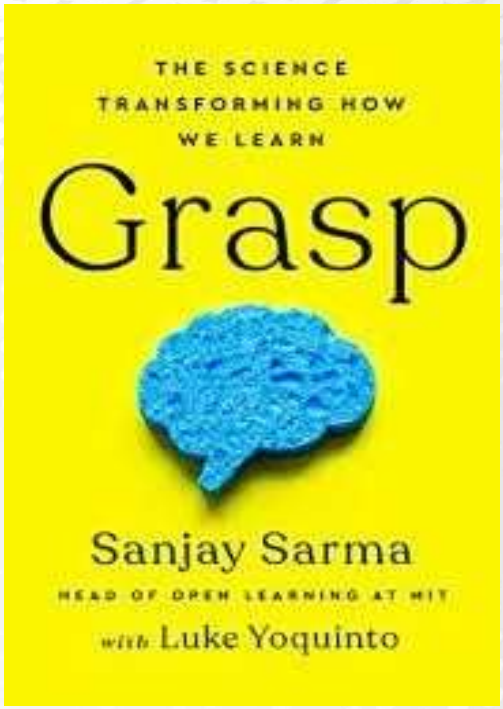
Principles and Practices: Why to Error is Human and What Can We Do About It?

Joe Estey

Lucas Engineering and Management Services

Today's Purpose



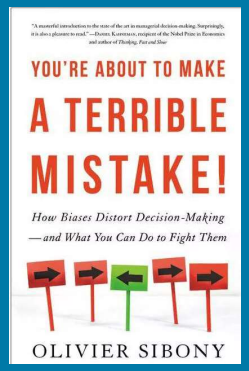
….to Promote Curiosity….

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

	Human Performance Improvement/Resilience Engineering	
Safety I and Safety II: Past and Future of Safety Management, (Hollnagel, Eric)	Title emphasizes Safety but this book is far broader, explaining the difference between the way we used to do business and the way business needs to be done in the 21st Century. Excellent examples of failed and traditional 'risk aversion' approaches to work versus performance-enhancing 'risk competency'. Resilience Engineering Must Read. **Video Link**	**
Lean Human Performance Improvement, Harbour, Jerry, 2015, Taylor and Francis Group	The author does an indepth review of various principles, practices and tools used to improve organization and individual performance. Each chapter contains specific take aways for identifying and managing the inevitable error likely situations and challenges created in complex, high hazard industries. If particular note, is the HEART analysis used to predict and prevent error precurosrs and flawed defenses early in task or project planning. Must read for those involved in Lean and HPI practices within the organization.	***
Safety II in Practice: Developing the Resilience Potentials, Hollnagel, Eric, 2017	"The measurement problem (in safety) is simply that an *increase* in safety is presented by a *decrease* in what is measured, so a lower number of reported accidents or other unwanted outcomes is seen as representing a higher level of safety. This produces a *regulator paradox* where the absence of feedback ultimately leads to a loss of control as the task of the regulator (control, safety system) is to eliminate variation –but this variation is the ultimate source of information about how well the regulator works". Hollnagel challenges the traditional 'safety by the numbers' and 'linear causation beliefs' throughout this insightful book. Using examples from a variety of industries, he creates a case for the Risk Competent mindset he first discussed in Safety I and II, highlighting the four Potentials of HRO's: Potential to Respond, Monitor, Learn and Anticipate.	***
Risk Based Thinking, Mushara, Tony, 2018	Generally, HPI provides a risk-based approach to managing human performance in operations. But, specifically, risk-based thinking enables foresight and flexibility—even when surprised—to do what is necessary to protect assets from harm while achieving mission success despite ongoing stresses or shocks to the operation. Although you cannot prepare for every adverse scenario, you can be ready for almost anything. When risk-based thinking is integrated into the DNA of an organization's way of doing business, people will be ready for most unexpected situations. Eventually, safety becomes a core value, not a priority to be negotiated with others depending on circumstances. (Amazon Review)	**
Conduct of Operations and Operational Discipline, (Chemical Process Safety Society)	Written as a College Textbook, focuses on Conduct of Operations and Human Performance Improvement techniques for industrial processes and complex systems. Provides a comprehensive understanding of the systematic approach to Operational Discipline. **Sample:** http://download.e-bookshelf.de/download/0000/5886/31/L-G-0000588631-0002362171.pdf	**
Human Error, Ashgaste Press, 2013 Reason, James	Foundational companion book to Safety Differently, Reason adds dimension to Dekker's explanation of human error using examples from a variety of events and near misses. Explains the three performance modes and provides error reduction techniques for each. **Video Link**	

CHOLearning.com

What are the Risks?



"Our challenge isn't human error,
It's human nature"

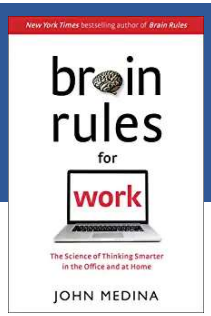
"We tend to underestimate the challenges We will face while overestimating our Ability to handle them" Olivier Sibony

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

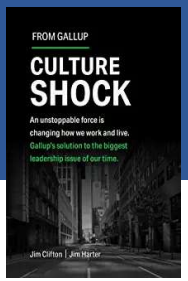
Plan A or Plan B?

What does a cat have in common with a refrigerator?

Ability Agility:
Apply what you know about Situation A to Situation B without Help

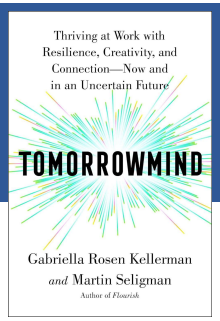


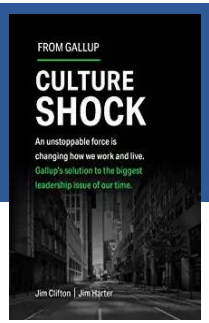
Things Have Changed

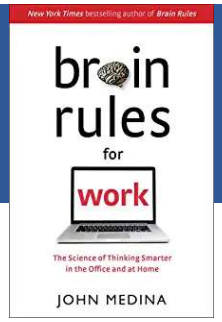


"Our response to Covid Pandemic was the most impactful change to business and the way we work than any other event in the past 200 years",

(Dr. John Medina, Brain Rules at Work)







Life Today

56% of 125 million workers believe they don't have to be in workplace to get work done—compared to 6% working at home in 2018

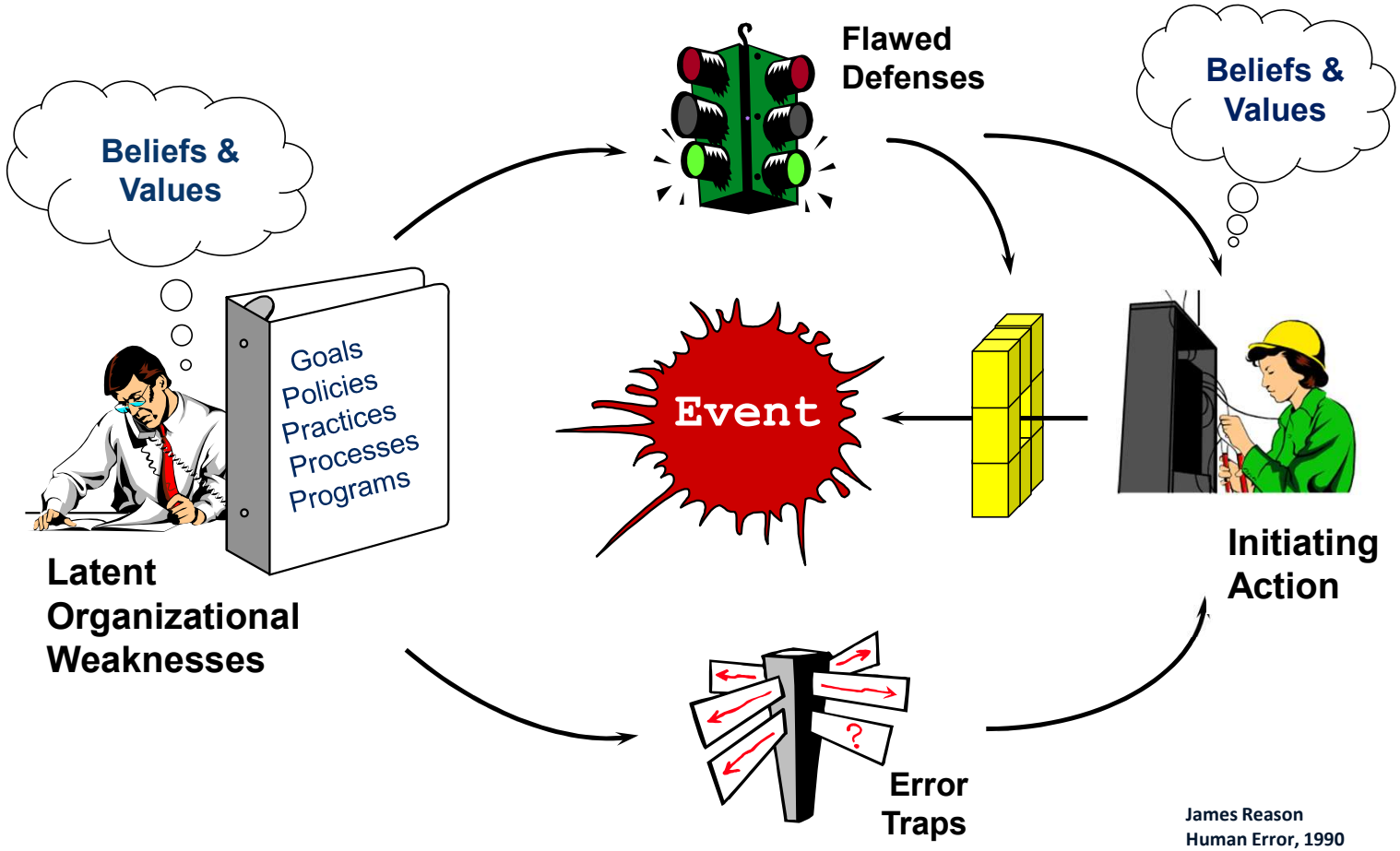
90% of knowledge workers (desk jobs) do not want the restrictions and routines associated with pre-covid workplaces

50 million workers switched careers not just employers from 2020 to 2022—largest transition in history (22% went back in one year)

People want their work to fit into their life not their life to fit into their work

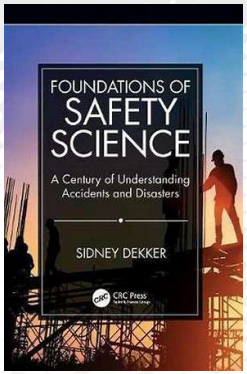
"We don't look for our work to always provide us 'meaning'—but we want our work to matter"

ANATOMY OF AN EVENT



Error Trap– Short List

Work Environment	Individual Capabilities
• Distractions / Interruptions	• Unfamiliarity with task / First time
• Changes / Departures from routine	• Lack of knowledge (mental model)
• Confusing displays or controls	• New technique not used before
• Workarounds / Out-of-service instruments	• Imprecise communication habits
• Hidden system response	• Lack of proficiency / Inexperience
• Unexpected equipment conditions	• Indistinct problem-solving skills
• Lack of alternative indication	• "Hazardous" attitude for critical task
• Personality conflicts	• Illness / Fatigue
Task Demands	**Human Nature**
• Time pressure (in a hurry)	• Stress (limits attention)
• High workload (memory requirements)	• Habit patterns
• Simultaneous, multiple tasks	• Assumptions (inaccurate mental picture)
• Repetitive actions, monotonous	• Complacency / Overconfidence
• Irrecoverable acts	• Mindset ("tuned" to see)
• Interpretation requirement	• Inaccurate risk perception (Pollyanna)
• Unclear goals, roles and responsibilities	• Mental shortcuts (biases)
• Lack of clear standards	• Limited short-term memory



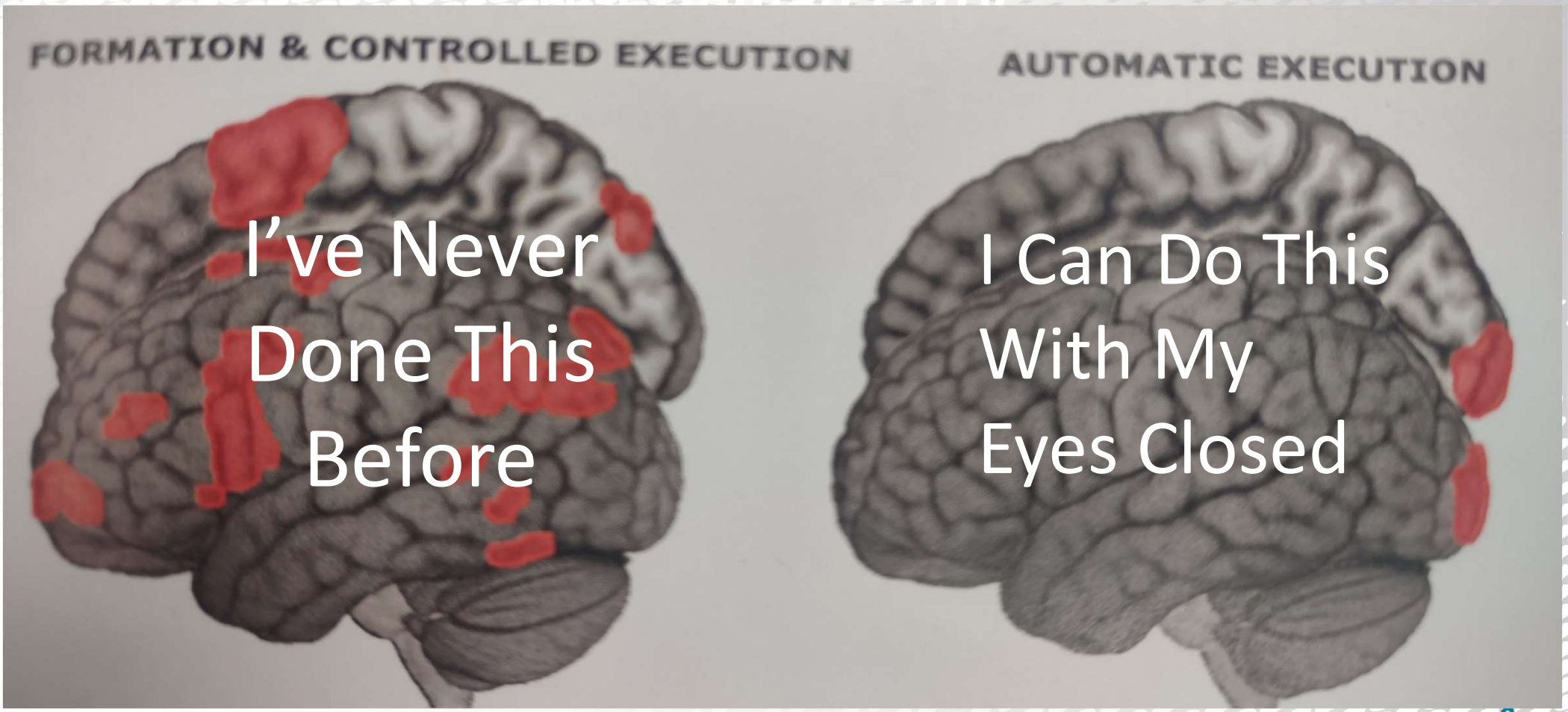
Performance Improvement: Past, Present and Future

1900-1980:
Improvement by increasing competency
(knowledge, skill, ability)

1980-2000:
Improvement made by reducing complacency and drift
(Rules, Requirements, Regulations)

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

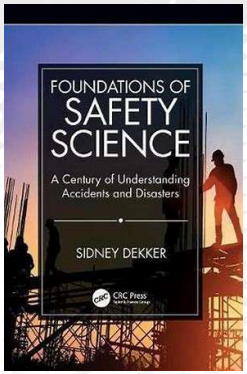
The Challenge is Human Nature



LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Greatest Challenge Today

Place index and pinky fingers directly parallel to each other—
index on top, pinky on bottom.



Performance Improvement: Past, Present and Future

1900-1980:
Improvement by increasing competency
(knowledge, skill, ability)

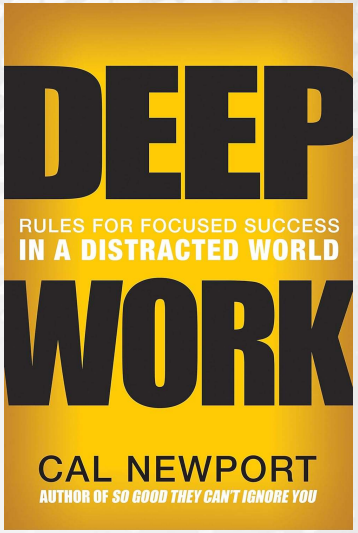
1980-2000:
Improvement made by reducing complacency and drift
(Rules, Requirements, Regulations)

2000-Today:
Improve by managing distractions and interruptions

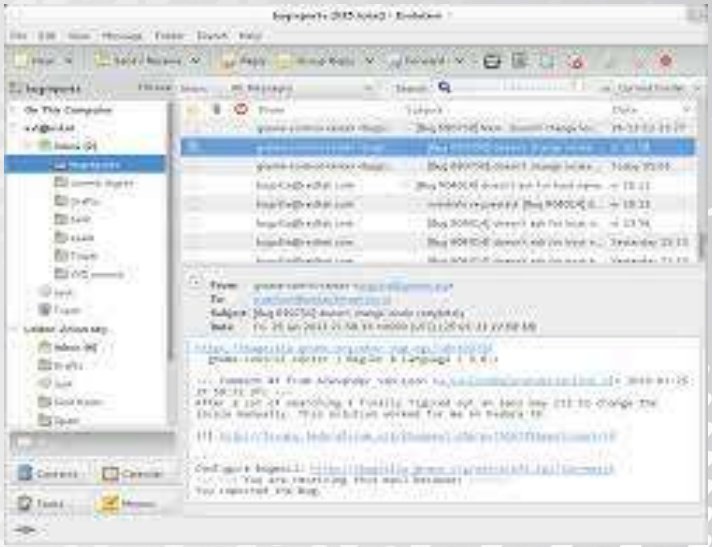
LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Life of Distractions and Interruptions

Checking In



Response Required



People are on average distracted every 3 minutes

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

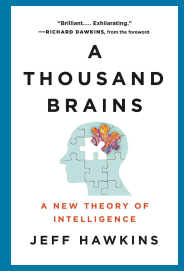
ATMOSPHERIC ADVERTIZING

Everyday Expertise in Everything
Choices, Challenges and Cognitive Overload

Brain makes 1,000 sensory predictions/sec.

35,000 unconscious choices per day.

122 yes and no decisions per day.



Nearly a ten-fold increase in the potential choices and decisions made just three decades ago while our brains have not changed significantly to adjust to the new demands.

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Challenges to Attention

Technology Metabolic Insecurity

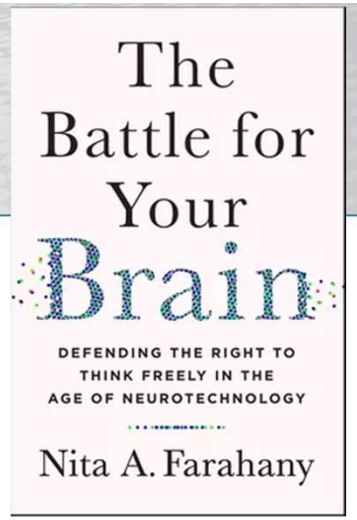
Setting a certain schedule to use technology just as setting a schedule to eat improves health (food insecurity)

Environmental Insulation

When we no longer expect or are ‘attuned’ to the unexpected…

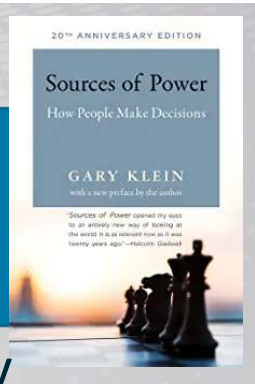
Clearing the Mind
and
Developing a Technology Metabolism

The Upcoming Challenge of Cognitive Monitors (Ethical Challenges)



"If we are concerned about machines built to think like adults, we should be more concerned about teaching adults to think like machines"

Organizational Expectations
Error Tolerance



Variation is your enemy

Cooks: Risk Averse

Know how to follow a recipe and as long as conditions don't change, they are rewarded for conformity not creative discretion.

Variation is your reality

Chefs: Risk Competent

Understand the principles behind each practice and decision. They can readily adjust their performance without jeopardizing the outcome.

(*Ability Agility*)

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

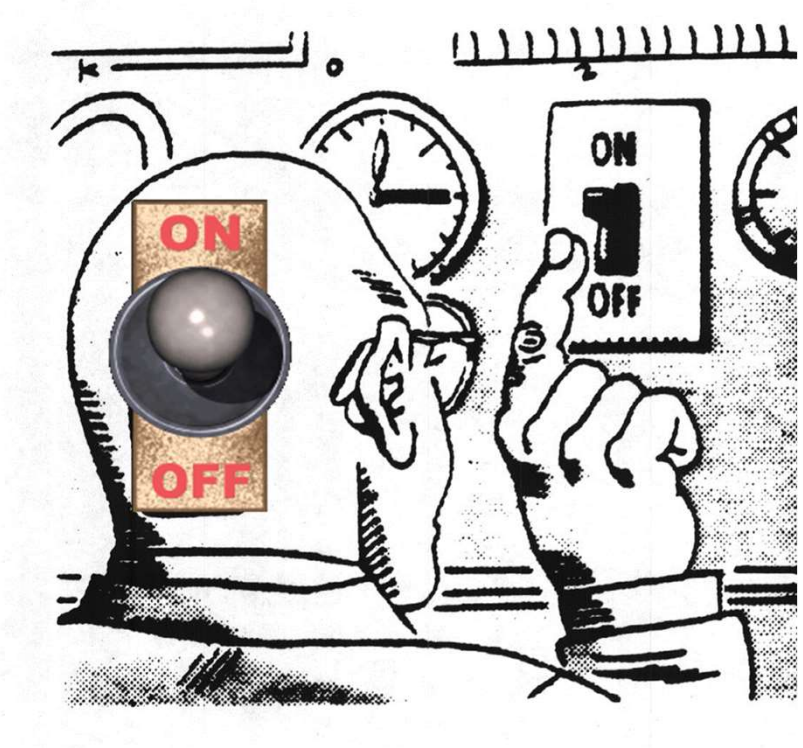

What Magicians
Know that Most
Other People
Don’t

1970 to 2000
3000 per year

10/10 SCAN

< 300 per year

Error Prevention Tools



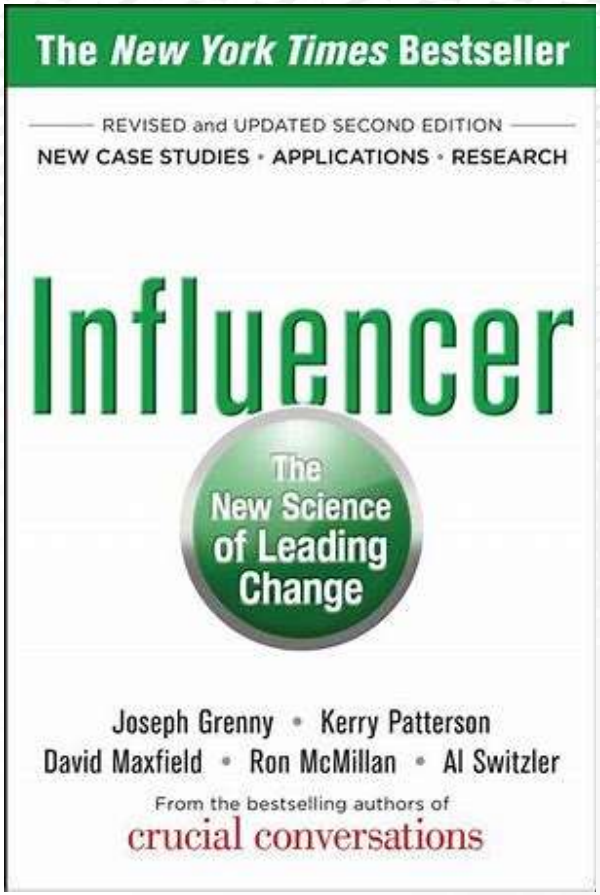
- Premortems
- Self-Checking (S-T-A-R)
- Stop When Unsure
- Questioning Attitude (What If/How)
- Pre-Job Briefing
- Peer Checking
- Procedure Use and Adherence
- Post-Job Briefing/After Action Review
- Learning Teams/From Every Day Work

Principles and Practices

Principle without a practice is a slogan
and
a Practice without a Principle is
a task but never a value

LUCAS ORGANIZATIONAL PERFORMANCE TEAM

Overriding Principle For Performance Improvement



Successful
for two reasons:
we want to be (motivation) and
we are able to be (ability).

Organizations spend more effort on *'getting people to care about what they are doing'*, less on increasing the capacity and ability to accomplish objectives and tasks.

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Improving Performance

Motivation:
Effort not Enthusiasm

Influences:

- Benefit and Purpose
- Risk and Reward

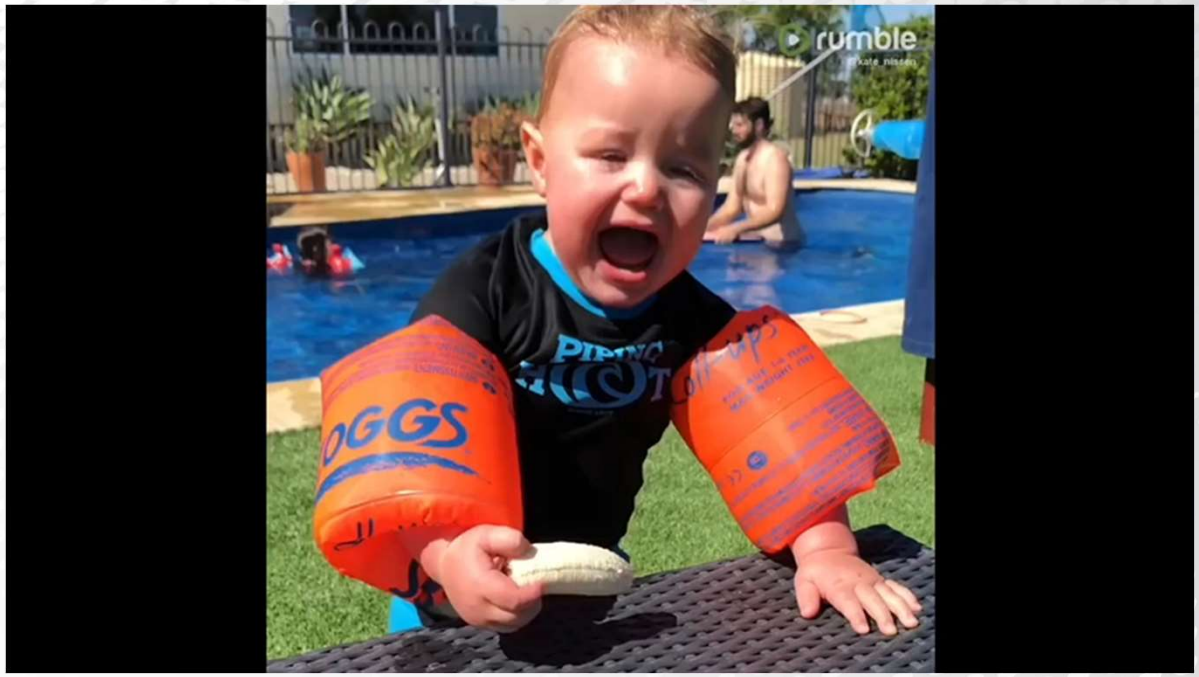
Ability:
Skills, Tools, Practice

Influences:

- Knowledge, Skills, Ability, Experiences, Familiarity

LUCAS ORGANIZATIONAL PERFORMANCE TEAM

Motivation or Ability?



LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Principle without a Practice…..

- **7.1.10.** Employees shall keep their mind on the job at hand and take time to think through what their next step will be.

- **7.1.11.** Employees shall place themselves, their tools and equipment in the proper position to do the job safely.

- **7.1.12.** If employees involved in the work feel it is necessary, a walk down of the site to assess the area hazards may be performed prior to the Pre-job Safety Briefing.

Principle with a Practice

Individual workers perform their own informal pre-job safety review.

As a minimum, worker evaluates individual safety review questions:

- Will I be exposed to hazards at the work location that are **not** associated with the job?
- Will I use chemicals or materials for the first time?
- Will the job require PPE that I do not normally use?
- Will bystanders or passersby be exposed to job hazards?
- Will any permits be required?
- Is there any aspect of the work that is causing uncertainty?
- If answer to any of the six questions is "yes," activity scope may not be skill based and should be re-evaluated.
- Worker stops and contacts task leader(supervisor) for resolution.

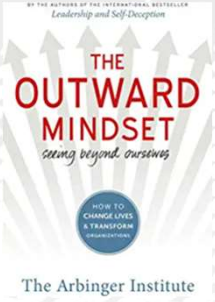
First Day to Learn Things First Hand

"Our camp doesn't accept a fatality or injury as a condition of employment"

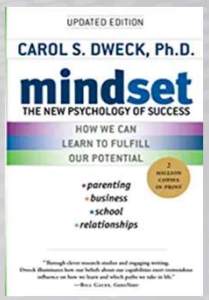
LUCAS ORGANIZATIONAL PERFORMANCE TEAM

ISSUE OF INTENTION

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM



Mindsets Matter: Fixed Versus Growth

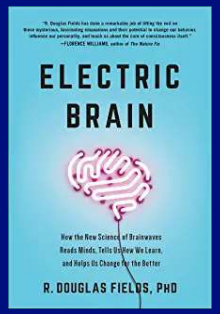


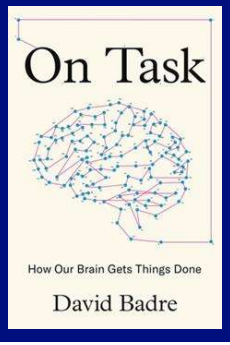
Fixed	Growth
Errors are a behavior issue	Errors are a performance issue
To fix error, fix the person	To reduce error, examine the process
"Thought you were better than that, more intelligent than that, more skilled than that…."	Learn from success and failure, improve knowledge, skill, ability, experience and/or familiarity
Don't do anything that carries risk	Risk leads to learning, innovation and growth

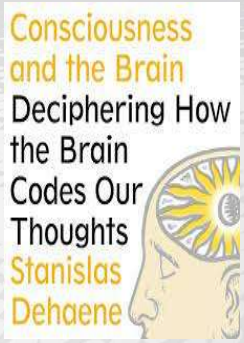
LUCAS ORGANIZATIONAL PERFORMANCE TEAM

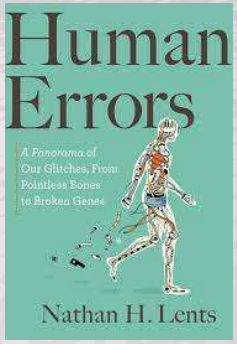
User Guide for the Human Mind

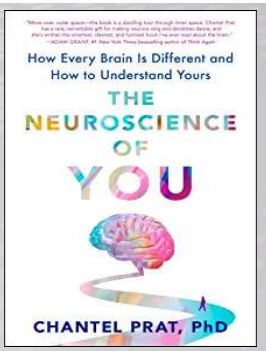
"If the brain were so simple we could understand it, we would be so simple we couldn't" Kaplan











Reducing the likelihood of error and failing safely requires we improve our Cognitive Control—attention, inhibition and working memory.
But we live in a world that increasingly creates an environment contrary to our nature"

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Cognitive Control
(Mentally Alert and Aware)

Planning and execution of work requires *cognitive control*

***Cognitive Control* consists of attention, inhibition (stopping) and a useful working memory**

Challenge:

We are built for speed not accuracy

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

How Many Can You Name?

On a piece of paper, create areas for two groups.

Group 1
1.
2.
3.
4.
5.
6.
7.

Group 2
1.
2.
3.
4.
5.
6.
7.

Group 1

Name a fruit beginning with the letter S

Name an animal beginning with the letter P

Name a bird beginning with the letter R

Name a country beginning with the letter T

Name a famous actor beginning with the letter C

Name a vegetable beginning with the letter A

Name a flower beginning with the letter D

GROUP 2

Name a fruit that ends with the letter A

Name an animal that ends with the letter G

Name a bird that ends with the letter D

Name a country that ends with the letter O

Name an actor that ends with the letter Y

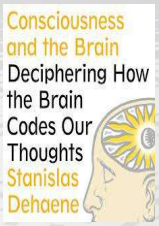
Name a vegetable that ends with the letter S

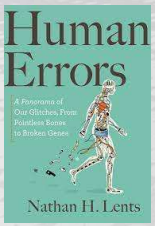
Name a flower that ends with the letter T

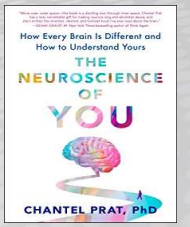
We've got a 20 Watt Limit…See Rule Number 1

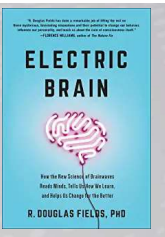
User Guide for the Human Mind

"If the brain were so simple we could understand it, we would be so simple we couldn't"
Kaplan









Gray Matter is Connected by the White Matter to What Matters

Born with 25% brain developed but all the wiring we will ever need

Our brain is 2.5 times more connected synoptically at age three than at 23

We prune connections at 5 and 15 to conserve energy

Counting backwards, dry mouth, biases and stereotypes

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Brain Rules

Rule #1:

Design and function of the brain is to ensure *conservation* to operate in an energy efficient manner

Rule #2:

There are no other rules…all functions, actions and activities within the brain are based on Rule #1…Period.

QWERTY Keyboard

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

I bet you 137946325642587 dollars you didn't read that number. You just skipped right over it. I put a letter in that crazy long number. Well, I guess I really didn't, but I am pretty sure you stopped and went back and looked.

Fast and Slow Thinking
From Knowledge to Skill

Fast Brain, automatic, Reflexive—
80% of neurons (69 billion)

Slow Brain, Deliberate, Reflective

Multitasking:

1. Say the alphabet out loud as fast and articulately as you can.

2. Count out loud 1 through 26 as fast as you can

3 Out loud, say the letter and corresponding number alternatively:
A-1, B2, C-3, as fast and articulately as you can.

LUCAS ORGANIZATIONAL PERFORMANCE TEAM

Cognitive Control
(Mentally Alert and Aware)

Planning and execution of work requires *cognitive control*

***Cognitive Control* consists of attention, inhibition (stopping) and a useful working memory**

Challenge:

We are built for speed not accuracy

We are wired NOT to pay attention

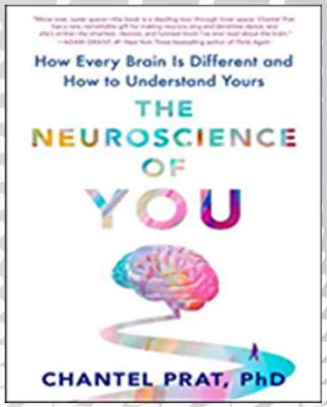
LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Can’t Take It All In….

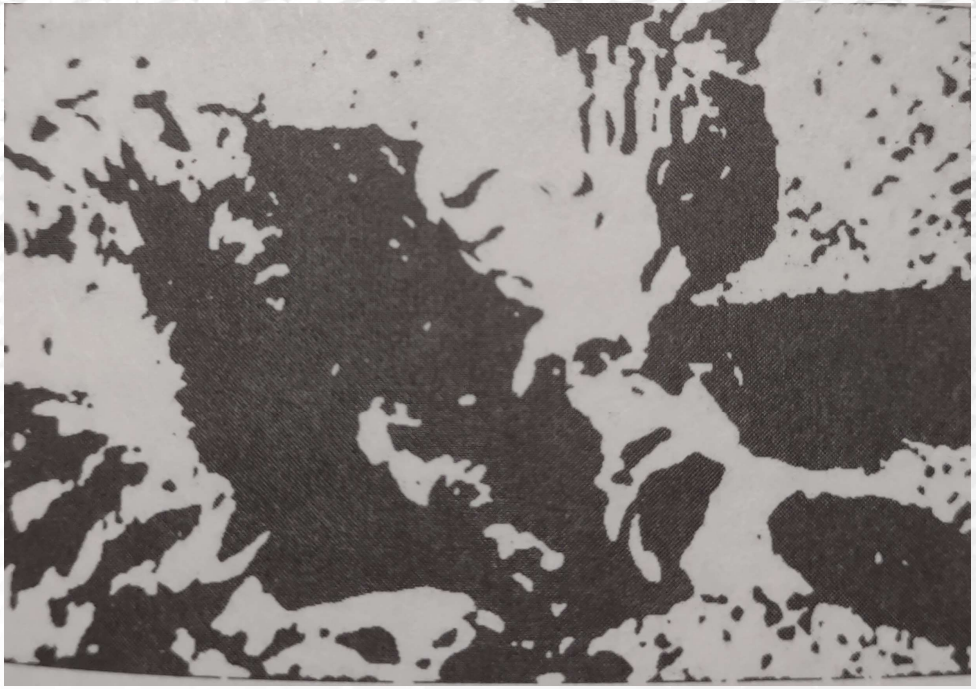
10,000,000,000 bits per second information around us

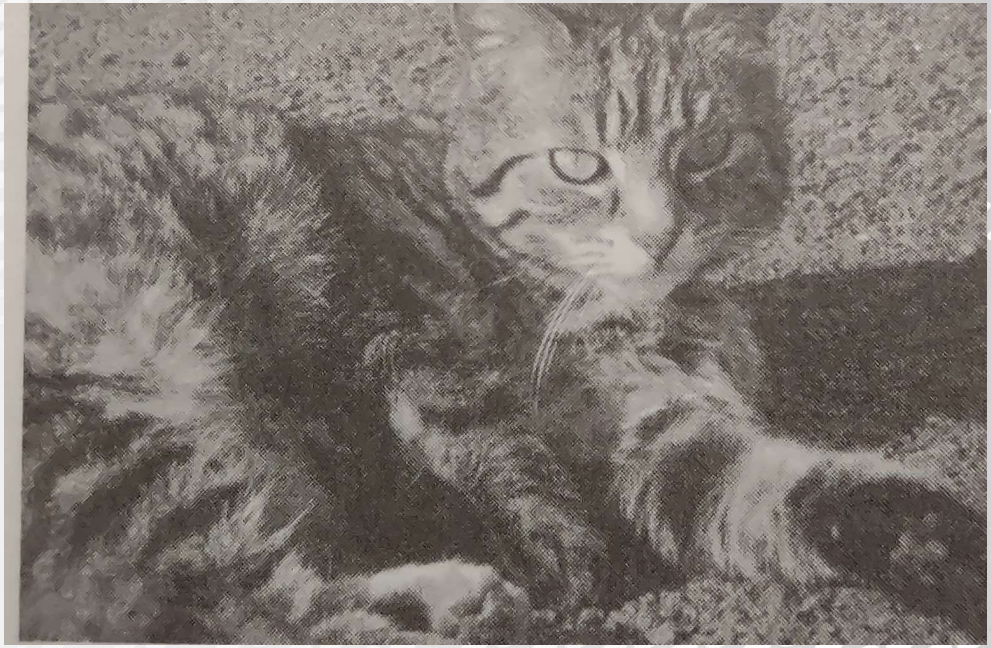
10,000 bits per second input to visual and verbal cortex

120 bits per second to the prefrontal cortex



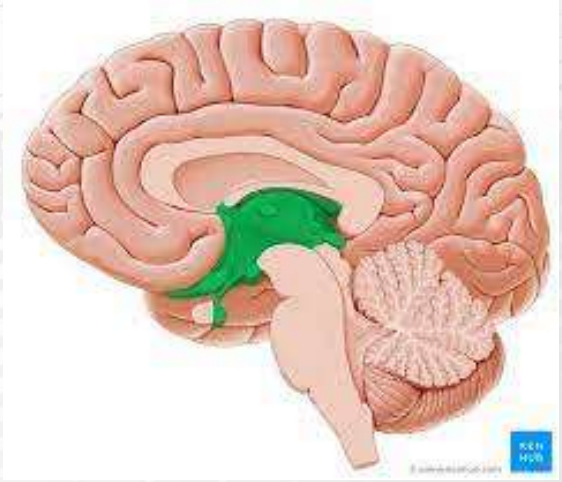
Everything is Obvious Once You Know the Answer….





LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

The Attention Filter



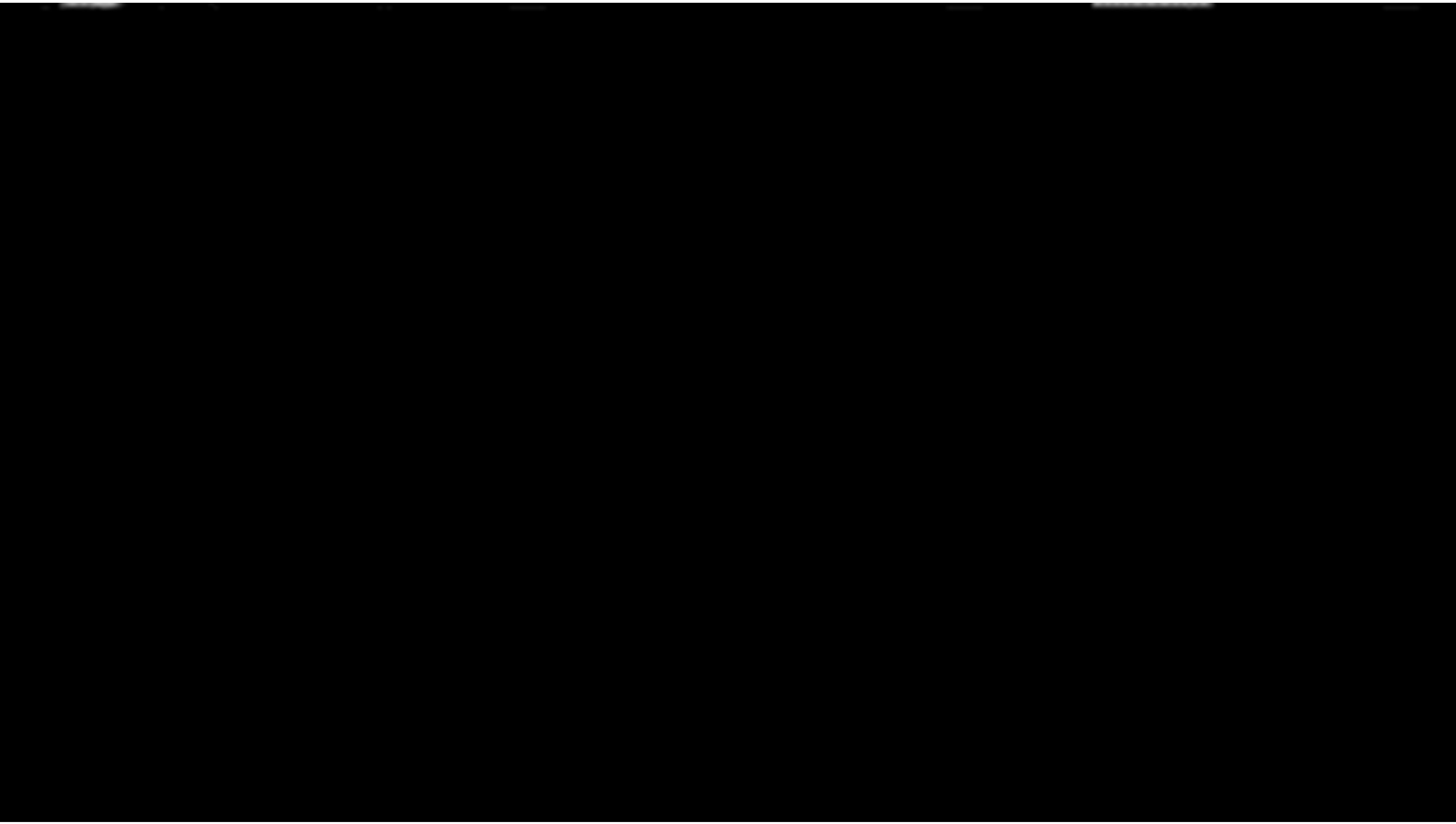
Diencephalon: Brain's Spam Filter

>6 months: heartbeat and breathing

"Don't worry about that…focus on this…."

Can't feel your glasses, rings, socks, etc…

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM



Managing Confusion and Uncertainty

Cognitive Control
(Mentally Alert and Aware)

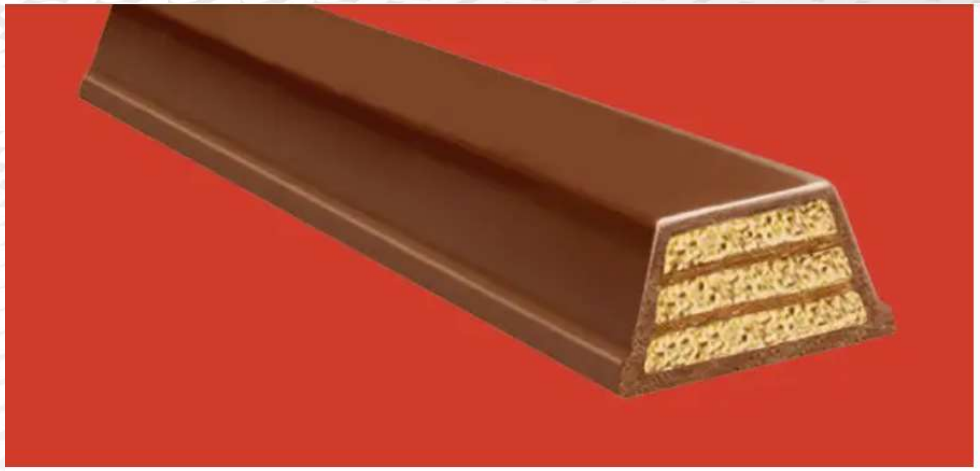
Planning and execution of work requires *cognitive control*

***Cognitive Control* consists of attention, inhibition (stopping) and a useful working memory**

Challenge:

- **We are wired NOT to pay attention**
- **We are built for speed not accuracy**
- **We have memories focused on 'messages' not details**

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM



Hershey's

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Via Fruit of the Loom

Via Fruit of the Loom

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

JIFFY

JIF

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Cognitive Control
(Mentally Alert and Aware)

Planning and execution of work requires *cognitive control*

***Cognitive Control* consists of attention, inhibition (stopping) and a useful working memory**

Challenge:

- **We are wired NOT to pay attention**
- **We are built for speed not accuracy**
- **We have memories focused on 'messages' not details**
- ***Stopping is not the suspension of starting---it's a separate action on a different circuit***

LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Memory On Task

"We don't use our memory to perform tasks, we use our tasks to help us remember",

Dr. David Baeder

A task is a series of subtasks:
Completion of one subtask is activated by the previous subtask and sets up the activation of the next subtask

When interrupted or distracted, part of the previous task remains in the working memory

Mentally walking through the next series of subtasks is a key to managing error

Rituals or Routine?

These are NOT superstitions—they trigger sub tasks that create the next necessary motor subtask required to keep the subtasks sequentially being executed as expected….

LUCAS ORGANIZATIONAL PERFORMANCE TEAM

When conditions change…

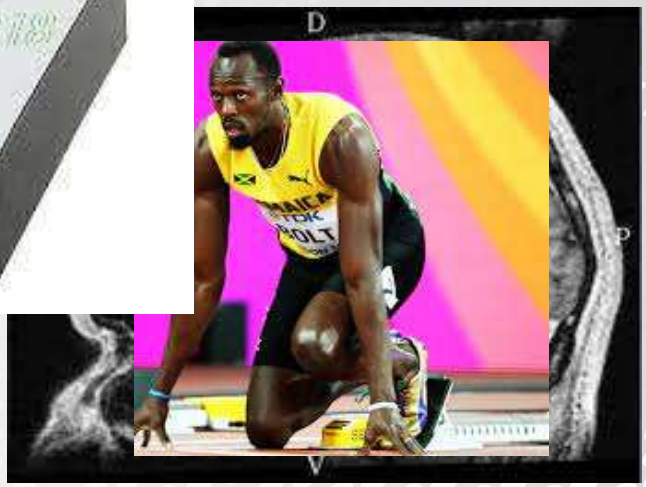
Starting and Stopping

Cerebellum

Subthalamus

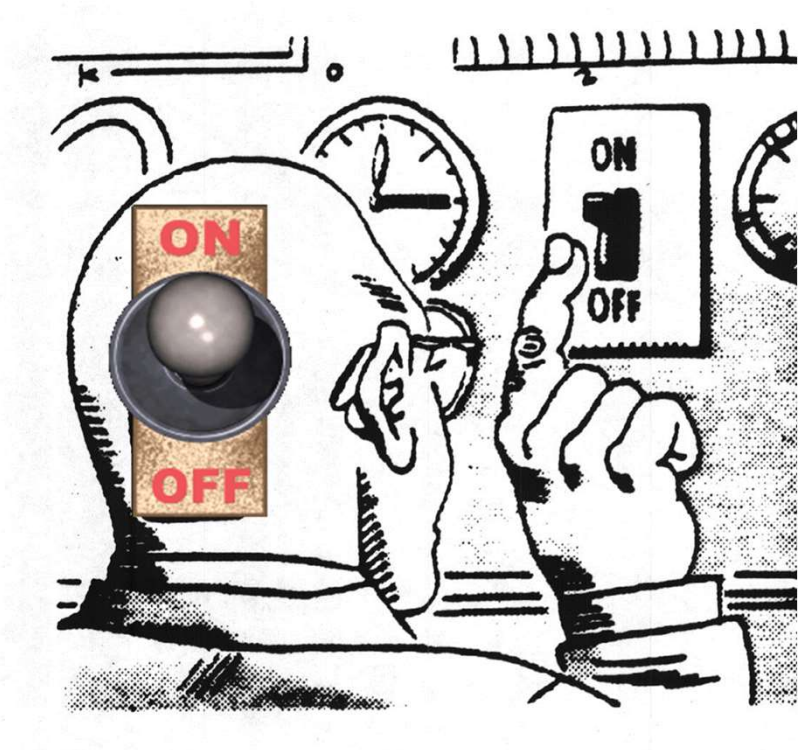
Stopping is an action (subthalamic)
ner energy expenditure
ission" to create

No brake in the cere
Lower energy cost t
Tied to various rewa



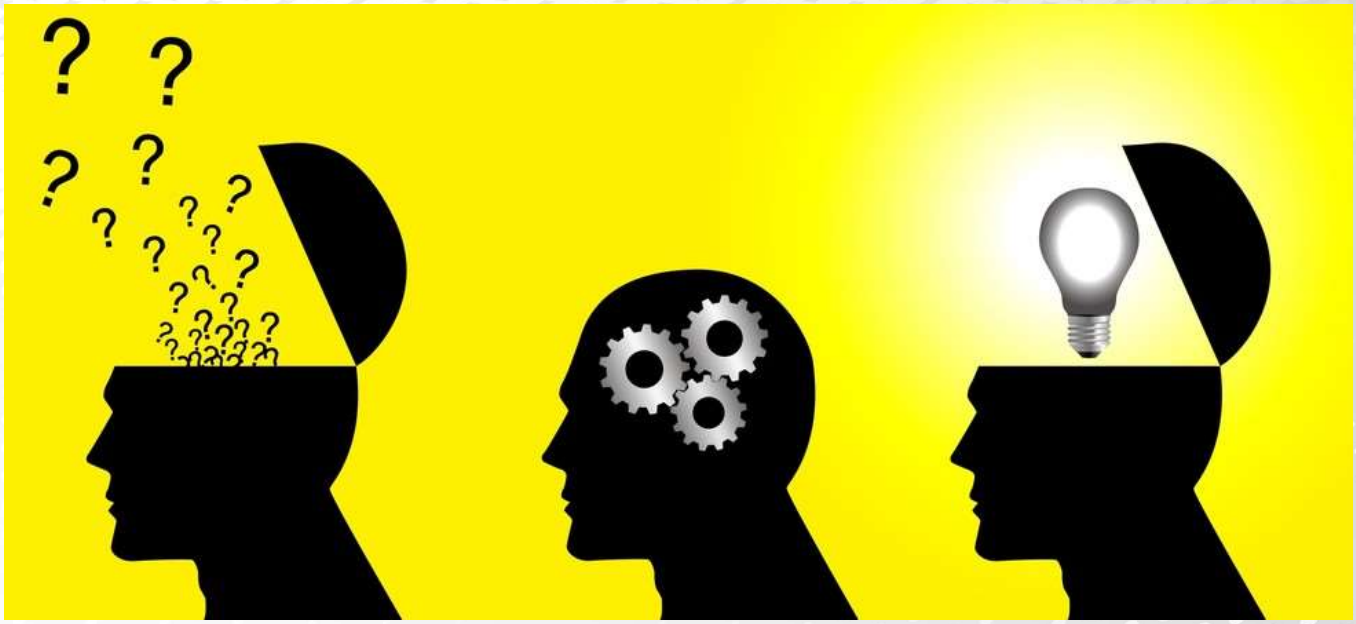
LUCAS
ORGANIZATIONAL PERFORMANCE TEAM

Error Prevention Tools



- Task Previews/PreMortems
- Self-Checking (S-T-A-R)
- 2 Minute Jobsite Review
- Stop When Unsure
- Questioning Attitude
- Communication
- Pre-Job Briefing
- Peer Checking
- Turnover
- Flagging
- Procedure Use and Adherence
- Post-Job Briefing

Thanks for Your Participation!



LUCAS
ORGANIZATIONAL PERFORMANCE TEAM