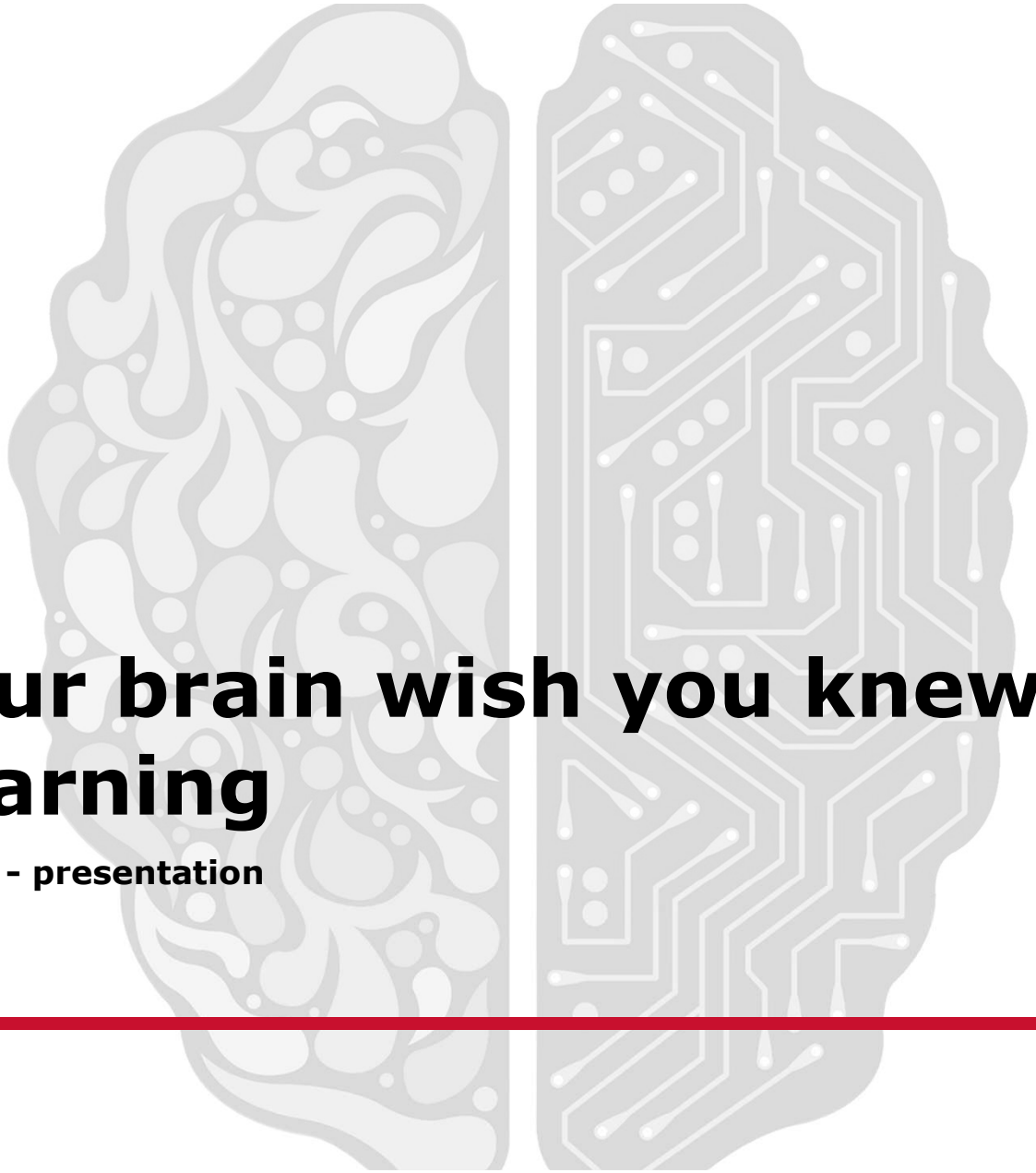
DANISH DEFENCE



What your brain wish you knew about learning

A ”food for thought” - presentation

DANISH DEFENCE

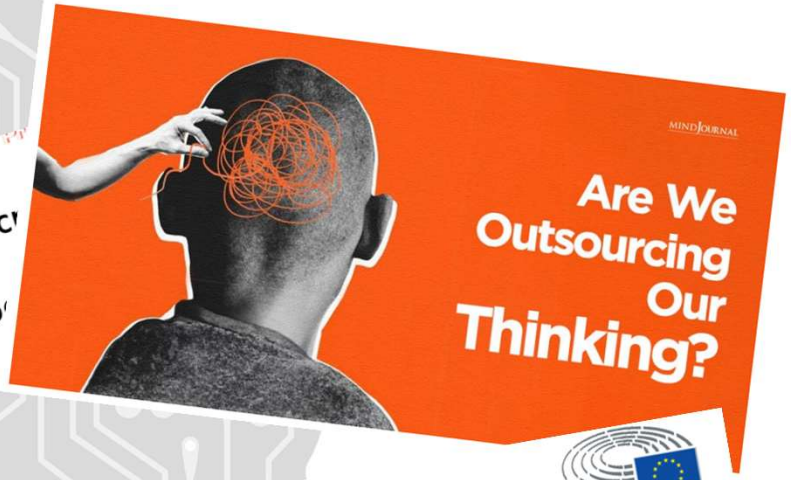
Turkish Online Journal of Distance Education-TOJDE January 2013 ISSN 1302-6488 Volume: 14 Number: 1 Article 23

MULTITASKING OR CONTINUOUS PARTIAL ATTENTION: A CRITICAL BOTTLENECK FOR DIGITAL NATIVES

Review

Digital dementia in the internet generation: excessive sc
time during brain development will increase the risk of
mer's disease and related dementias in adulthoo

Tadros[2], Tiana M. Ciccarelli[2], Roelof Eikelboom[1]



AI Tools in Society: Impacts on Cognitive Offloading and the Future of Critical Thinking

by Michael Gerlich

Center for Strategic Corporate Foresight and Sustainability, SBS Swiss Business School, 8302 Kloten-Zurich, Switzerland

European Parliament

BRIEFING
Requested by the CULT committee

Artificial Intelligence in Classrooms:
Cognitive Dimensions

The Memory Paradox: Why Our Brains Need Knowledge in an Age of AI

50 Pages • Posted: 14 May 2025 • Last revised: 19 Jun 2025

DANISH DEFENCE

Your Brain on ChatGPT: Accumulation of Cognitive Debt when Using an AI Assistant for Essay Writing Task△

Ye Tong Yuan
Wellesley College
Wellesley, MA

Jessica Situ
MIT
Cambridge, MA

Iris Braunstein
MIT

Pattie Maes
MIT Media Lab
Cambridge, MA

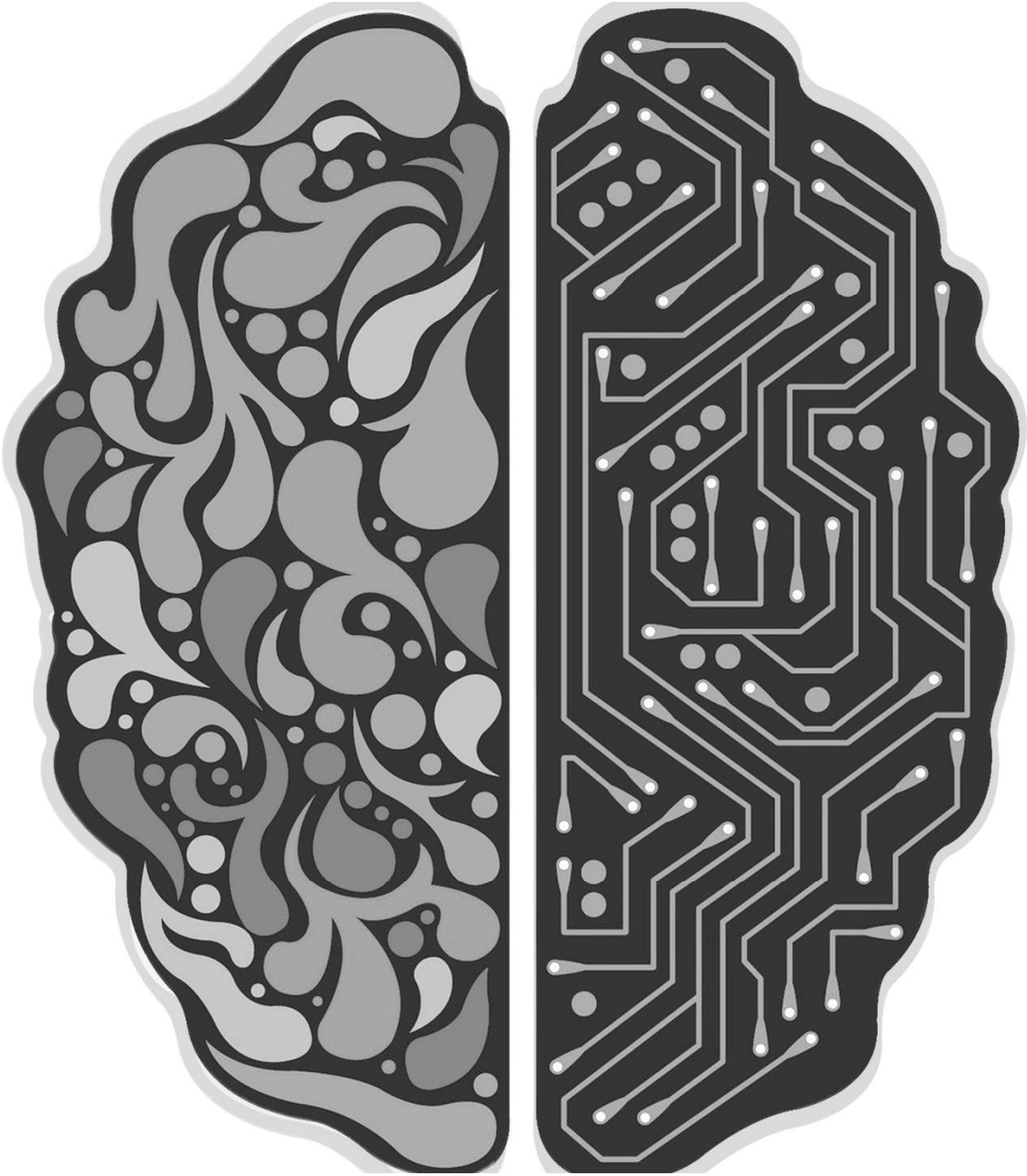
(dDTF) EEG analysis of Alpha Band for groups: ... only, including p-values to show significance from moderately significant (*) to highly significant (***).

83.3% could not recall or accurately quote from their own essays minutes after "writing" them

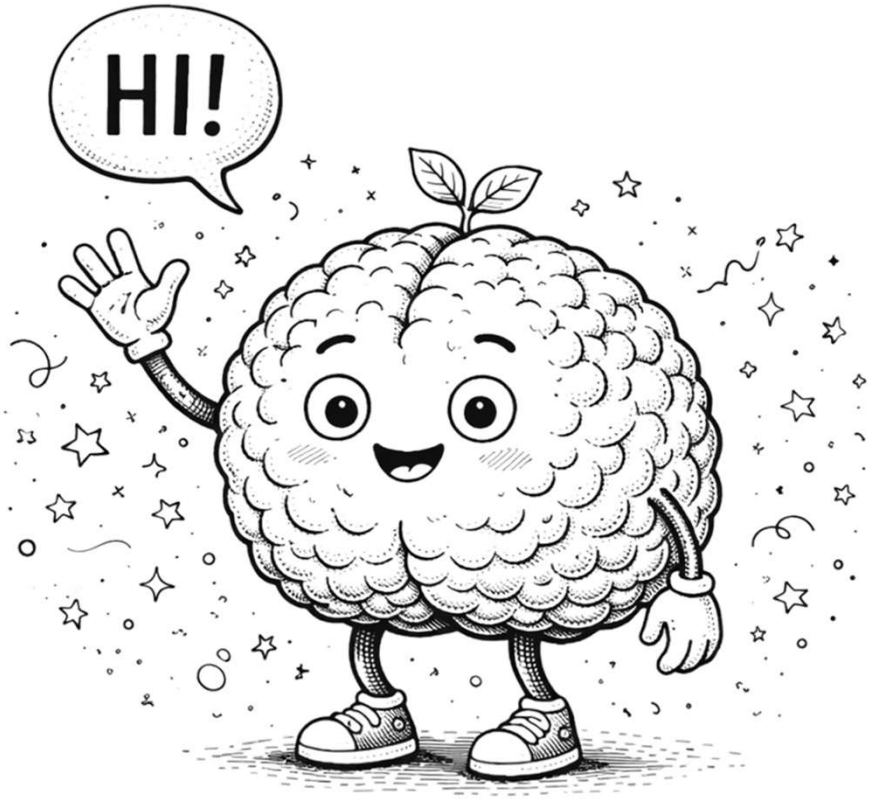
55% significantly reduced neural connectivity compared to "brain only"-group

Reduced brain activity in the EEG's
Increased laziness over time (copy-paste-ism)

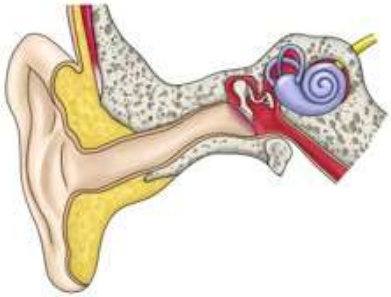
DANISH DEFENCE



DANISH DEFENCE



*All drawings in this presentation are made by Gen-AI



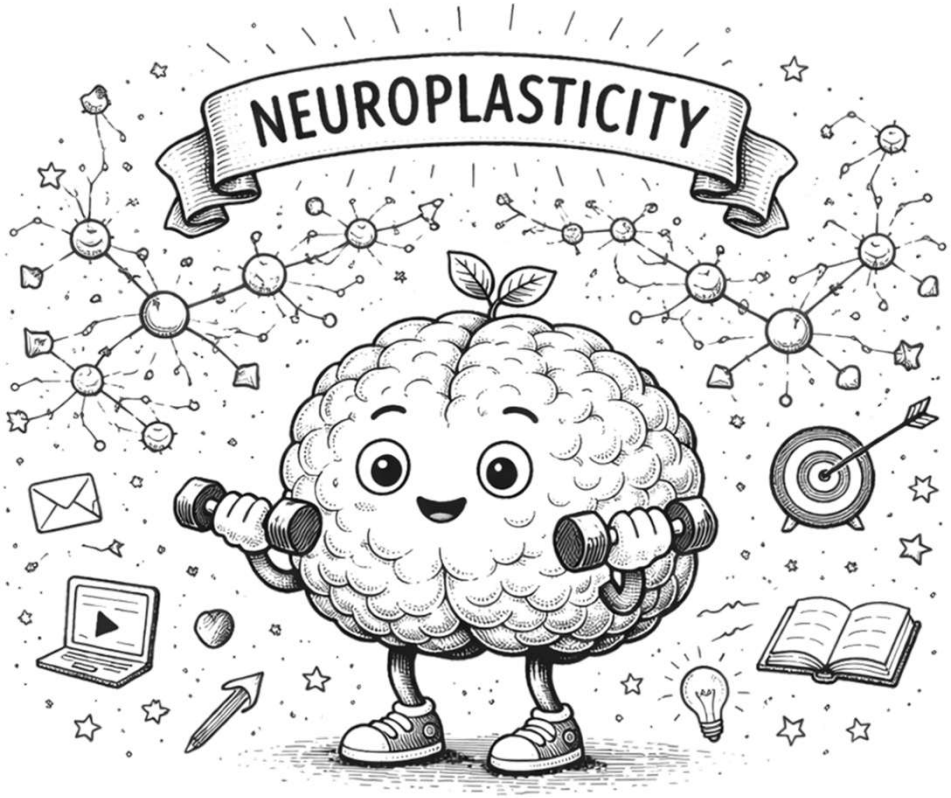
DANISH DEFENCE

1. Neuroplasticity

"If it feels to easy, I stay the same. No friction – no adaptation."

I need:

- Friction - to adapt.
- Repetition – to strengthen connections
- Variation – to make the connections flexible.



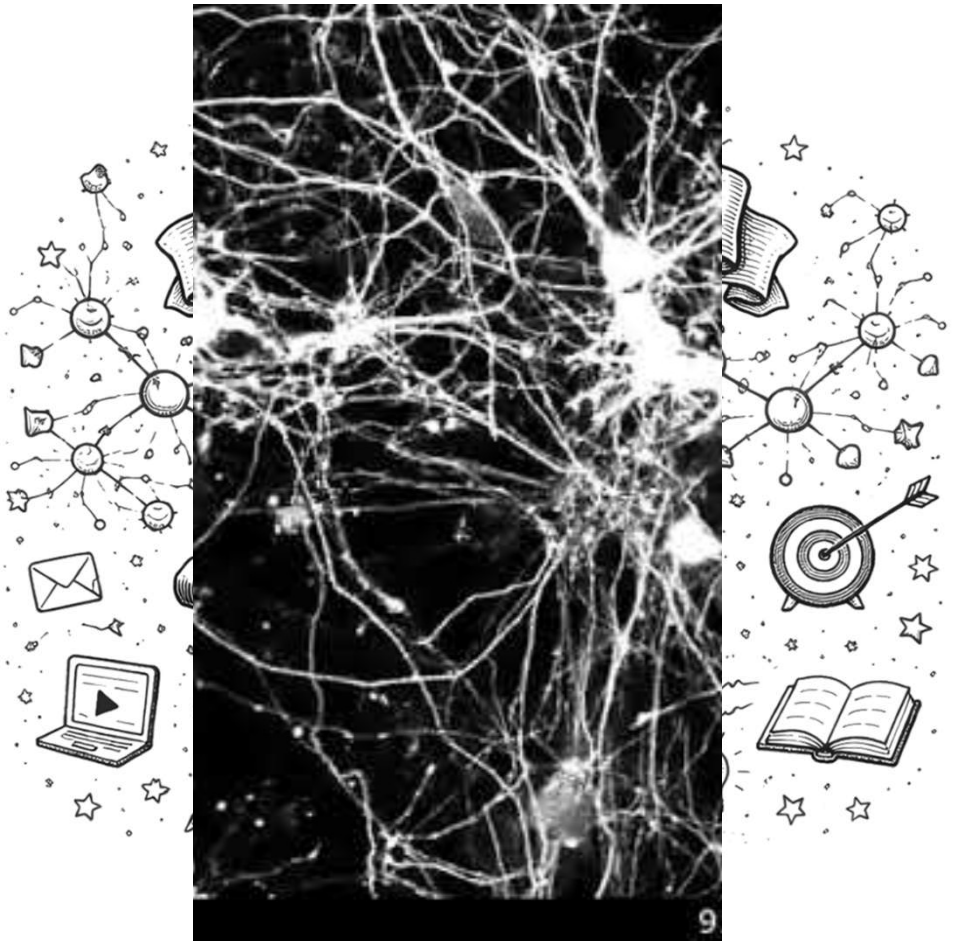
DANISH DEFENCE

1. Neuroplasticity

"If it feels to easy, I stay the same. No friction – no adaptation."

I need:

- Friction - to adapt.
- Repetition – to strengthen connections
- Variation – to make the connections flexible.



DANISH DEFENCE

2. Energy optimization

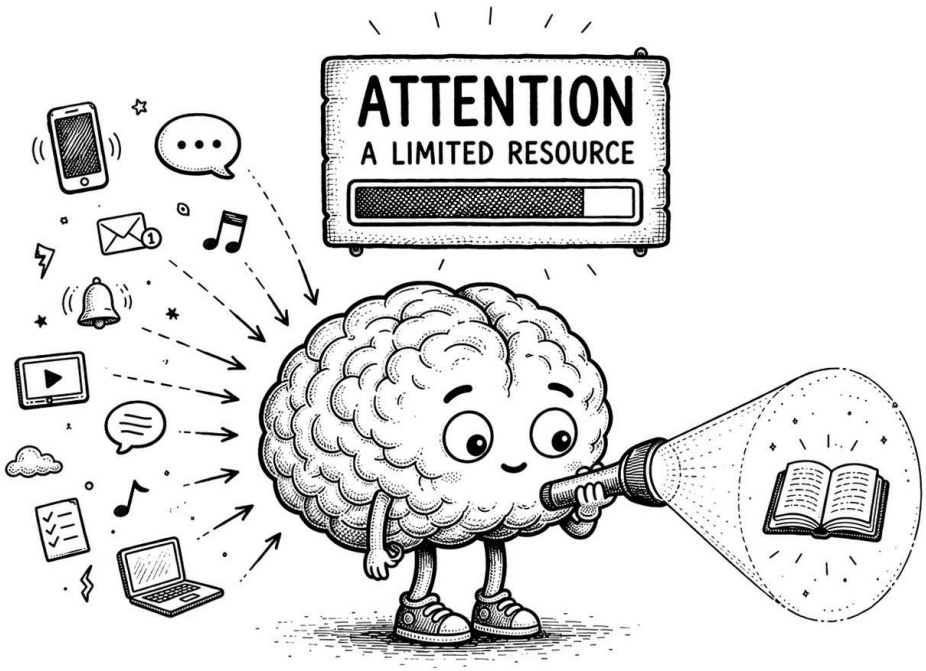
"What you call resistance towards learning, I call energy conservation".

- It uses prediction to minimize surprises
- Known patterns -> low neural activity
- Learning is demanding and potentially unpleasant

DANISH DEFENCE

3. Attention and memory

"You're speaking to more than one billion sensory inputs, I only select 1%."



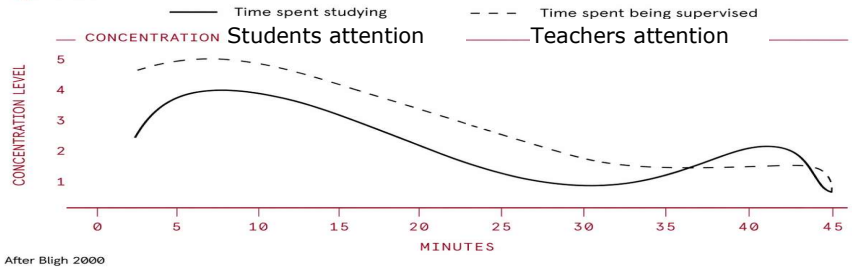
Attention

- works like a spotlight
- can't be split it can only switch from one focus point to another
- drops over time

DANISH DEFENCE

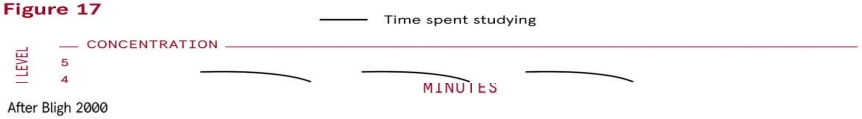
3. Attention and memory

Figure 16



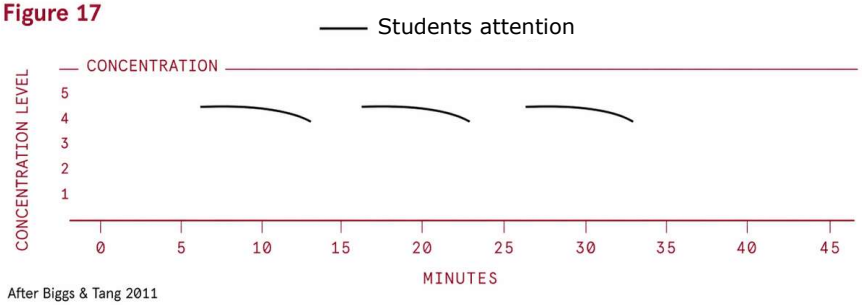
After Bligh 2000

Figure 17

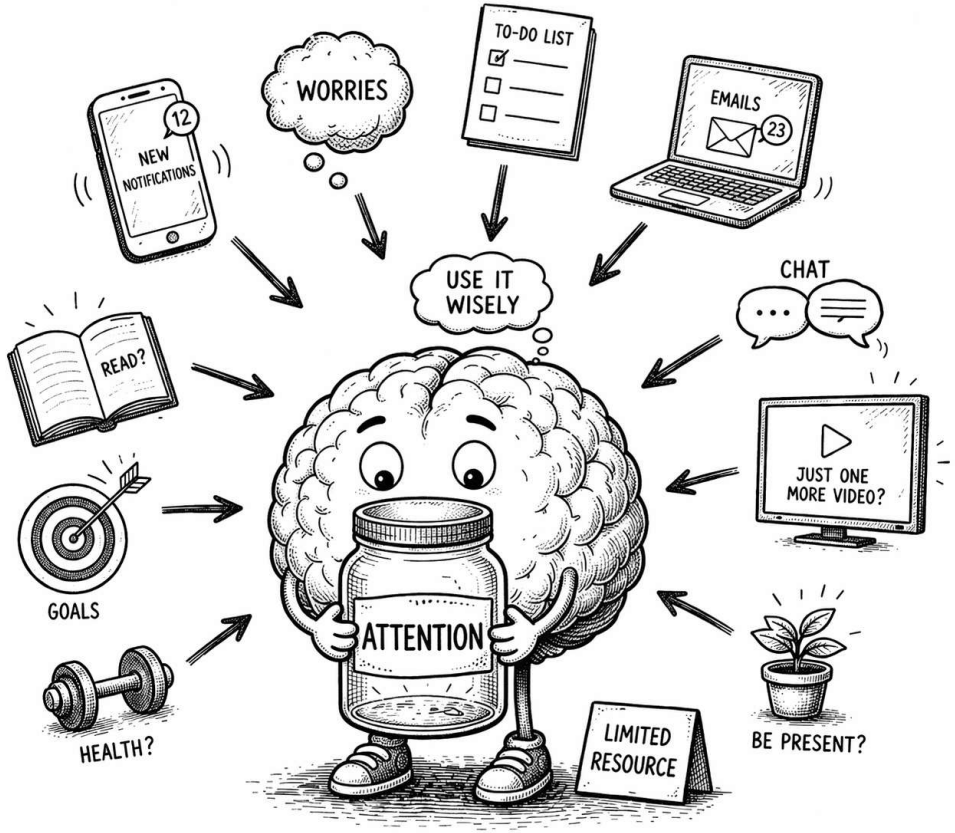


After Bligh 2000

Figure 17



After Biggs & Tang 2011

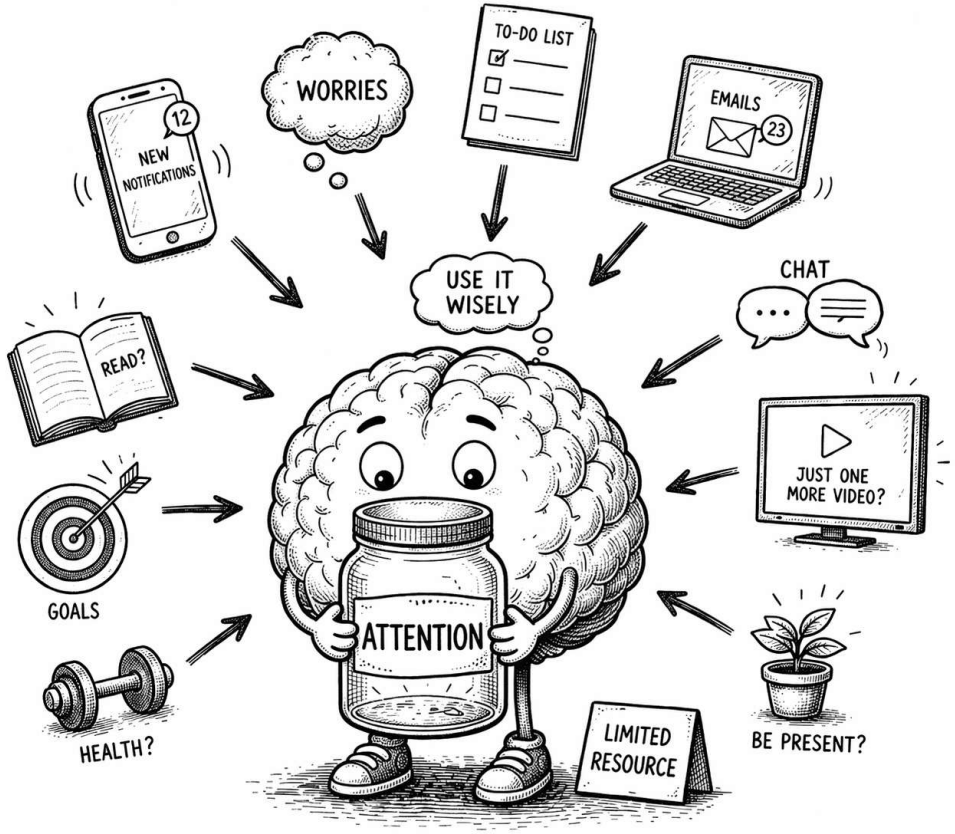


DANISH DEFENCE

3. Attention and memory

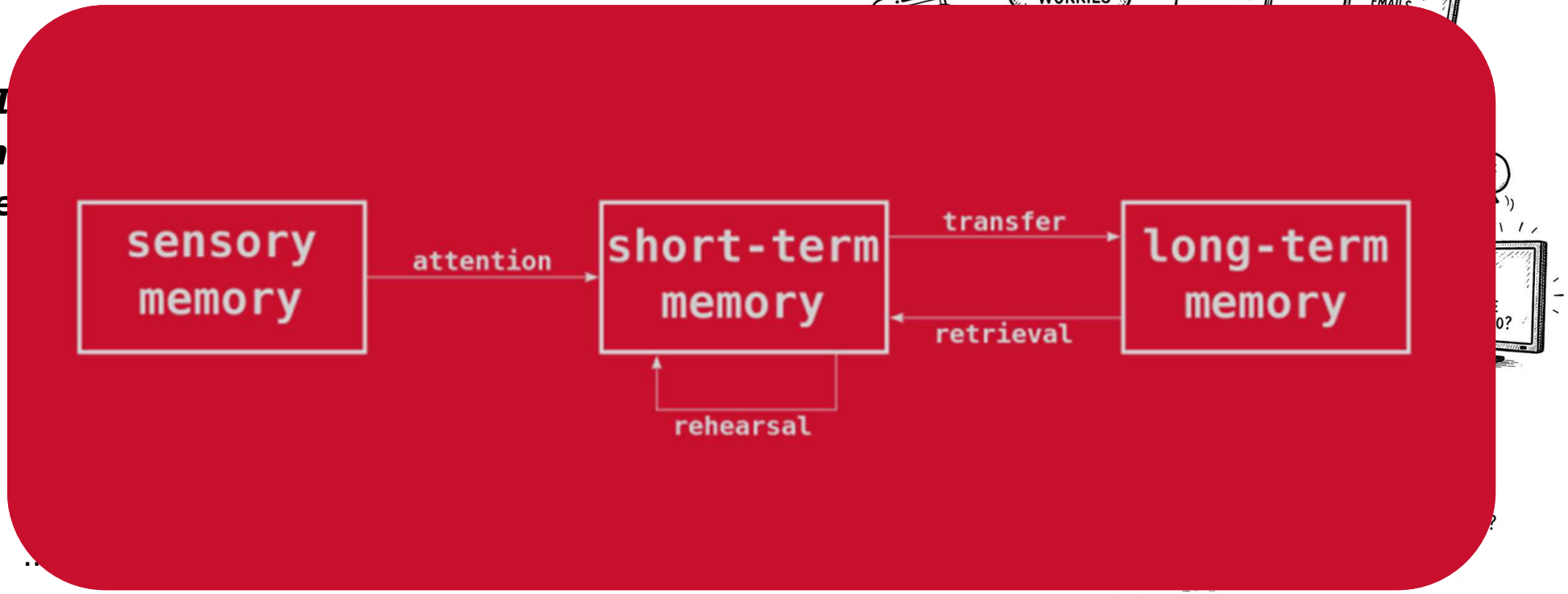
"If I don't actively work with information, I delete it again within seconds."

- What attention selects enters short term and working memory
- But it can only hold 3-7 pieces of information at a time
- … and only for 20 s.



DANISH DEFENCE

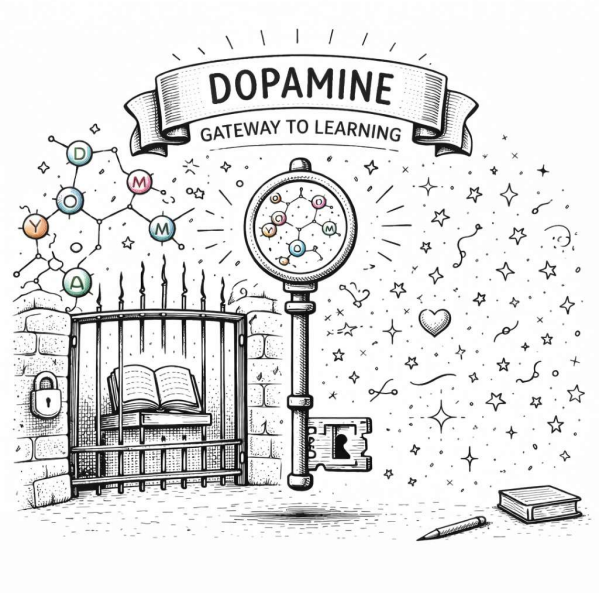
3. Attention and memory



DANISH DEFENCE

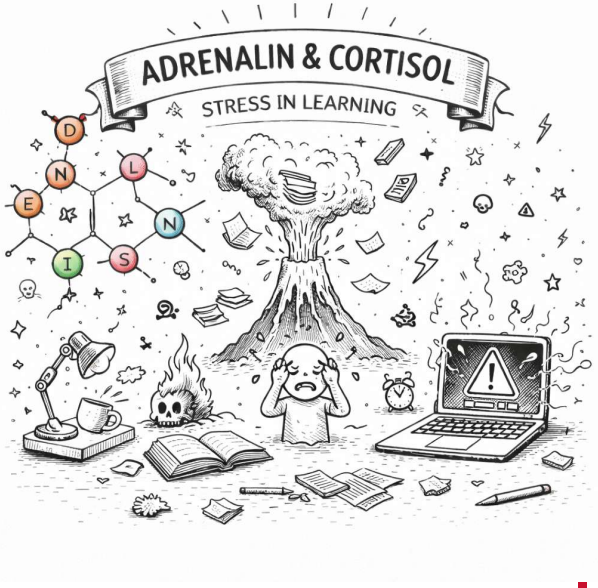
4. Hormonal influence

"If I can see the target – and think it is within reach – I will invest the energy to achieve it"



"I learn better from people I feel safe with."

"When I am bored or stressed, I find it difficult to learn."

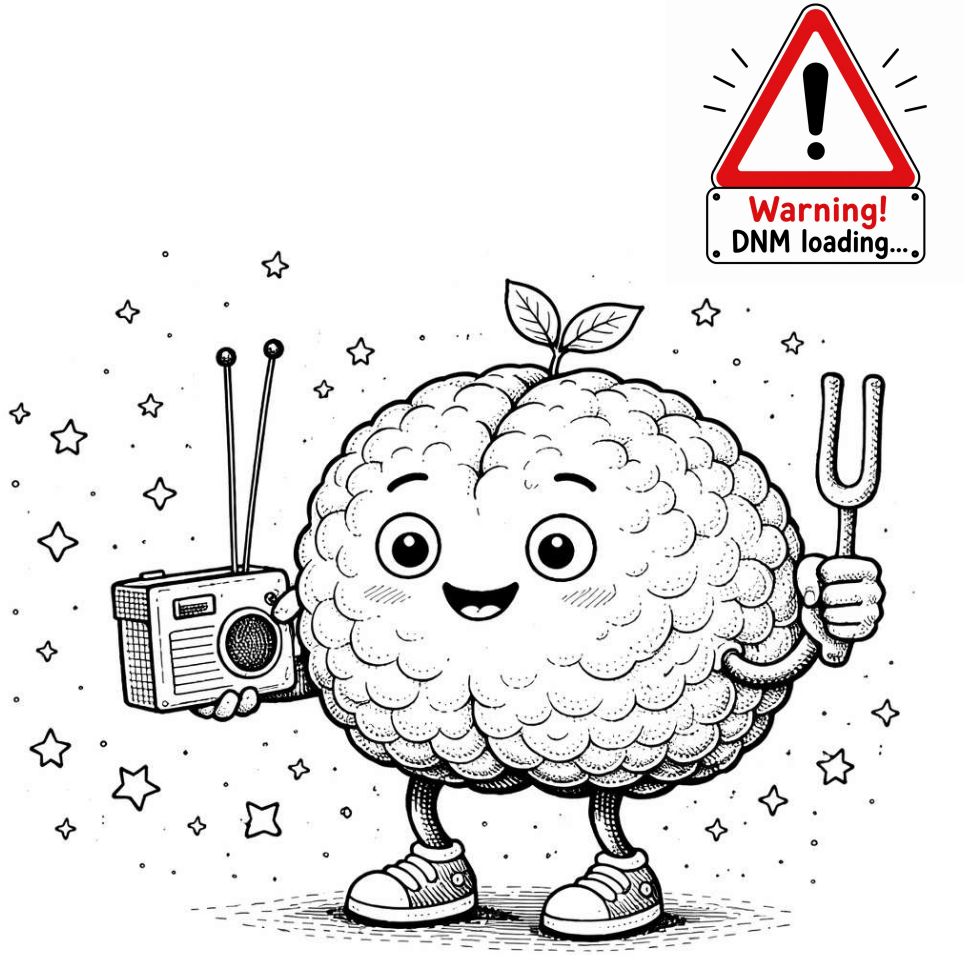


DANISH DEFENCE

5. Brain states

"My ability to learn depends less on what you teach and more on the state—frequency—you help me enter.

If I'm in beta, I'll perform.
If I'm in alpha, I'll absorb.
If I'm in theta, I'll connect and rewire.
So don't just give me content—
help me shift state."



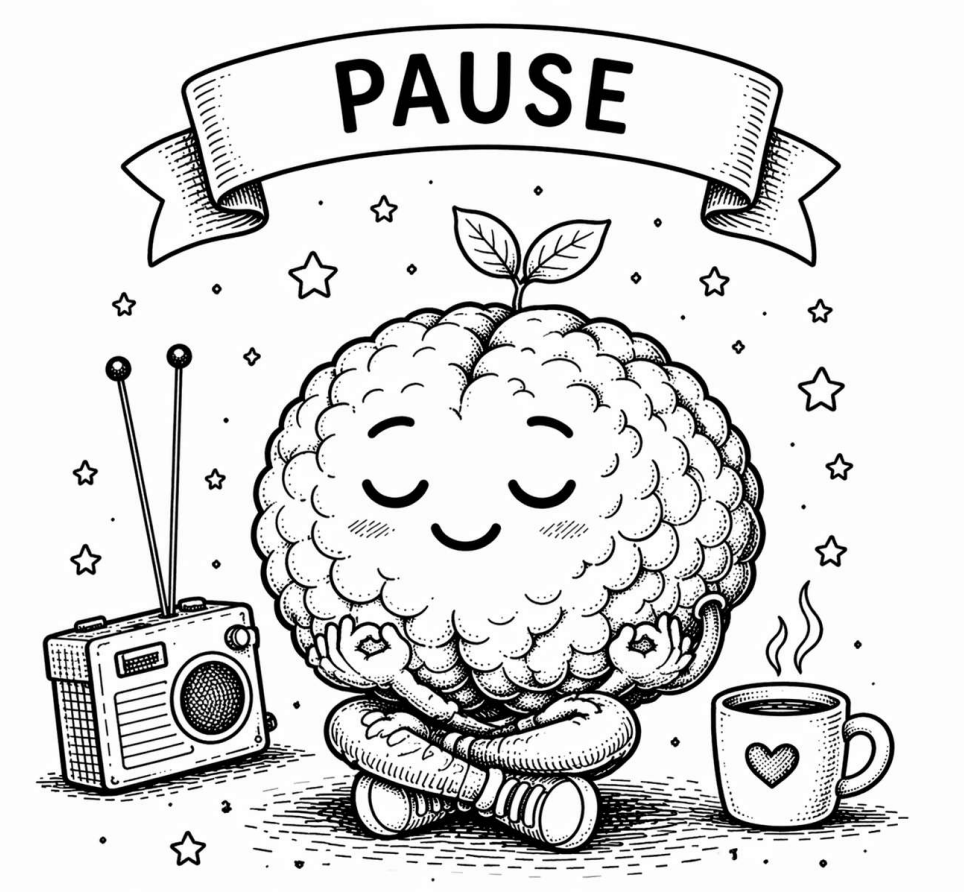
Give me a break – a brain break

DANISH DEFENCE

6. Work, breaks and movement

"I am not designed for constant attention"

- It works in cycles – teach it in cycles
- Constant attention decreases acces to prefrontal cortex

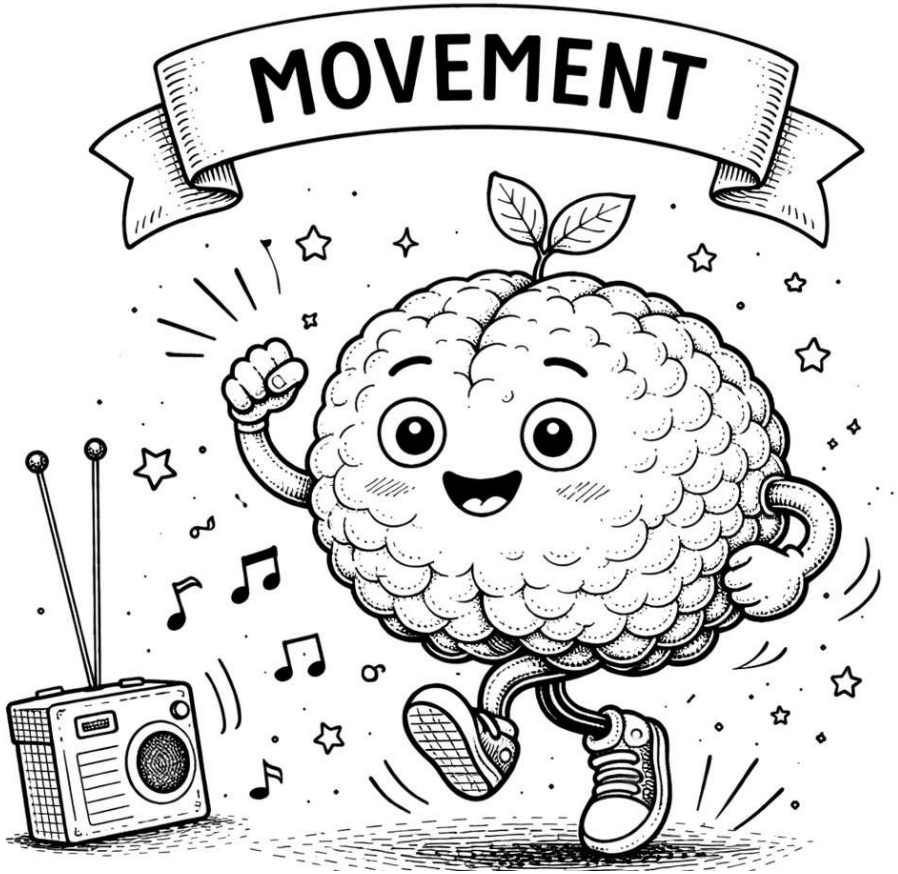


DANISH DEFENCE

6. Work, breaks and movement

- Physical activity seems to increase executive functions and memory

- Cognitive work = effort
- Pause = integration
- Movement = regulation



DANISH DEFENCE

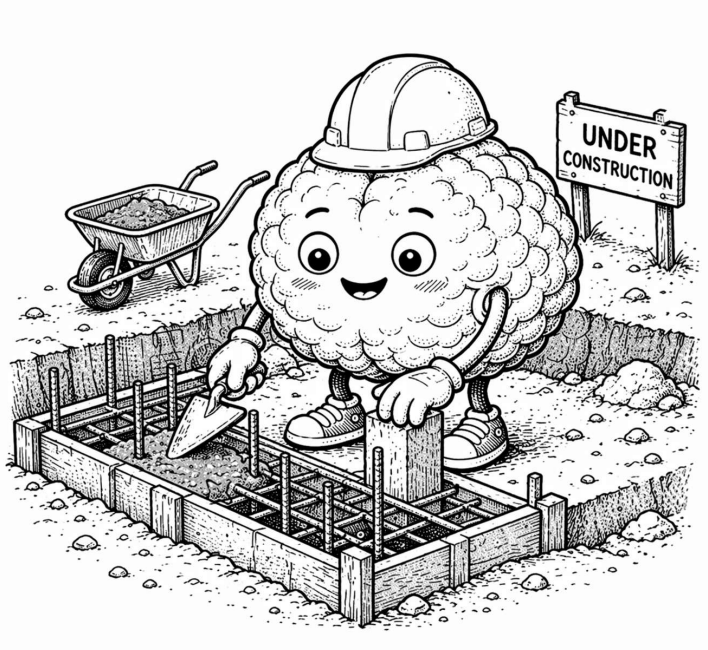
Our ”top 15” Neurodidactial factors

(What you need to facilitate learning that actually sticks)

DANISH DEFENCE

TOP 5 Non-negotiables (The foundation):

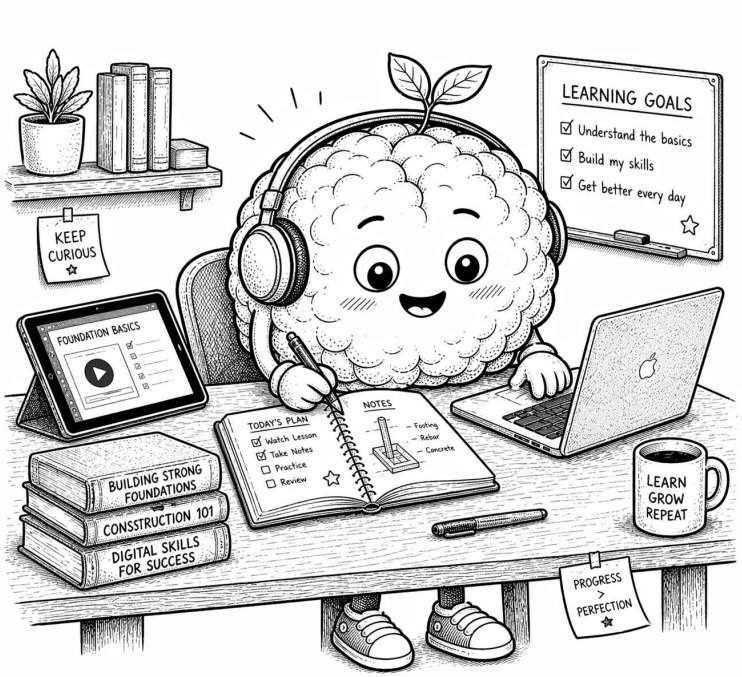
- Get the attention (over and over…)
- Create an appropriate level of arousal
- Make processing/learning active
- Make space in working memory
- Focus on meaning/percieved relevance



DANISH DEFENCE

Top 6-10 – What creates real learning

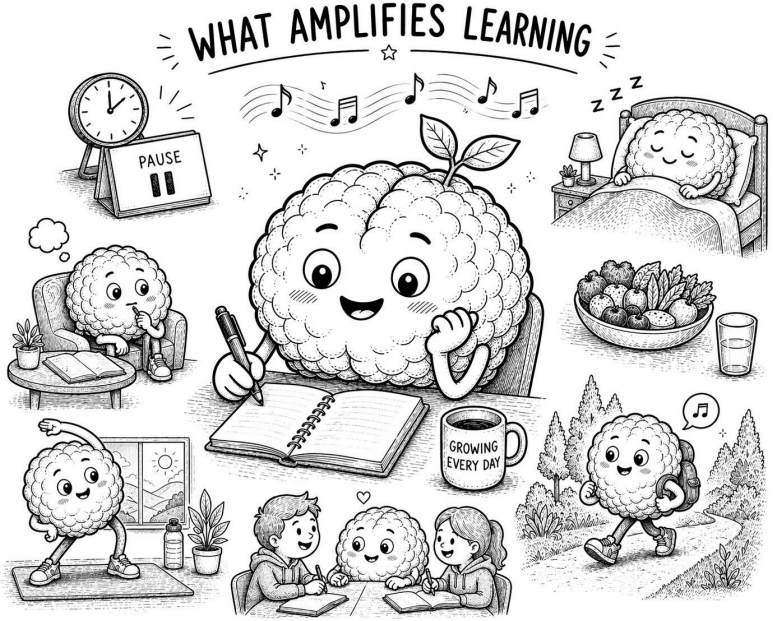
- Friction/discomfort
- Repetition + retrieval over time
- Repeated load over time
- Focus on one thing at a time
- Variation over time



DANISH DEFENCE

Top 11-15 – What amplifies learning

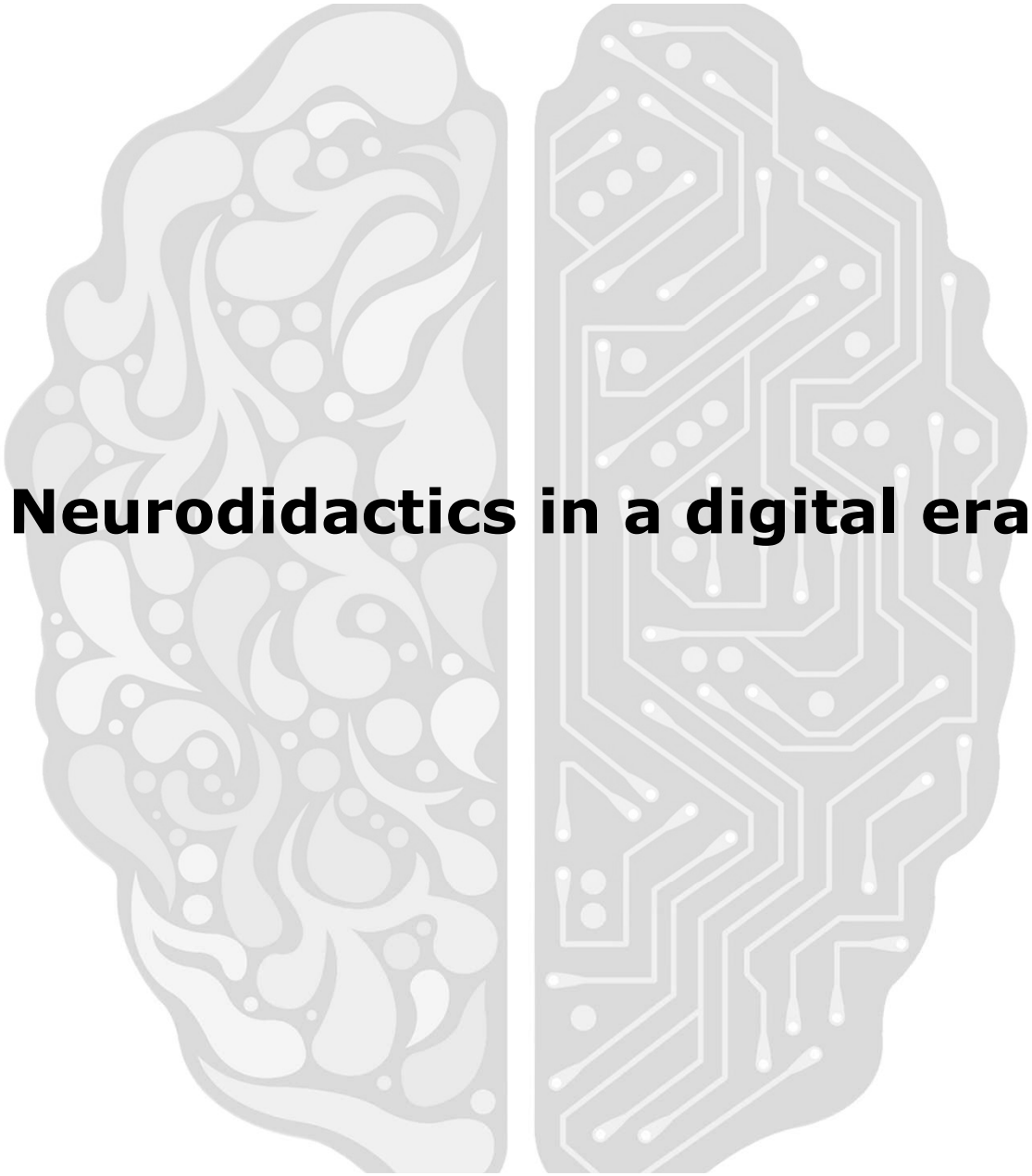
- Pauses (and rythm)
- Shifts between mental states
- Reflection after pressure
- Multiple sensory channels
- Movement



Contextual enablers:

- Safety and relationsships (trust)
- Learning mindset (dynamic vs. static)
- Sleep and nutrition

DANISH DEFENCE



Neurodidactics in a digital era

DANISH DEFENCE

Points of attention

- **Are we improving user experience at the cost of necessary learning friction?**
- Are we turning learning into “gamer mode”—where dopamine chases points instead of progress?
- Are we still just delivering content—when we should be training adaptable skills?
- Are we designing for the senses the brain actually needs—movement, balance, embodied input—not just screens? And are these needs aligned with the platform? (ex. vestibular systems and VR)

DANISH DEFENCE

Points of attention

- Are we improving user experience at the cost of necessary learning friction?
- **Are we turning learning into “gamer mode”—where dopamine chases points instead of progress?**
- Are we still just delivering content—when we should be training adaptable skills?
- Are we designing for the senses the brain actually needs—movement, balance, embodied input—not just screens? And are these needs aligned with the platform? (ex. vestibular systems and VR)

DANISH DEFENCE

Points of attention

- Are we improving user experience at the cost of necessary learning friction?
- Are we turning learning into “gamer mode”—where dopamine chases points instead of progress?
- **Are we still just delivering content—when we should be training adaptable skills?**
- Are we designing for the senses the brain actually needs—movement, balance, embodied input—not just screens? And are these needs aligned with the platform? (ex. vestibular systems and VR)

DANISH DEFENCE

Points of attention

- Are we improving user experience at the cost of necessary learning friction?
- Are we turning learning into “gamer mode”—where dopamine chases points instead of progress?
- Are we still just delivering content—when we should be training adaptable skills?
- **Are we designing for the senses the brain actually needs—movement, balance, embodied input—not just screens? And are these needs aligned with the platform? (ex. vestibular systems and VR)**

DANISH DEFENCE

Points of attention

- **Are we falling for “shiny toy syndrome” or “scenario seduction”?**
- **And are we taking distractions seriously—where are our learners, and what environment are they actually in? (ipad notifications etc.)**

DANISH DEFENCE

Points of attention

- Are we falling for “shiny toy syndrome” or “scenario seduction”?
- **And are we taking distractions seriously—where are our learners, and what environment are they actually in? (ipad notifications etc.)**

DANISH DEFENCE

Points of attention

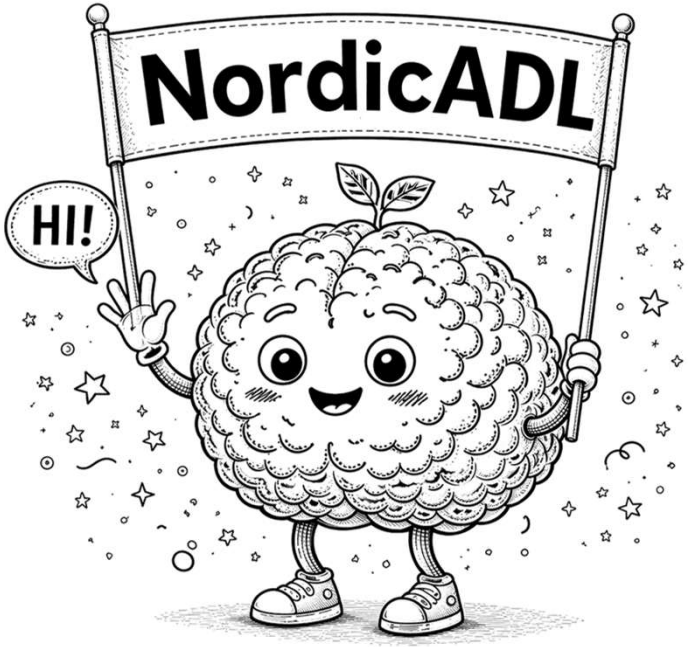
- Are we falling for “shiny toy syndrome” or “scenario seduction”?
- And are we taking distractions seriously—where are our learners, and what environment are they actually in? (ipad notifications etc.)

“The brain that does the thinking,

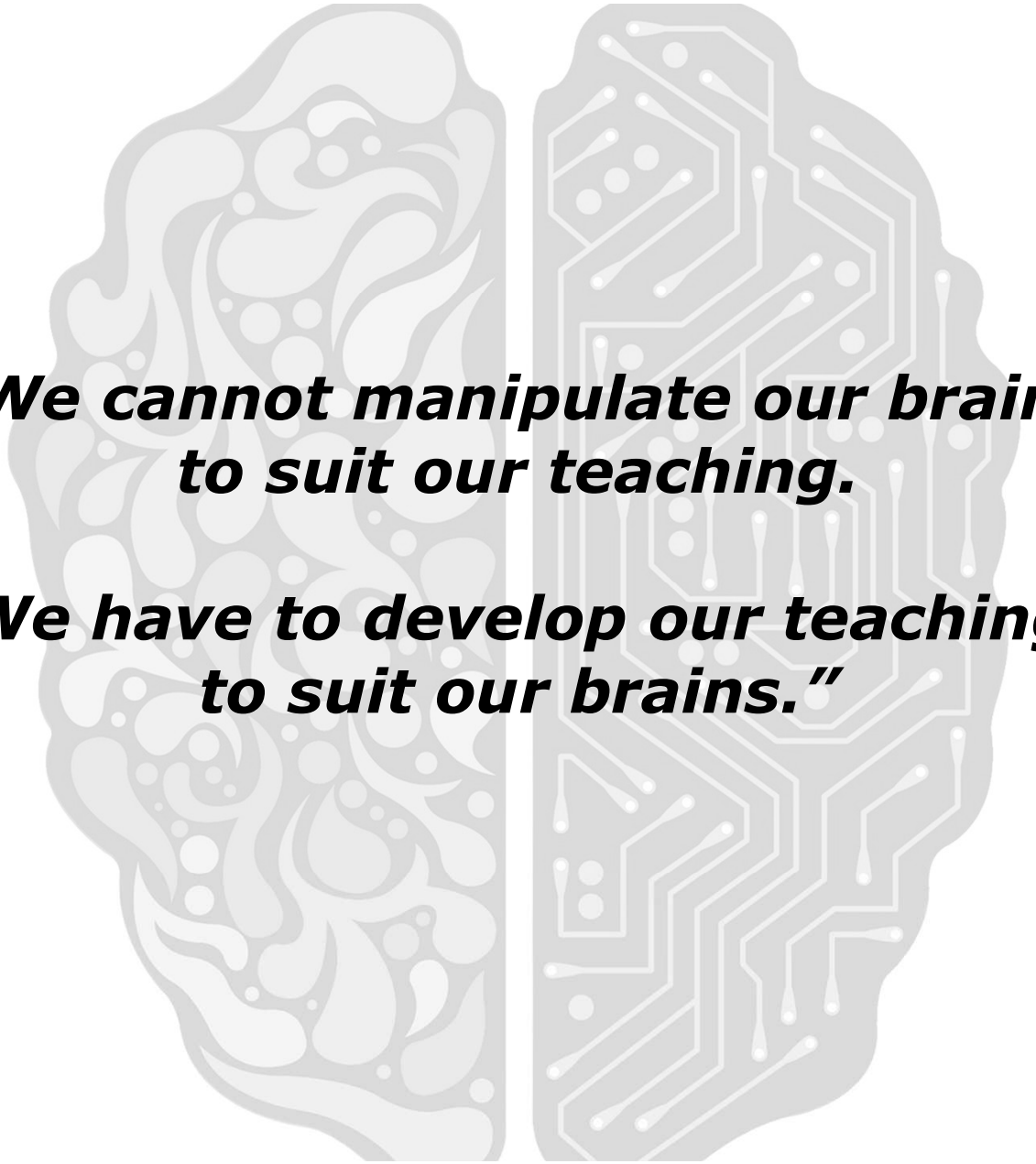
is the brain that achieves the learning.”

DANISH DEFENCE

NordicADL: Good examples for neuro compatible learning design



DANISH DEFENCE



”We cannot manipulate our brains to suit our teaching.

We have to develop our teaching to suit our brains.”

DANISH DEFENCE

”We cannot manipulate our brains to suit our teaching.

We have to develop our teaching to suit our brains.”

Questions? Please feel free to connect:
Stefan Astrup Madsen: STMA@FAK.DK
Victoria Grønning Iverssøn: VIIV@FAK.DK