

# **THE SCIENCE OF ATTENTION AND ENGAGEMENT FOR LEARNING**

Julie Dirksen, Usable Learning

# WHO HAS THE MOST BORING TOPIC?



# HYPOTHESIS:

One of the primary responsibilities of Instructional Design is

*the Ruthless Management of Cognitive Load*

Agree?

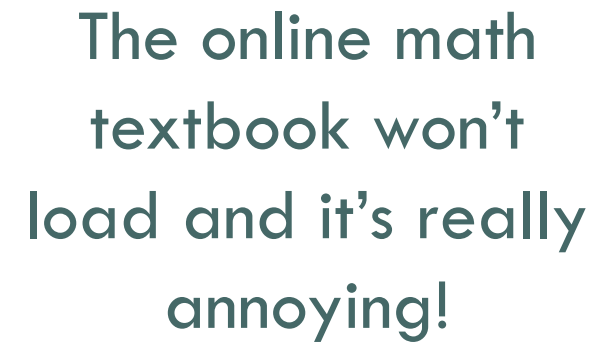
# COGNITIVE LOAD THEORY (SWELLER)

Intrinsic

Germane

Extraneous


$$2 \times 4 = 8$$

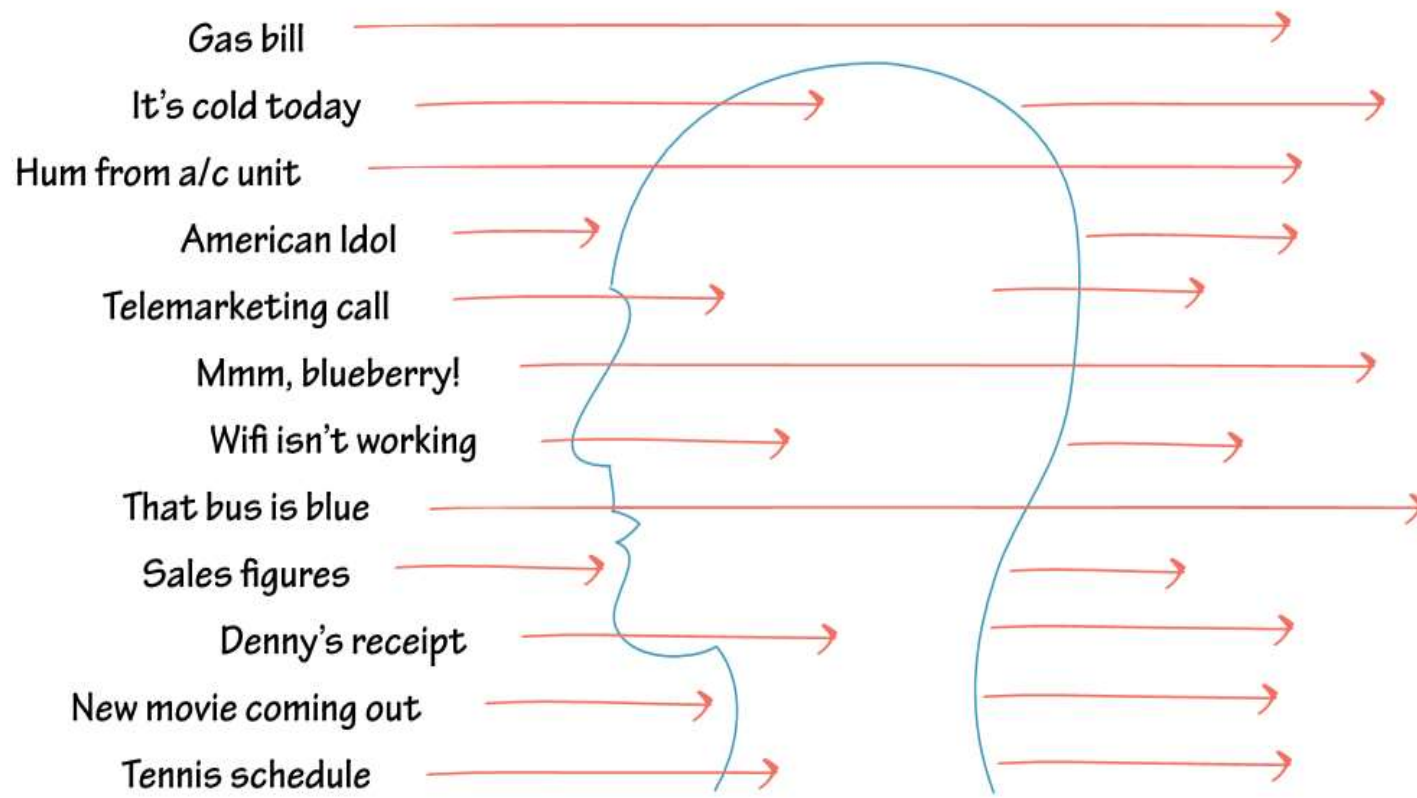


The online math textbook won't load and it's really annoying!

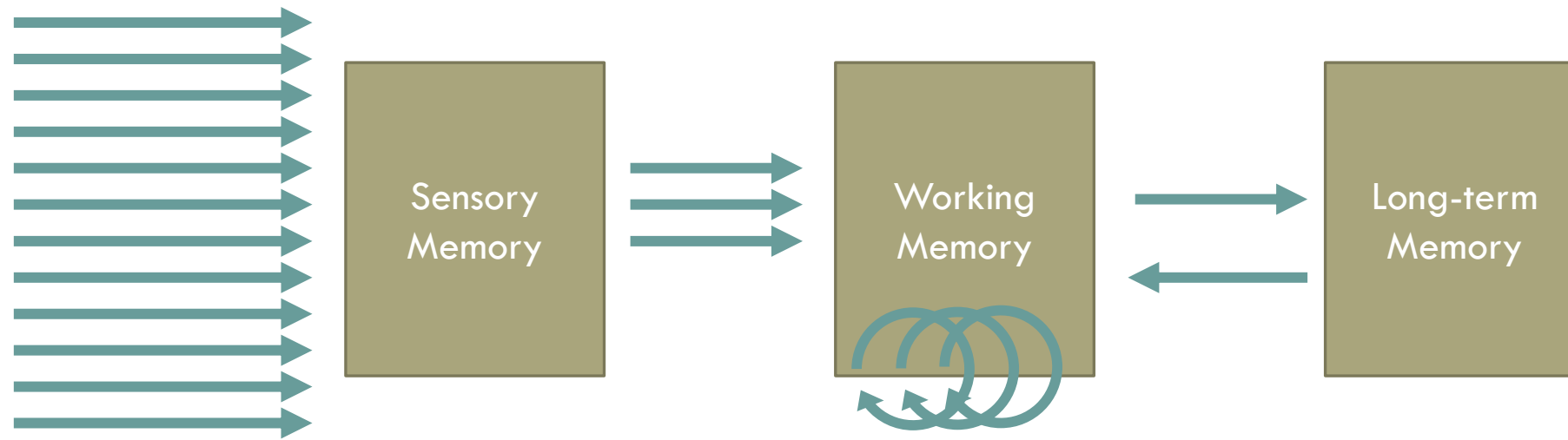
# COGNITIVE LOAD IN ELEARNING



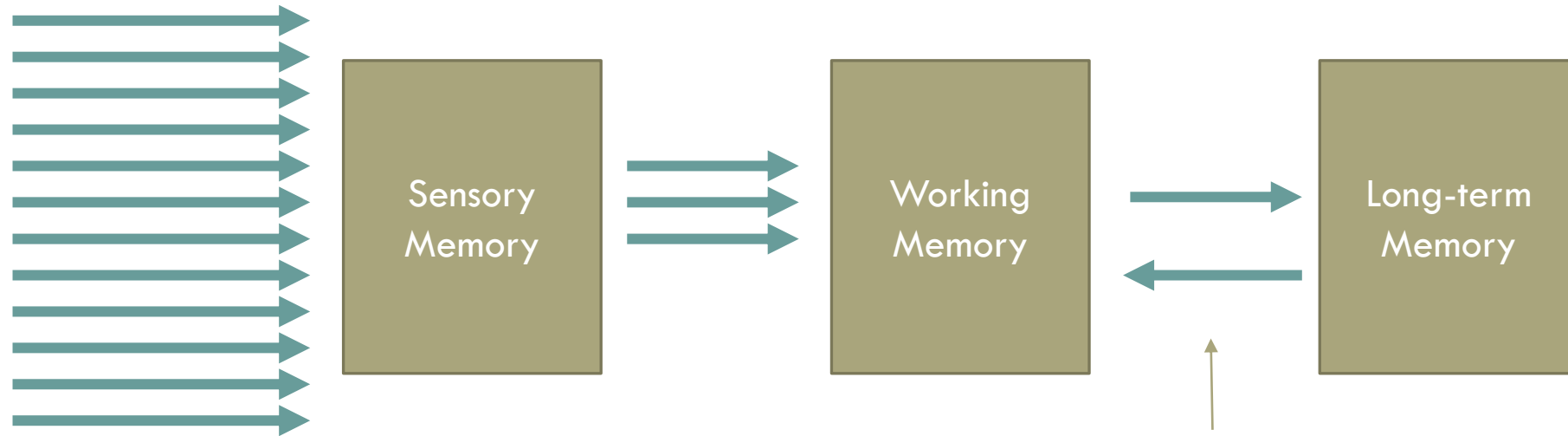
# FLOODED WITH DATA



# INFORMATION PROCESSING MODEL



# WHAT IS THE LAST CAR YOU REMEMBER SEEING?



- Unusual or surprising
- Emotional reaction
- Meaningful or relevant
- Previous experience
- Interacted with
- Repetition



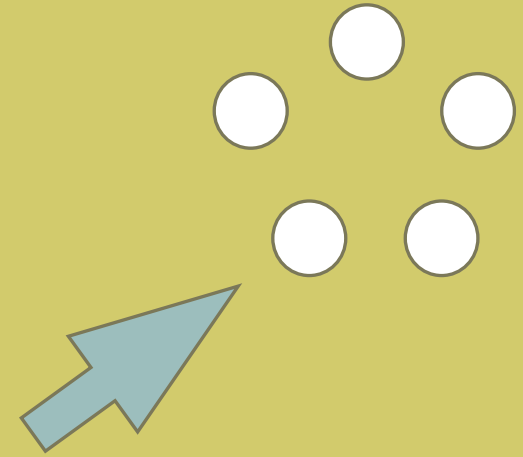
# WE'VE ALL SEEN THIS SLIDE

## Something Really Important

- Not Kirkpatrick:
  - Reaction (participants' opinions)
  - Learning (pre/post test)
  - Behavior (measurable behavior change)
  - Results/ROI (return on investment)
- A quicker and less expensive method to ensure a feedback loop that can be used to assess and improve the training intervention
- Not intended to be a full measure of efficacy
- Qualitative measures of:
  - Retention of information
  - Attitude
  - Anecdotal or Observable behavior change for a small sample size
- Levels 3 & 4 are difficult and costly
  - Require access to the full target audience
  - Measuring behaviors requires extensive and costly observation
  - Difficult to implement without pre-existing organizational performance metrics in place
  - Difficult to attribute due to confounding variables

How does it do?

- Unusual or surprising
- Emotional reaction
- Meaningful or relevant
- Previous experience
- Interacted with
- Repetition



# ATTENTION

A Resource Allocation Problem

# HOW LONG IS THE AVERAGE ATTENTION SPAN?

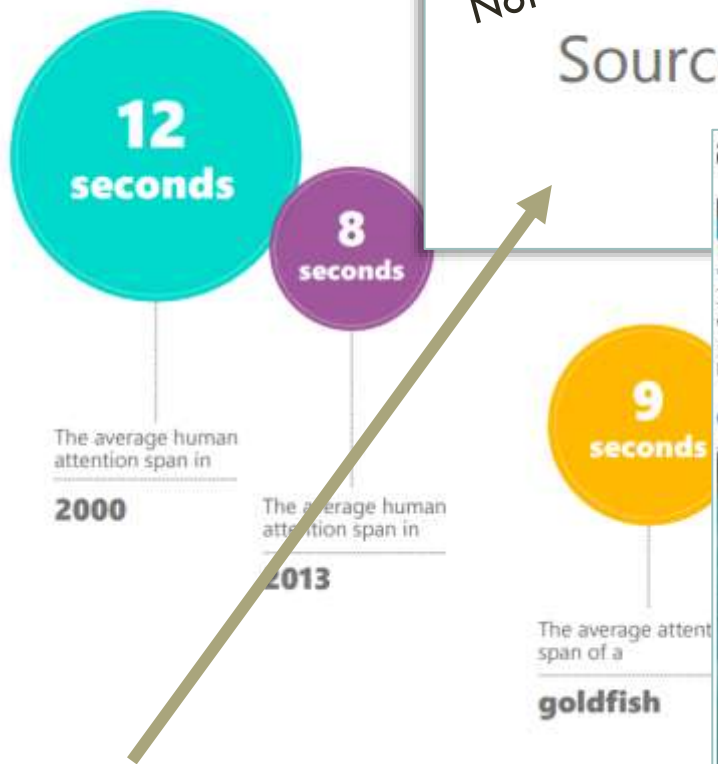
Most of what you've heard is probably **wron**

Microsoft attention span, Spring 2015 | @msadvertising #msattentionspan

Not a verifiable source:

Source: Statistic brain

We know human attention is dwindling



## The Telegraph

Home Video News World Sp  
Politics Investigations Obits  
Science News Dinosaurs Spa  
HOME NEWS SCIENCE SCIENCE N  
Humans have shorter  
to smartphones  
A Microsoft study highlights  
saying it has fallen from 12 s

### You Now H a Goldfish

Kevin McSpadden @KevinMcSp

No longer can we boas

The average attention spa  
seconds, but according to  
generally lose concentrati  
an increasingly digitalized

Researchers in Canada su  
activity of 112 others usin  
that since the year 2000 (i  
average attention span dr

"Heavy multi-screensers fi  
they're more easily distra  
read.

On the positive side, the r  
improved in the mobile ag

Microsoft theorized that t  
adapt and change itself ov

## Microsoft Advertising

How does dig



"We are moving from a world where  
limitless, and where the true scarce c  
The average human attention span is  
shorter than a goldfish).  
With news reduced to 140 character  
way consumers see and interact with  
Are they doing what people have do

## Attention Span Sta



Attention Span Statistics
The average attention span in 2015
The average attention span in 2000
The average attention span of a gold fish
Percent of teens who forget major details of
Percent of people who forget their own birth
Average number of times per hour an office

## The Telegraph

Home Video News World Sport Finance Comment Culture Travel Life Women Fa  
Politics Investigations Obit Education Science Earth Weather Health Royal Calen  
Science News Dinosaurs Space Night Sky Botany Pictures Galleries Science Video

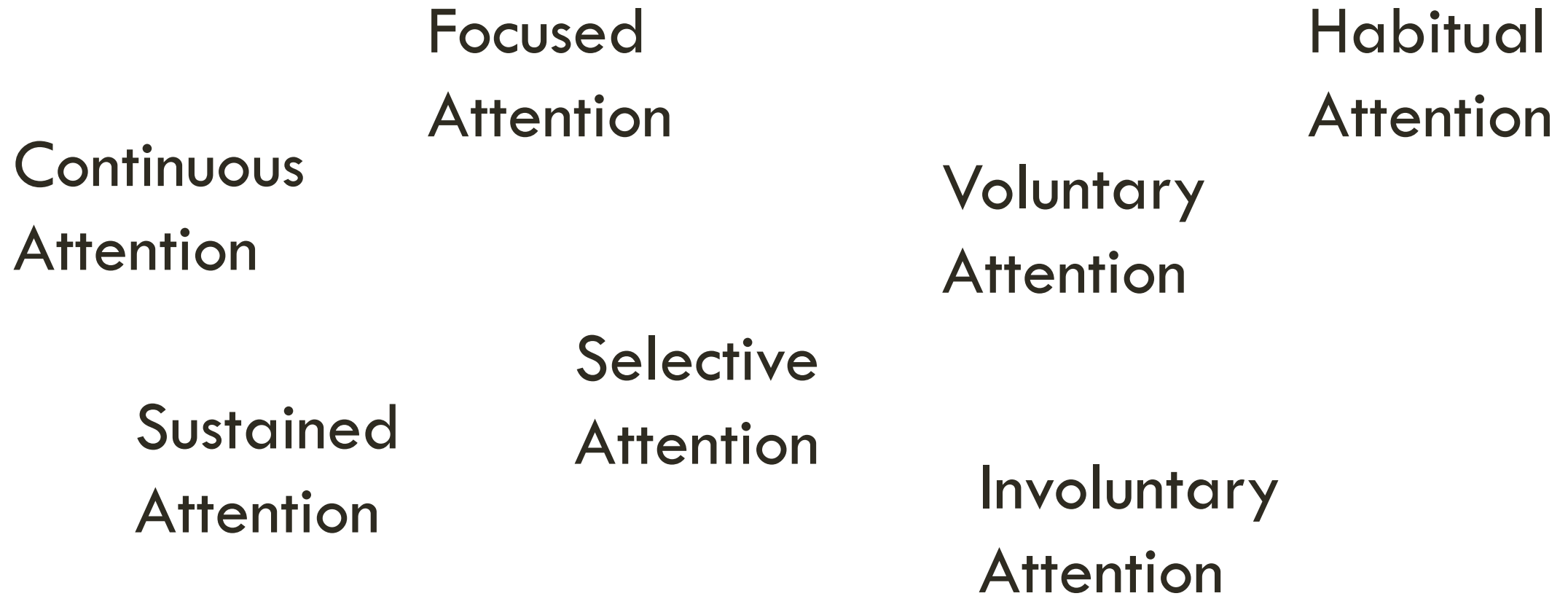
### Memory of a goldfish? Actually fish can recall events 12 days ago

Fish can remember where they found food up to 12 days previously, research by scientists at MacEwan University found



AFRICAN CICHLIDS returned to where they had previously found food. Photo: Alamy

# THERE ISN'T A SINGLE KIND OF "ATTENTION"



# INTERRUPTION OF CONTINUOUS ATTENTION



Reading, reading,  
reading, reading –  
oh look, the sun's out  
– reading reading  
reading – what time  
is it? – reading,  
reading...

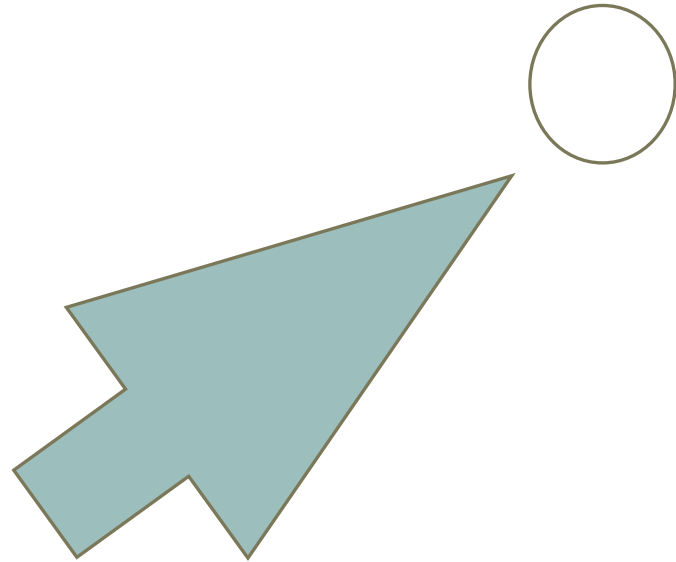
<b>Level</b>	<b>Description</b>
1. Focused Attention (easiest level)	Response to external stimuli.
2. Sustained Attention	Ongoing focus to carry out repetitive tasks.
3. Selective Attention	Staying focused while distractions are present.
4. Alternating Attention	Shifting focus between tasks that need different skills.
5. Divided Attention (most difficult level)	Responding simultaneously to multiple tasks. (May be rapid switching of alternating attention.)

*Sohlberg and Mateer Attention Model, from Patti Shank on Elearning Industry*

# TYPES OF ATTENTION

- **Voluntary** (*I need to read this...*)
- **Involuntary** (*Squirrel!*)
- **Habitual** (*Did you say something? Sorry, I was checking my phone...*)

# VOLUNTARY ATTENTION: WHAT ARE YOU PAYING ATTENTION TO RIGHT NOW?





# WHAT ARE THE CUES?



What are the cues telling you what to pay attention to?

# SOCIAL CUES (OKITA)



The belief that they were interacting with a live person increased arousal, attention and learning.

# CUES DEPEND ON THE AUDIENCE (VOGT & MAGNUSSEN)

What the general population focuses on:

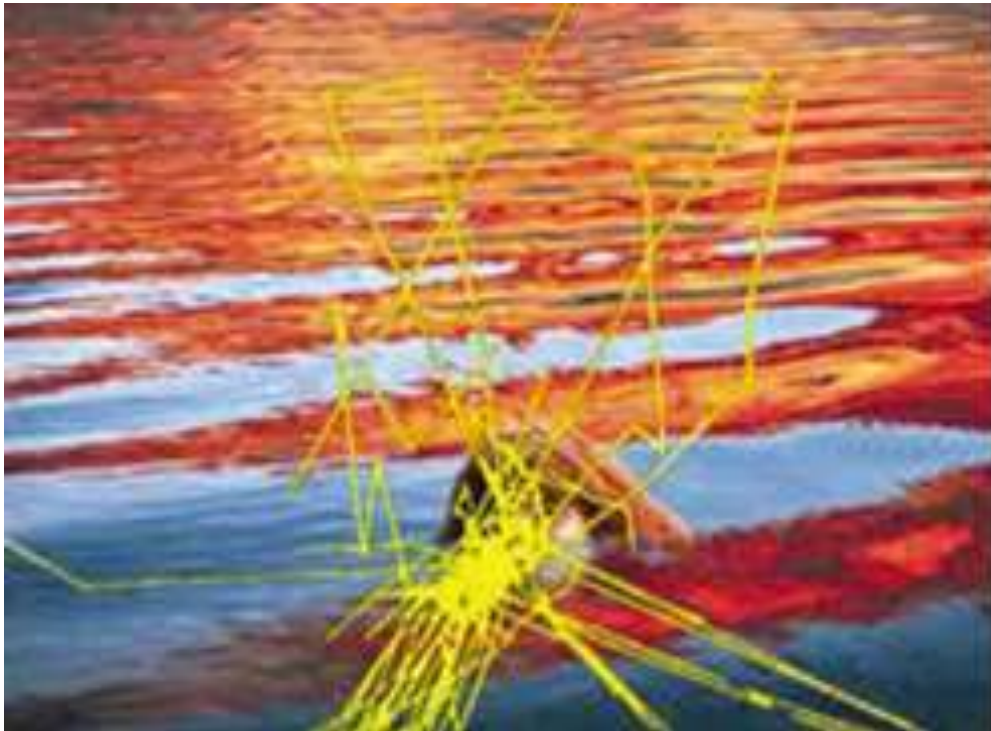


What an artist focuses on:



# CUES DEPEND ON THE AUDIENCE (VOGT & MAGNUSSEN)

What the general population focuses on:



What an artist focuses on:



# MILGRAM — STREET CORNER EXPERIMENT

One person looking up on a street corner drew several other people also looking up

Social Norming



# LET'S COMPARE

Intrinsically motivated attention



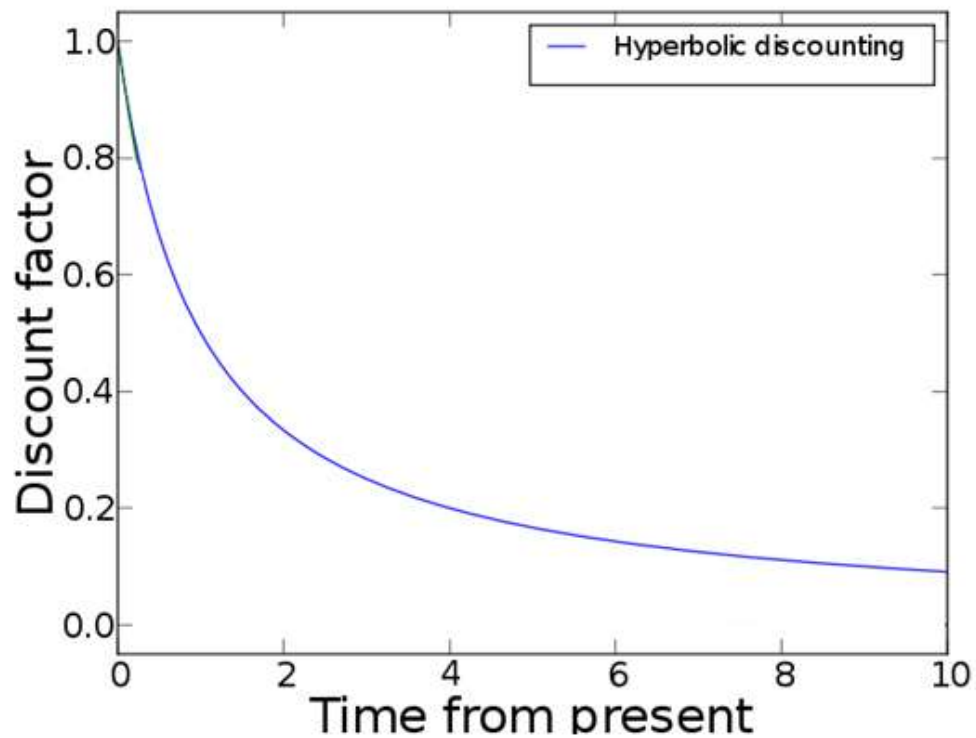
Extrinsically motivated attention

The cover of the 2014 IRS Form 1040 Instructions booklet. The number '1040' is written in large, bold, black font at the top. Below it, the text 'THIS BOOKLET DOES NOT CONTAIN INSTRUCTIONS FOR ANY FORM 1040 SCHEDULES' is printed in a smaller font. To the right of this text, the word 'INSTRUCTIONS' is written in a larger, bold, black font. Below the 'INSTRUCTIONS' text, the year '2014' is written in a large, bold, black font. At the bottom left, there is a small image of an American flag. To the right of the flag, the 'irs e-file' logo is displayed, followed by the text 'makes doing your taxes faster and easier.' Below this, the 'freefile' logo is shown, followed by the text 'is the fast, safe, and free way to prepare and e-file your taxes. See www.irs.gov/freefile.'

# WHICH WOULD YOU RATHER HAVE?



# HYPERBOLIC DISCOUNTING (KAHNEMAN AND TVERSKY)





# CHALLENGE



Who wants to watch a video about printer repair?

# WE CAN FORCE OURSELVES TO PAY ATTENTION, BUT ...

# 1040

THIS BOOKLET DOES NOT CONTAIN INSTRUCTIONS FOR ANY FORM 1040 SCHEDULES

## INSTRUCTIONS



# 2014

**IRS e-file**

makes doing your taxes faster and easier.

**freefile**

is the fast, safe, and free way to prepare and e-file your taxes. See [www.irs.gov/freefile](http://www.irs.gov/freefile).

# NEUROENERGETIC THEORY (KILLEEN)



frontiers  
in Psychology

Personality and Social Psychology

← Archive

## HYPOTHESIS & THEORY ARTICLE

Front. Psychol. 01 July 2013 | <http://dx.doi.org/10.3389/fpsyg.2013.00373>

## Absent without leave; a neuroenergetic theory of mind wandering

Peter R. Killeen\*

Department of Psychology, Arizona State University, Tempe, AZ, USA

Absent minded people are not under the control of task-relevant stimuli. According to the Neuroenergetics Theory of attention (NeT), this lack of control is often due to fatigue of the relevant processing units in the brain caused by insufficient resupply of the neuron's preferred fuel, lactate, from nearby astrocytes. A simple drift model of information processing accounts for response-time statistics in a paradigm often used to study inattention, the Sustained Attention to Response Task (SART). It is suggested that errors and slowing in this fast-paced, response-engaging task may have little to do with inattention. Slower-paced and less response-demanding tasks give greater license for inattention—aka absent-mindedness, mind-wandering. The basic NeT is therefore extended with an ancillary model of attentional drift and recapture. This Markov model, called NEMA, assumes probability  $\lambda$  of lapses of attention from 1 s to the next, and probability  $\alpha$  of drifting back to the attentional state. These parameters measure the strength of attraction back to the task ( $\alpha$ ), or away to competing

“Lack of control is often due to fatigue of the relevant processing units in the brain caused by insufficient resupply of the neuron's preferred fuel, lactate, from nearby astrocytes.”

# DOODLING TO REDUCE ATTENTION DRIFT (ANDRADE)

APPLIED COGNITIVE PSYCHOLOGY  
*Appl. Cognit. Psychol.* (2009)  
Published online in Wiley InterScience  
(www.interscience.wiley.com) DOI: 10.1002/acp.1561

## What Does Doodling do?

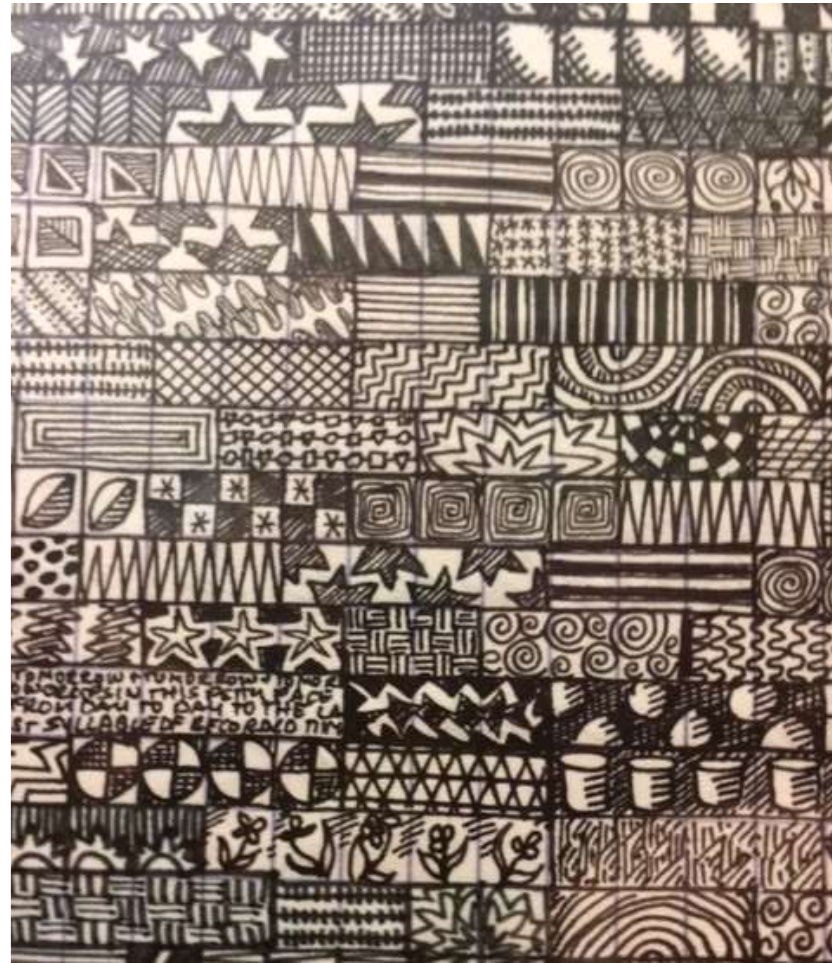
JACKIE ANDRADE\*

*School of Psychology, University of Plymouth, UK*

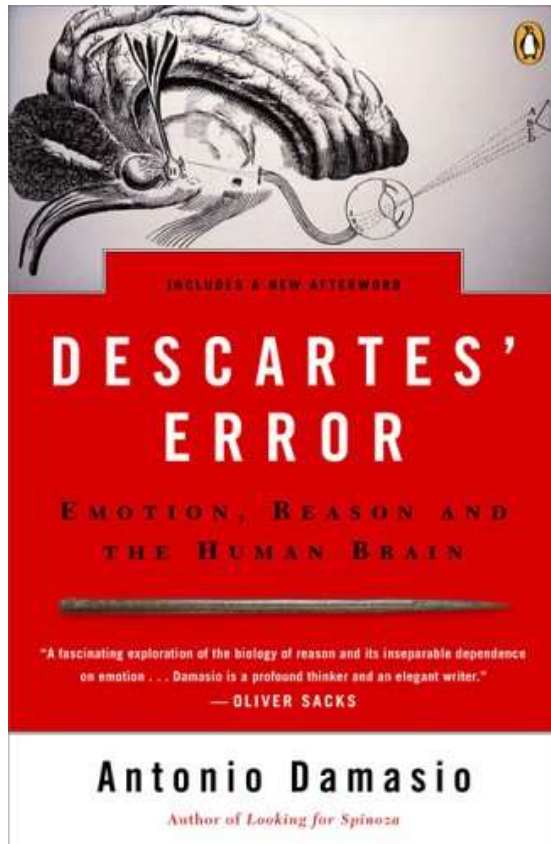
### SUMMARY

Doodling is a way of passing the time when bored by a lecture or telephone call. Does it improve or hinder attention to the primary task? To answer this question, 40 participants monitored a monotonous mock telephone message for the names of people coming to a party. Half of the group was randomly assigned to a 'doodling' condition where they shaded printed shapes while listening to the telephone call. The doodling group performed better on the monitoring task and recalled 29% more information on a surprise memory test. Unlike many dual task situations, doodling while working can be beneficial. Future research could test whether doodling aids cognitive performance by reducing daydreaming. Copyright © 2009 John Wiley & Sons, Ltd.

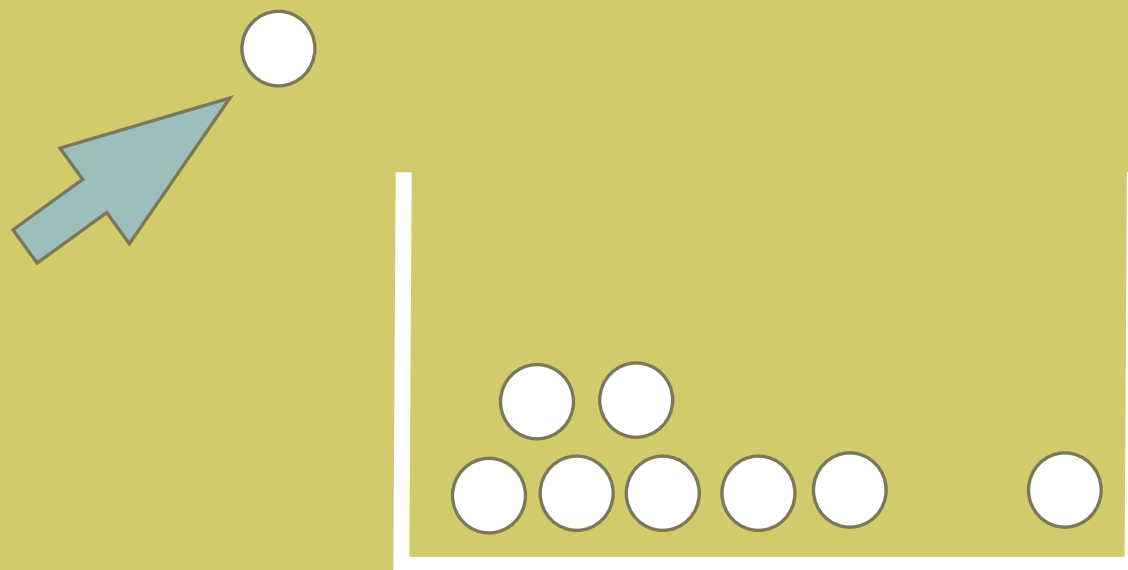
The call centre has put you on hold yet again and you start thinking about how good it would be to have a holiday, where you would like to visit ... then you realize that the person you have been waiting to speak to has already started talking and you have not taken in anything they have said. This scenario illustrates the tendency for daydreaming to start in moments of boredom and, once started, to distract attention from the task in hand. In such a situation some people resort to doodling, aimlessly sketching patterns and figures unrelated to the primary task. It is not known whether doodling impairs performance by detracting resources from the primary task, as would be the case for the most concurrent cognitive tasks or whether it improves performance by aiding concentration (Do & Schallert, 2004) or maintaining arousal (Wilson & Korn, 2007). This question ties into more general issues in cognitive and applied psychology. Boredom is a very common experience (Harris, 2000) and daydreaming is a common response, even in the laboratory (Smallwood & Schooler, 2006). A way of aiding concentration would have implications for psychological research



# SOMATIC MARKERS (DIMASSIO)



Rational Decision Making  
(is probably a myth...)

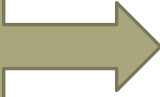


# SO WHAT DO WE DO WITH THIS?

A few suggestions

# RUTHLESSLY REDUCE EXTRANEANOUS LOAD

Extraneous



The screenshot shows a web browser window titled "ESI - Course 3 v2 - Google Chrome". The address bar shows "www.myudutu.com/myudutu/preview/previewcourse.aspx?CourseID=35165". The page has a navigation bar with "YOUR LOGO" on the left and several icons on the right: "exit", "course map", "glossary", "mute", "refresh", "previous", and "next". Below the navigation bar, the page content includes the text "introduction > Where did it go wrong?" and "In this activity, you will identify where errors occurred." There is a photograph of a doctor in a white coat and blue scrubs, holding a clipboard. To the right of the photo, the text reads: "Everything was set up right—the initial assessment was good, the care plan was excellent, and this patient still got a pressure ulcer. Where did it go wrong?"

Intrinsic



# IMPROVE READABILITY

## High text density

A company has recently implemented a self-appraisal system for its annual performance evaluations. All employees are required to attend a classroom learning event that is designed to help them learn about the new system and the tools they should use to conduct and submit the self-appraisals.

### Readability

Passive Sentences	50%
Flesch Reading Ease	40.0
Flesch-Kincaid Grade Level	13.3

## Lower text density / direct speech:

Our company just added a self-appraisal system to help with annual performance reviews.

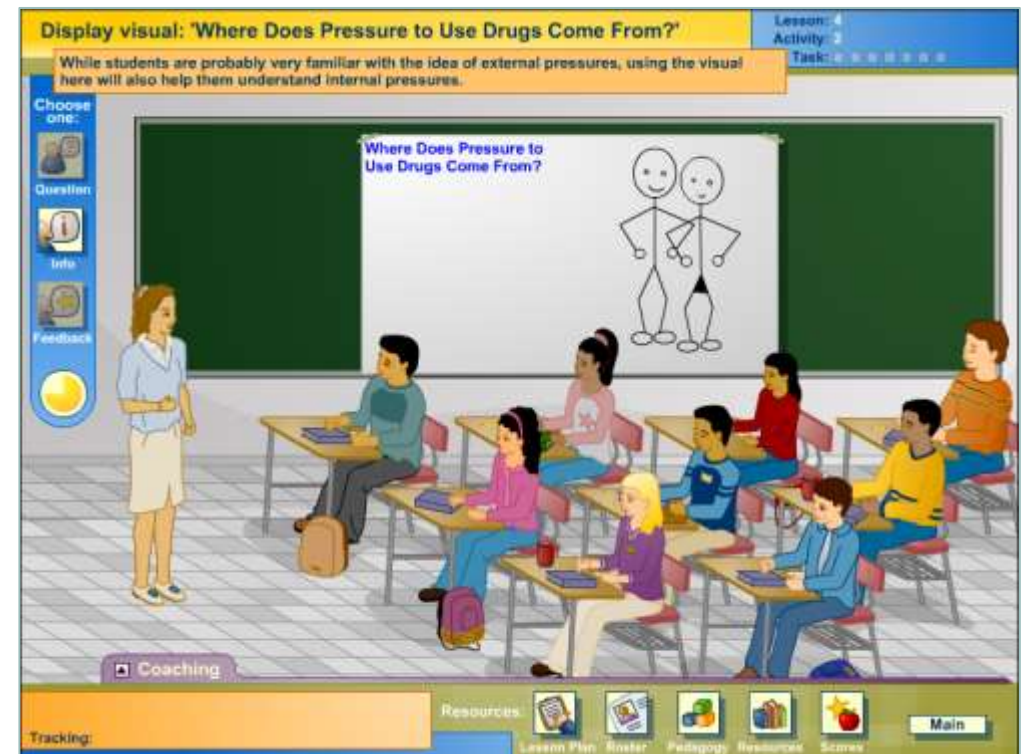
You will attend a class to learn how to use it.

### Readability

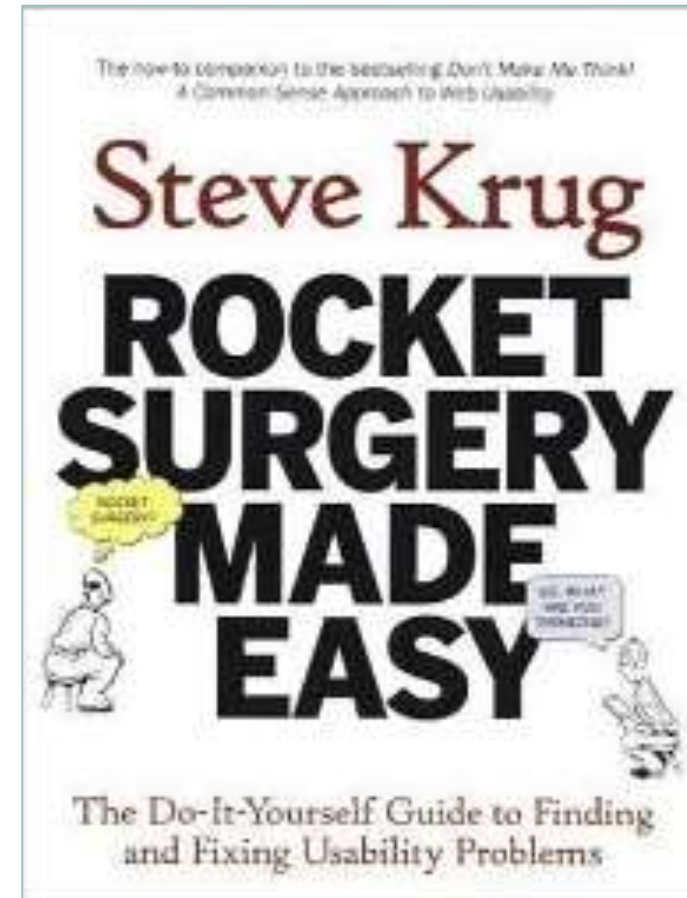
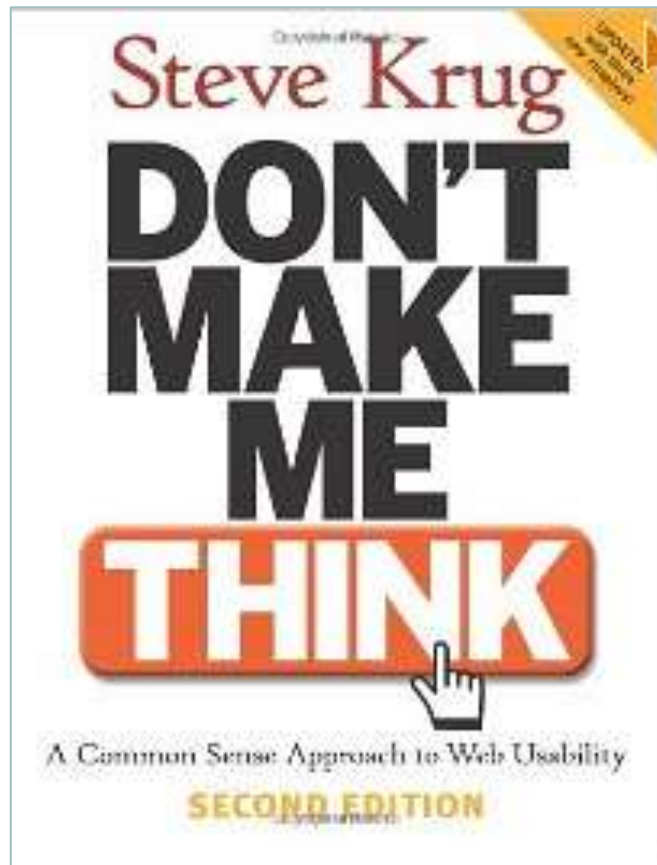
Passive Sentences	25%
Flesch Reading Ease	53.8
Flesch-Kincaid Grade Level	10.2



# USER TEST



# USER TEST



# MAKE CHOICES A BIT EASIER (OR HARDER)



**“in seven weeks, New York Googlers consumed 3.1 million fewer calories from M&Ms”**

Source <http://abcnews.go.com/Health/google-diet-search-giant-overhauled-eating-options-nudge/story?id=18241908>



Sugary drinks  
at the bottom  
behind the  
frosted glass:

The Google Diet: Search Giant's Revamped Eating Habits

NEXT VIDEO

Source <http://abcnews.go.com/Health/google-diet-search-giant-overhauled-eating-options-nudge/story?id=18241908>

# LET PEOPLE CHOOSE

## Course: Introduction to Dealing with Back Pain

Where   
would you  
like to  
start?

Overview & Facts

Symptoms & Types

Diagnosis & Tests

Treatment & Care

Living & Managing

Support & Tools

MAKE IT AS SHORT AS POSSIBLE (BUT NOT SHORTER)



# CREATE A SENSE OF IMMEDIACY

*This is important material, so please pay attention.*



*Your senior account manager left the office and is booked on a flight to South America. You have two hours to audit the accounts and figure out if there's been financial wrongdoing. What should you look for?*



# DON'T STRIP OUT THE EMOTION

## Insurance procedures

### Something Important about Insurance

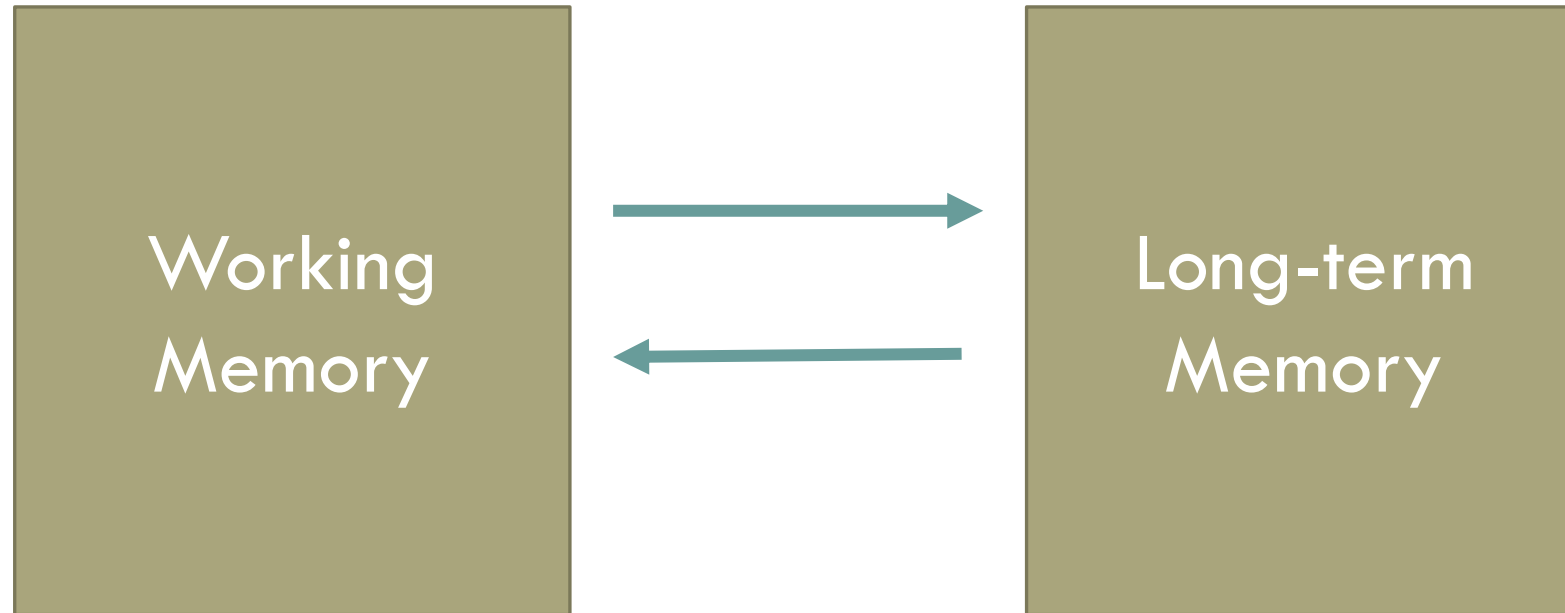
- Not Kirkpatrick:
  - Reaction (participants' opinions)
  - Learning (pre/post test)
  - Behavior (measurable behavior change)
  - Results/ROI (return on investment)
- A quicker and less expensive method to ensure a feedback loop that can be used to assess and improve the training intervention
- Not intended to be a full measure of efficacy
- Qualitative measures of:
  - Retention of information
  - Attitude
  - Anecdotal or Observable behavior change for a small sample size
- Levels 3 & 4 are difficult and costly
  - Require access to the full target audience
  - Measuring behaviors requires extensive and costly observation
  - Difficult to implement without pre-existing organizational performance metrics in place
  - Difficult to attribute due to confounding variables

A story about Jim, a teen who was injured in a car accident, and how his family dealt with the aftermath





# TIE TO THEIR OWN EXPERIENCE



# LET LEARNERS DRIVE



What do you  
want to learn  
about?

# MATERIALS

Slides and Resources:

<https://usablelearning.com/resources/attention-and-learning/>

[Julie@usablelearning.com](mailto:Julie@usablelearning.com)

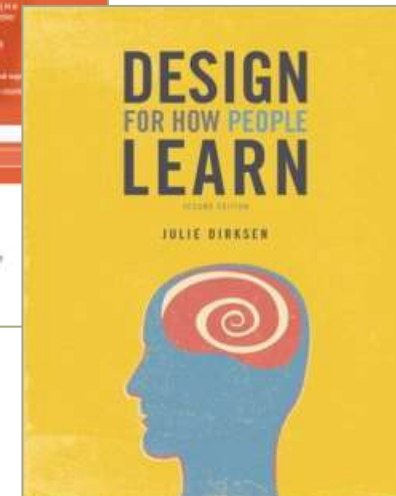
Twitter: usablelearning

Facebook group:

[Facebook.com/groups/designforhowpeoplelearn](https://www.facebook.com/groups/designforhowpeoplelearn)

Information about courses at:

[Designbetterlearning.com](https://designbetterlearning.com)



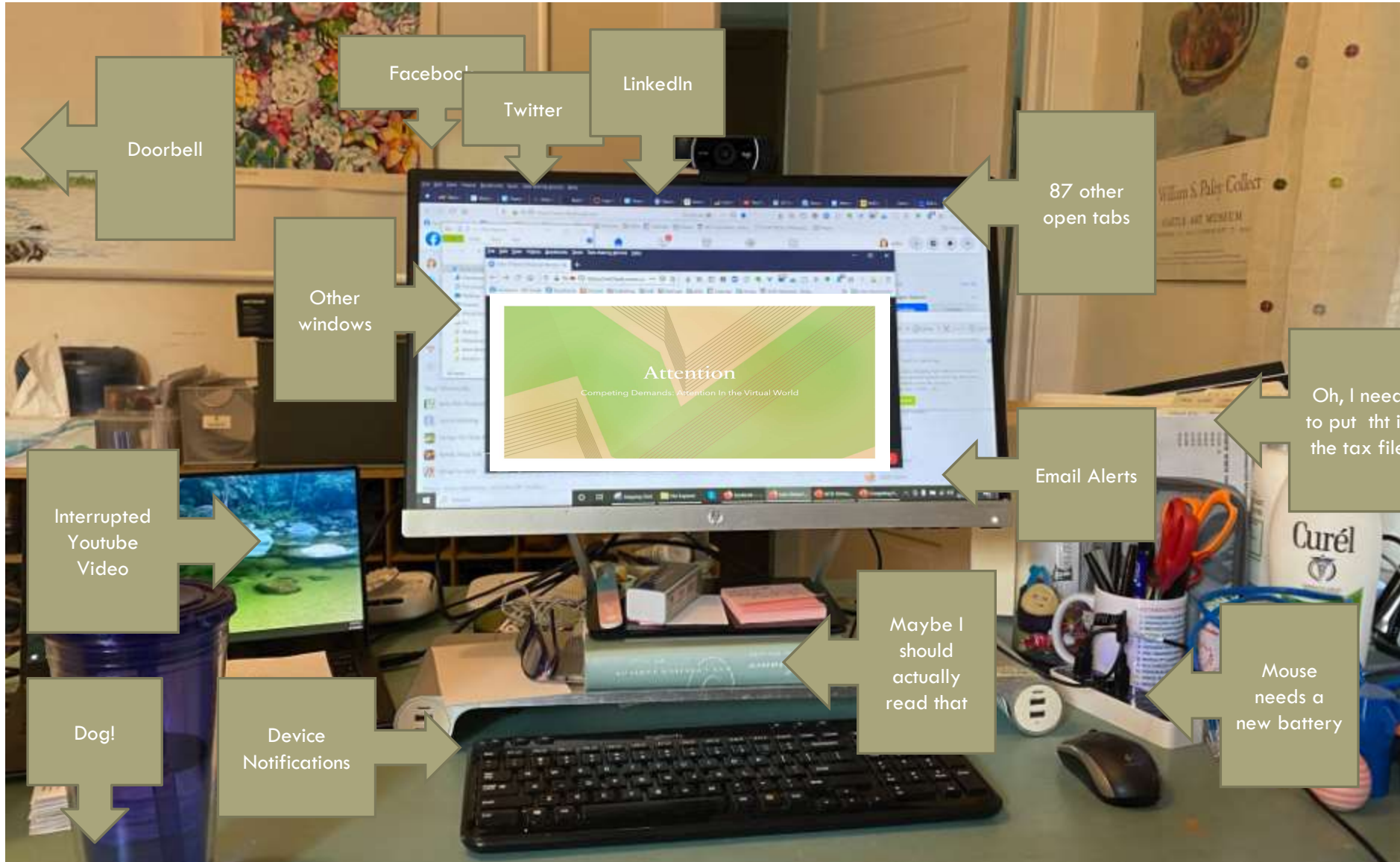
# SO WHAT ABOUT VIRTUAL?

What can you do? What can  
you help your learners do?



# Attention

Competing Demands: Attention In the Virtual World



Doorbell

Facebook

Twitter

LinkedIn

87 other open tabs

Other windows

Attention

Competing Demands: Attention In the Virtual World

Email Alerts

Oh, I need to put tht in the tax file

Interrupted Youtube Video

Dog!

Device Notifications

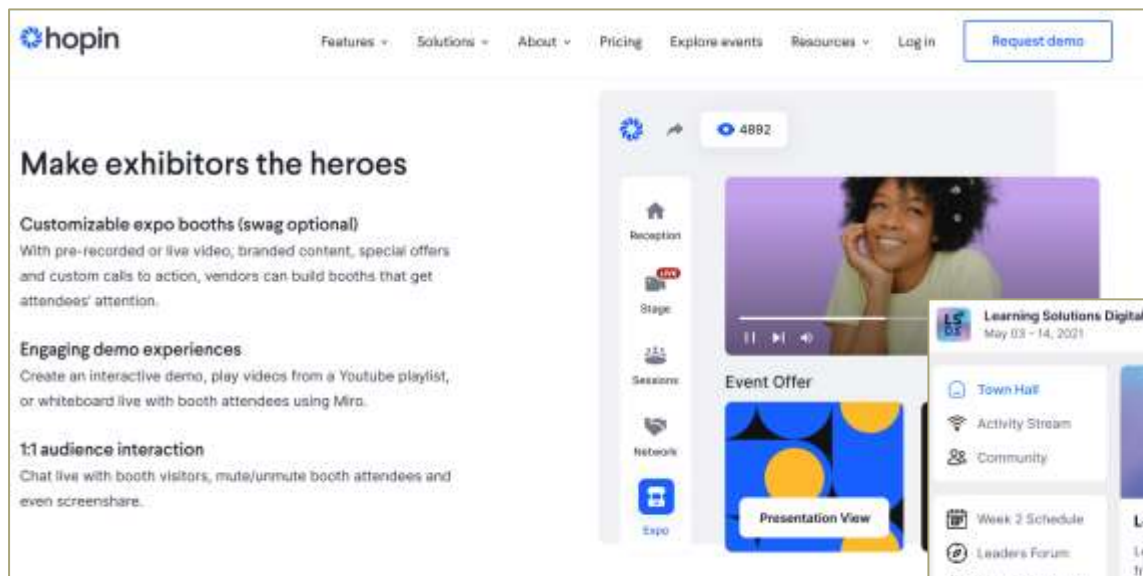
Maybe I should actually read that

Mouse needs a new battery

# WHAT ARE THE CUES?



# WHAT DO YOU DO IRL?



The screenshot shows the Hopin website homepage. At the top, there is a navigation bar with links for Features, Solutions, About, Pricing, Explore events, Resources, Log in, and a Request demo button. The main heading is "Make exhibitors the heroes". Below this, there are three sections: "Customizable expo booths (swag optional)", "Engaging demo experiences", and "1:1 audience interaction". A video player is visible on the right side of the page, showing a woman smiling.

**hopin** Features Solutions About Pricing Explore events Resources Log in Request demo

## Make exhibitors the heroes

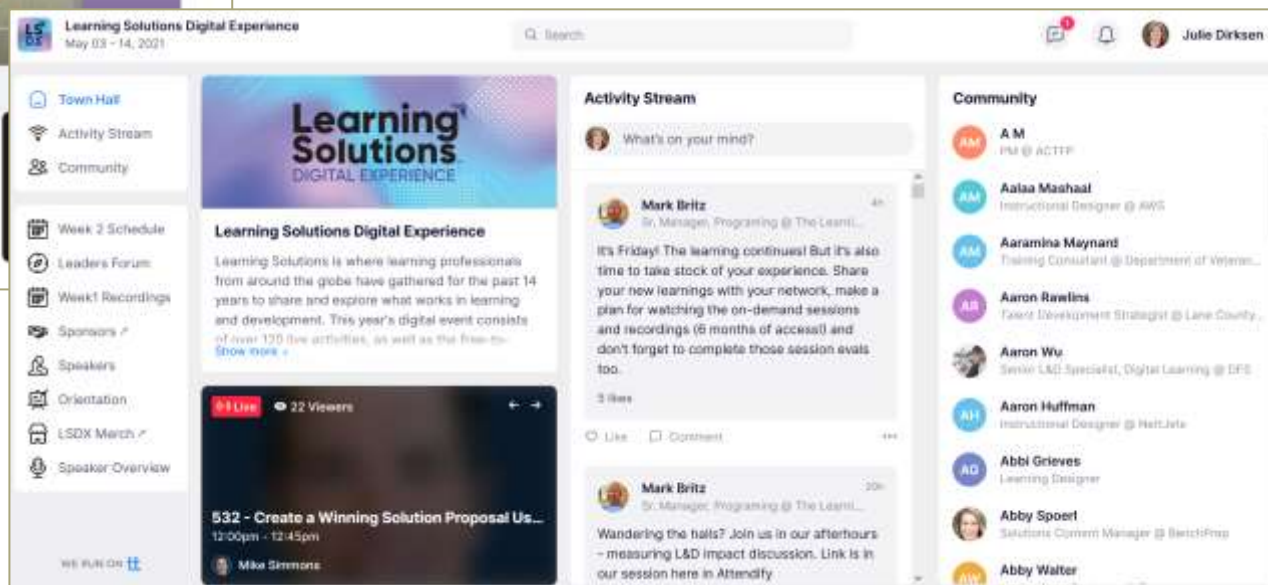
**Customizable expo booths (swag optional)**  
With pre-recorded or live video, branded content, special offers and custom calls to action, vendors can build booths that get attendees' attention.

**Engaging demo experiences**  
Create an interactive demo, play videos from a Youtube playlist, or whiteboard live with booth attendees using Mira.

**1:1 audience interaction**  
Chat live with booth visitors, mute/unmute booth attendees and even screenshare.

Reception Stage Sessions Network Expo

Event Offer Presentation View



The screenshot shows the Learning Solutions Digital Experience event interface. The top navigation bar includes a search bar, a notification bell, and the user's name, Julie Dirksen. The main content area is divided into several sections: "Town Hall", "Activity Stream", "Community", "Week 2 Schedule", "Leaders Forum", "Week 1 Recordings", "Sponsors", "Speakers", "Orientation", "LSDX Merch", and "Speaker Overview". The "Activity Stream" section shows a post by Mark Britz with a video player and a "Live" indicator. The "Community" section lists several users with their avatars and names.

Learning Solutions Digital Experience May 03 - 14, 2021

Town Hall Activity Stream Community

Week 2 Schedule Leaders Forum Week 1 Recordings Sponsors Speakers Orientation LSDX Merch Speaker Overview

## Learning Solutions DIGITAL EXPERIENCE

**Learning Solutions Digital Experience**  
Learning Solutions is where learning professionals from around the globe have gathered for the past 14 years to share and explore what works in learning and development. This year's digital event consists of over 170 live activities, as well as the free-to-[show more](#).

**532 - Create a Winning Solution Proposal Us...**  
12:00pm - 12:45pm  
Mike Simmons

**Activity Stream**  
What's on your mind?

**Mark Britz**  
Sr. Manager, Programing @ The Learn...  
It's Friday! The learning continues! But it's also time to take stock of your experience. Share your new learnings with your network, make a plan for watching the on-demand sessions and recordings (6 months of access!) and don't forget to complete those session evals too.  
3 likes  
Like Comment

**Community**

- A M** PM @ ACTIP
- Aataa Maashaal** Instructional Designer @ AWS
- Aaramina Maynard** Training Consultant @ Department of Veterans...
- Aaron Rawlins** Talent Development Strategist @ Lane County...
- Aaron Wu** Senior L&D Specialist, Digital Learning @ DFS
- Aaron Huffman** Instructional Designer @ HeltiJeta
- Abbi Grieves** Learning Designer
- Abby Spoerl** Solutions Content Manager @ BirchProg
- Abby Walter**



# TAKE CONTROL

Joe Edelman

Humane Tech

<https://www.humanetech.com/take-control>

Don't accept defaults

What do you value?



## Turn Off Notifications

Red is a trigger color that instantly draws our attention. Reclaim your time by turning off notifications.

### TAKE CONTROL

- Go to **Settings > Notifications**, or swipe left on any incoming notification and hit **Manage > Turn Off**



## Remove Toxic Apps

Remove apps that profit off of addiction, distraction, outrage, polarization, and misinformation.

### TAKE CONTROL

- **Remove Facebook** → Message friends with **Signal**
- **Remove TikTok** → Send video messages by direct text or with **Marco Polo**
- **Remove Snapchat** → Get creative in Text instead
- **Remove Instagram** → Use **VSCO** for photography

# FOCUS APPS

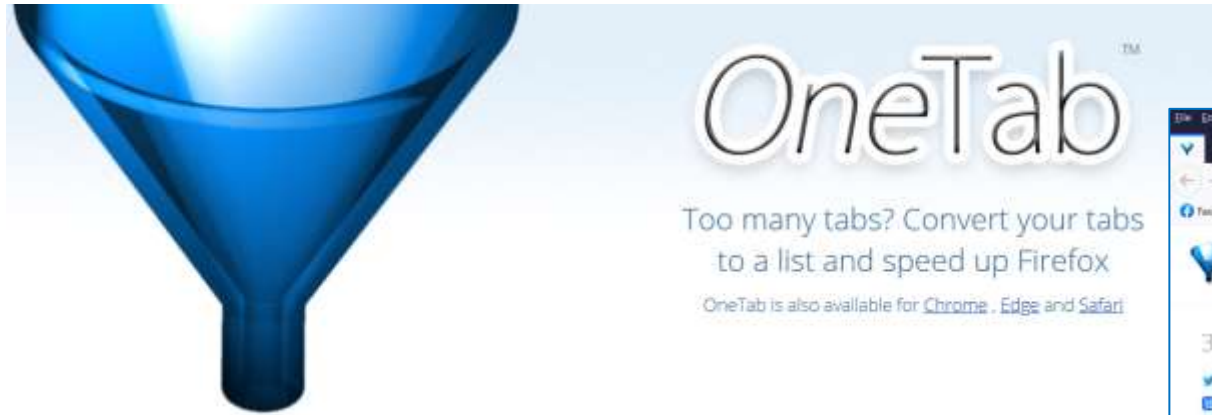


## Forest

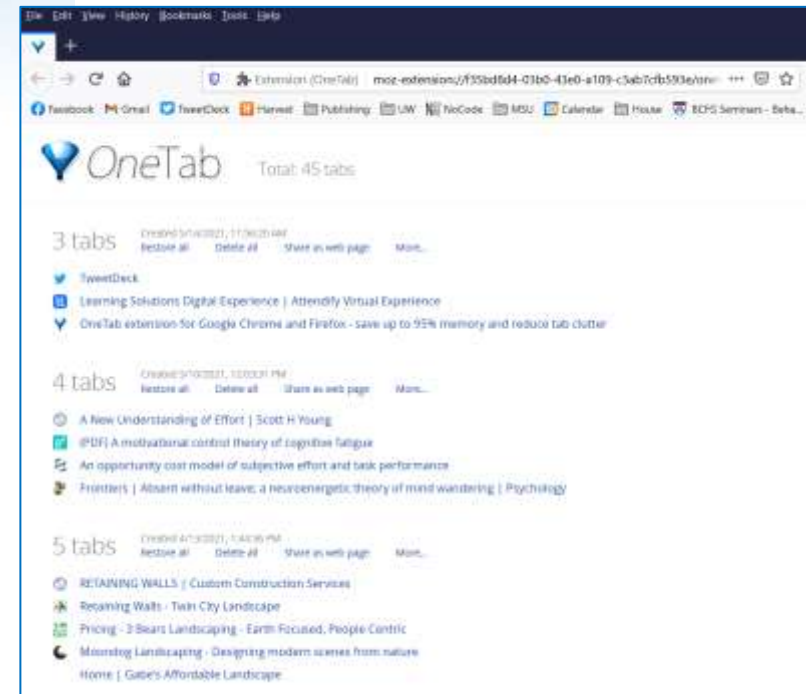
Stay focused, be present



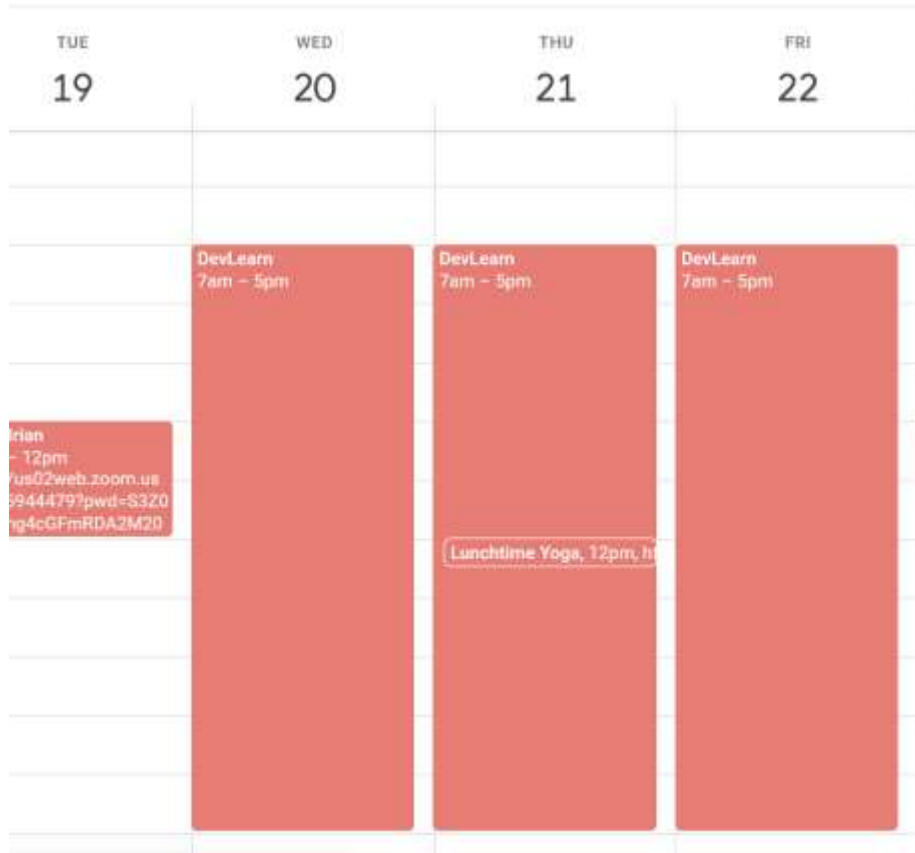
# GATHER UP LOOSE ENDS



Before: Lost in a mess of tabs, browser is slow



# TIME BLOCKING AND OUT-OF-OFFICE

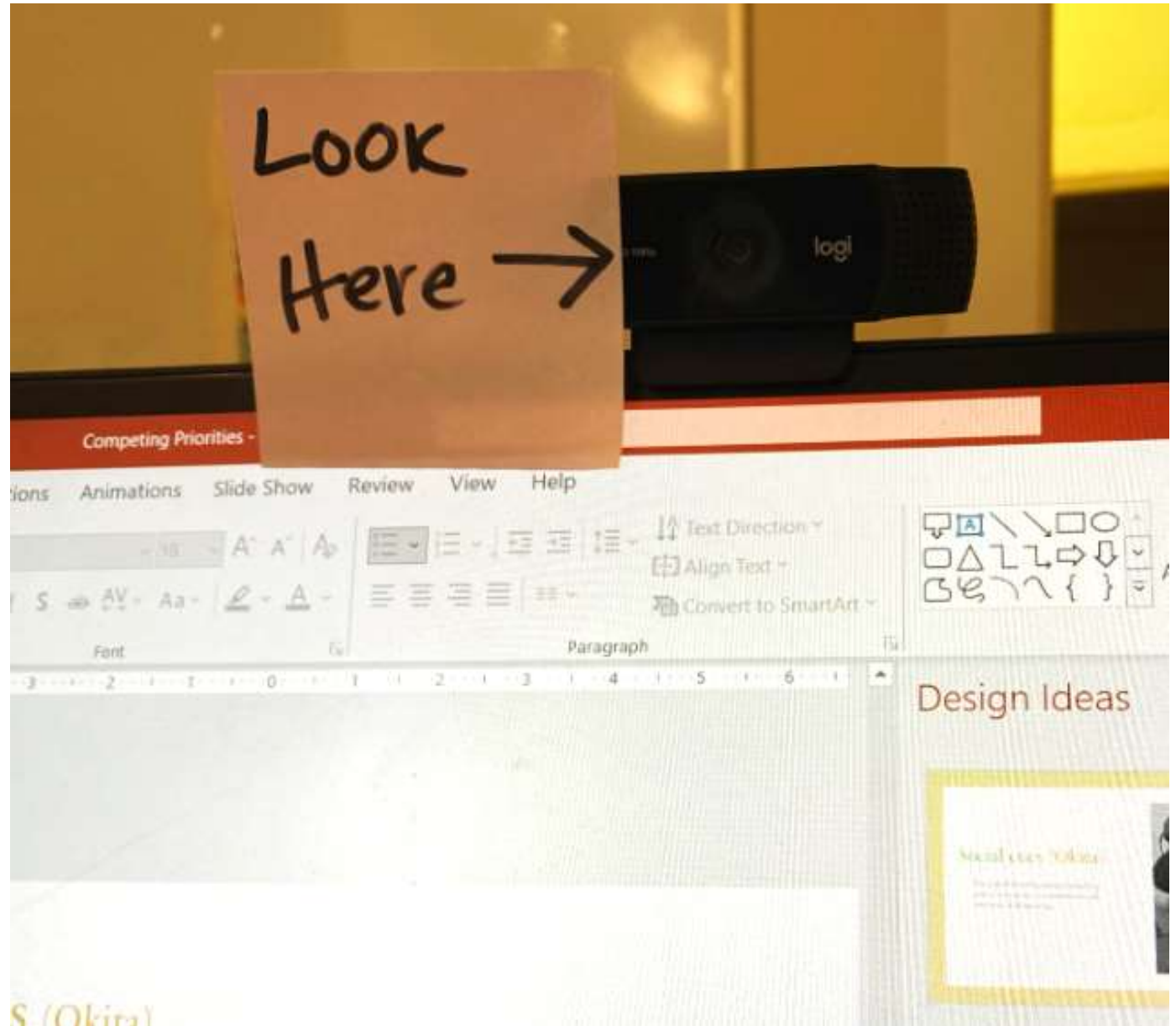


What do you do when you are \*really\* out of the office?

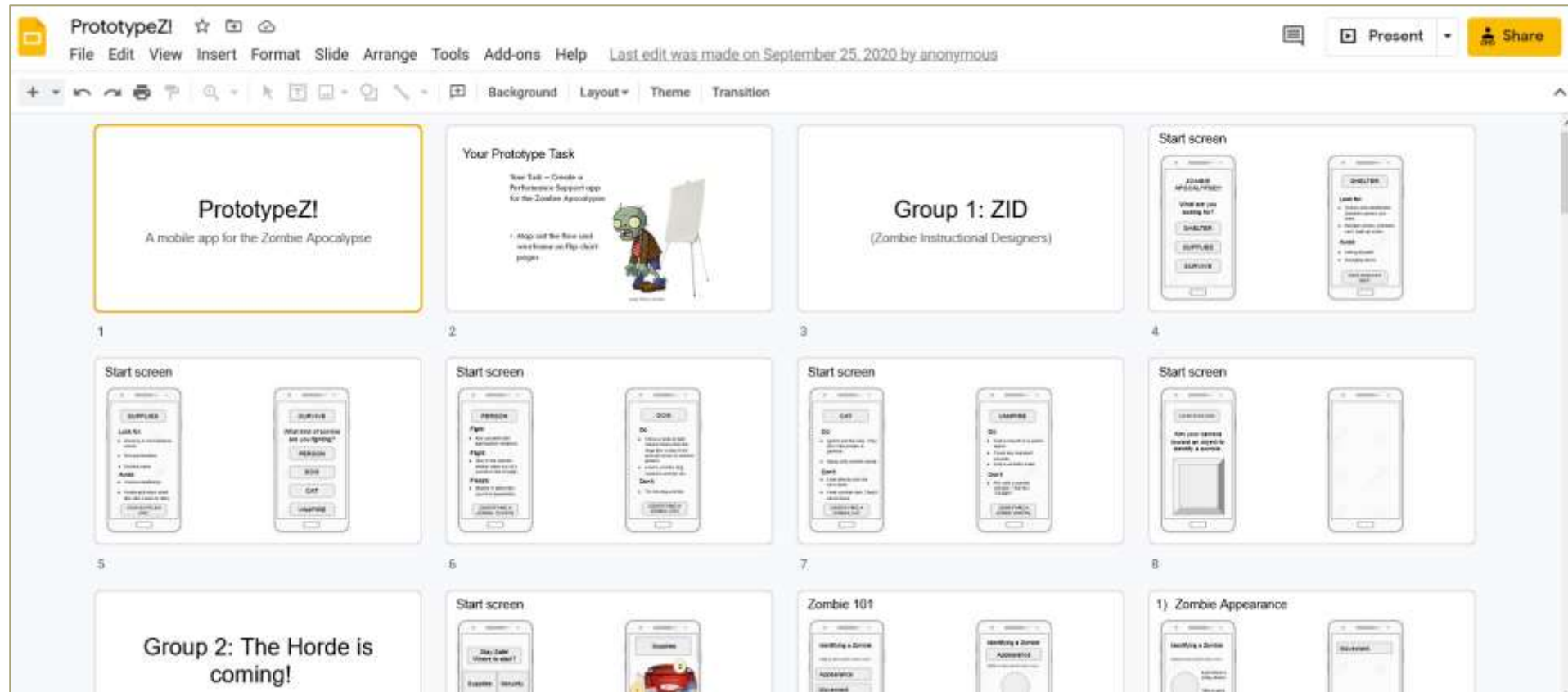
# EYE CONTACT

From Will Thalheimer  
Virtual Eye Contact

[https://www.youtube.com/watch?v=Yp\\_nbz-puE](https://www.youtube.com/watch?v=Yp_nbz-puE)



# USING VIRTUAL WHITEBOARDS

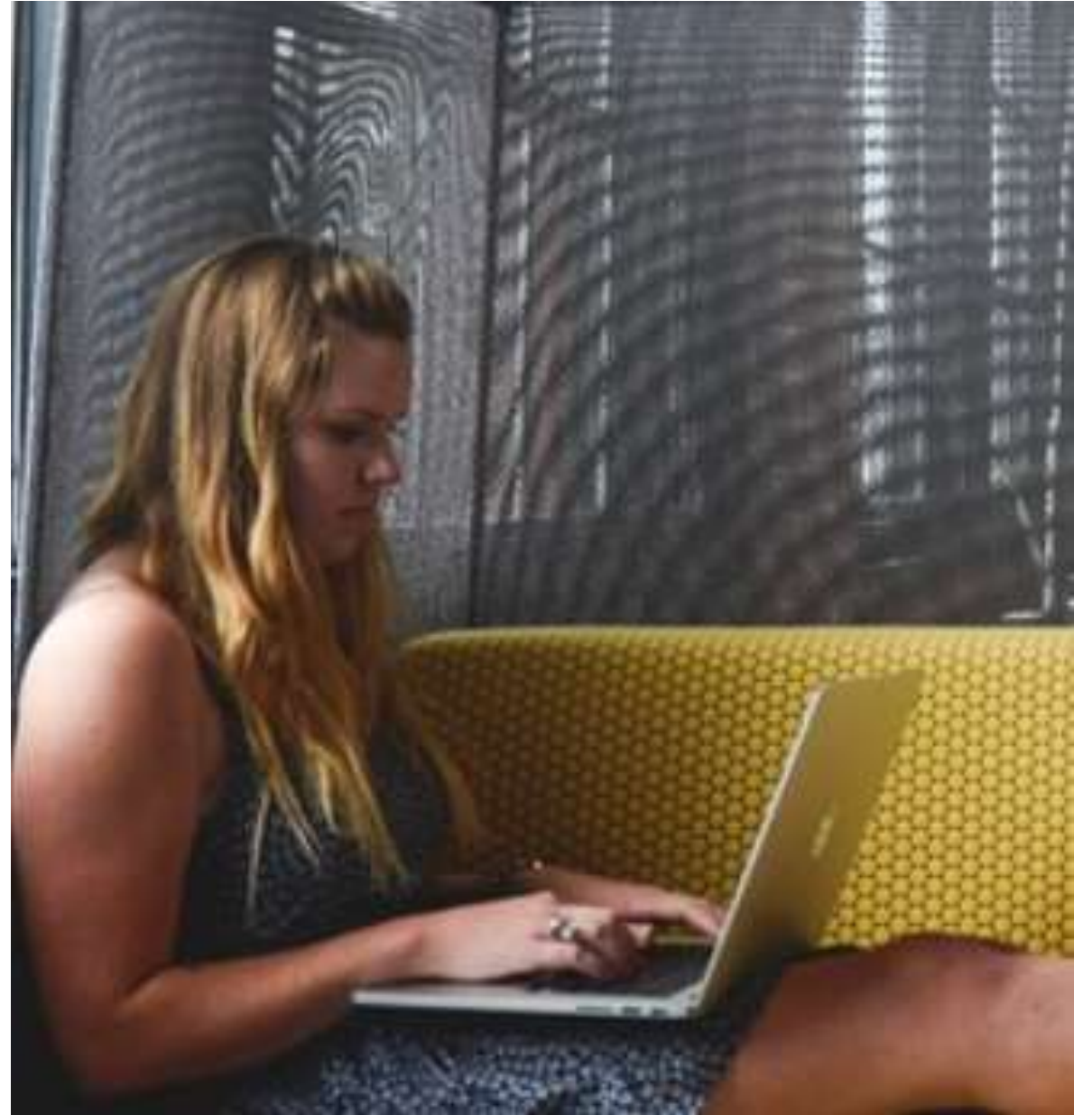


---

# HABITS

Are you bringing your meeting habits to virtual classes?

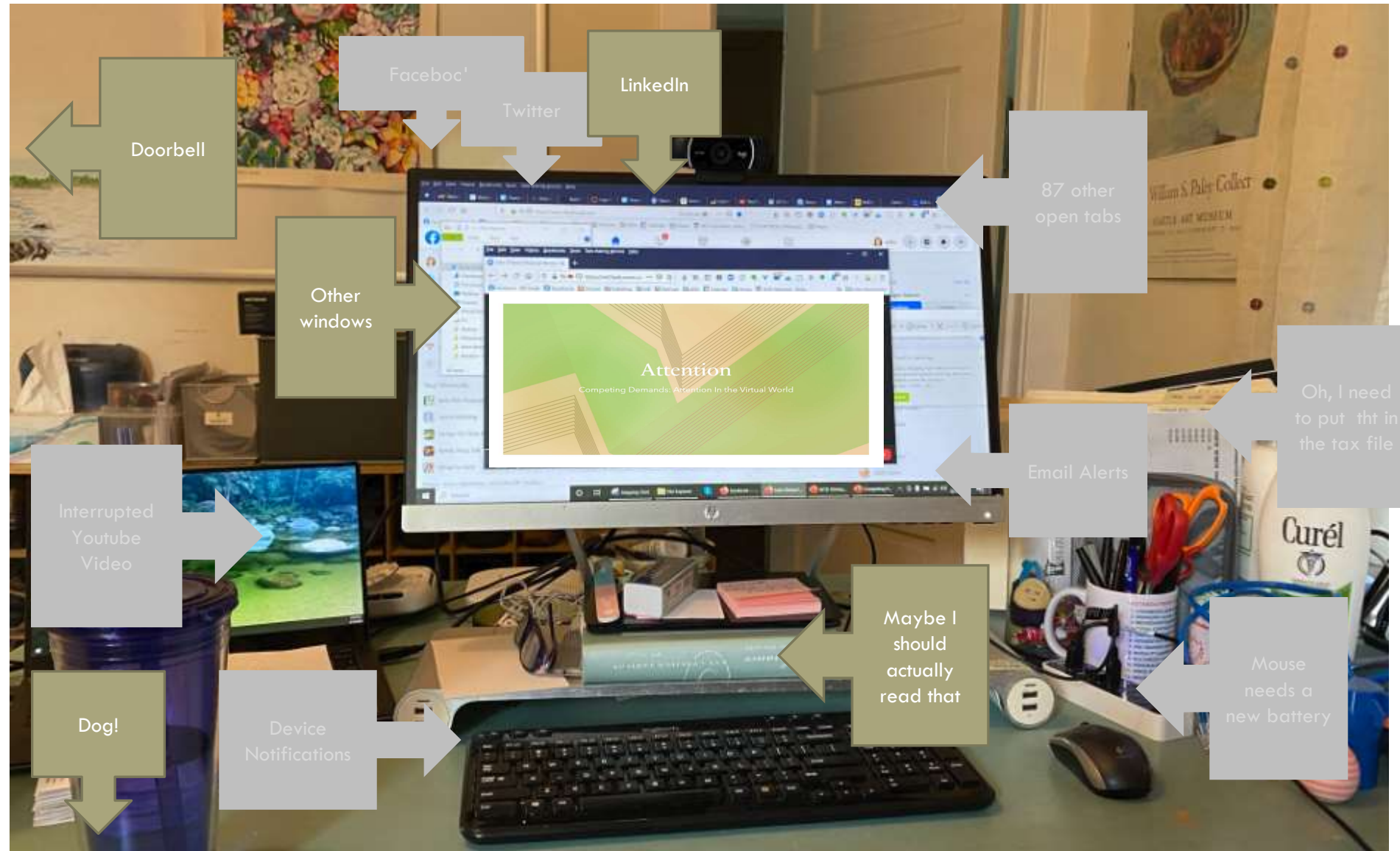
Ask the question “How are you handling this differently?”



# PRESERVING COGNITIVE LOAD

ASK YOUR LEARNERS:

What strategies can learners come up with?

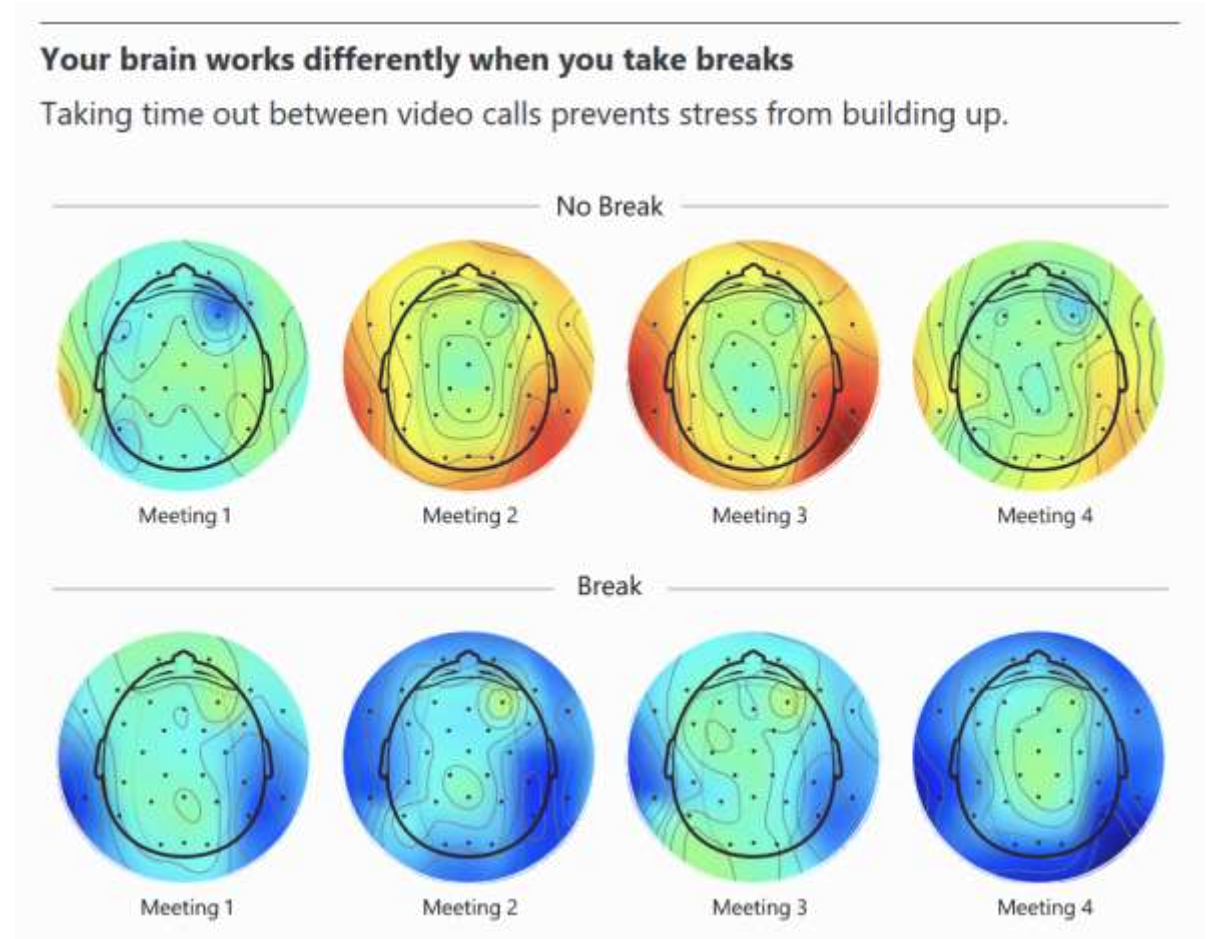




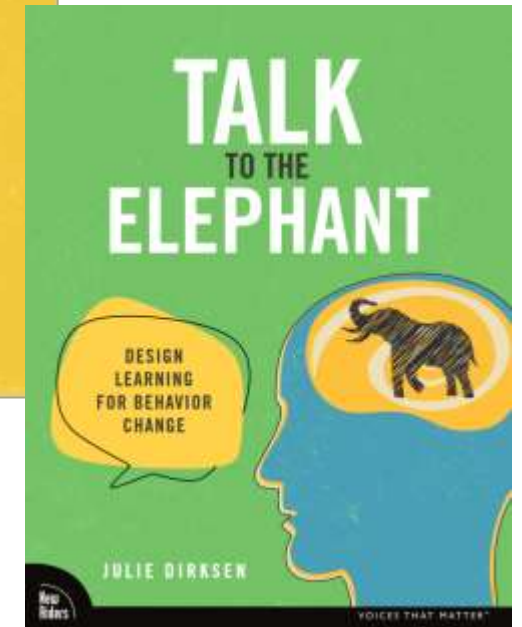
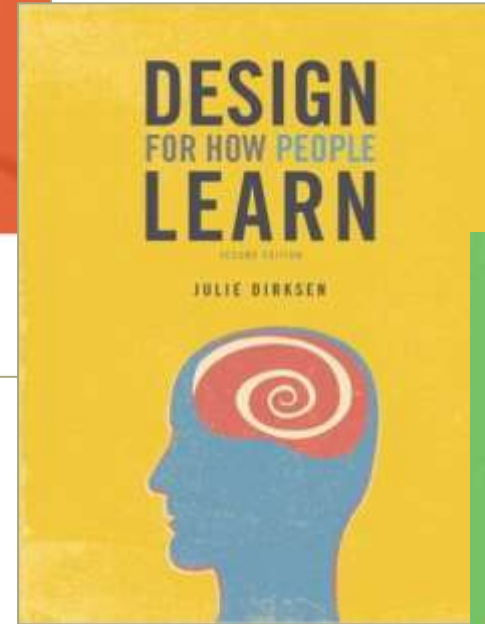
# BREAKS

Microsoft study looking at EEG images from back-to-back meetings, and meetings with breaks in between

<https://www.microsoft.com/en-us/worklab/work-trend-index/brain-research>



# MATERIALS



[Julie@usablelearning.com](mailto:Julie@usablelearning.com)

Twitter: usablelearning

Facebook group:

[Facebook.com/groups/designforhowpeoplelearn](https://www.facebook.com/groups/designforhowpeoplelearn)

Information about courses at:

[Designbetterlearning.com](https://www.designbetterlearning.com)

# REFERENCES

- Andrade, Jackie. What Does Doodling Do? APPLIED COGNITIVE PSYCHOLOGY Appl. Cognit. Psychol. (2009) Published online in Wiley InterScience
- Bechara, A., Damasio, A. R., Damasio, H., & Anderson, S. W. (1994). Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition*, 50(1-3), 7-15. doi: 10.1016/0010-0277(94)90018-3
- Danziger, Shai, Jonathan Levav and Lior Avnaim-Pesso, Extraneous Factors in Judicial Decisions, PNAS Vol 108 No 17, 2011
- Dimassio, Antonio. Descartes' Error. Penguin Books; Reprint edition (September 27, 2005)
- Dutton, Donald G and Arthur P Aron, Some Evidence for Heightened Sexual Attraction Under Conditions of High Anxiety. *Journal of Personality and Social Psychology* Vol 30 No 4 1974
- Gaillot, Matthew T. & Roy F. Baumeister, The Physiology of Willpower: Linking Glucose to Self-Control. *Personality and Social Psychology Review*, 2007.
- Iyengar, Sheena and Mark Lepper, When Choice is Demotivating: Can One Desire Too Much of a Good Thing? *Journal of Personality and Social Psychology* 2000.
- Johnson, Eric J & Daniel Goldstein, Do Defaults Save Lives? *Science* November 2003.
- Kahneman, Daniel; Tversky, Amos (1979). "Prospect Theory: An Analysis of Decision under Risk" (PDF). *Econometrica* 47 (2): 263. doi:10.2307/1914185. ISSN 0012-9682.
- Killeen, Peter R. Absent Without Leave: A Neuroenergetic Theory of Mind.
- McCabe DP1, Castel AD. Seeing is believing: the effect of brain images on judgments of scientific reasoning. *Cognition*. 2008 Apr;107(1):343-52. Epub 2007 Sep 4.
- Okita, S.Y., J. Bailenson, and D.L. Schwartz. 2008. Mere Belief of Social Action Improves Complex Learning. *Proceedings of the 8th International Conference for the Learning Sciences*.
- Shiv, B. and A. Fedorikhin. 1999. Heart and Mind in Conflict: Interplay of Affect and Cognition in Consumer Decision Making. *Journal of Consumer Research* 26 (December): 278-282.
- Sweller, John. Cognitive Load During Problem Solving: Effects on Learning. *Cognitive Science* 12, 257-285. 1988
- Vogt, S. & Magnussen, S. (2007). Expertise in pictorial perception: Eye-movement patterns and visual memory in artists and laymen. *Perception*, 36, 91-100.