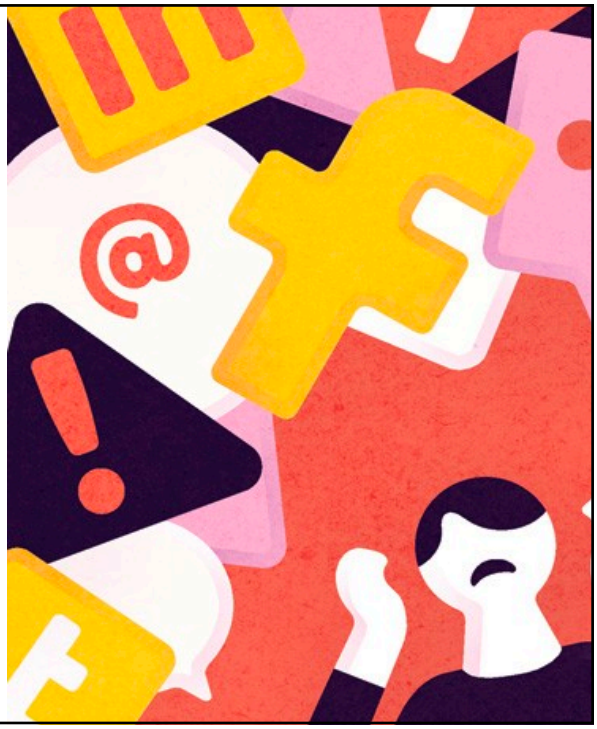
Digital Devices and Distracted Minds:

Evaluating evidence of the relationship between media use and cognitive control



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Maties Machine Learning, 21 August 2020

CTRG
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STELLENBOSCH UNIVERSITY

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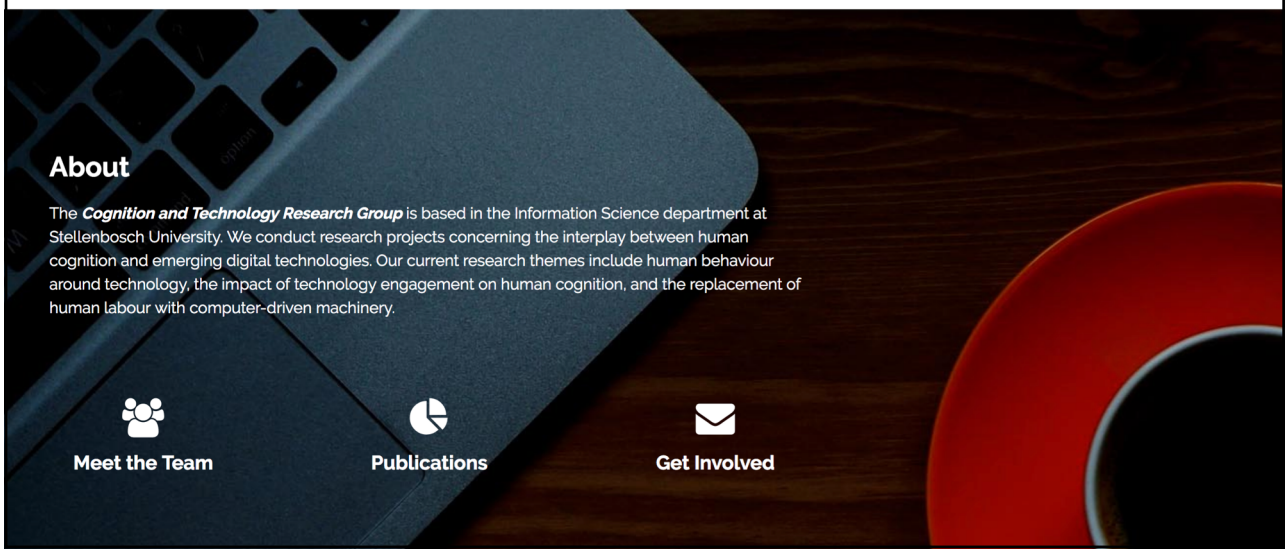


Media use → Well-being

- Watching TV
- Following "the news"
- Gaming
- Pornography
- Social media
- E-mail
- Etc…

- Depression
- Anxiety
- Insomnia
- FOMO
- Envy
- Addiction
- Etc…

Media multitasking

Media multitasking (MMT) describes a form of behaviour during which a person simultaneously performs one or more activities of which some involve the use of media (Lang and Chrzan, 2015).

Primary task performance

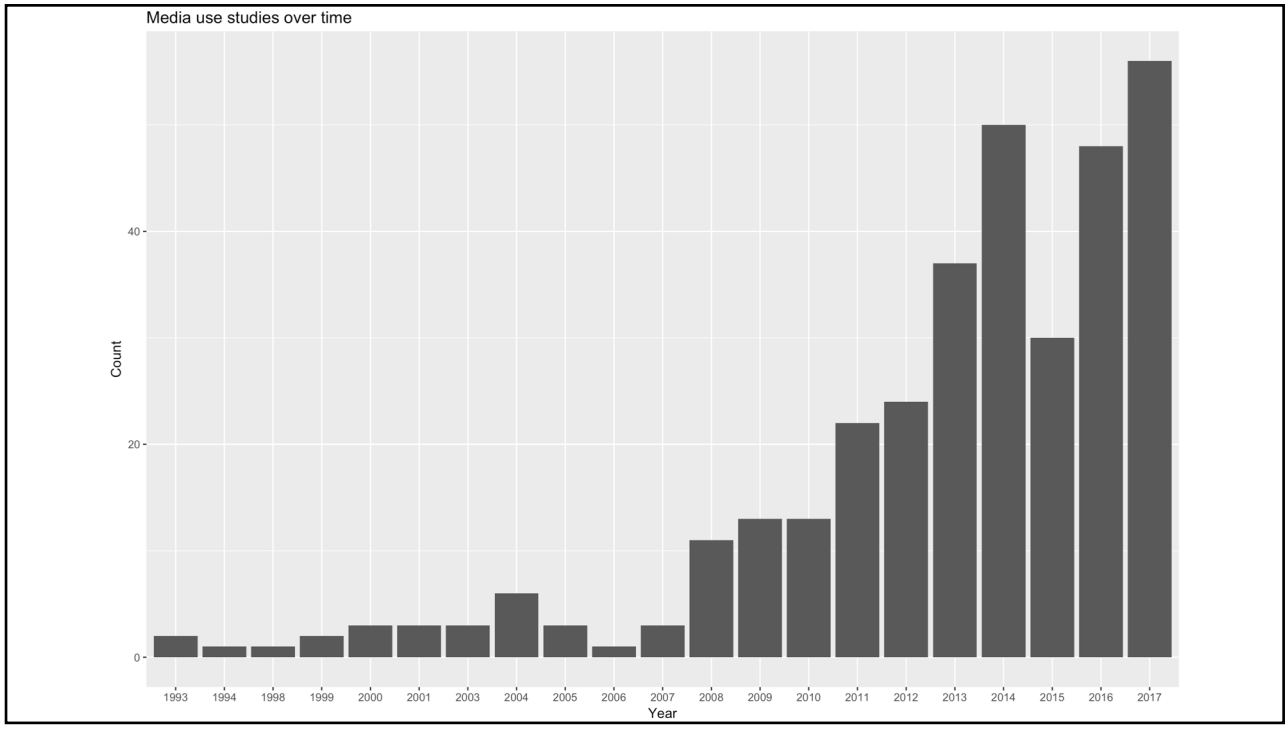
When media use interrupts an ongoing task which requires attention (e.g., driving a car, attending a lecture, studying etc.)

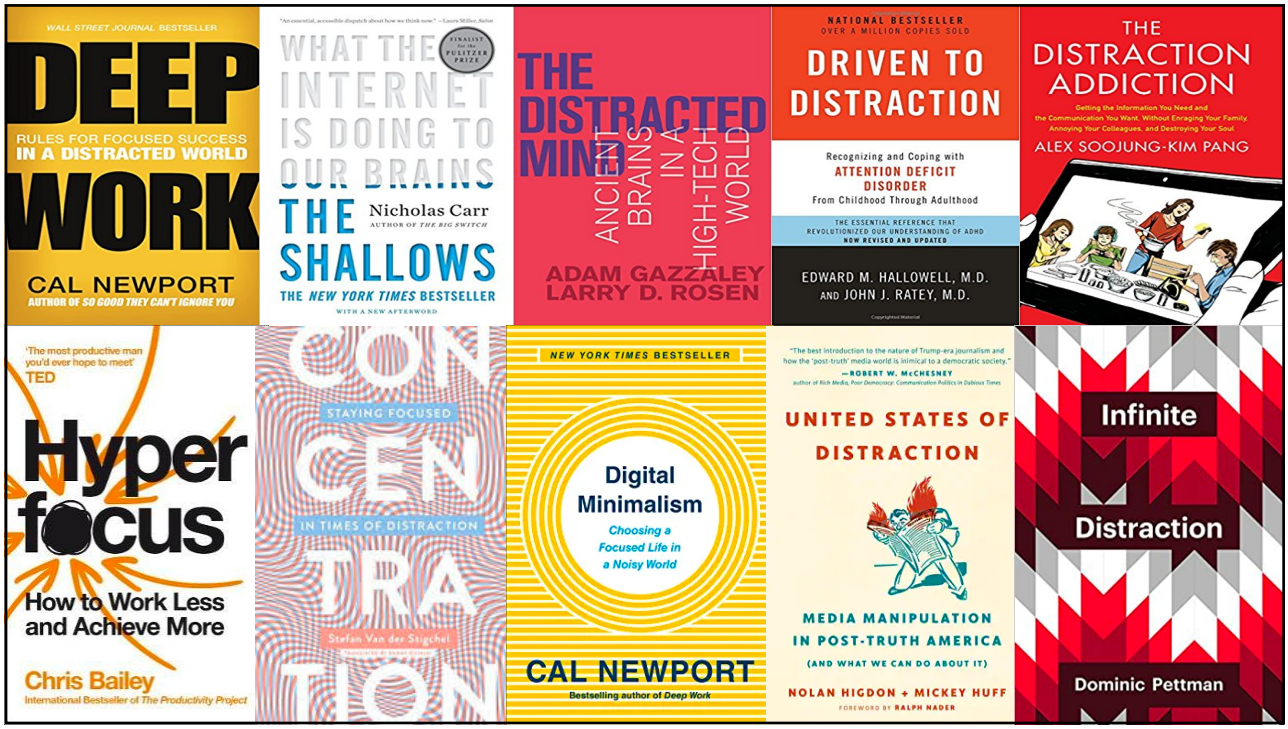
Cognitive control

The ability to direct (focus) and sustain attention (i.e., to not be distractible)

Even in peacetime I think those are very wrong who say that schoolboys should be encouraged to read the newspapers. Nearly all that a boy reads there in his teens will be seen before he is twenty to have been false in emphasis and interpretation, if not in fact as well, and most of it will have lost all importance. Most of what he remembers he will therefore have to unlearn; and he will probably have acquired an incurable taste for vulgarity and sensationalism and **the fatal habit of fluttering from paragraph to paragraph to learn how an actress has been divorced in California, a train derailed in France, and quadruplets born in New Zealand.**

C.S. Lewis in *Surprised by Joy* (1955)





Three parts to the central thesis

Part 1: We *swim* in media

You live *in* media. Who you are, what you do, and what all of this means to you does not exist outside of media. Media are to us as water is to fish.

~ Mark Deuze

Part 2: New media are designed to attract and hold our attention

- Ubiquity
- Hyper-textuality
- Always-on
- Persuasive design
- Notifications
- The "Attention economy"

Part 3: Our media use behaviour effects our cognitive processes (in some way or other)

The "online brain": how the Internet may be changing our cognition

Joseph Firth[1-3], John Torous[4], Brendon Stubbs[5,6], Josh A. Firth[7,8], Genevieve Z. Steiner[1,9], Lee Smith[10], Mario Alvarez-Jimenez[3,11], John Gleeson[3,12], Davy Vancampfort[13,14], Christopher J. Armitage[2,15,16], Jerome Sarris[1,17]

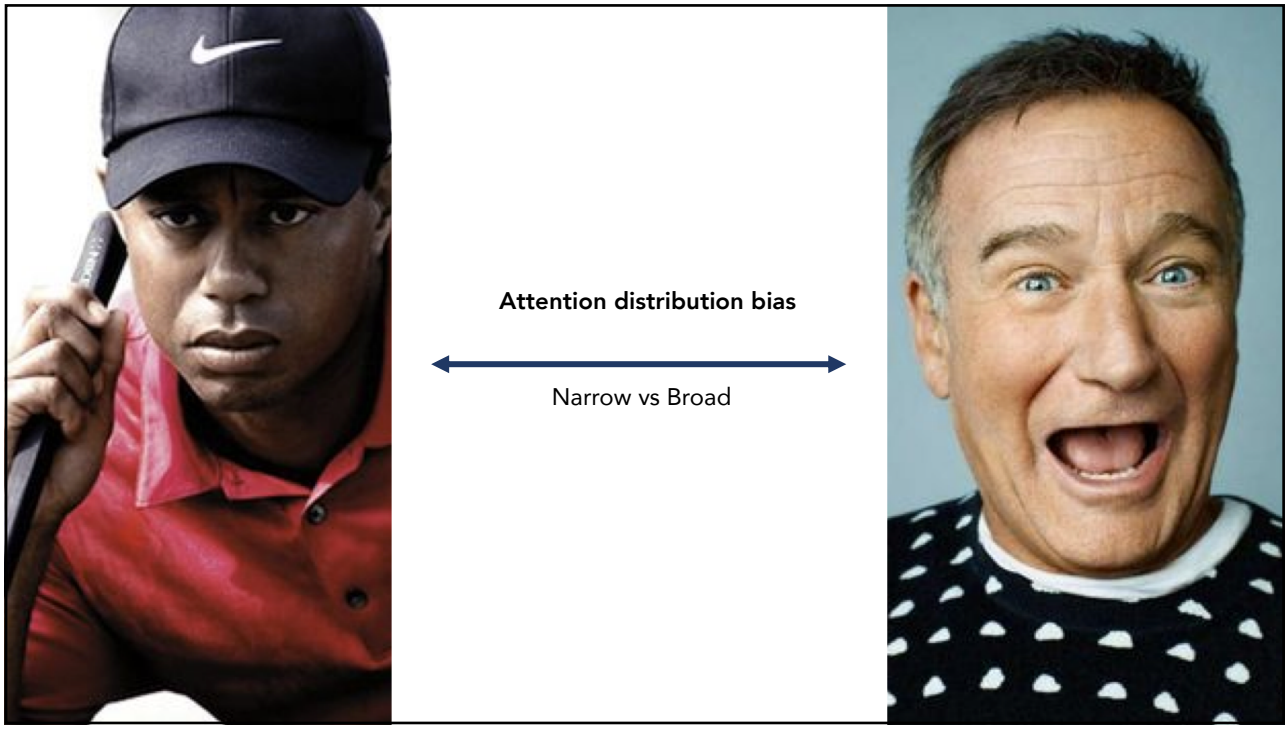
*"… available evidence indicates that the Internet can produce both acute and sustained **alterations** in each of these areas of cognition …"*

Attention 101

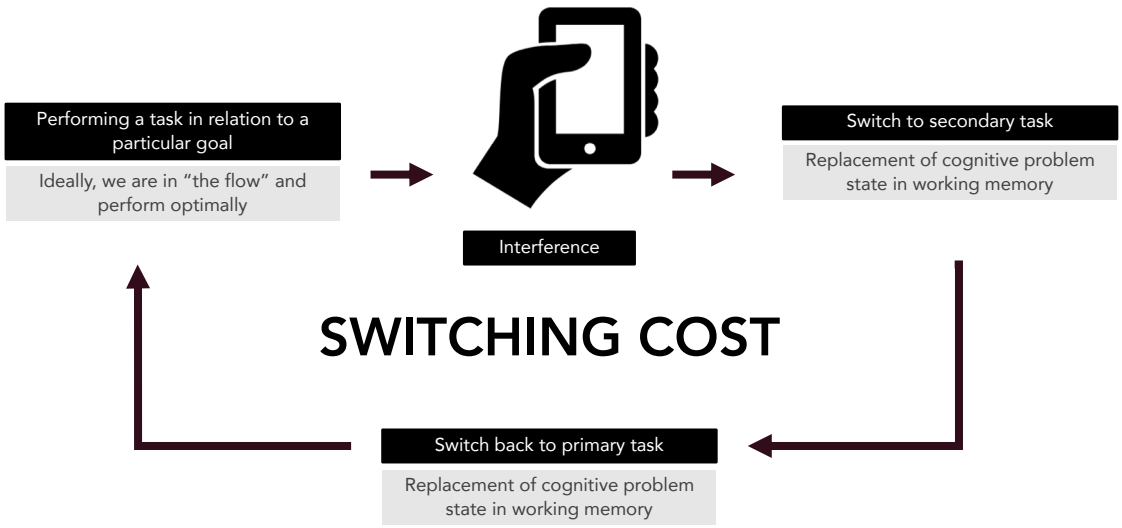
"Bottom-up"

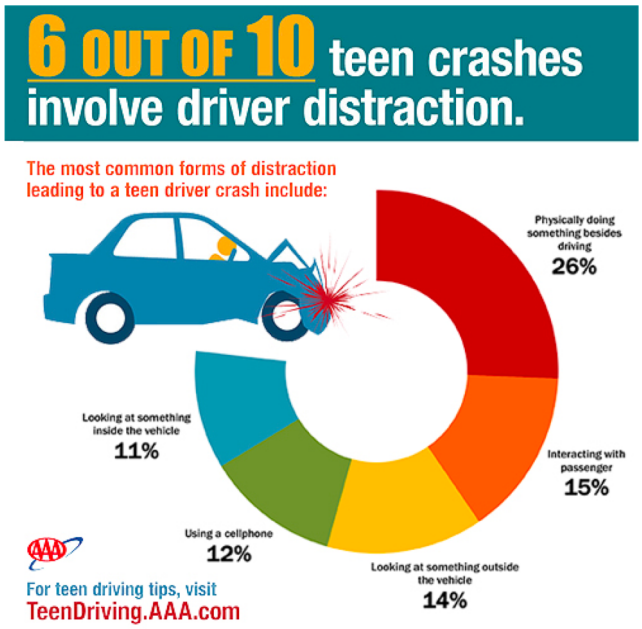
Directed

Three core executive functions combine to enable cognitive control — **working memory, cognitive flexibility or shifting, and inhibition**.
Miyake, et al., 2000



How does media multitasking impact attention distribution?

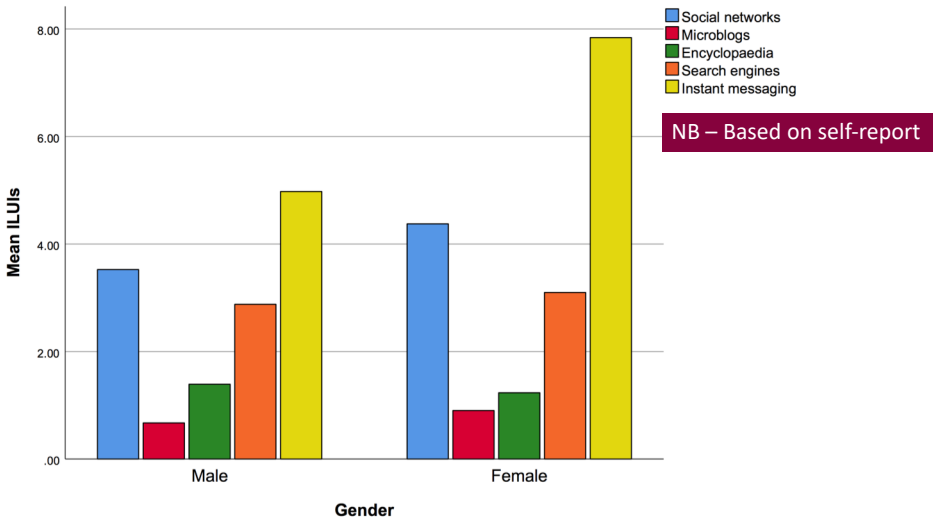




Cell phone usage may cause inattentional blindness even during a simple activity that should require few cognitive resources.
Hyman et al., 2010

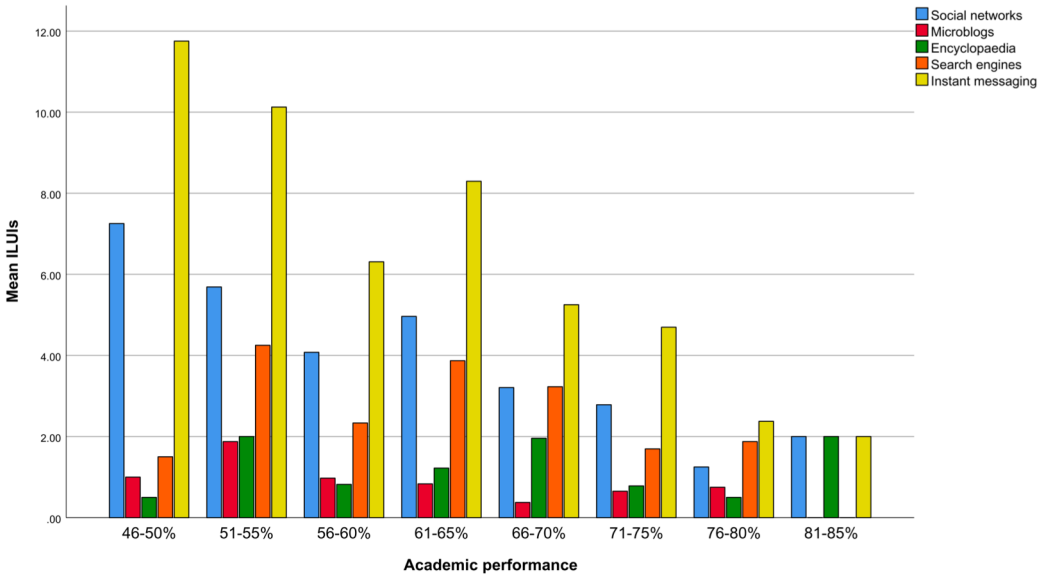
Pedestrian injuries related to mobile phone use were higher for men than women.
Nasar and Troyer, 2013

The results show that when the primary task was considered difficult, subjects forced to multitask had significantly lower performance compared with not only the subjects who did not multitask but also the subjects who were able to multitask at their discretion. Conversely, when the primary task was considered easy, subjects forced to multitask had significantly higher performance than both the subjects who did not multitask and the subjects who multitasked at their discretion.
Adler and Benbunan-Fich, 2015



NB – Based on self-report

During a **50-minute lecture, the average Stellenbosch University student engages in over 15 media use instances**, almost all of which are unrelated to the lecture content.

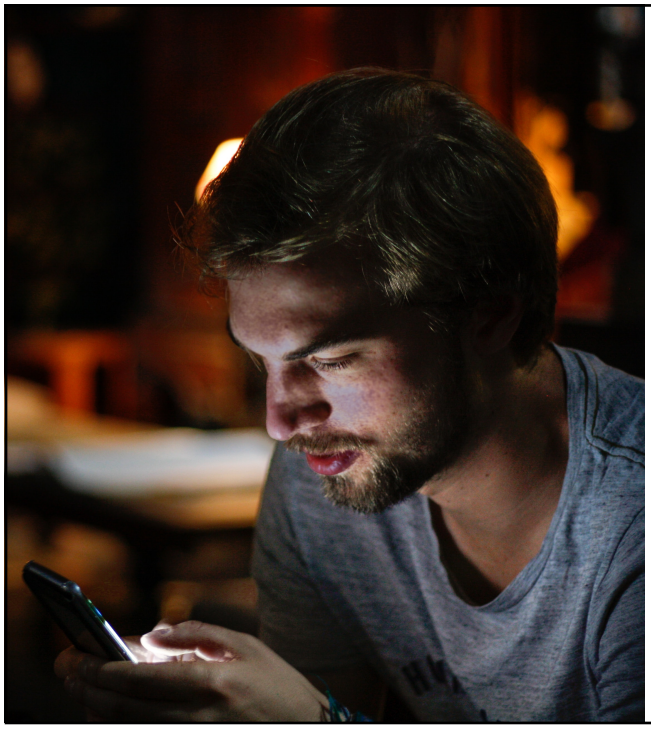


Parry, D. A., & Le Roux, D. B. (2018). In-Lecture Media Use and Academic Performance: Investigating Demographic and Intentional Moderators. *South African Computer Journal*, *30*(1), 85–107. https://doi.org/10.18489/sacj.v30i1.434

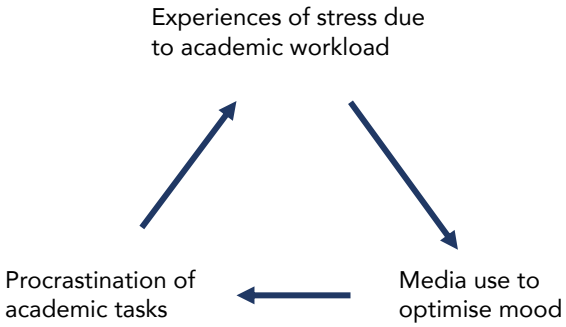
In other studies…

Relationship between MM (while in class or studying) and AP as course grade or grade point average (GPA)*			
	N	Negative correlation	No significant correlation
Higher Education	11	8	3
School	1	1	
	12	**9**	**3**
Relationship between MM (while in class or studying) and lecture or study outcomes*			
	N	Negative correlation	No significant correlation
Higher Education	16	14	2
School	4	3	1
	20	**17**	**3**

* As reported in van der Schuur et al. (2015)



The Media Procrastination Cycle



le Roux, D. B., & Parry, D. A. (2019). Off-task media use in academic settings: cycles of self-regulation failure. *Journal of American College Health*, 1–8. https://doi.org/10.1080/07448481.2019.1656636

What about media use outside class?

Table 6: Results of multiple linear regression predicting academic performance with media use behaviours, country and online vigilance.

Variable	B	SE	β	t	95% CI
Daily smartphone use	-0.05	0.03	-0.04	-1.72	[-0.10, 0.02]
Video watching	-0.07	0.04	-0.06	-1.93	[-0.12, 0.03]
Messaging	0.10	0.04	0.08	2.39*	[-0.04, 0.13]
Social media	-0.02	0.05	-0.03	-0.38	[-0.06, 0.12]
Media multitasking	-0.31	0.09	-0.12	-3.64***	[-0.42, -0.08]
Online vigilance	-0.38	0.06	-0.33	-4.35***	[-0.43, -0.19]
R^2	0.09				
adj. R^2	0.09				
F Statistic	18.59*** (df=8;1436)				

Note. $N = 1445$. B represents unstandardised regression coefficients; SE represents the standard error of B; β represents standardised regression coefficients.
$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

* Currently in press

Behaviour with media (in general) predicts around **9% of variance in academic performance** among university students.

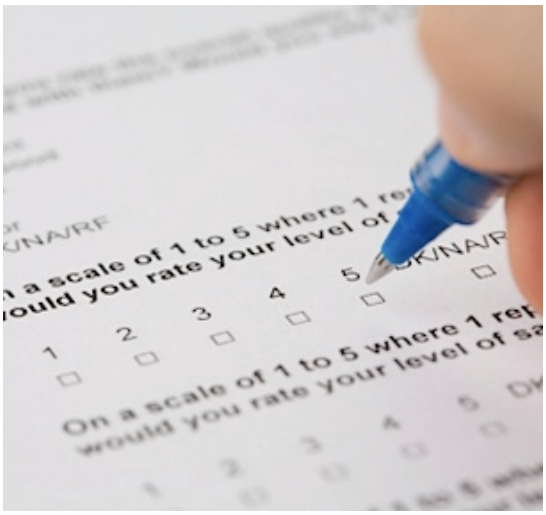
Benchmarks from meta-analyses
Socio-economic background: 1%
General intelligence: 4%
Conscientiousness: 7%
High school scores: 16%
Class attendance: 17%

Media Multitasking ⟶ Cognitive control

Premise

Chronic media multitasking may, over time, train attention to be distributed broadly, allowing cues from our environment to dictate our attentional focus.

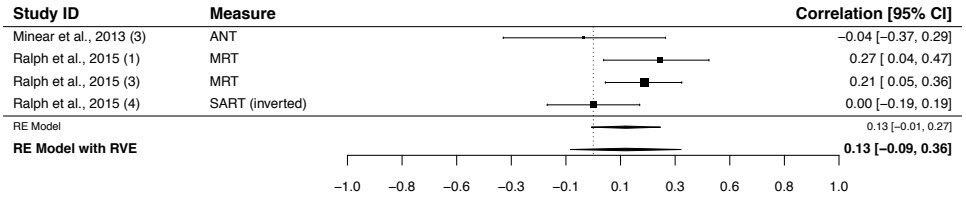
Measuring cognitive control



Performance-based measures

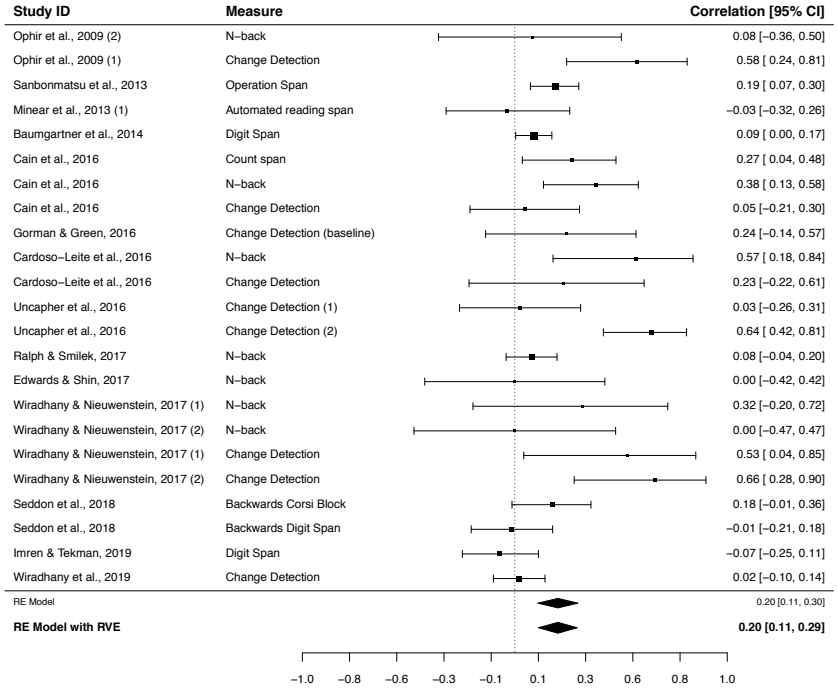
Performance-based measures of sustained attention

Effect sizes (Fisher's z)



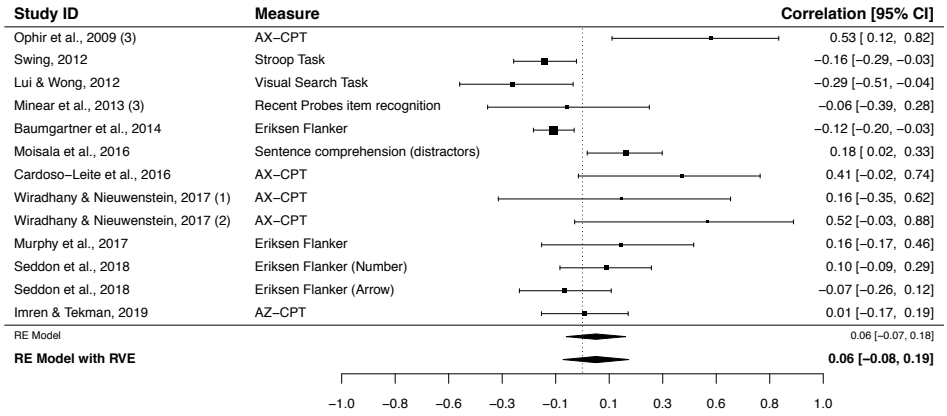
Performance-based measures of working memory

Effect sizes (Fisher's z)



Performance-based measures of interference management

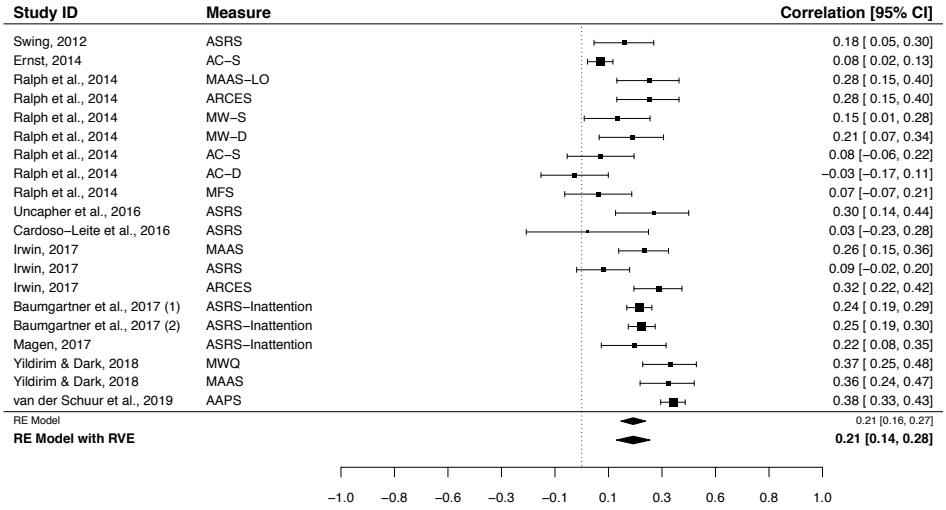
Effect sizes (Fisher's z)

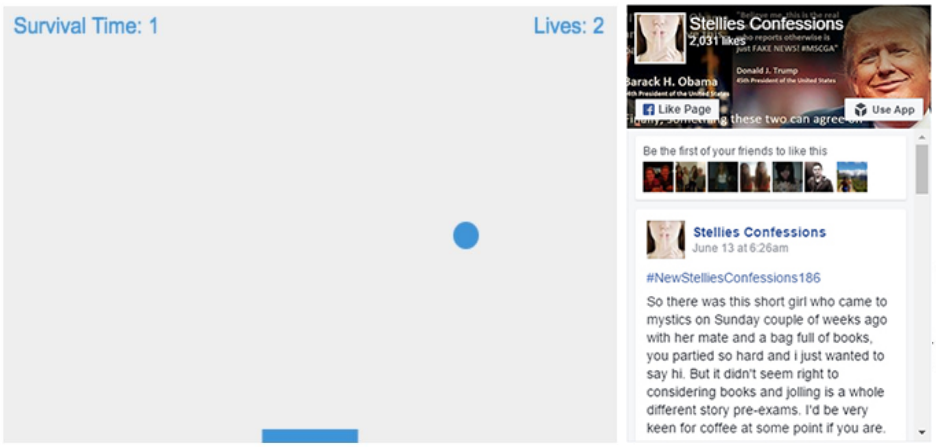


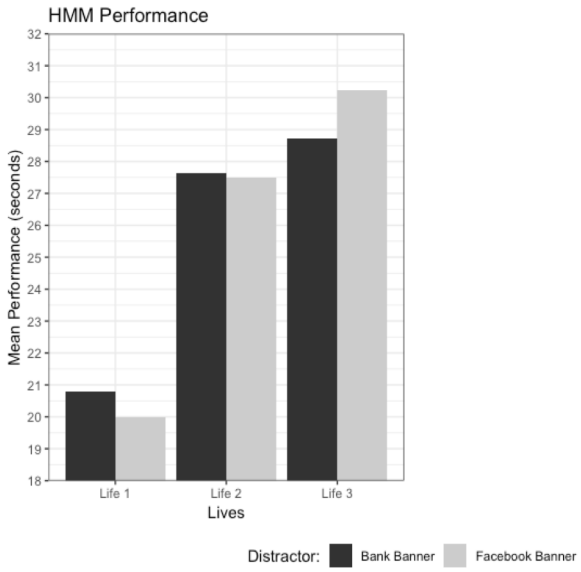
Self-report measures

Self-report measures of sustained attention

Effect sizes (Fisher's z)

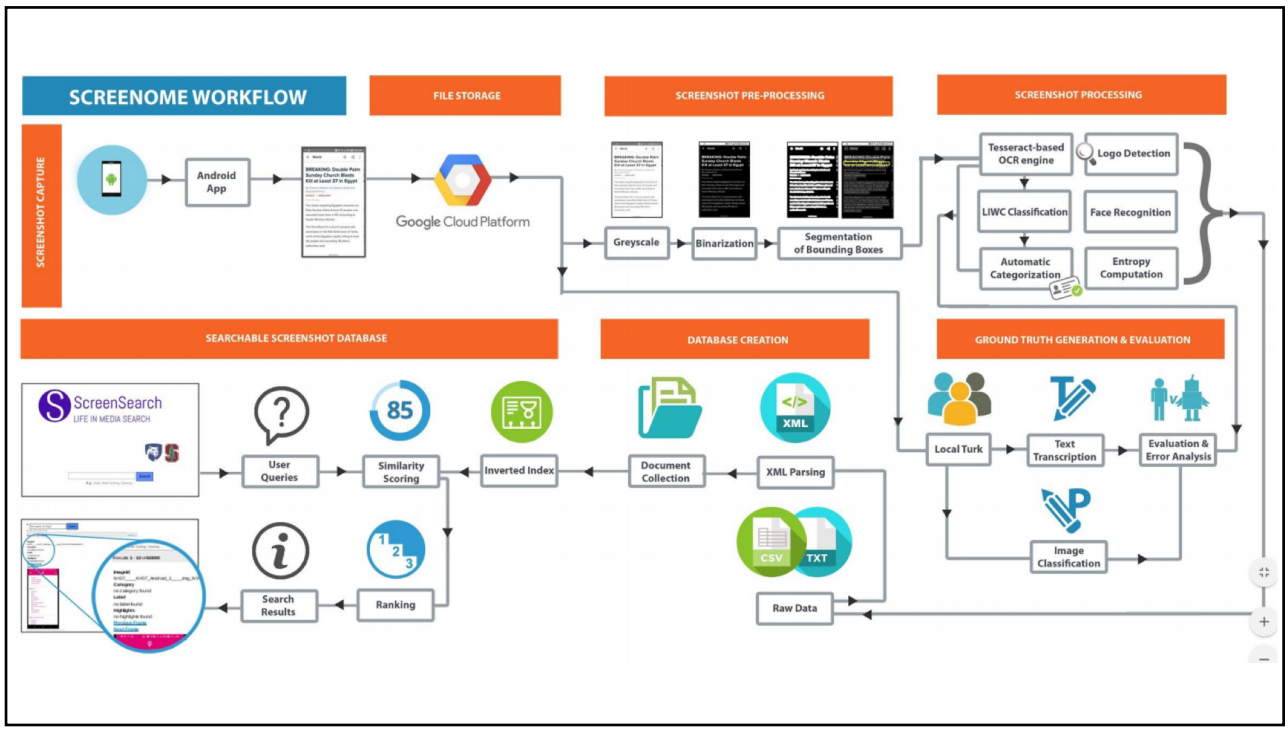


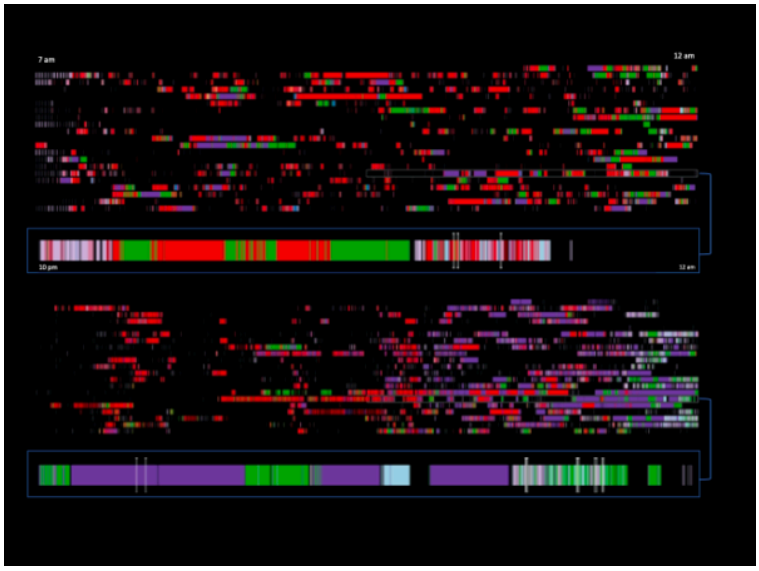




Interpretations of the evidence

- Direction of causality
- Motivation vs Ability to direct attention
- If the relationship is causal, what is the nature of the mechanisms
- Getting textured data – see https://screenomics.stanford.edu/





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