Behavioural aspects of safety

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Cefic sector group

euro chlor 17.

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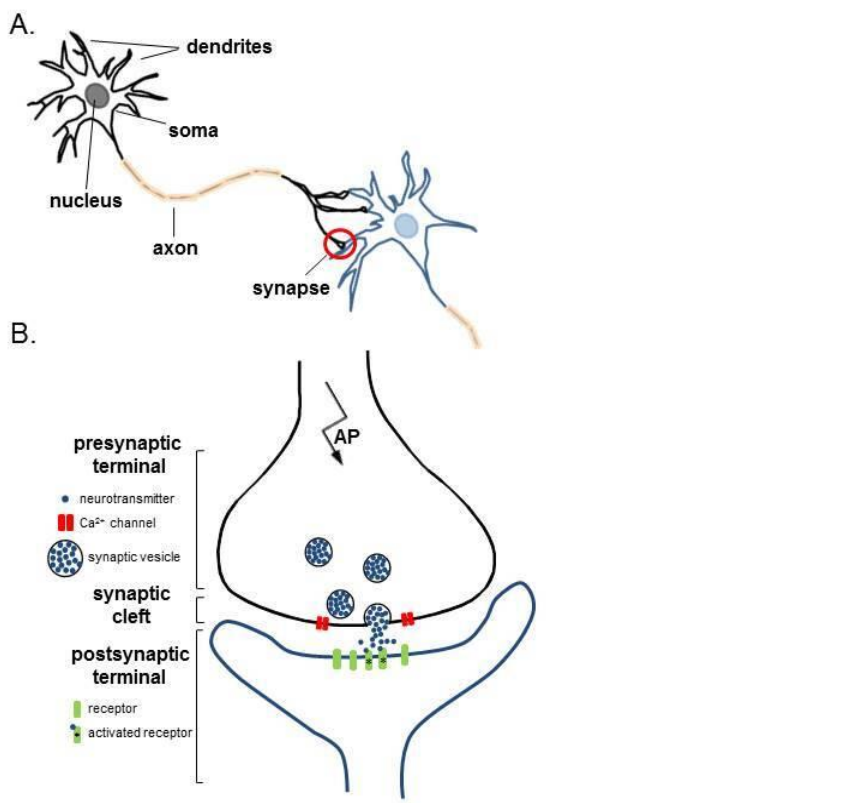
How does our brain get information?

- Electrical impulses
- Specific chemical transmitters/ ions
- Connections



Physiology, Neurotransmitters
Zachary M. Sheffler; Vamsi Reddy; Leela Sharath Pillarisetty.

How does our brain get information?
How do we translate the impulses?

Learning means making new connections:

- At birth we have 90 billion neurons with few to no connections with other neurons
- Creating new connections results in a change in the anatomy of our brains

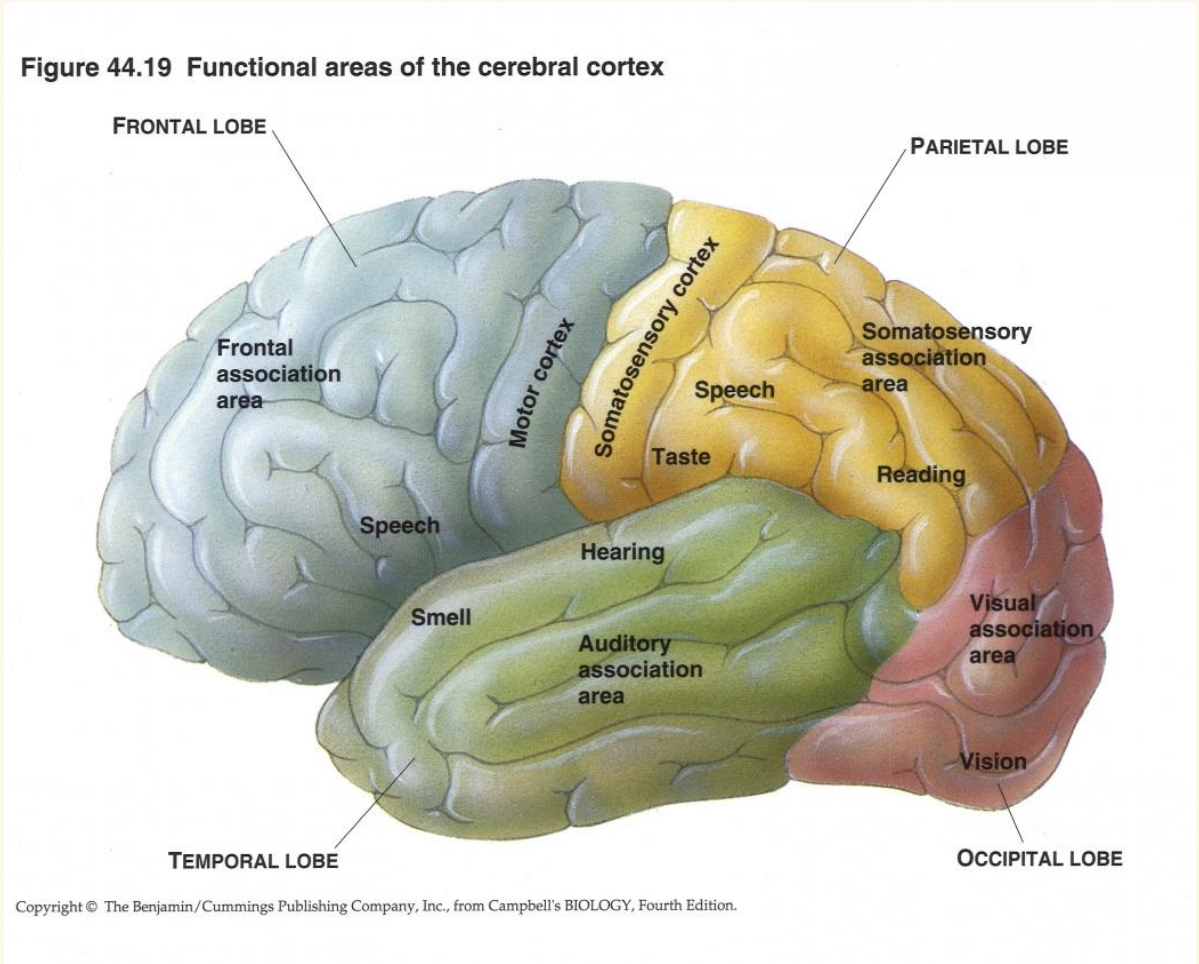
How does our brain get information?
How do we translate the impulses?

Learning means decoding the information based on:

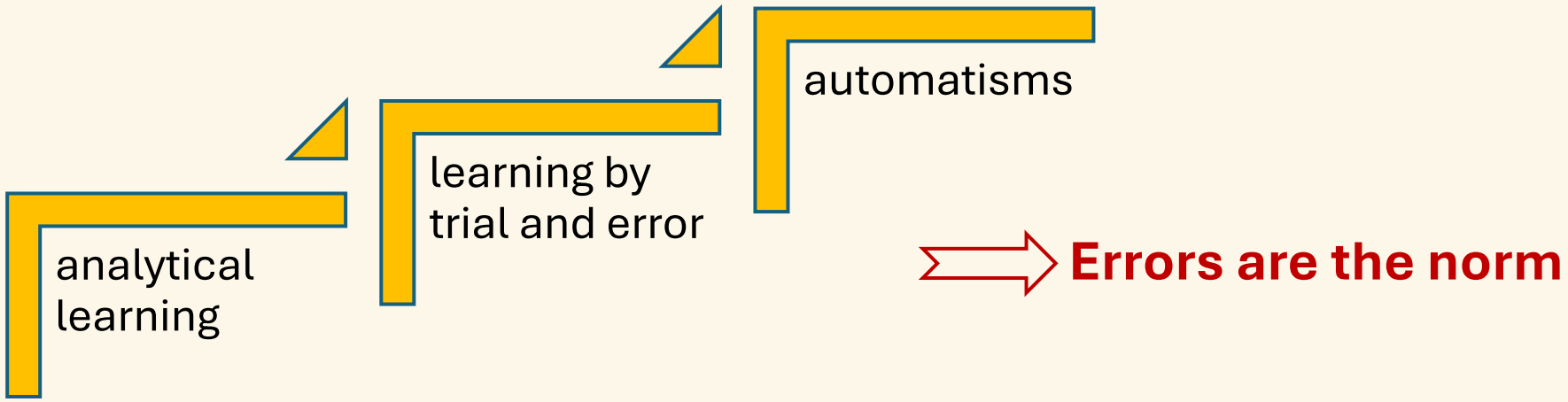
- The number of action potentials emitted
- Their frequency
- The way they are organised into bursts
- The duration of the message

How does our brain get information?

- Storage is organised in functional areas



How does our brain get information? Best learning?



⟹ **Errors are the norm**

How does our brain get information? Why automatisms?

Optimising energy expenditure is the message:

- 25% of the oxygen we breathe
- 20% of the glucose we ingest

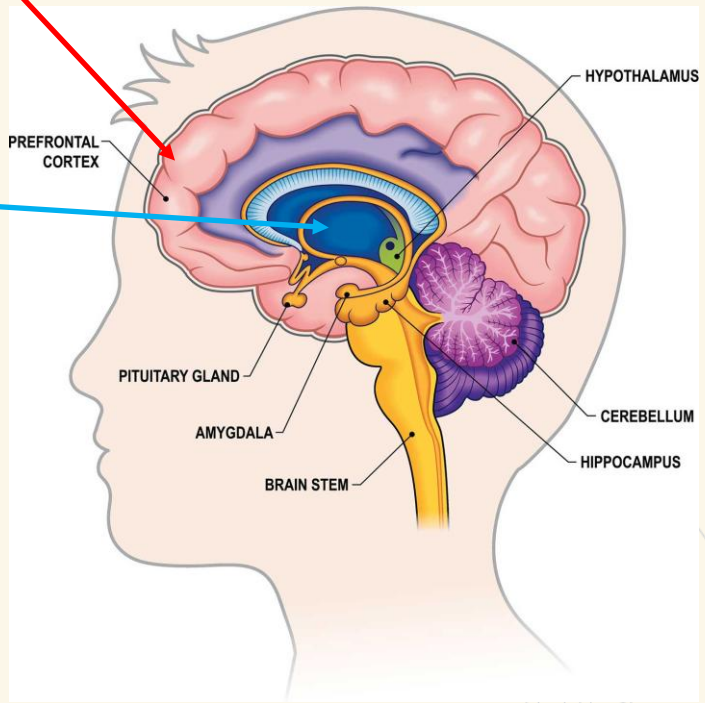
Two control centres

conscious mode

- thinking
- conscious learning
- decision making
- one activity at a time
- **high energy consumption**

automatic mode

- routine activities
- automatisms
- several activities at a time
- **low energy consumption**



Brain properties:
How do we interpret reality?

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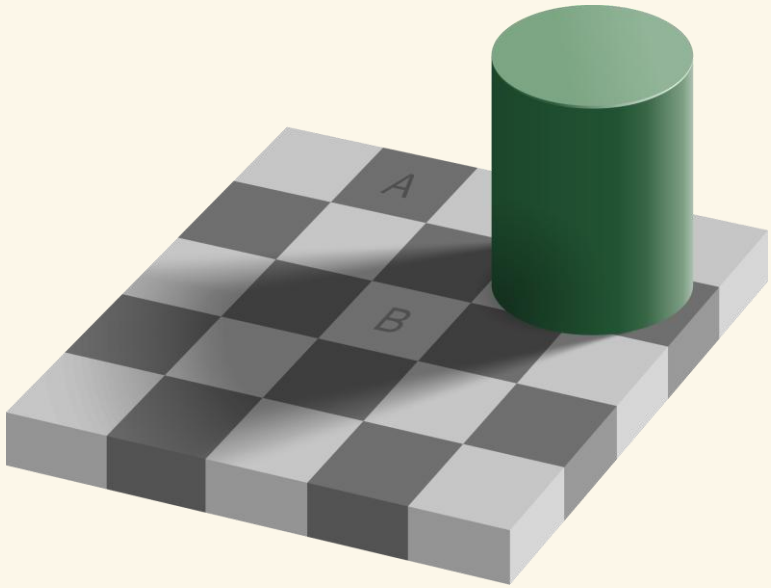

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Brain properties:
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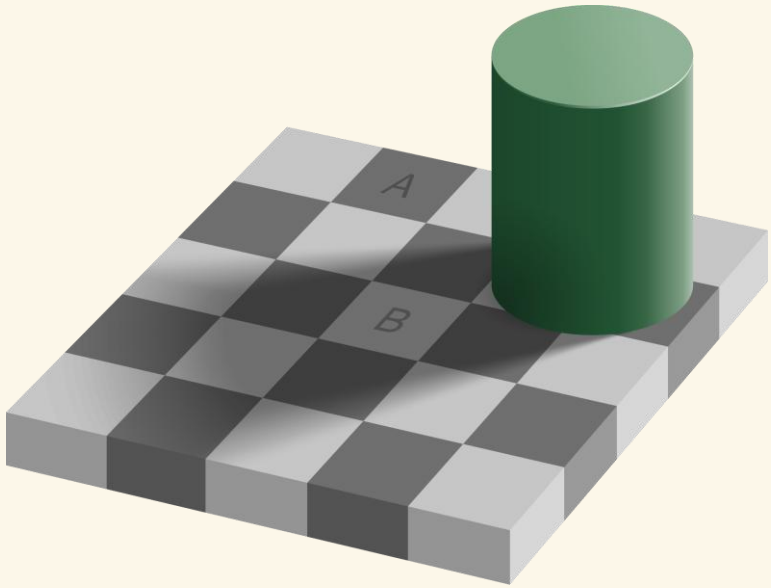

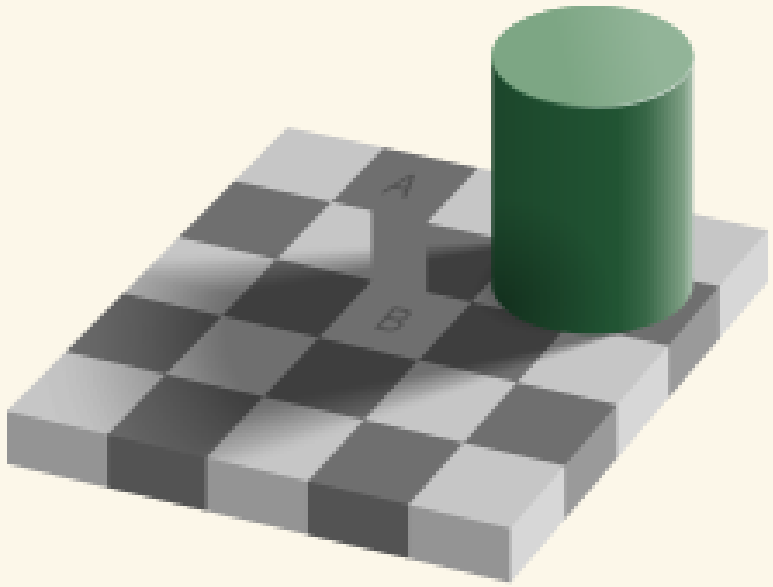

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Brain properties:
How do we interpret reality?

W3 CAN DO TH1S 3X3RC153 W1THOUT PROBL3M5
B3CAU53 OUR BRA1N AUTOMAT1CALLY CORR3CTS
M15TAK35 OR WHAT 1T CON51D3R5 TO B3 M15TAK35.

Brain properties:
How do we interpret reality?

We interpret reality based on what we have learned

Our reality is what we believe
(we force us to decode the action potentials incorrectly)

Visual environment:
10% from the eyes, 90% from different regions in our brain

Brain properties:
How do we interpret reality?

When we are focused on an activity, we become "blind and deaf" to everything else:

Majority of processing of action potentials carried out in automatic (subconscious) mode.

Only small amount of info consciously processed in our prefrontal cortex

Multitasking:

Performance declines (97.5% of cases)

The reliability decreases

Habituation:

Brain detects: new info or not

In order to concentrate we NEED to filter out most of our environment. Importance of 4 eyes.

Brain properties:
How do we interpret reality?

Advice:

- **Pay attention by taking a Stop Time.**
- **Shared vigilance.**

“blind and deaf”

Multitasking

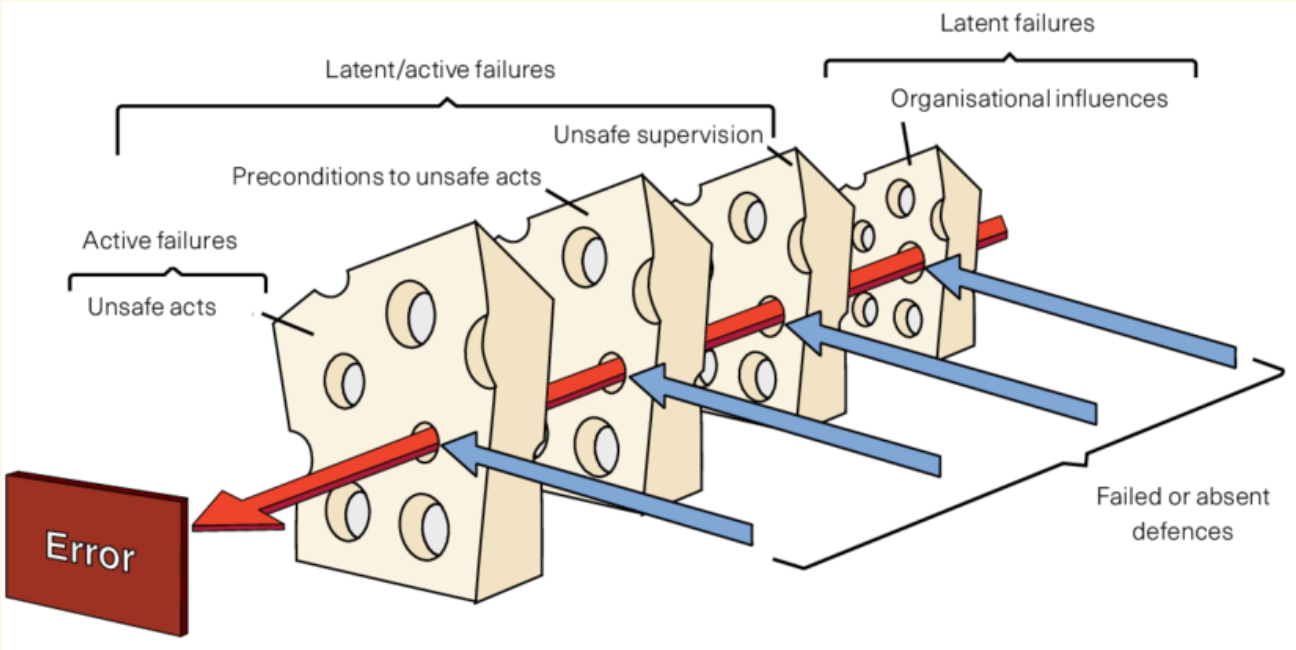
Habituation

Filter out most of our environment

How to avoid mistakes?

Lines of defence

- The person approach
  - Establish a joint reporting culture based on trust and a just culture
- The system approach
  - The Swiss Cheese model (James Reason)
    - Planning/ organisation
    - Preparation
    - Activities
    - Staff



In practice?
Pre-job briefing

Aim:

- Prior activation of the correct neural networks
- React better to unforeseen circumstances
- Switch from automatic mode to conscious mode

In practice?
Pre-job briefing

How?

- What is the expected result?
- What are the risks, and which risk is the most serious?
- What human tools will be put in place?
- What situations are likely to result in errors?
- What is the feedback on this activity?

In practice?
Self-check

Aim:

- Ensure reliability and alignment with expected outcomes when reading
- Switch from automatic mode to conscious mode in a reliable way

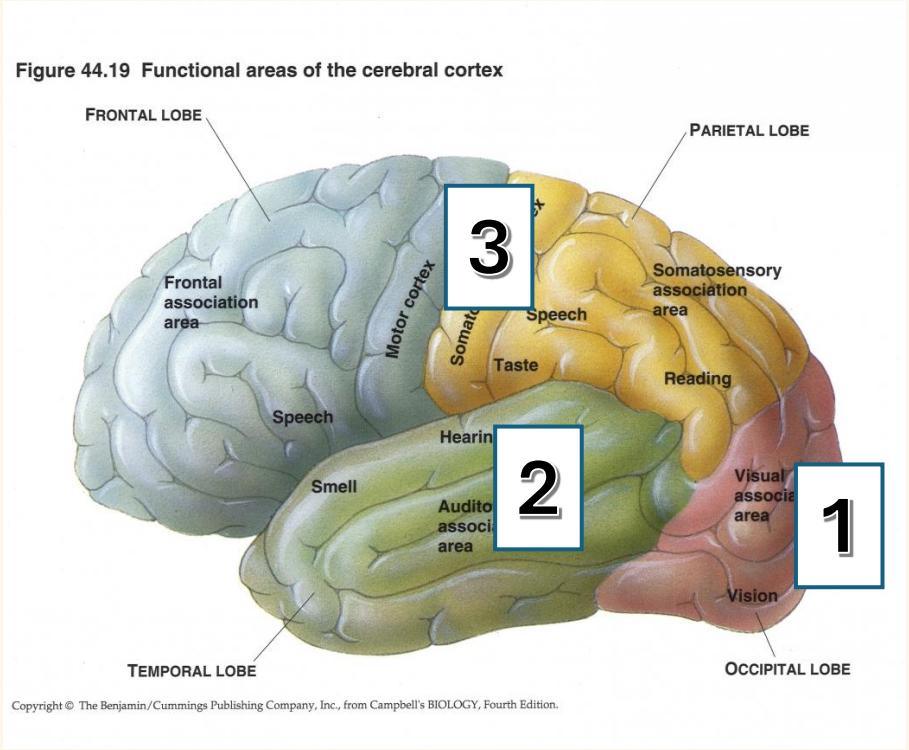
In practice?
Self-check

Sensory triangulation

Activating all three senses at once

- Reading: sight (**1**)
- Reading out loud: hearing (**2**)
- Following along with your finger: touch/ motor function (**3**)

How?



In practice?
Self-check

How?

STAR

- **STOP** – Is my attention focused on the task?
- **THINK** – What action am I about to perform?
- **ACT** – Am I performing correctly?
- **REVIEW** – Did I get the expected result?

Brain properties: So what?

Errors are the norm: **we are** falible	•get organised in order to identify errors before acting •wear PPE •anticipate other people's errors
We interpret reality based on context/ what we've learned: **we are interpretative**	•take a step back from the context/ pre-job briefing •stop-time when interrupted and restarting after an interruption •stop-time in case of incidents
We perceive what we've learned to perceive: **we are unique**	•receive safety training = first safety measure •hiring people as diverse as possible
We only perceive part of our environment: **we are selective**	•stop to perceive = stop-time •sharing = shared vigilance

Other pitfalls: Short-Term Memory

Role:

Enables communication

Enables to keep track of an activity

Storage limitation:

Capacity:

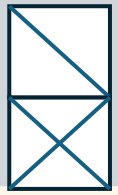
- 5 – 9 pieces of information
- Reduced by stress

Time : 18 seconds on average

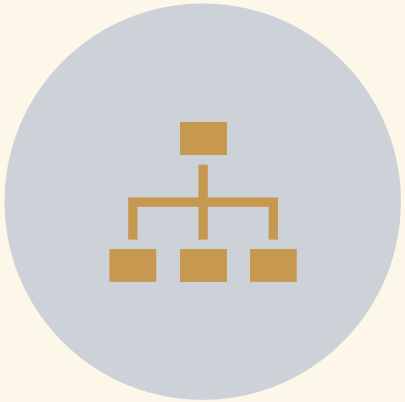
Very sensitive to interruptions

How to avoid errors?

Secure communication	• 3 steps
Limiting interruptions	• Organisation of work and the environment • Human side
Stop Time when interrupted:	• Ensure reliability by returning the brain in conscious mode (2 questions)

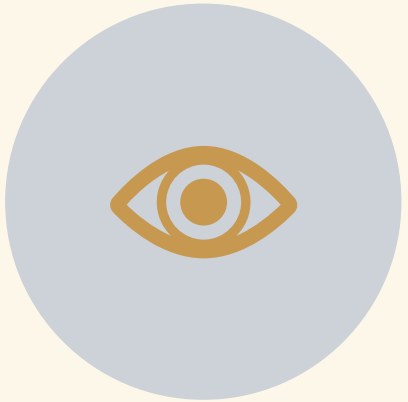
Step-by-step procedures	• For activity that depends on a precise series of actions:
	  • start activity:
	  • stop activity: 

Other pitfalls: Long-Term Memory
Effective memorisation strategies



STRUCTURING

ASSOCIATION OF IDEAS



MENTAL IMAGERY OR VISUALISATION

Long-Term Memory Recall

Computer hard drive	Human memory
1. Limited capacity.	1. No need to erase information in order to absorb more.
2. Information is stored in the form of 0 and 1 located in a matrix.	2. Storage relies on multiple senses and there are several ways to access a memory.
3. Information is stable.	3. Each time we recall a memory, we reconstruct it; it is not stored in a fixed form in our memory.
	Errors

In practice:
How to increase the reliability of our long-term memory?

Pre-job briefing

Answering the ‘5 questions’ activates long-term memories

Overseen & validated by a third party

Stop time when interruption happens

Checklist gives 100% reliability in spite of possible contingencies

Traceability

By video, audio recordings and written accounts

Cross-checking information

In high-risk situations and irreversible actions where an error is fatal + Cross-checking checklist

Conclusions

- Energy optimisation constantly forces our brain into an ‘automatic mode’
- As a result we are fallible/ interpret reality/ are unique but also selective in what we perceive
- There are aids to push our brain into an ‘active mode’ to avoid mistakes

THANK YOU

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Cefic sector group

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Chlor-alkali: achieving climate neutrality