

## Technology and its effects Inside the screenage brain

John Royce  
Robert College of Istanbul

After an idea by Coralie Clark  
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ECIS November Conference 2011

## Current understanding ...

### The NEURO-PLASTIC brain

- changes throughout life
- can continue developing, even into old age
- may lose what we do not use
- can *sometimes* compensate for what is lost

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## TECHNOLOGY AND ITS EFFECTS – INSIDE THE SCREENAGE BRAIN

Technology is increasingly used inside and outside the classroom. Many welcome the trend. Many feel disquiet. One thing seems clear: technology is not going to go away.

In this session, current research and anecdotal evidence on the effects of technology use will be shared, with special focus on reading and learning. Participants are encouraged to share their concerns, approaches and solutions.

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## Watson : screenage...

- Children as young as 5 spend an average 6 hours every day in front of a screen.
- In the UK, between ages 10 and 11, average child spends 900 hours at school, 1,300 hours with family, 2,000 hours in front of a screen.
- In the US, 8 to 18 year-olds spend an average 11 hours a day in front of a screen (television, computer, cellphone, iPod) – often two or more screens simultaneously.

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## What we used to think...

### The BRAIN ...

- developed through childhood and into puberty
- stopped developing in late teens
- then began dying, losing cells, unstoppable and irreplaceable

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## Multi-screen viewing (UK)



The screenshot shows a PDF document viewer displaying an abstract from the International Journal of Behavioral Nutrition and Physical Activity. The abstract title is "I'm on it 24/7 at the moment": A qualitative examination of multi-screen viewing behaviours among UK 10-11 year olds. The authors listed are Russell Jago, Simon J Sebire, Trish Gorely, Itziar Cillero, and Stuart JH Biddle. The abstract text begins with "Background: Screen-viewing has been associated with increased body mass, increased risk of metabolic syndrome and lower psychological well-being among children and adolescents. There is a shortage of information about the nature of contemporary screen-viewing amongst children especially given the rapid advances in screen-viewing."

Russell Jago, Simon J Sebire, Trish Gorely, Itziar Cillero, Stuart JH Biddle  
International Journal of Behavioral Nutrition and Physical Activity 2011, 8:85 (3 August 2011). <<http://www.ijbnpa.org/content/pdf/1479-5868-8-85.pdf>>

## Multi-screen multi-tasking

(Tapscott, p. 44)

Visiting his son at Amherst College, MA:

- 5 in one room, each with a laptop,
- Watching 3 televisions, set to sports, news, sitcom
- Talking, playing a game they had just invented
- Something comes up on one of the 3 tvs – they race (on laptops) to be the first to answer
- During any of the all this activity, one might cell-phone or SMS a friend

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10,000 survey  
respondents  
and interviews

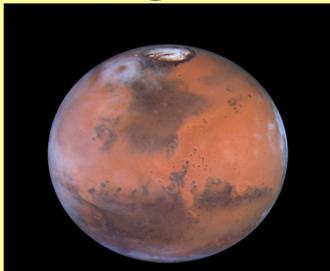
"Demonstrates the world-changing power of the Net Generation.  
If you want to understand their impact, read this book."  
-Eric Schmidt, Chairman and CEO, Google

# grown up digital



DON TAPSCOTT  
bestselling author of *growing up digital* and *wikinomics*

# W\*O\*W\*!



Picture: HubbleSite Picture Gallery : Mars Image Centered Near Location of  
Pathfinder Landing Site <[http://imgsrc.hubblesite.org/hu/db/images/hs-1999-27-b-full\\_jpg.jpg](http://imgsrc.hubblesite.org/hu/db/images/hs-1999-27-b-full_jpg.jpg)>

Story: Don Tapscott, Grown up digital: how the net generation is changing your  
world, p. 20

## NetGen (Tapscott)

- comfortable with technology
- speed round web pages
- ever moving on to the next link / next tab
- multitasking
  - plugged into iPods,
  - making notes on a cell phone
  - texting a friend
  - .....

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## Alan Kay

Technology is "technology only for people  
who are born before it was invented."

cited by Don Tapscott, p. 19

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## Tapscott : the dark side – myths? 1

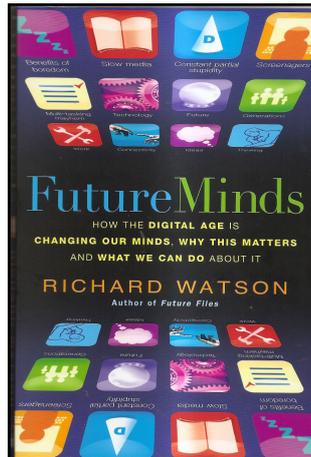
- They're dumber than we were at their age.
- They're screenagers, Net-addicted, losing their social skills, and they have no time for sports or healthy activities.
- They have no shame.
- Because their parents have coddled them, they are adrift in the world and afraid to choose a path.

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## Tapscott : the dark side – myths? 2

- They steal.
- They're bullying their friends online.
- They're violent.
- They have no work ethic and will be bad employees.
- This is the latest narcissistic "me" generation.
- They don't give a damn.

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Interpretation of  
many many  
research studies  
– in the lab

## Tapscott : the eight Net Gen norms

- Freedom
- Customization
- Scrutiny
- Integrity
- Collaboration
- Entertainment
- Speed
- Innovation

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## Watson : 10 ways screenagers are thinking differently (1)

- Screenagers prefer multitasking, parallel processing, and personalized experiences, read text in a non-linear fashion, and prefer images over words.
- Memory is something found on a hard drive. If they need information they Google it.
- The ability to create, personalize, and distribute information easily is creating more of a focus on the self.

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## Screenagers

- Teens are impatient, soon bored, quick to move from one window to another
- Do not read deeply, cannot read long passages
- Sometimes do not see the information they seek, even when it's there

Nielsen (2005)

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## Watson : 10 ways screenagers are thinking differently (2)

- Screenagers frequently use digital devices to avoid confrontation and commitment.
- Virtualization is removing the necessity for direct human contact...
- The reset generation thinks that if something goes wrong they can always press a button and start again.
- The digital generation demands sensory-laden environments, instant response, and frequent praise and reward.

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## Watson : 10 ways screenagers are thinking differently (3)

- Screenagers live in the now and everything is just gr8, although they may be less literate and numerate than their forebears.
- The screenage brain is hyper-alert to multiple streams of information, although attention and understanding can be shallow.
- The screenage brain is agile but is often ignorant of wider context and culture.

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Free vitamins given in bid to halt rise of rickets in Cardiff

by Madeleine Brindley, South Wales Echo | Aug 22 2011

ALMOST 10,000 courses of free vitamins have been handed out in Cardiff in a bid to address widespread vitamin D deficiency.

The pilot project, which will run until December, comes after there have been six new cases of rickets diagnosed in the city in the past two years.

Rickets – a disease chronic lack of vitamin D – is a disease normally associated with Victorian Britain – is caused by a chronic lack of vitamin D and can result in bone deformities.

But Cardiff dieticians said anecdotal evidence suggests large numbers of children are not getting enough vitamin D.

The main source is sunlight – exposure to short bursts of sun allows the body to produce the essential nutrient. But it is feared children's love of computer games, coupled with increased sun safety awareness and cultural reasons means children are not getting enough.

Helen Nicholls, the community dietetics service manager at Cardiff and Vale University Health Board, which runs the Cardiff Vitamins Pilot, said "It's not just that there have been cases of rickets, it's also this wider deficiency of vitamin D."

Large numbers of Welsh children could be in danger of developing rickets' Aug 22 2011

\*Childhood is when you lay down health bone and healthy bone density. Many

Madeleine Brindley. Free vitamins given in bid to halt rise of rickets in Cardiff. *South Wales Echo*, Aug 22 2011, *Wales online*. <http://www.walesonline.co.uk/cardiffonline/cardiff-news/2011/08/22/free-vitamins-given-in-bid-to-halt-rise-of-rickets-in-cardiff-91466->

**The Telegraph**

Children being taught how to climb trees

Once climbing a tree came naturally to children, now they are being lessons in how to do it.



Hanging out: climbing to the tops of trees is hard work, but worth it in the end. Photo: HEATHCLIFF O'MALLEY

By David Milward (<http://www.telegraph.co.uk/journalists/david-milward/>)  
5:21PM BST 11 Aug 2011  
145 followers

<http://www.telegraph.co.uk/news/uknews/8696167/Children-being-taught-how-to-climb-trees.html>

## Talking points

- What examples?
  - What you know / have read / have seen?
- What fears?
- What hopes?

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Social websites harm children's brains: Chilling warning to parents from top neuroscientist | Mail Online - Mozilla Firefox

http://www.dailymail.co.uk/news/article-1153583/Social-websites-harm-childrens-brain

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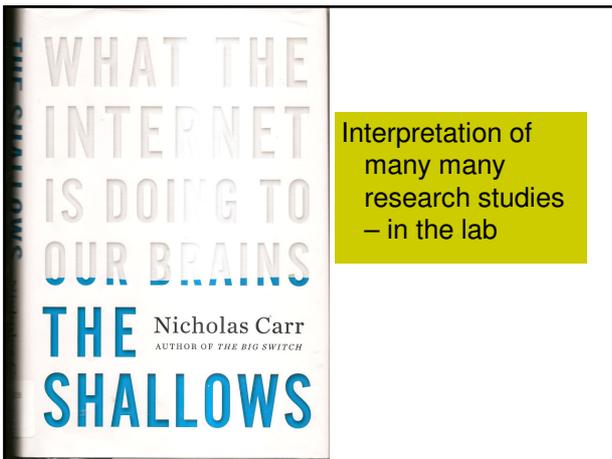
**Social websites harm children's brains: Chilling warning to parents from top neuroscientist**

By DAVID GEBY/SHARE  
Last updated at 1:45 AM on 24th February 2009

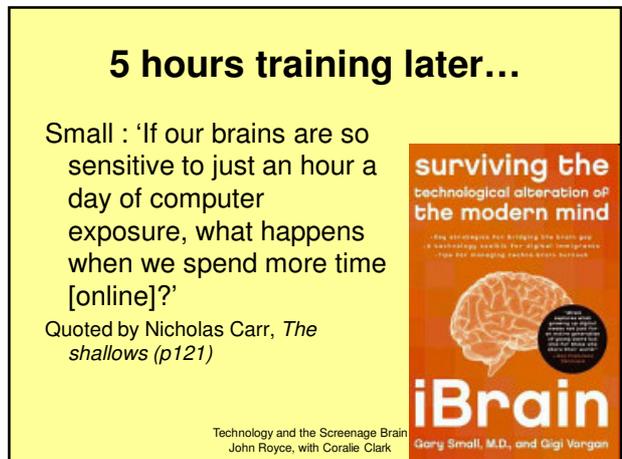
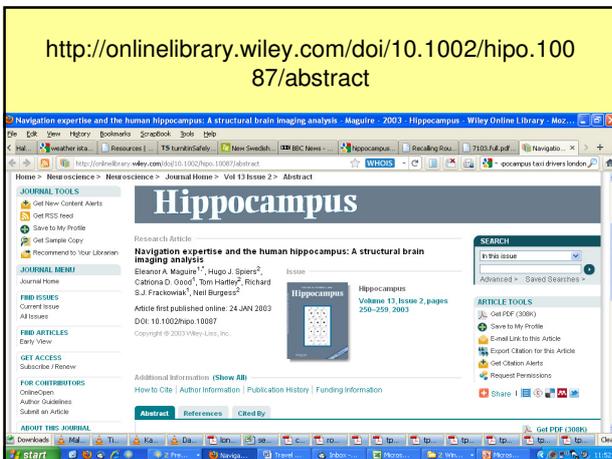
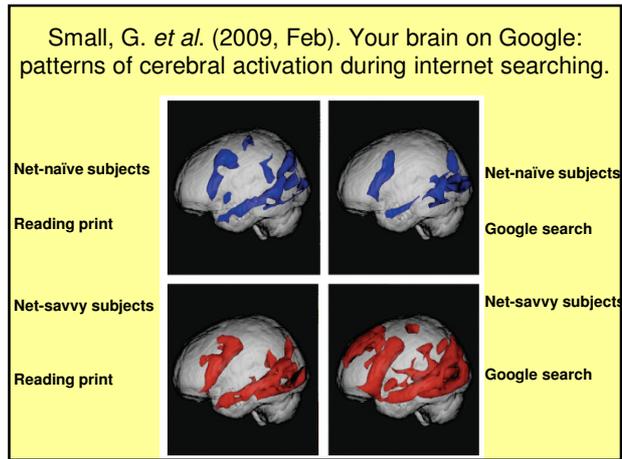
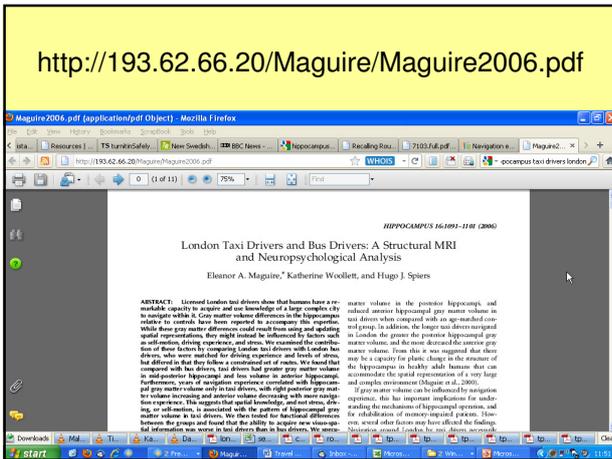
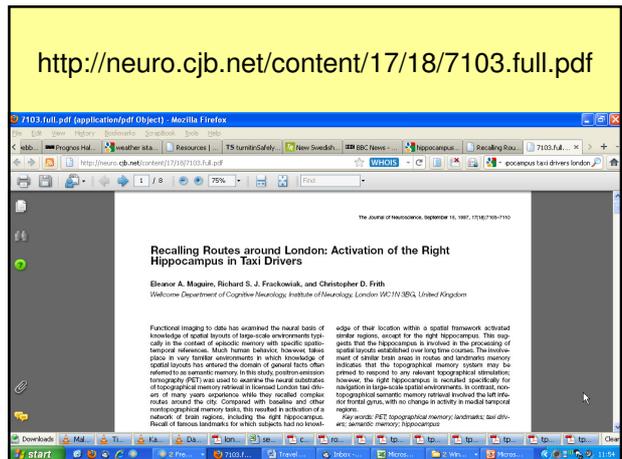
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Social networking websites are causing alarming changes in the brains of young users, an eminent scientist has warned.

Sites such as Facebook, Twitter and Bebo are said to shorten attention spans, encourage instant gratification and make young people more self-centred.



Interpretation of many many research studies – in the lab



## Get lost!

When is the last time YOU  
got lost in a book?

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## Digital text, hypertext & multitasking

An ever-growing number of studies  
suggest that our brains **cannot**  
successfully multitask – especially  
when handling non-automatic tasks.

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John Royce, with Coralie Clark

Nicholas Carr, *The shallows*, p. 90

“All reading,’ writes Anne Mangen ... is  
'multi-sensory.' There's a 'crucial link'  
between 'the sensory-motor  
experience of the materiality' of a  
written work and the 'cognitive  
processing of the text content.'  
(Mangen, 2008)

(continued...)

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## Crenshaw's challenge (2011)

### Multitasking is worse than a lie

1 2 345 ..... 252627

Crenshaw, D. (2011). Think you're good at multitasking? Take this test.

<http://www.youtube.com/watch?v=HHQv1Kdpl-8>

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“The shift from paper to screen doesn't  
just change the way we navigate a  
piece of writing. It also influences the  
degree of attention we devote to it  
and our immersion in it.”

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genM: The Multitasking Generation  
By CLAUDIA WALLIS Monday, Mar 27, 2006

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A first grader in Pennsylvania uses a fingerprint scanner to pay for lunch.  
William Thomas Cain / AFP / Getty

It's 9:30 p.m., and Stephen and Georgina Cox know exactly where their children are. Well, their bodies, at least. Piers, 14, is huddled up in his bedroom—eyes fixed on his computer screen—where he has been logged onto a MySpace chat room and AOL Instant Messenger (IM) for the past three hours. His twin sister Bronie is planted in the living room, having commandeered her dad's iMac—as usual. She, too, is busily IM'ing, while chatting

91171117469600.html  
http://www.time.com/time/magazine/article/0,9171,1174696,00.html

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Take off

genM: The Multitasking Generation

“... the ability to multiprocess has its limits, even among young adults. When people try to perform two or more related tasks either at the same time or alternating rapidly between them, errors go way up, and it takes far longer--often double the time or more--to get the jobs done than if they were done sequentially, says David E. Meyer, director of the Brain, Cognition and Action Laboratory at the University of Michigan...”

Wallis (2006)

**Multi-Tasking Adversely Affects Brain's Learning**

ScienceDaily

**Multi-Tasking Adversely Affects Brain's Learning, UCLA Psychologists Report**

<http://www.sciencedaily.com/releases/2006/07/060726083302.htm>

Multitasking Brain Divides And Conquers, To A Point

by JON HAMILTON

Listen to the Story

EarthShare

<http://www.npr.org/templates/story/story.php?storyId=126018984>

Our brains are set up to do two things at once, but not three, a French team reports in the journal Science.

The researchers reached that conclusion after studying an area of the brain involved in goals and rewards. Their experiment tested people's abilities to accomplish up to three mental tasks at the same time. The tasks involved matching letters in different ways, and for incentive, participants were paid up to a euro for doing a task perfectly.

When volunteers were doing just one task, there was activity in goal-oriented areas of both frontal lobes, says Etienne Koechlin, a professor at the Ecole Normale Supérieure in Paris. That suggested that the two sides of the brain were working together to get the job done, he says.

But when people took on a second task, the lobes divided

It's a really great read.

Reading on iPad is just like reading a book. You hold iPad like a book and flip the pages like a book. And you do it all with your hands — just like a book. But once you tap open the first page, you'll see it's nothing like a book. Read one page at a time in portrait. Or turn iPad on its side and view two pages at once. Either way you look at it, the bright LED-backlit display brings crisp and colorful detail to every page, without using illumination. So illustrations and images — and brilliant writing — appear just as the author intended.

<http://www.apple.com/ipad/built-in-apps/ibooks.html>

Multitasking Brain Divides And Conquers, To A Point

“They offered people rewards to do three things at once.”

“And when people started a third task, one of the original goals disappeared from their brains, Koechlin says. Also people slowed down and made many more mistakes.”

most pop Hamilton (2010)

“Just like reading a book”?

Mangen (2008) – points to studies (10, all published in the last 10 years) which show that we read digital text “in a shallower, less focused way.”

“We tend to scan text on screen. Such a reading mode is highly vulnerable to distractions, particularly when these distractions are as easily available as a click with the mouse.”

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## Hypertext

“The most basic feature of hypertext, of course, is its *nonlinear structure* ...

“... information within a hypertext may be retrieved in a sequence specified by each user.”

Shapiro & Niederhauser (2004)

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## The Web is **all** about hyperlinks



Freefoto.com. Spider's web. <<http://www.freefoto.com/download/01-17-2/Spiders-Web>>

Jakob Nielsen's Alertbox, September 12, 2011

### How Long Do Users Stay on Web Pages?

#### Summary:

Users often leave Web pages in 10–20 seconds, but pages with a clear value proposition can hold people's attention for much longer because visit-durations follow a negative Weibull distribution.

How long will users stay on a Web page before leaving? It's a perennial question, yet the answer has always been the same:

- Not very long.

The average page visit lasts a little less than a minute.

As users rush through Web pages, they have [time to read only a quarter of the text](#) on the pages they actually visit (let alone all those they don't). So, unless your writing is extraordinarily clear and focused, little of what you say on your website will get through to customers.

However, while users are always in a hurry on the Web, the time they spend on individual page visits varies widely: sometimes people [bounce away](#) immediately, other times they linger for far longer than a minute. Given this, [the average is not the most fruitful way of analyzing user behaviors](#). Users are human beings — their [behaviors are highly variable](#) and are [not captured fully by a single number](#).

#### Leaving Web Pages: The Weibull Hazard Function

<http://www.useit.com/alertbox/page-abandonment-time.html>

## Screen reading

- Text with fewer hyperlinks is better remembered and understood than text with many hyperlinks
- Text-only screen readers scored better than those with text and audiovisual material
- CNN study
  - Group 1 suffered distraction / lacked concentration
  - Group 2 remembered more, understood more.
- DeStefano and LeFevre (2005)
- Rockwell and Singleton (2007)
- Bergen and others (2005)

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## Hypertext

“Specifically, the learner must now monitor to a greater extent whether he or she understands what has been read, determine whether information must be sought to close information gaps, and decide where to look for that information in the text. In short, **there are greater metacognitive demands on the reader during HAL.**”

Shapiro & Niederhauser (2004)

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## Some do read more, electronically

“My reading habits have indeed changed and, if anything, I'm reading more than ever... I can read serially on the run -flipping between books as mood or need dictates- with hundreds of books in hand ... I'm buying books just as frequently, but they're eBooks.”

Moon (2010).

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## Some do read more, electronically

'But the biggest impact has been in encouraging children to swap books. Bluetooth technology allows the handheld readers to connect to each other, so pupils can "beam" books they think are "sick", or cool, to as many as six others at a time.

'Normally you can only get them to do two or three book reviews in a half- term, but now they are beaming books across to their friends, they are reading a lot more,' says Mr Welton.'

Morrison (2009)

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## Santana's study (2011) comprehension and memory

- Review of the literature, includes....
    - print readers remember more than online readers.
      - Adam et al (2007) – Eyetrack study
    - text only or text and still pictures are remembered better than stories with video clips
      - Pippis et al (2009) : online news
- And many more studies with similar findings*

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**Shafer, J. Print vs. Online. Slate 19 Aug 2011.**  
[http://www.slate.com/articles/news\\_and\\_politics/press\\_box/2011/08/print\\_vs\\_online.single.html](http://www.slate.com/articles/news_and_politics/press_box/2011/08/print_vs_online.single.html)

## Santana's study (2011) Medium Matters

Santana et al's own study concluded:

"print readers ... remember significantly more news stories than online news."

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## Print vs. Online

"While it's a joy to carry 25 editions of *The New Yorker* and whole libraries of books on an iPad, for real reading satisfaction I still reach for the print editions.

"I still find it difficult to finish any newspaper story longer than 1,000 words on a computer screen. I either find a copy of the newspaper or, failing that, print it out."

Shafer (2011).

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## Generational differences?

	Group A	Group B
TEXT 1	Screen first	Print first
TEXT 2	Print first	Screen first

**Comprehension : no significant difference**  
**Reading speed : screen readers read 10% faster than print readers**

**Kaye (2011) testing 14 – 17 year-old students**  
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## A passing thought ...

WHAT are the implications for IB e-marking?

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Nicholas Carr, *The shallows*, p. 122/3

Notes Johnson's study which suggests that computer use 'provides more intense mental stimulation than does book reading.'

(Similar finding to Gary Small's Google study, cited earlier)

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## Brain research – addiction?

- When kids do something they like, the brain receives a blast of dopamine in the prefrontal cortex.
- Too much dopamine can reduce ability to reason.
- "Electronic euphoria thus creates fewer possibilities and less opportunity to develop an original mind.

Watson (p.2), citing Susan Greenfield's research

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Nicholas Carr, *The shallows*, p.122/3

"It is the very fact that book reading 'understimulates the senses' that makes the activity so intellectually rewarding. By allowing us to filter out distractions, to quiet the problem solving functions of the frontal lobes, deep reading becomes a form of deep thinking."

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## Watson on reading

"Reading on a computer screen is fast and is suited to foraging for facts. In contrast, reading on paper is reflective and is better suited to trying to understand an overall argument or concept." (p.3.)

"Deep thinking ... can't be done in a hurry or an environment full of interruptions or hyperlinks. It can't be done in 140 characters. It can't be done in multitasking mayhem." (p.4.)

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## Thinking points

We're not going to stop technology.

- What to do? / what have you already done?
- What to do, using 21<sup>st</sup> century tools rather than (or as well as) the tools we would prefer to use?
- Stopgap techniques for avoiding distraction

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## Nicholas Carr, *The shallows*

Details Christof van Nimwegen's various studies, which suggest that

- when people are given help (by the software) they may become less able, become more reliant on the software.
- When not given help, they learn the rules - and the learning lasts...

**User-friendly software might NOT be in our best interests.**

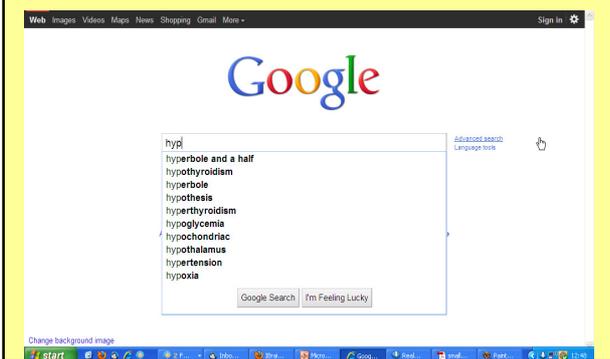
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## Nicholas Carr, *The shallows*

Leads on to thoughts of James Evans' research into citations, and the dangers of the googlification of knowledge – the same resources are increasingly cited because they are increasingly cited  
BUT scholars are also making fewer citations, relying more on less

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## Is Google making us more reliant?

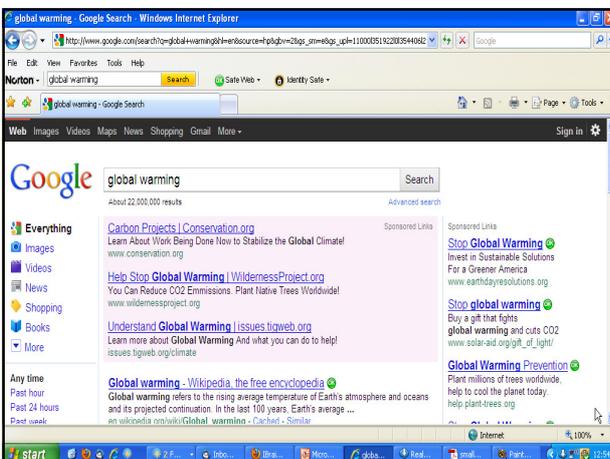


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## The Googlification of knowledge

- Semantic search
- Data and identity theft
- Digital footprints
- Targeted advertising
- Googlified knowledge
  
- Choice, serendipity, analysis, ...?

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## Nicholas Carr, *The shallows*, p. 180

quotes Clive Thompson: "I've almost given up making an effort to remember anything because I can instantly retrieve the information online."

Clive Thompson, "Your Outboard Brain Knows All," *Wired*, October 2007.

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Nicholas Carr, *The shallows*, p. 181

quotes Don Tapscott, "Why should we spend hours in schools memorizing long passages or historical facts when you can look them up in an instant?"

Don Tapscott, *Grown up digital...* p. 115

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KNOWLEDGE  
IS  
POWER

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Nicholas Carr, *The shallows*, p. 180

quotes David Brooks: "I had thought the magic of the information age was that it allowed us to know more, but then I realized the magic of the information age is that it allows us to know less."

David Brooks, "The Outsourced Brain," *New York Times*  
October 26, 2007.

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LACK OF  
KNOWLEDGE  
IS  
?

Technology and the Screenage Brain  
John Royce, with Coralie Clark

attrib. Francis Bacon

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## Technology and its effects

Inside the screenage brain

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The handout can be downloaded from  
<http://read2live.com/ecis-screenage.html>

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