitionally assigned attentional control to targets and filtered out distracters. They appeared to attend to information serially (the bottleneck account). It is possible that practice increases efficiency, and thus reduces the amount of resources that need to be allocated to a task. Support for this view was evident in the shift in the Passive users' performance from Block 1 to subsequent blocks. In Block 1, they were less accurate and had more misses compared to the Active users. However, with practice they were able to automatize their Sustained Attention and there was no difference in accuracy between the Active and Passive users in subsequent blocks. Thus, the bottleneck effect were minimized in the Passive users as a result of practice.

It is possible that increased use of SNS is changing how attention is allocated. The data from the present study suggest that Active engagers did not prioritize information and gave equal weight to all incoming stimuli in the Sustained Attention test. This profile fits well with reports that Facebook users are frequently bombarded with what can appear as drivel—random comments, status updats and so on. Yet, it seems that individuals are not choosing to inhibit these so-called distractors, but rather turn them into useful networking information (Selg, 2010).

The differing profiles of attentional control (Active vs. Passive) can have implications for ways in which we best respond to demands in the workplace (Schieman & Young, 2010). Active users prefer to process information in parallel and thus, may be at an advantage in a workplace environment that demands they manage multiple streams of information. In contrast, Passive users process information successively and so they find it easier to focus on a target and filter out distractions (Aston-Jones & Cohen, 2005; Daw, O'Doherty, Dayan, Seymour, & Dolan, 2006). These users may be at an advantage in a workplace environment that demands they frequently switch between tasks.

Table 3
The relationship between social connectedness and the different types of SNS; zero-order correlations in the bottom half of the triangle; partial correlations with age partialed out in the top half of the triangle.

	1	2	3	4	5
1. Social connectedness composite	1	.13[a]	.09	.08	.01
2. Facebook composite	.13[a]	1	.21[b]	.24[b]	.23[b]
3. Twitter composite	.07	.19[a]	1	.21[b]	.17[a]
4. YouTube Passive composite	.09	.32[b]	.22[b]	1	.26[b]
5. YouTube Active composite	.01	.23[b]	.18[b]	.26[a]	1

[a] Significant at alpha level .05.
[b] Significant at alpha level .001.

4.3. Social connectedness and SNS

Finally, the data on social connectedness and SNS suggest that higher self-reported levels of connectedness were significantly related to Facebook use, but not to Twitter or YouTube use. In a recent review, Nadkarni and Hoffman (2012) identified a primary motivation of Facebook use as the need to belong. There are multiple features in Facebook that facilitate social interaction, including sharing of photos, and commenting of friends' updates and interests, which in turn may foster a greater sense of connectedness. This premise is supported by the data from present study, as greater Facebook use was significantly associated with greater levels of social connectedness.

In contrast, it is possible that Twitter and YouTube do not engage social interaction sufficiently to foster such feelings of belonging. For example, these two sites do not require you to post any personal details or your 'life story', unlike Facebook. The lack of divulging personal information could be a key reason for why the participants in the present study did not report high levels of social connected from either Twitter or YouTube use. Gao, Dai, Fan, and Kang (2010) suggested that although SNS offers individuals an opportunity to make a meaningful social and emotional connection, the *social climate* of the site is a key factor in fostering opportunities to connect. Thus, it is possible that if a social networking site does not promote a social climate of sharing unique, personal details, then it is unlikely to result in any deeper social benefits.

4.4. Conclusion

The present study offered new information on the impact of SNS engagement on cognitive skills and social connectedness. It extended previous research to focus specifically at working memory and attentional skills, as well as possible benefits that different SNS has on reported levels of connectedness and affiliation. The findings suggest that some SNS activities can be particularly beneficial, especially those that involve keeping track of friends' lives. Given the importance of working memory in education, further research can investigate whether working memory skills mediate the association between Facebook use and grades (e.g., Junco, 2011; Kirschner & Karpinski, 2010). The association between Facebook use and social connectedness is interesting and can lead to further investigation on the interplay between SNS, belonging and affiliation, and loneliness (see Ryan & Xenos, 2011). Finally, given the different cultural emphasis on individualism and collectivism (see Nadkarni & Hoffman, 2012), it would worth exploring whether the patterns of findings in the present study would be present in different cultural groups as well.

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