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RESEARCH REPORT

Everyday Attention Failures: An Individual Differences Investigation

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The present study examined individual differences in everyday attention failures. Undergraduate students completed various cognitive ability measures in the laboratory and recorded everyday attention failures in a diary over the course of a week. The majority of attention failures were failures of distraction or mind wandering in educational contexts (in class or while studying). Latent variable techniques were used to perform analyses, and the results suggested that individual differences in working memory capacity and attention control were related to some but not all everyday attention failures. Furthermore, everyday attention failures predicted SAT scores and partially accounted for the relation between cognitive abilities and SAT scores. These results provide important evidence for individual differences in everyday attention failures as well as for the ecological validity of laboratory measures of working memory capacity and attention control.

Keywords: attention control, attention failures, working memory capacity, individual differences, SAT

Our ability to focus and sustain attention is a hallmark of a highly functioning attentional system. This attentional system allows us to perform both highly important as well as mundane tasks. Despite the efficiency of such a system, sometimes we experience lapses of attention. For example, have you ever been distracted by people talking while you were trying to read an important document? Have you ever found yourself zoning out at work because you were daydreaming about an upcoming vacation? Most of us will likely answer in the affirmative to these questions. These attention failures reflect temporary shifts of attention away from the task at hand to either external stimuli (distractions) or to internal thoughts and ruminations (mind wandering/daydreaming) that can result in failures to perform an intended action (absent-mindedness). Although there are some benefits to these lapses (e.g., attentional capture toward a threat stimulus, problem solving an unrelated task), for the most part these attention failures are seen as unwanted breakdowns of our attentional system. As such, everyday attention failures have been linked to both minor and major accidents (Broadbent, Cooper, FitzGerald, & Parkes, 1982; Reason, 1990; Reason & Mycielska, 1982) as well as to educational difficulties (Brown, 1927; Lindquist & McLean, 2011).

Despite the importance of everyday attention failures to a number of domains, work examining these failures remains relatively scarce (relative to experimental studies of laboratory tasks) due to the difficulties inherent in recording attention failures. Several methods have been used to examine everyday attention failures, including experience sampling techniques with thought probes (Smallwood & Schooler, 2006) and diary methods (Reason & Lucas, 1984). In diary studies individuals are required to carry a diary for some amount of time and record their attention failures. These studies provide important information about broad classifications of attention failures as well as when these failures are likely to occur (Norman, 1981; Reason, 1984). For example, Reason (1984) had 63 undergraduates record their attention failures in the course of a week. Reason found that many of the attention failures occurred because participants were either preoccupied by internal thoughts or distracted by external stimuli. Furthermore, Reason found that most of these errors occurred during the late afternoon and early evening. Although this work provides important evidence for general classes of attention failures as well situations in which attention failures are likely to occur, there is little indication of the specific types of attention failures that occur as well as the relative frequency with which different failures occur. That is, are attention failures due to external distraction more common than attention failures due to mind wandering? Likewise, given a sample of undergraduate students, are attention failures mostly related with educational contexts or with other contexts such as social or work contexts? Examining specific types of attention failures as well as the frequency with which different types of failures occur should provide important information on the nature of attention failures. One main goal of

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the current study was to better examine the relative frequency of specific attention failures in order to gauge which types of failures occur most frequently. That is, much like early diary studies of memory failures (Crovitz & Daniel, 1984; Terry, 1988), it would be desirable to know what types of attention failures people (in this case, undergraduate students) are most likely to experience.

In addition to a goal of examining frequency estimates of various attention failures, another goal of the current study was to examine individual differences in everyday attention failures. In particular, are certain individuals more likely to experience everyday attention failures than others? Theoretically, one might assume that individuals with poor attention control (AC) abilities should be more likely to experience everyday attention failures than individuals high in AC abilities. That is, individuals high in AC should be better able to focus and sustain attention on important everyday tasks than individuals low in AC, leading low AC individuals to experience more attention failures in everyday life. While such statements seem relatively straightforward and intuitive, it should be noted that relatively little work has directly examined these types of claims, in which laboratory assessments of AC have been linked to everyday attention failures. Recently, Kane et al. (2007) assessed the extent to which individual differences in constructs related to attention control (such as working memory capacity) are related to mind wandering in everyday life (see Smallwood & Schooler, 2006, for a review of mind wandering). Specifically, Kane et al. had participants perform a number of working memory capacity (WMC) tasks in the laboratory and then these participants were required to carry personal digit assistants (PDAs) around for 1 week. During that time the PDA would signal the participant to fill out a questionnaire regarding whether they had experienced any mind wandering at the time of the signal, thereby providing information on everyday attention failures. According to attentional control theories of WMC (Engle & Kane, 2004; Unsworth & Engle, 2007), individuals high in WMC are better at controlling aspects of their attention to actively maintain goal-relevant information in order to successfully perform a task than individuals low in WMC, and these differences are especially pronounced under conditions of high interference or distraction in which attentional capture away from task or goal-relevant information is likely. Accordingly, Kane et al. found that individual differences in mind wandering were strongly related with measures of WMC, especially during challenging tasks. Specifically, during challenging tasks low WMC individuals reported more mind wandering than did high WMC individuals. Thus, individual differences in WMC predicted individual differences in everyday mind wandering.

Furthermore, despite this initial evidence, it is not clear that individual differences in WMC and AC should predict individual differences in all attention failures. Rather, according to attentional control views, individual differences in attention control abilities should predict the occurrence of attention failures when sustained and focused attention is needed for successful performance in the current task (Kane et al., 2007). Thus, individual differences in WMC and AC should be related to some, but not all, attention failures. Furthermore, according to the attentional control theories of WMC, the relation between individual differences in WMC and everyday attention failures should be due to AC abilities. This means that variation in AC abilities should fully mediate the relation between WMC and everyday failures. To our knowledge, a direct test of this notion has yet to be examined.

Finally, assuming that there is a relation between individual differences in the cognitive ability laboratory measures of WMC and AC with everyday attention failures, one can ask whether the variation in attention failures accounts for the relation between WMC and AC with scholastic abilities as measured by the SAT (which can be seen as a proxy for general intelligence; Frey & Detterman, 2004). Specifically, prior research has found that variation in WMC strongly predicts SAT scores, and this relation is theoretically due to variation in AC abilities (Engle, Tuholski, Laughlin, & Conway, 1999). Thus, one might suspect that individuals with lower AC abilities who also experience more attention failures should also have lower scholastic abilities, as a lapse of attention or being distracted while taking a test could potentially lead to a lower than normal score. Likewise, a general history of zoning out during schooling could lead to poorer learning of the material tested on the SAT. If this is the case, then individual differences in everyday attention failures should be related to scholastic abilities as measured by the SAT, and individual differences in everyday attention failures should mediate (fully or partially) the relation between cognitive ability measures (AC and WMC) and SAT scores.

Using a novel combination of diary and cognitive ability methods, we examined the nature of individual differences in everyday attention failures. In particular, we examined four questions of primary interest. (a) What are the most common attention failures in a sample of undergraduate students? (b) How are different everyday attention failures related to laboratory assessments of WMC and AC? (c) Do individual differences in AC abilities mediate the relation between WMC and everyday attention failures? (d) Do individual differences in everyday attention failures account for the relations between AC and WMC with scholastic abilities as measured by the SAT?

To address these questions, we tested a large number of participants on several laboratory tasks thought to measure WMC and AC. Participants also agreed to carry diaries for a week in which they recorded any attention failures (as well as other cognitive failures not discussed in the current study) that they experienced each day (see Unsworth, Brewer, & Spillers, 2012). Finally, we obtained SAT scores for each participant. To examine the relations between the laboratory cognitive ability measures and everyday attention failures we used a latent variable approach. By examining a large number of participants and a large and diverse number of measures, we should be able to better examine individual differences in everyday attention failures and address our four questions of primary interest.

Method

Participants

A total of 100 participants (66% female) were recruited from the subject pool at the University of Georgia. Participants were between the ages of 18 and 35 years old (M = 19.33 years, SD = 1.35).

WMC Tasks

Operation span. Participants solved a series of math operations while trying to remember a set of unrelated letters. At recall, participants recalled letters from the current set in the correct order by clicking on the appropriate letters (see Unsworth, Heitz, Schrock, & Engle, 2005). For all of the WMC measures, items were scored if the item was correct and in the correct position. There were 75 trials. The score was the number of correct items in the correct position.

Symmetry span. Participants were required to recall sequences of red squares within a matrix while performing a symmetry-judgment task. In the symmetry-judgment task, participants were shown an 8 × 8 matrix with some squares filled in black. Participants decided whether the design was symmetrical about its vertical axis. The pattern was symmetrical half of the time. At recall, participants recalled the sequence of red-square locations in the preceding displays, in the order they appeared, by clicking on the cells of an empty matrix. There were 42 trials. The score was the number of correct items in the correct position (see Unsworth, Redick, Heitz, Broadway, & Engle, 2009).

Reading span. Participants were required to read sentences while trying to remember a set of unrelated letters. At recall, participants recalled letters from the current set in the correct order by clicking on the appropriate letters. There were 75 trials. The score was the number of correct items in the correct position (see Unsworth et al., 2009).

AC Tasks

Antisaccade. In this task participants were instructed to stare at a fixation point and then a flashing white equals sign was flashed either to the left or right of fixation, followed by the target stimulus (the letter *B*, *P*, or *R*) on the opposite side of the screen (Kane, Bleckley, Conway, & Engle, 2001). The participants' task was to identify the target letter by pressing a key as quickly and accurately as possible. There were 40 test trials. Proportion correct was the dependent measure.

Flankers. Participants were presented with a fixation point for 400 ms. This was followed by an arrow directly above the fixation point for 1,700 ms. The participants' task was to indicate the direction in which the arrow was pointing as quickly and accurately as possible. On 30 neutral trials the arrow was flanked by two horizontal lines on each side. On 30 congruent trials the arrow was flanked by two arrows pointing in the same direction as the target arrow on each side. Finally, on 30 incongruent trials the target arrow was flanked by two arrows pointing in the opposite direction as the target arrow on each side. All trial types were randomly intermixed. The dependent variable was the reaction time difference between incongruent and congruent trials.

Psychomotor vigilance task. Participants were presented with a row of zeros onscreen, and after a variable amount of time, the zeros began to count up in 1-ms intervals from 0 ms. The participants' task was to press the spacebar as quickly as possible once the numbers started counting up. The entire task lasted for 10 min for each individual. The dependent variable was the average reaction time for the slowest 20% of trials (Dinges & Powell, 1985).

SAT

Quantitative and verbal SAT scores for each individual were obtained via self-report. It was not possible to obtain SAT scores from university records. Prior research has suggested that self-report SAT scores tend to be slightly overestimated but that self-report and actual SAT scores are highly correlated (e.g., Mayer et al., 2007).

Diary

Participants were given a booklet and asked to keep a diary of their attention failures over the course of 1 week. Participants were told to indicate their various failures by writing a brief description of the failure and recording when it occurred (morning, afternoon, or evening). Participants were encouraged to document the failures as soon as they happened or soon after they happened. Participants were given detailed instructions about how to record responses in the diary, and examples were provided to assist them (see also Unsworth et al., 2012). Diary responses were coded by two raters who classified each response into its respective category. Interrater agreement was high (>95%), and disagreements were resolved.

Results and Discussion

The 100 participants provided a total of 934 attention failures with a mean of 9.34 ($SD = 5.47$) failures per person. Of these, 703 attention failures fell into one of 15 specific types of failure. The other failures were either relatively idiosyncratic failures or were not specified enough to be placed into one of the specific types. The major types of attention failures are listed in Table 1 in descending order of frequency.

The most frequently occurring attention failure was being distracted while studying. These failures were followed by attention failures due to mind wandering in class, being distracted in class,

Table 1
Descriptive Statistics and Rankings of Most Frequent Everyday Attention Failures

Attention failure	*M*	*SD*	Sum	Range
1. Distracted while studying	2.10	1.74	210	9
2. Mind wandering in class	1.40	1.22	140	5
3. Distracted in class	0.82	1.32	82	7
4. Mind wandering while studying	0.50	0.87	50	5
5. Mind wandering during a conversation	0.30	0.67	30	4
6. Absent-minded in class	0.29	0.64	29	3
7. Mind wandering while driving	0.28	0.53	28	2
8. Distracted during a conversation	0.27	0.89	27	8
9. Absent-minded while cooking	0.23	0.53	23	3
10. Absent-minded while studying	0.17	0.43	17	2
11. Distracted while trying to sleep	0.16	0.63	16	5
12. Absent-minded while getting ready	0.14	0.40	14	2
13. Absent-minded while doing chores	0.14	0.45	14	3
14. Distracted at work	0.12	0.41	12	2
15. Mind wandering at work	0.11	0.20	11	2

and mind wandering while studying.[1] Given the composition of the current sample, it is clear that the majority of attention failures that typical college students experience are related to educational contexts. In fact, 76% of the attention failures classified were somehow related to educational contexts in terms of either attention failures in class or attention failures while studying. These results point to the importance of an efficient attentional system in educational contexts and suggest that despite the fact that these participants can be considered somewhat high functioning, they are likely to experience attention failures related to academics in the course of a typical week.

We used confirmatory factor analysis to examine how each of the attention failures listed in Table 1 was related to individual differences in WMC, AC, and SAT scores. First, we examined a base measurement model of the WMC, AC, and SAT. Three latent variables were constructed based on their respective tasks. Specifically, the WMC latent variable was composed of the three WMC tasks (operation span, symmetry span, and reading span), the AC latent variable was composed of the three AC tasks (antisaccade, flankers, and psychomotor vigilance), and the SAT latent variable was composed of the two SAT measures (verbal and quantitative SAT scores). All of the factors were allowed to correlate. Descriptive statistics for the cognitive ability measures are shown in Table 2. The fit of the model was acceptable, $\chi^2(17) = 18.45$, $p > .36$, root-mean-square error of approximation (RMSEA) = .03, standardized root-mean-square residual (SRMR) = .05, nonnormed fit index (NNFI) = .98, comparative fit index (CFI) = .99, suggesting that the specified model provided a good description of the underlying pattern of data. The resulting model is shown in Figure 1. Each of the tasks loaded significantly on its respective construct, and all of the latent constructs were moderately to strongly correlated with one another.

Next, we included the 15 specific attention failures (total number of each for each participant) into the model to see how WMC, AC, and SAT would relate with each type of failure.[2] The fit of the model was acceptable, $\chi^2(92) = 101.47$, $p > .23$, RMSEA = .03, SRMR = .05, NNFI = .90, CFI = .96. The resulting correlations are shown in Table 3.

As seen in Table 3, the most common attention failures were significantly related to the cognitive ability measures. In particular, attention failures related to distraction and mind wandering in educational contexts tended to be related to WMC, AC, and SAT scores, whereas other attention failures were typically not related to the cognitive abilities. The exceptions to this trend were the following: (a) Absent-mindedness failures while cooking were related to WMC and AC, and (b) distraction and mind-wandering failures at work were related to AC. Thus, for the most part these results suggest that only some attention failures are related to individual differences in attention control as indexed by WMC and AC latent variables. These results are consistent with prior work by Kane et al. (2007) suggesting that individual differences in WMC

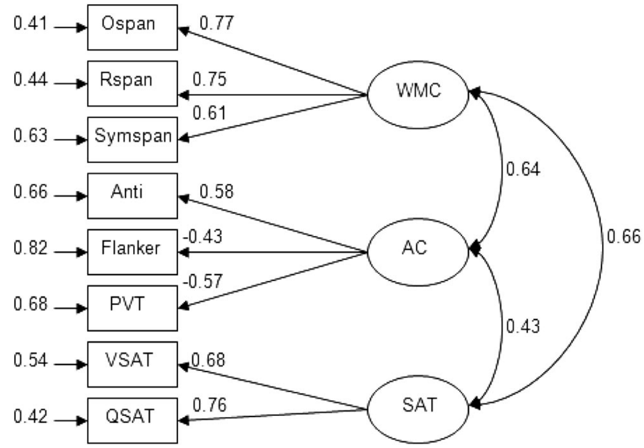

Figure 1. Confirmatory factor analysis for working memory capacity (WMC), attention control (AC), and SAT scores. Paths connecting latent variables (circles) to each other represent the correlations between the constructs, the numbers from the latent variables to the manifest variables (squares) represent the loadings of each task onto the latent variable, and the numbers appearing next to each manifest variable represent the error variance associated with each task. All loadings and paths are significant at the $p < .05$ level. Ospan = operation span; Rspan = reading span; Symspan = symmetry span; Anti = antisaccade; Flanker = flankers; PVT = psychomotor vigilance task; VSAT = verbal SAT score; QSAT = quantitative SAT score.

Table 2
Descriptive Statistics and Reliability Estimates for Laboratory Cognitive Ability Measures

Measure	*M*	*SD*	Skew	Kurtosis	Reliability
Ospan	61.78	10.25	−1.01	0.59	.84
Rspan	60.16	11.35	−0.92	0.52	.79
Symspan	30.14	6.59	−0.86	0.92	.76
Anti	0.52	0.14	0.08	−0.82	.74
Flanker	117.15	61.46	0.71	0.50	
PVT	642.71	450.36	2.12	3.81	.98
VSAT	608.25	56.59	−0.14	1.39	
QSAT	606.85	67.80	−0.89	−0.92	

Note. The standard error of skew for each measure was 0.24, and the standard error of kurtosis for each measure was 0.48. Ospan = operation span; Rspan = reading span; Symspan = symmetry span; Anti = antisaccade; Flanker = flankers; PVT = psychomotor vigilance task; VSAT = verbal SAT; QSAT = quantitative SAT.

[1] Attention failures due to distraction were failures where the participant specifically mentioned being distracted by some external stimulus. For example, "Couldn't study because I kept getting distracted by students talking at the library" would be considered an attention failure due to distraction while studying. In contrast, attention failures due to mind wandering were failures where participants specifically mentioned that they were mind wandering, daydreaming, or zoning out without specifically being distracted by some external stimulus. For example, "I was daydreaming in my calculus class and I missed half the lecture" would be considered an attention failure due to mind wandering while in class. Finally, attention failures due to absent-mindedness were failures where the participant specifically mentioned that a lapse of attention led to failure to perform some action. For example, "I ran out of gas on the way home from class because I didn't pay attention to the warning" would be considered an attention failure due to absent-mindedness.

[2] Note that because many of the distributions of attention failures were positively skewed, we applied a square-root transformation to each attention failure and reanalyzed the data. All of the results were virtually identical to those reported.

Table 3
Latent Correlations of Everyday Attention Failures With Working Memory Capacity (WMC), Attention Control (AC), and SAT Scores

Attention failure	WMC	AC	SAT
1. Distracted while studying	−.35*	−.32*	−.24*
2. Mind wandering in class	−.25*	−.27*	−.24*
3. Distracted in class	−.20*	−.24*	−.38*
4. Mind wandering while studying	−.42*	−.28*	−.25*
5. Mind wandering during a conversation	−.07	−.08	−.06
6. Absent-minded in class	−.03	−.28*	−.10
7. Mind wandering while driving	−.09	−.14	−.11
8. Distracted during a conversation	−.01	.06	.08
9. Absent-minded while cooking	−.27*	−.23*	−.14
10. Absent-minded while studying	.11	.12	−.06
11. Distracted while trying to sleep	−.05	.08	−.05
12. Absent-minded while getting ready	.08	−.08	.02
13. Absent-minded while doing chores	.10	−.09	.15
14. Distracted at work	−.11	−.60*	−.24*
15. Mind wandering at work	−.03	−.29*	.04

* $p < .05$.

are related to mind wandering in challenging contexts, but not in other contexts. Given the importance of academics to typical undergraduate students, these results similarly suggest that individual differences in attention control are primarily important in situations that require focused and sustained attention in order to do well in school. Furthermore, these results go beyond the work of Kane et al. by demonstrating that not only are mind-wandering failures important but so are failures due to external distraction. In fact, there were more attention failures in class and while studying due to distraction than due to mind wandering, $t(99) = 4.71$, $p < .01$. As such, the current results provide important real-world evidence for the role of WMC and AC in educational contexts.

To examine these issues more thoroughly, we specified another confirmatory factor analysis model in which the three most common attention failures formed a single latent factor and were added to the base model from Figure 1. This model examines the extent to which the three most common attention failures (which were all attention failures in educational contexts) would load on the same factor and how this factor would be related to cognitive abilities. The fit of the model was acceptable, $\chi^2(38) = 42.42$, $p > .28$, RMSEA = .03, SRMR = .07, NNFI = .96, CFI = .97. The resulting model is shown in Figure 2. As can be seen, the three most common attention failures all loaded significantly on the same attention failure (AF) factor. Furthermore, this factor was strongly related to the cognitive ability factors. This provides important ecological validity for WMC and AC laboratory measures and suggests that individual differences in AC indexed in the laboratory are strongly related with individual differences in everyday attention failures.

For our final set of analyses we used structural equation modeling (SEM) to better examine how the laboratory measures of WMC and AC would predict everyday attention failures and the extent to which individual differences in everyday attention failures account for the relations between WMC and AC with SAT scores. In the first SEM analysis we examined a prediction of attentional control theories of WMC (Engle & Kane, 2004; Unsworth & Engle, 2007) that suggests that the relation between WMC and attention failures should be mediated by individual differences in AC. To examine this we specified a model in which WMC predicted both AC and attention failures, and AC predicted attention failures. If AC accounts for the relation between WMC and attention failures, then the direct path from WMC to attention failures should be nonsignificant and the indirect path from WMC to attention failures through AC should be significant. The resulting model is shown in Figure 3a. The fit of the model was acceptable, $\chi^2(24) = 29.24$, $p > .21$, RMSEA = .05, SRMR = .07, NNFI = .94, CFI = .96. As can be seen, WMC significantly predicted AC, and AC predicted attention failures, but the direct path from WMC to attention failures was not significant. The indirect path from WMC to attention failures was significant (indirect effect = .37, $p < .05$), suggesting that AC mediated the relation between WMC and attention failures. Indeed, fixing the path from WMC to attention failures to zero did not significantly change the fit of the model, $\Delta\chi^2(1) = 0.25$, $p > .61$. These results are consistent with attentional control views of WMC, which suggests that the relation between WMC and attention failures should be mediated by variation in AC.

In the next SEM analysis we examined the extent to which individual differences in everyday attention failures (especially failures in educational contexts) would mediate the relation between AC and SAT scores. Therefore, we specified a model in which AC predicted both attention failures and SAT scores and attention failures also predicted SAT scores. Like the previous SEM, if attention failures mediate the relation between AC and

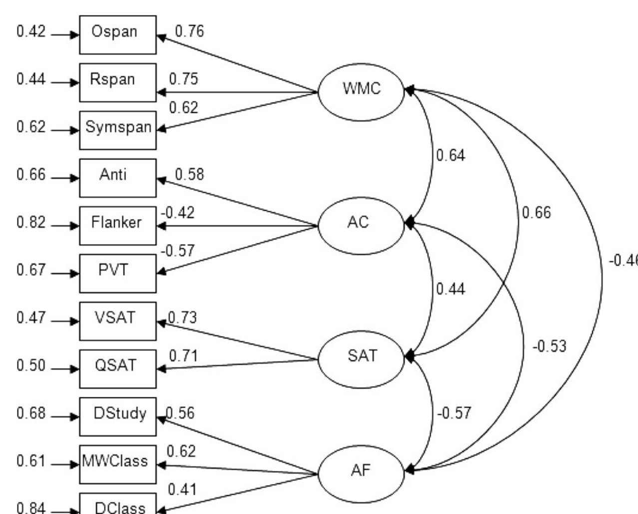

Figure 2. Confirmatory factor analysis for working memory capacity (WMC), attention control (AC), SAT scores, and everyday attention failures (AF). Paths connecting latent variables (circles) to each other represent the correlations between the constructs, the numbers from the latent variables to the manifest variables (squares) represent the loadings of each task onto the latent variable, and the numbers appearing next to each manifest variable represent the error variance associated with each task. All loadings and paths are significant at the $p < .05$ level. Ospan = operation span; Rspan = reading span; Symspan = symmetry span; Anti = antisaccade; Flanker = flankers; PVT = psychomotor vigilance task; VSAT = verbal SAT score; QSAT = quantitative SAT score; DStudy = diary study; MWClass = mind wandering in class; DClass = distraction in class.

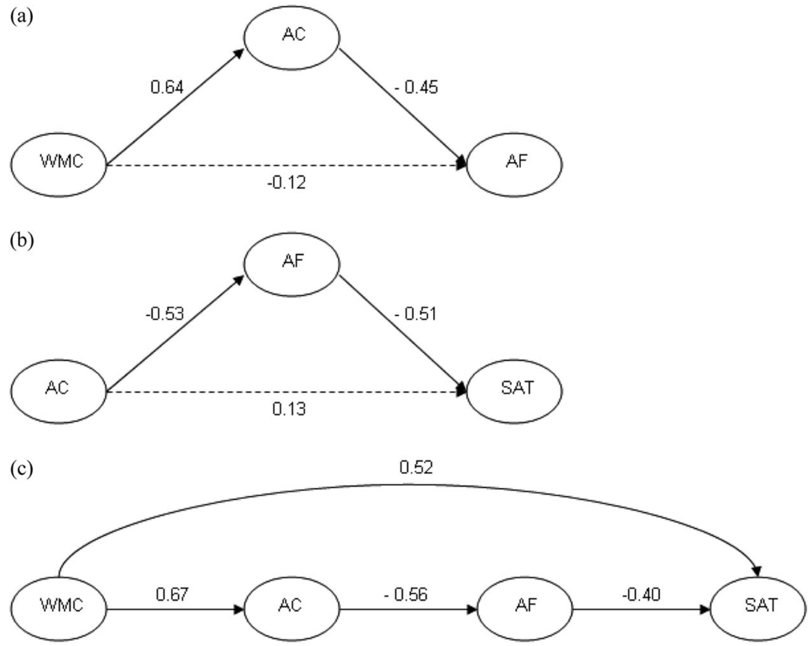

Figure 3. (a) Structural equation model for working memory capacity (WMC), attention control (AC), and everyday attention failures (AF). (b) Structural equation model for AC, AF, and SAT scores. (c) Structural equation model for WMC, AC, AF, and SAT scores. Single-headed arrows connecting latent variables (circles) to each other represent standardized path coefficients indicating the unique contribution of the latent variable. Solid lines are significant at the $p < .05$ level, and dotted lines are not significant at the $p < .05$ level.

SAT then the direct path from AC to SAT scores should be nonsignificant and the indirect path from AC to SAT scores through attention failures should be significant. The resulting model is shown in Figure 3b. The fit of the model was acceptable, $\chi^2(17) = 13.99$, $p > .66$, RMSEA = .01, SRMR = .05, NNFI = 1.0, CFI = 1.0. As can be seen, AC significantly predicted attention failures, and attention failures predicted SAT scores, but the direct path from AC to SAT scores was not significant. The indirect path from AC to SAT scores was significant (indirect effect = .34, $p < .05$), suggesting that attention failures mediated the relation between AC and SAT scores. Indeed, fixing the path from AC to SAT scores to zero did not significantly change the fit of the model, $\Delta\chi^2(1) = 0.40$, $p > .52$. These results suggest that the relation between individual differences in AC and SAT scores is accounted for by individual differences in everyday attention failures. Thus, individuals low in AC abilities are more likely to be distracted while studying and in class and are more likely to mind wander in class, which leads to poorer performance on standardized tests of scholastic ability such as the SAT.

For our final SEM analysis we examined how WMC, AC, and attention failures would account for SAT scores. On the basis of the prior SEMs, we specified a model in which WMC predicted AC, and AC predicted attention failures, which in turn predicted SAT scores. Additionally, in order to examine whether AC and attention failures would account for the relation between WMC and SAT scores, which has been found previously (Engle et al., 1999), we allowed WMC to have a direct path to SAT scores. If the reason WMC strongly predicts SAT scores is due to differences in attention control that emerge in everyday attention failures, then the direct path from WMC to SAT scores should not be significant, but the indirect path through AC and attention failures should be significant. If, however, attention control abilities only partially mediate the relation between WMC and SAT scores, then both the direct path from WMC to SAT scores as well as the indirect path should be significant. The resulting model is shown in Figure 3c. The fit of the model was acceptable, $\chi^2(40) = 42.22$, $p > .37$, RMSEA = .02, SRMR = .07, NNFI = .96, CFI = .97. As can be seen, all paths were significant, including the direct path from WMC to SAT scores. Furthermore, the indirect path from WMC to SAT scores through AC and attention failures was significant (indirect effect = .15, $p < .05$), suggesting that individual differences in AC and everyday attention failures only partially accounted for the strong relation between WMC and SAT scores that has been found previously. Indeed, fixing the path from WMC to SAT scores to zero resulted in a significantly worse fit of the model, $\Delta\chi^2(1) = 8.15$, $p < .01$. The current results suggest that at least part of the relation between WMC and intelligence (SAT scores) is due to differences in attention control (Unsworth & Spillers, 2010) that are manifested in everyday attention failures.

Summary and Conclusions

In a unique approach to study everyday attention failures, we combined laboratory assessments of cognitive abilities with diary methods. We found in a sample of undergraduate students that the most frequently reported attention failures were being distracted or mind wandering in educational contexts (in class or while studying). Individual differences analyses suggested that measures of

AC and WMC were significantly related to some, but not all, of the reported everyday attention failures. In particular, variation in attention failures related to educational contexts was consistently related with the cognitive ability assessments, whereas variation in other attention failures was not. These results are consistent with prior research, which suggests that individual differences in attentional control should be related to everyday attention failures when focused and sustained attention is needed for relatively important tasks (Kane et al., 2007).

Furthermore, it was found that the most common attention failures were all related and formed a single latent variable that was strongly related to WMC, AC, and SAT scores, thereby providing important ecological validity to laboratory assessments of WMC, AC, and intelligence. Specifically, those individuals who are less able to control their attention during laboratory tasks are more susceptible to external distraction and mind wandering in everyday situations compared with individuals who are better at controlling aspects of their attention. Further examination of these attention failures suggested that the relation between WMC and attention failures was fully mediated by individual differences in AC, consistent with attentional control views of WMC (Engle & Kane, 2004; Unsworth & Engle, 2007). Also consistent with these views, structural equation models suggested that the relation between AC and SAT scores was fully mediated by everyday attention failures and the relation between WMC and SAT was partially mediated by AC and everyday attention failures. These results suggest that the ability to control one's attention is an important predictor of everyday attention failures and a major source of individual differences in scholastic abilities and intelligence as measured by the SAT. As such, the current results point to the importance of studying attention failures both inside and outside of the laboratory in order to better understand what types of failures individuals experience on a daily basis as well as who is most likely to experience various different types of attention failures. Of course it should be noted that despite the obvious strengths of using diary methods to assess everyday attention failures, there are also clear limitations with these types of studies. For example, given that diary methods require both prospective and retrospective memory, it is clear that not all failures will be reported and not all failures will be reported entirely accurately. Indeed, the frequency of mind wandering reported in the current study is far less than is typically reported with experience sampling techniques (Kane et al., 2007; Smallwood & Schooler, 2006). However, despite these limitations, diary methods are particularly useful (especially when combined with laboratory measures and individual differences analyses) in examining naturalistic data on a variety of attention failures. As noted by Reason and Lucas (1984), diaries "serve a valuable function as wide-gauge trawl nets, picking up the more salient types of lapse" (p. 56). Thus, although the overall number of attention failures is likely underestimated, diary methods provide a valuable tool to examine the variety of everyday attention failures. Future work using experience sampling techniques is needed to replicate and extend the current results. Furthermore, future work is needed to examine how the current results generalize to a more representative sample and how individual differences in everyday attention failures are related to other important cognitive constructs. Combining laboratory assessments of cognitive abilities with assessments of everyday attention failures is a promising avenue for future research.

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