The Learning Brain

Dr. Jeb Schenck

Knowa@directairnet.com

Jessica Cruickshank

Program Director

SROM, Laramie, Wyoming

Video

- Count the number of passes between players in the white shirts.
- What did you see?
- Did *anyone* miss anything?
- What does that suggest about important information directly in front of them when their attention is directed elsewhere?


The Brain is the most complex
thing ever studied in the universe.

Our brain constantly interacts with the environment in order to stay alive (maintain homeostasis)

Why do we need to know the brain?

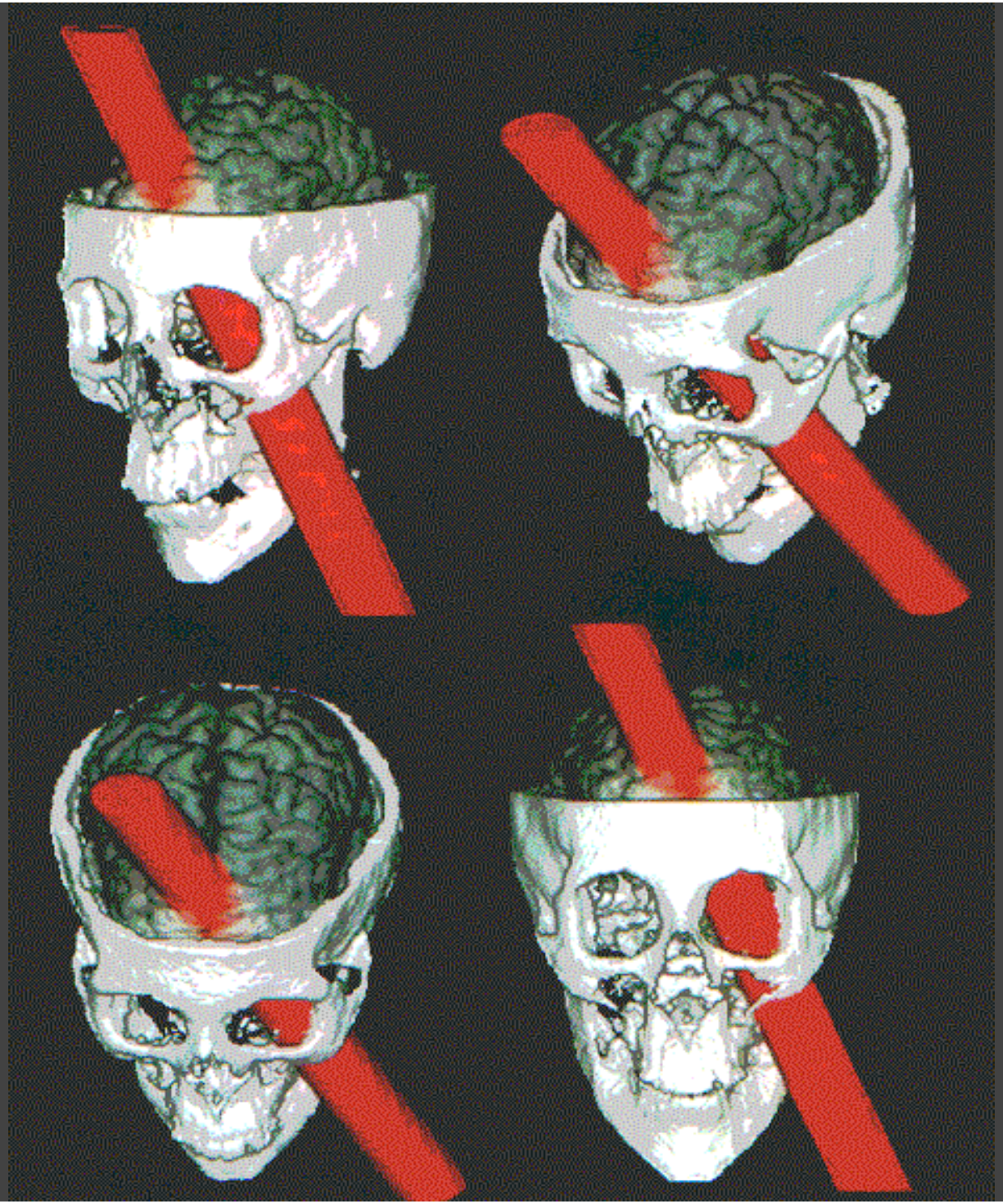
Because:

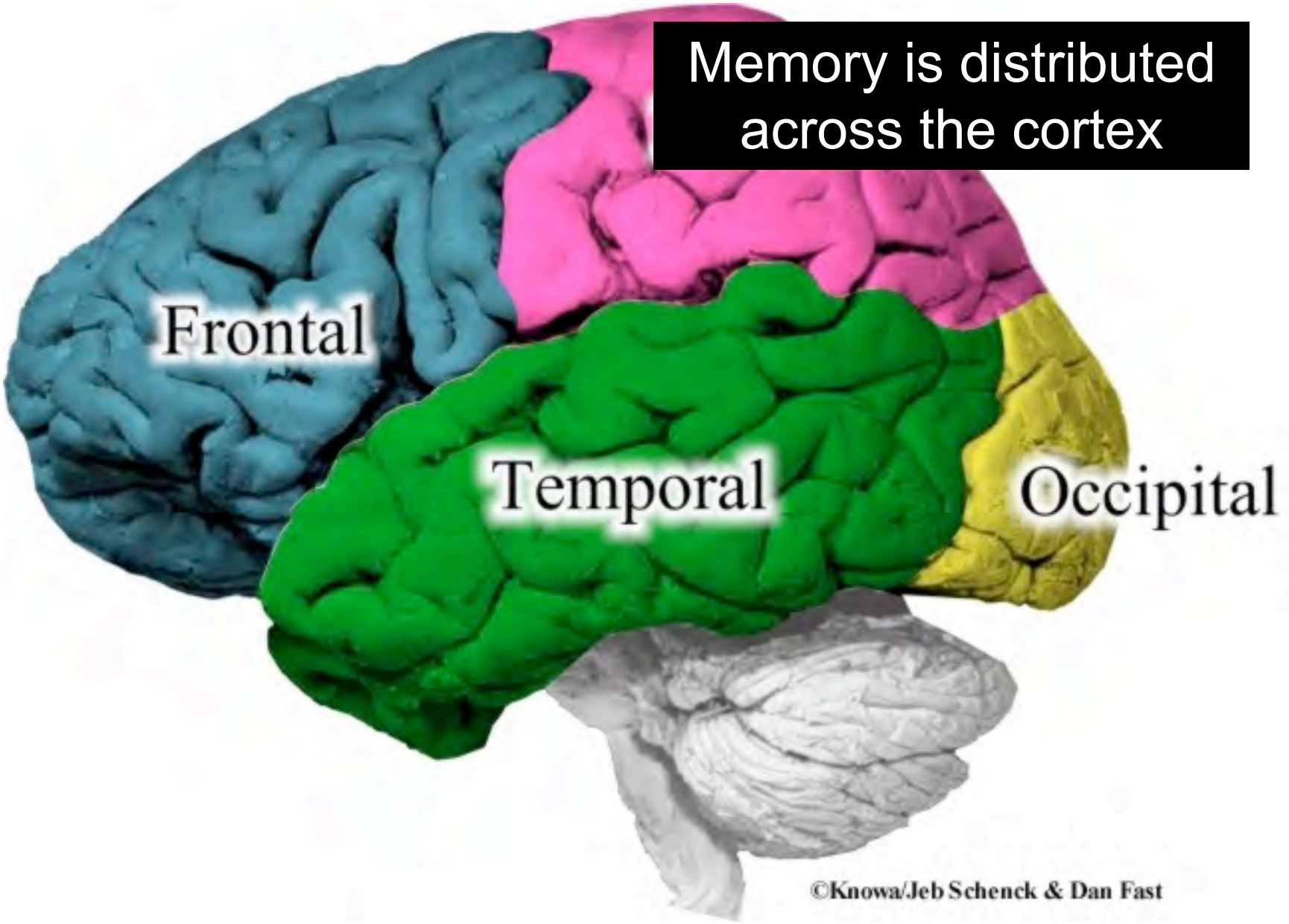
Where does learning actually occur?

Why do we need to know the brain?

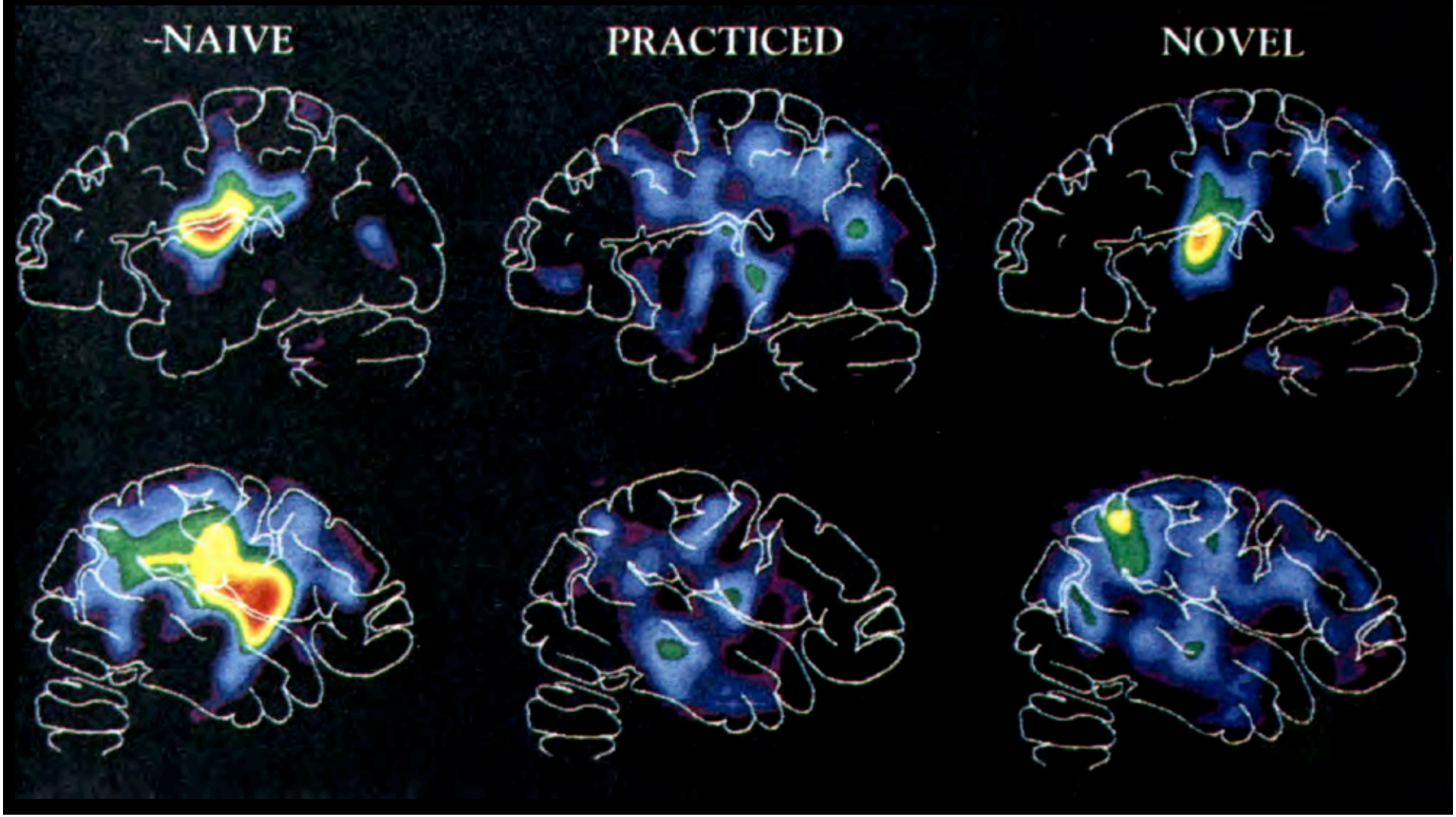
Knowing *how* and why the brain/mind works allows us to more effectively design instruction for better learning.

How ***DO*** We Know How The Brain Works?




Memory is distributed across the cortex
Frontal
Temporal
Occipital
©Knowa/Jeb Schenck & Dan Fast

PET SCANS



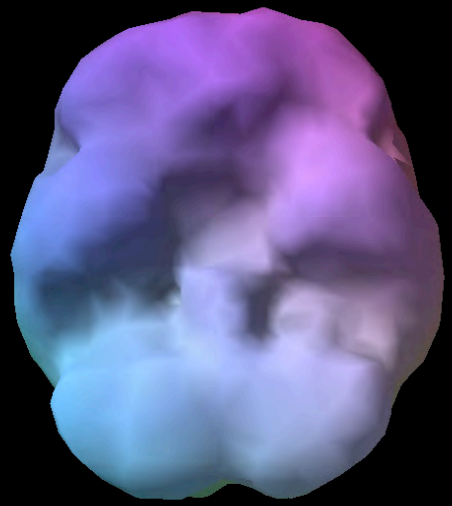
Sex Differences: We Literally DO NOT PROBLEM SOLVE the same way

Males & Females ARE Different

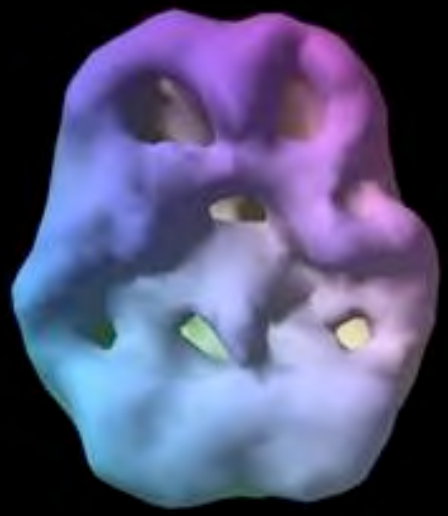
Field examples of sex differences

- Girls do better in climbing school (learning knots, putting on harness) and are usually more patient in teams
- Boys better at belaying, not necessarily better at climbing; but routinely are better at navigation
- Differences in skills level and type vary by age group

SPECT SCANS



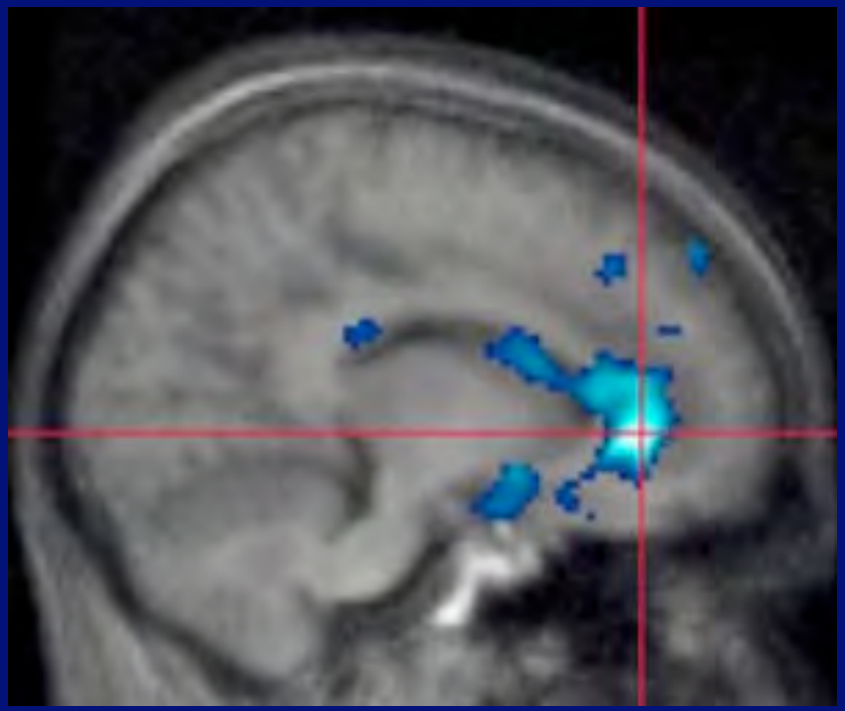
NORMAL



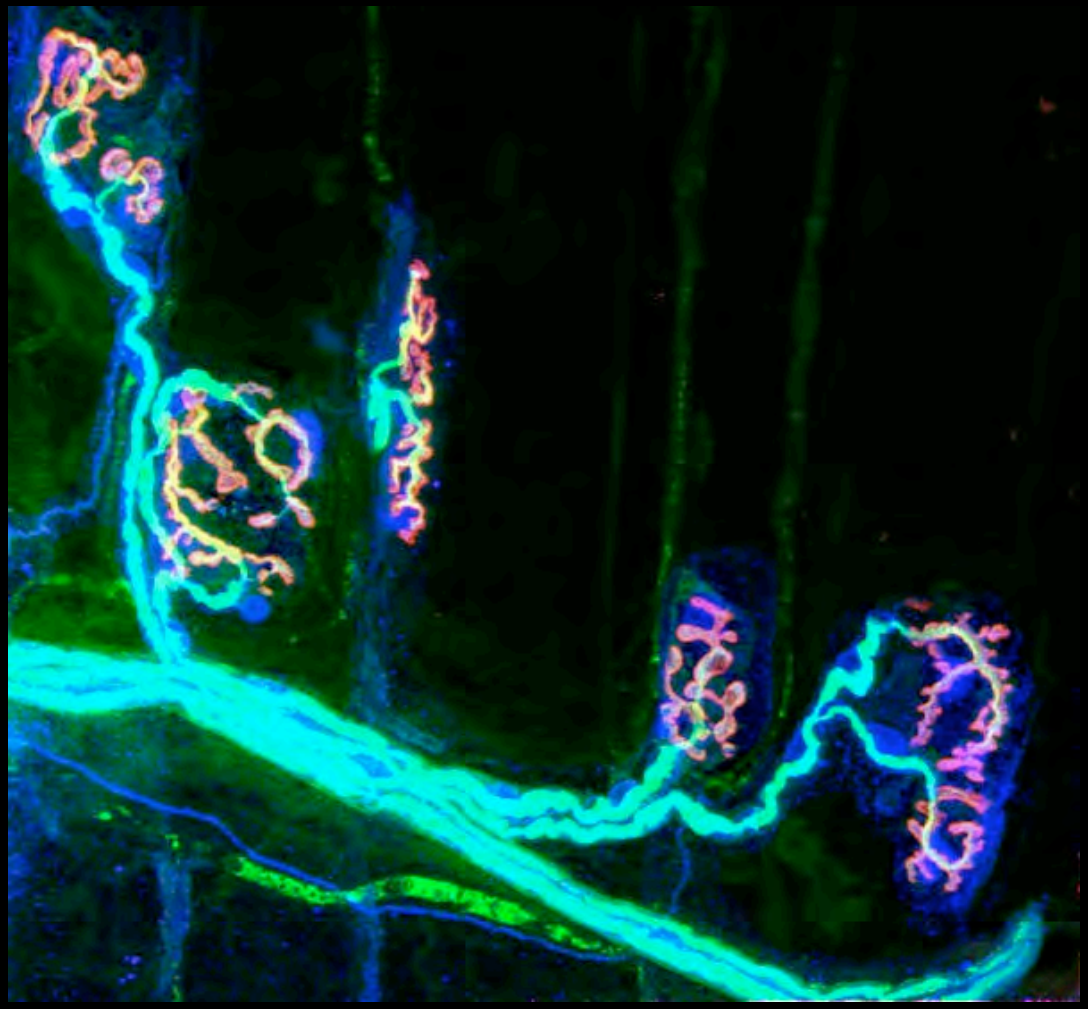
ADHD

ON ALCOHOL

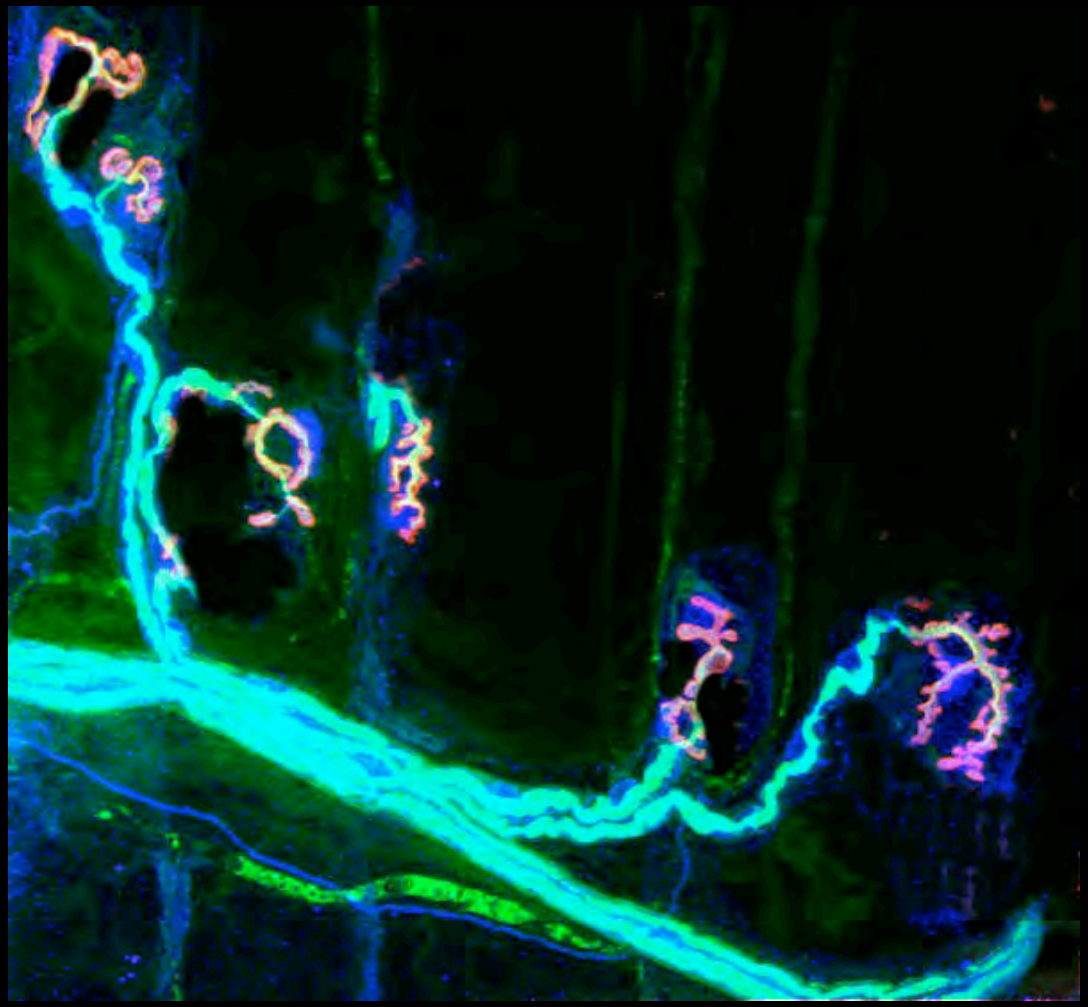
Attention System Highly Engaged:
Violent Video



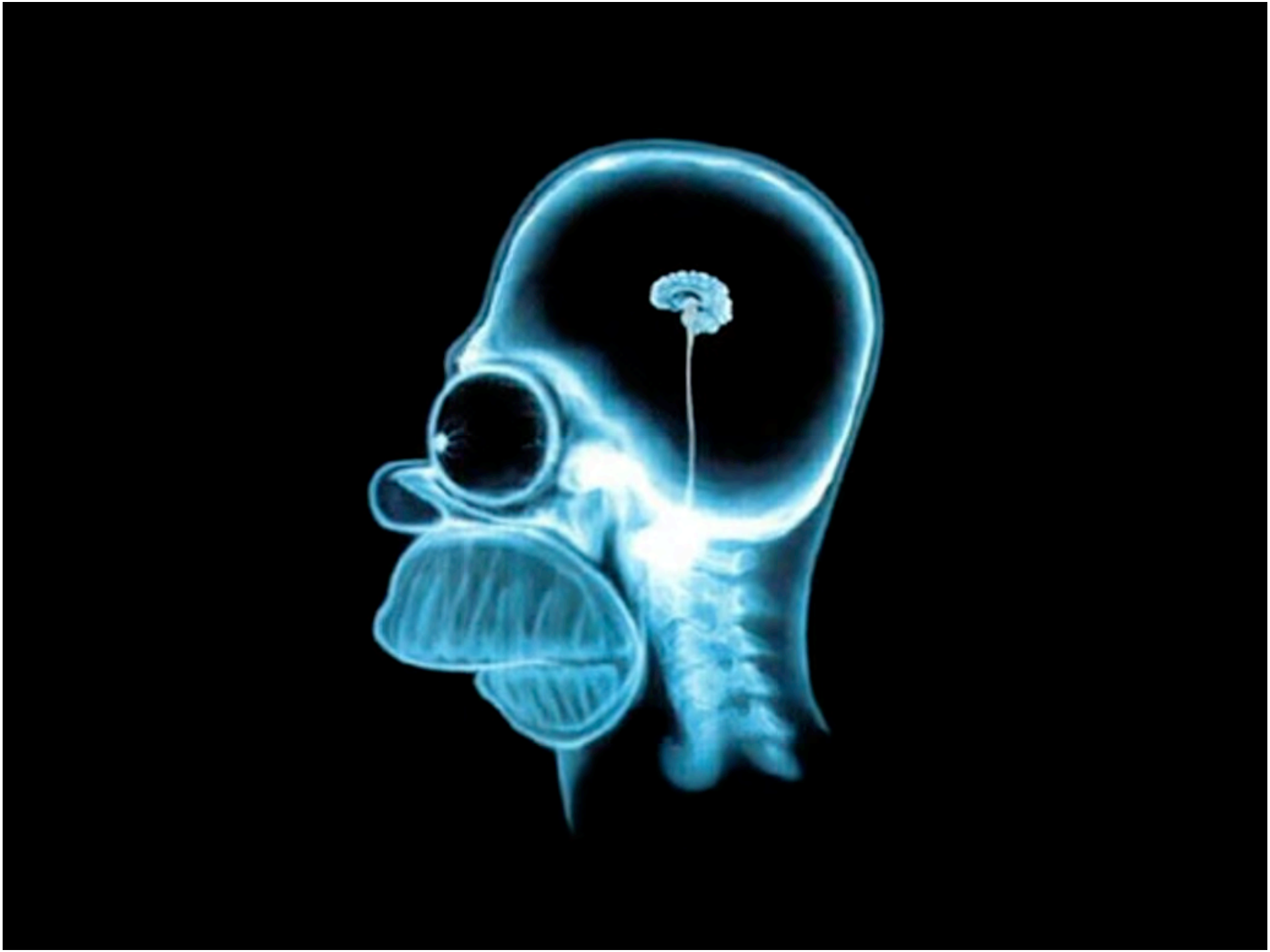
Neural Selection (use it or Lose it



Neural Selection (use it or Lose it

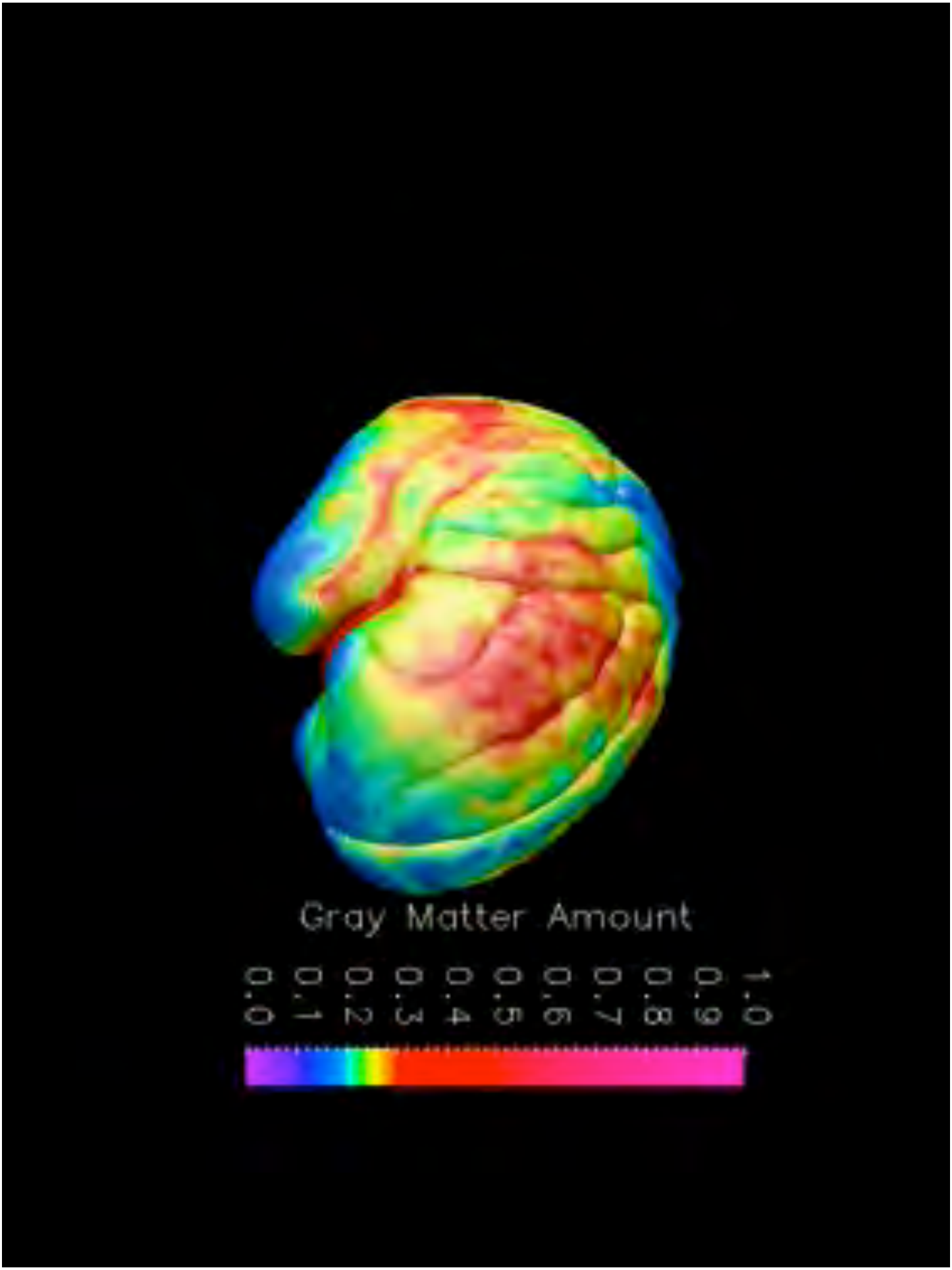


If You Use Only 10%
of your brain
What would an X ray Show?



We Learn By

- Growing a memory
- Using the memory (dendritic spines) or losing it
- Consolidating the memory by Practicing Past Perfection (we'll visit this later)


Gray Matter Amount
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

Cycles of Brain Growth

- Many cycles in early years
- 10-12 Years 14-16 Years
- **18-20 Years**
- **21-24 Years**

(From K. Fischer, 2000)

Optimal Performance During Brain Growth Spurt

- **Optimal performance requires direct support/instruction vs instruction by book or computer.**
- **Independent student performance is at a lower level (suboptimal)…You don't get best performance when they do the task independently w/o coaching**
- **Students can't transfer from an optimal level in one area to a high performance level in a different area***

Incomplete Frontal Lobe Development In A Group

- What happens to judgment?
- What happens to anticipating how *<u>others</u>* will feel?
- What happens to anticipating how *<u>they</u>* will feel?

Incomplete Growth

- Impaired decision making
- More impulsive
- Less emotional control
- Lower ability to reason
- Lower ability to see consequences
- Lower ability to anticipate emotional impact

Examples of poor judgment display in adults (>18)

- Instructor (21) with entire instructor team traveling, beeches truck on a rock in the Winds
- Girls sunbathing without sunscreen at 10,000ft
- Instructor (21) boulder leaping because he has the skills
- Young adults ‘toughing it out’ when it starts to rain mid-activity

Myth & Facts
about your Brain

- **Facts**
- Neither sex is superior
- Brain automatically organizes information
- Memories are emotionally encoded
- Emotions & Memories are chemically based

- **Myths**
- You use only 10%
- Right vs. Left Brain
- Smarter people have more brain wrinkles
- Intelligence is fixed (can be expressed as a single number)

RECENT FINDINGS

- Memory is distributed across the cortex
- **Overriding impulsive reactions is harder** in teens because frontal lobe isn't fully functional
- **Teen brain doesn't consider other's emotions**
- Act of asking a question ***changes*** the memory
- Recalled information is reconstructed
- Female memory generally outperforms males

RECENT FINDINGS CONT.

- In adolescence there is a major pruning of neurons that aren't used
- **Emotions are chemically based**
- Old info. Is gradually lost but the gist or basic concepts remain …not the details
- **Memory is chemically based**

Brain Break # 1

- List two things that were new or personally interesting
- Write down *one thing* you'd like to know more about
- *Stand up* & Turn to your neighbor and share those things

Shouldn’t we teach the entire organism, since its the entire organism that learns?

Gessner Geyer 2001

- **We process information**

  Physically: ***Touch***, ***Movement***

  Visual-Imagery

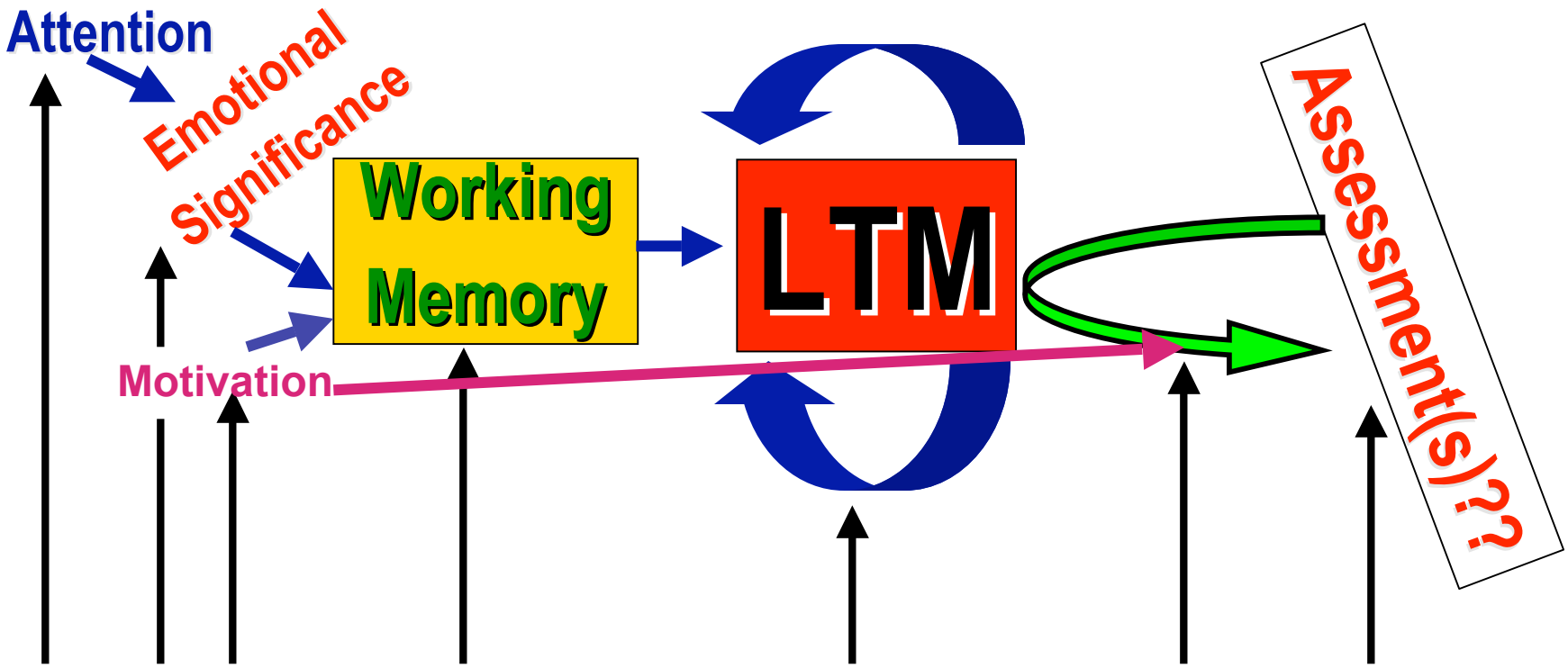
  Semantically: **Reading or Hearing Words**

  Socially: **Group interactions** (pairs or small groups)

  Modeling

Dr. Barbara Given

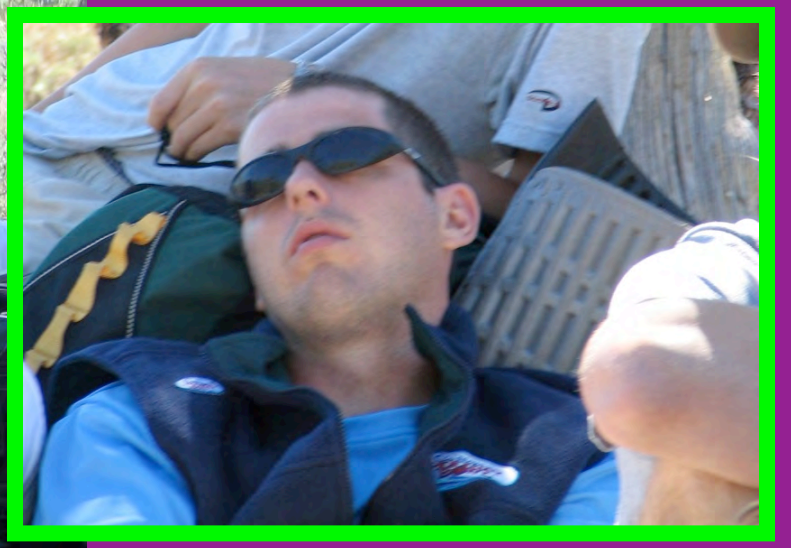
Processing Information



First Task:
The brain tries to detect patterns

First Task:
The brain tries to detect patterns


Sara Nader



“ I’m Not inattentive,------you’re just boring.”

From Thom Hartmann

Attention Systems

- Systems are limited
- You (or student) can't give full attention to multiple tasks = Divided attention
- Ex. Setting up rappels—multiple tasks, better handled sequentially (but you can get better when some become automatic)

What I hear I forget

What I see I remember

What I do I understand

Confucius

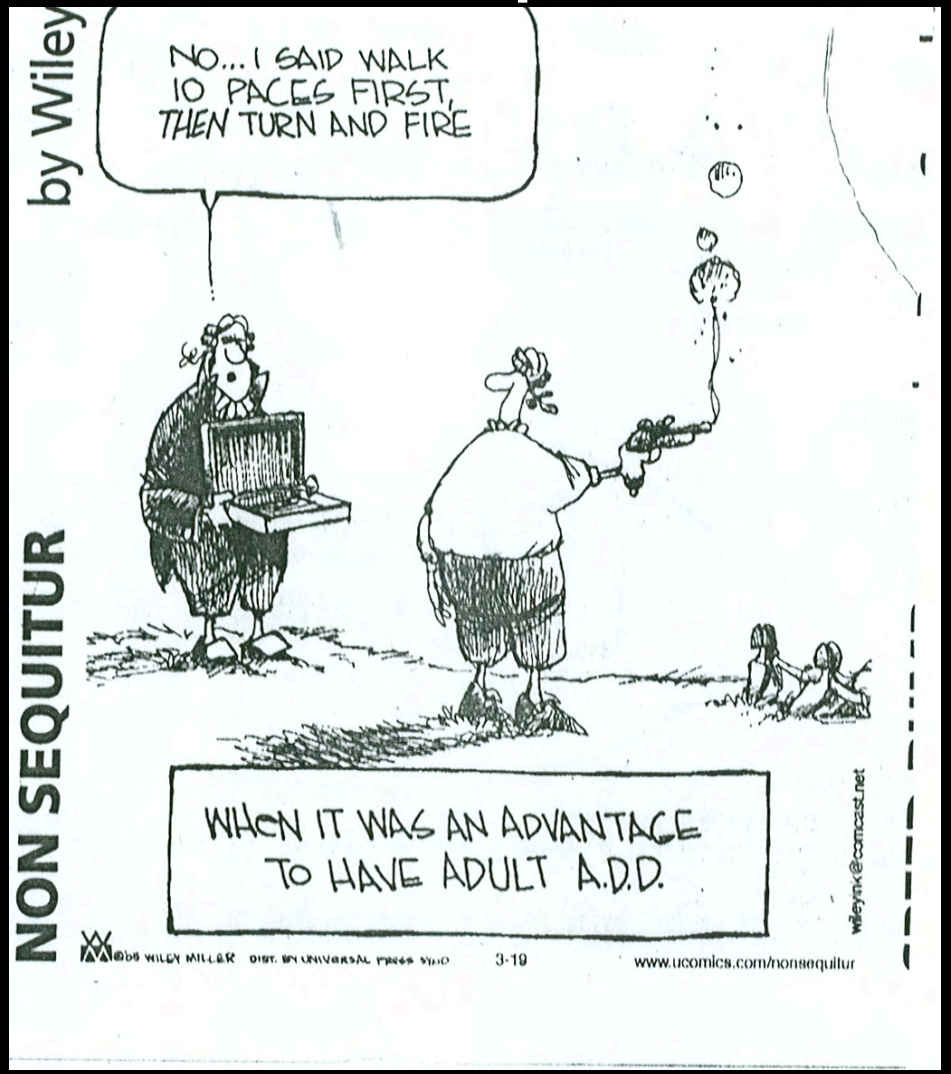
Attention !

- **Grab & Maintain it!**
- **HOW ???**

- Maintain attention by varying activities, & length
- *Significant Physical movement* about every 15 minutes
- Everything Counts

A Demonstration of Attention

Outcomes are influenced by *HOW* information is processed



ADHD

- Approximately 70% is inherited
- About 30% results from head injury
  (any blow to the head: football, soccer, baseball, falling down etc.)
- It may NOT be outgrown*

* While many will catch up developmentally, others retain symptons all their life

Staff Survey

- Miss place keys, items frequently
- Attracted to action
- Easily bored
- Taps foot, pencil, drums fingers
- Fidgets a lot, always in motion
- Easily distracted
- Capable of periods of intense concentration
- Bumps into things
- Interrupts others in conversation
- Impulsive
- Hard time waiting for turn

Attention Strategies:

Physical— manipulate objects, or move the whole body, pantomime, build, model, MUSIC (non-vocal)

Visual Imagery --imagine a picture or object, draw, sketch

Semantic – Reflect, summarize, describe, explain, tell,
NOTE THE DIFFERENCES and then SIMILIARITIES

Brain can recognize *differences* easily;
similarities are difficult to tell apart

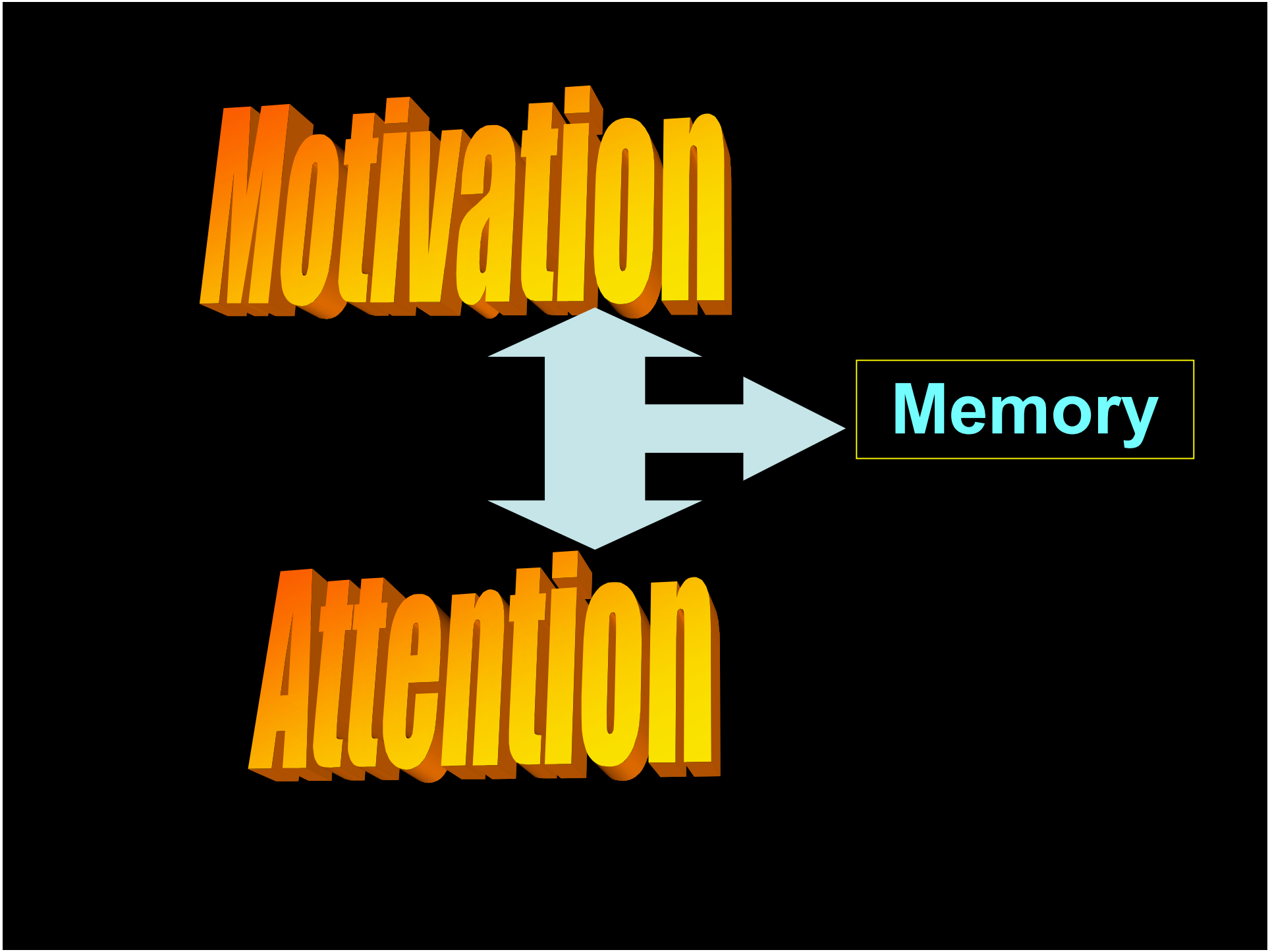
Social -- watch & then explain their partner's procedures.

Sex Differences Girls are more attracted to activities where ***EMOTION*** can be expressed
Boys more attracted to **ACTION, MOVEMENT**

YOUR TURN: Brain Break # 2

Getting Their Attention

- In your group, Suggest your own way of getting and maintaining ATTENTION
- Be Prepared to share one of your ideas.


Motivation
Memory
Attention

3 Major Motivational Questions

- Can I do this task?
- Do I WANT to do this task & WHY?
- What do I need to do to succeed at this task?
- ***Lay out answers for all three BEFORE the task, or as they start it, and continue to reinforce during the task.***

Can I Do This Task?

Two Examples

Say the *COLOR* of the name

RED

Blue Green Yellow Silver

Pink Purple Orange Gold Red

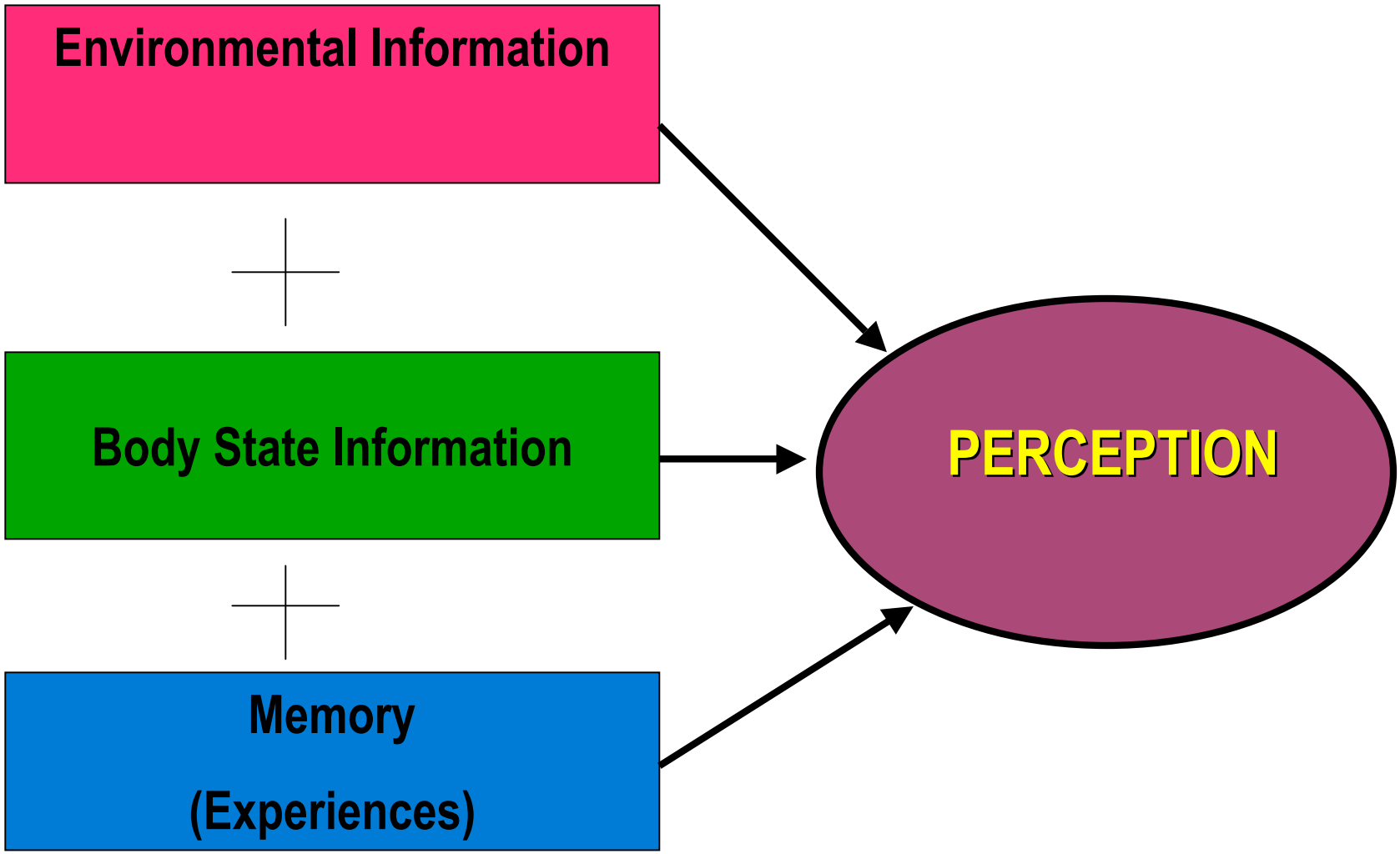
White Blue Blue Brown Green

Yellow Green Gray Blue Red

Red Pink Brown Purple White

3 Innate Needs

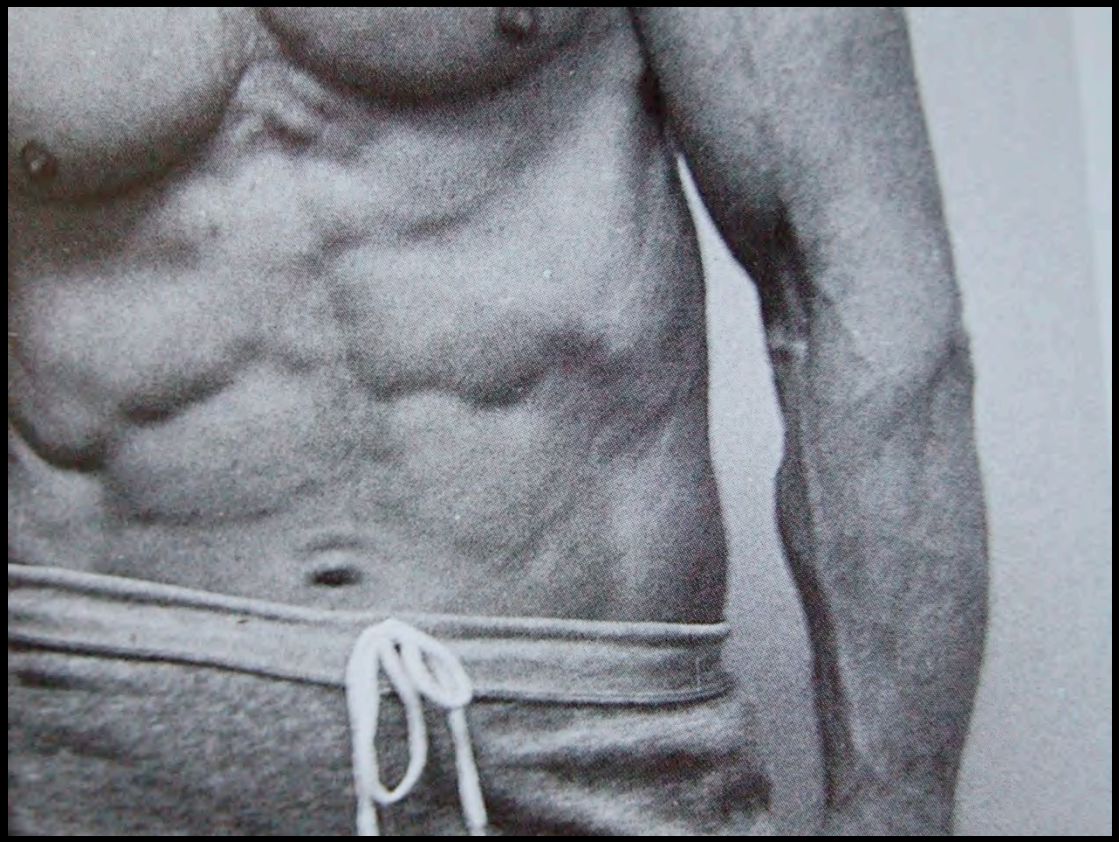
- ***Belonging:*** A need to know others care about their well-being and success (*Avoid:* it's *NOT MY* problem)
- ***Autonomy:*** A need to have a feeling that they are in charge of their own actions (They have some choice in the matter)
- ***Competence:*** A need to believe they are competent and their actions are related to that competence

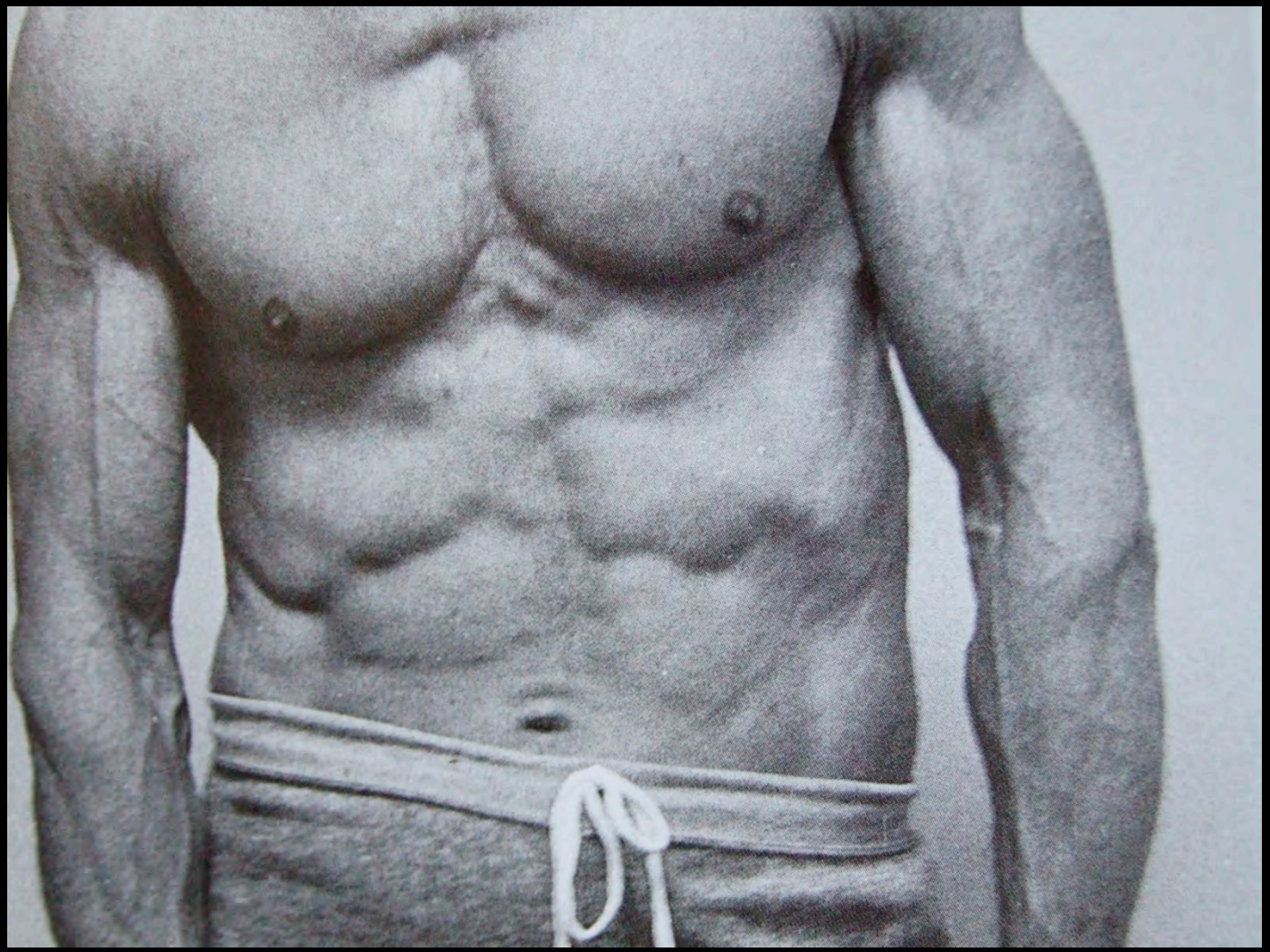

Environmental Information
Body State Information
Memory
(Experiences)
PERCEPTION

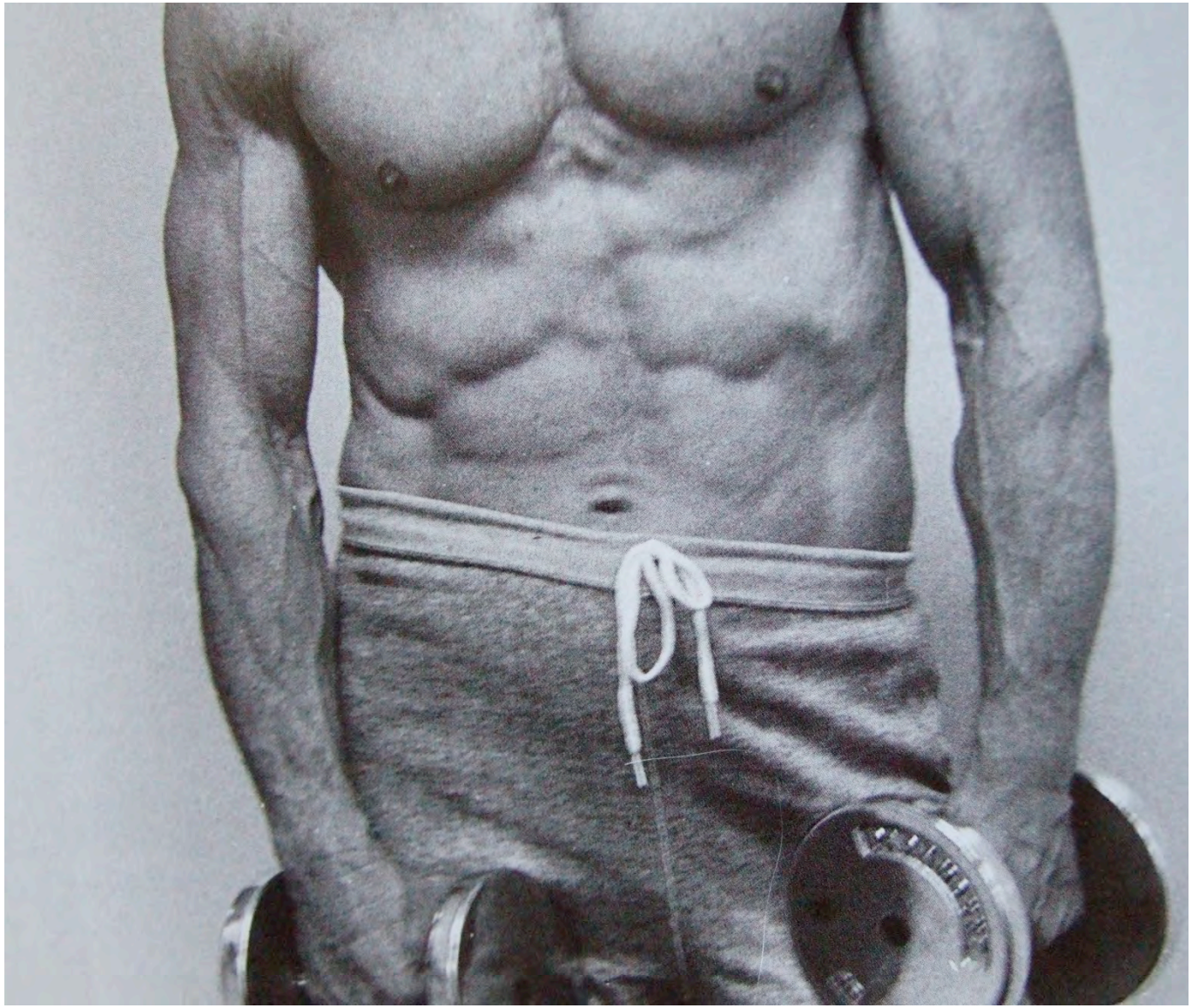
Perceptions

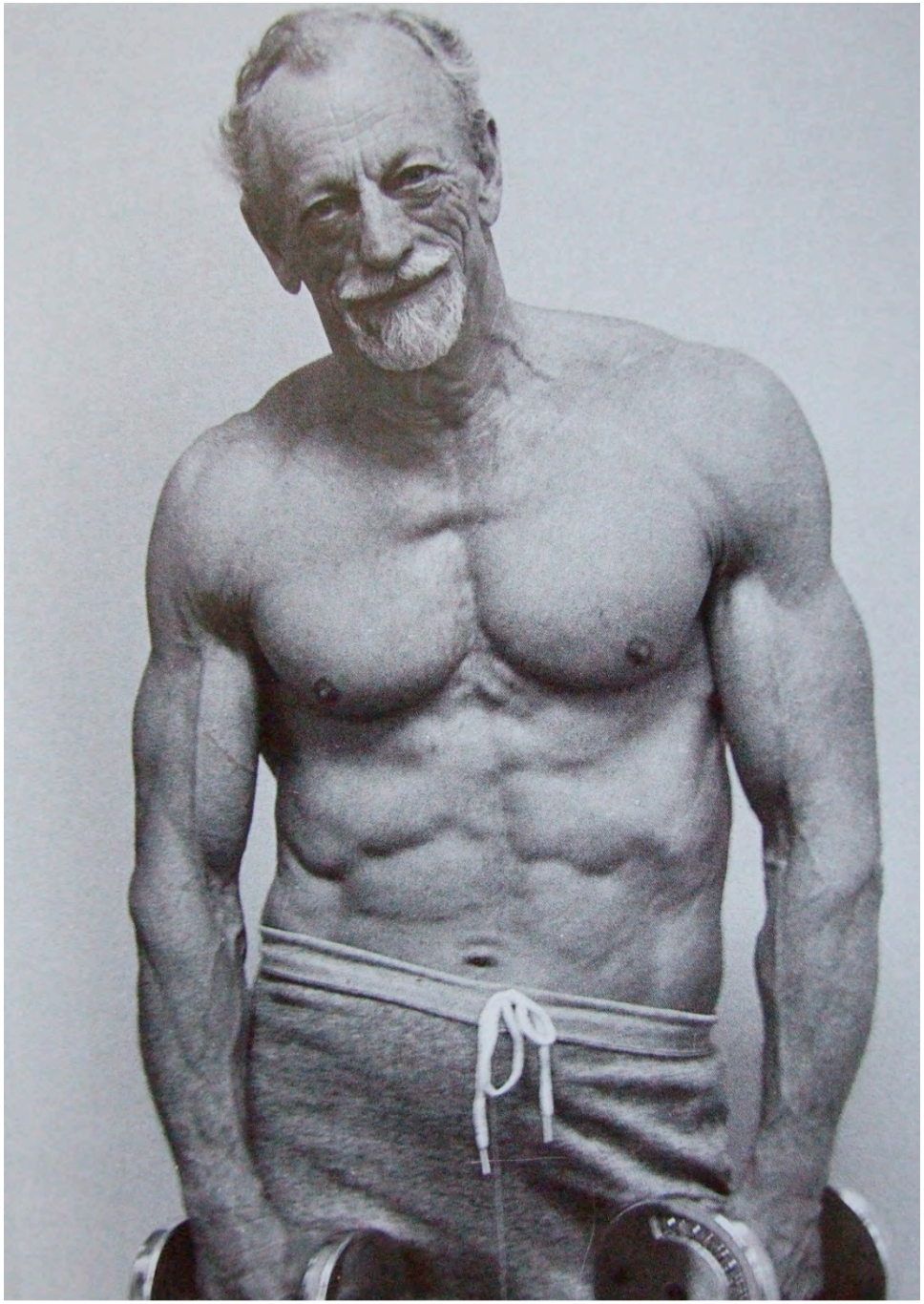
BASED UPON:

- Environmental Info. + Body State Info.
- Interpreted through lens of Experience









John Turner,

Age 67

From:

Growing Old is Not for Sissies II

By Etta Clark

Their Perception Is Their Reality

Perception of threat

affects the ability to THINK & LEARN

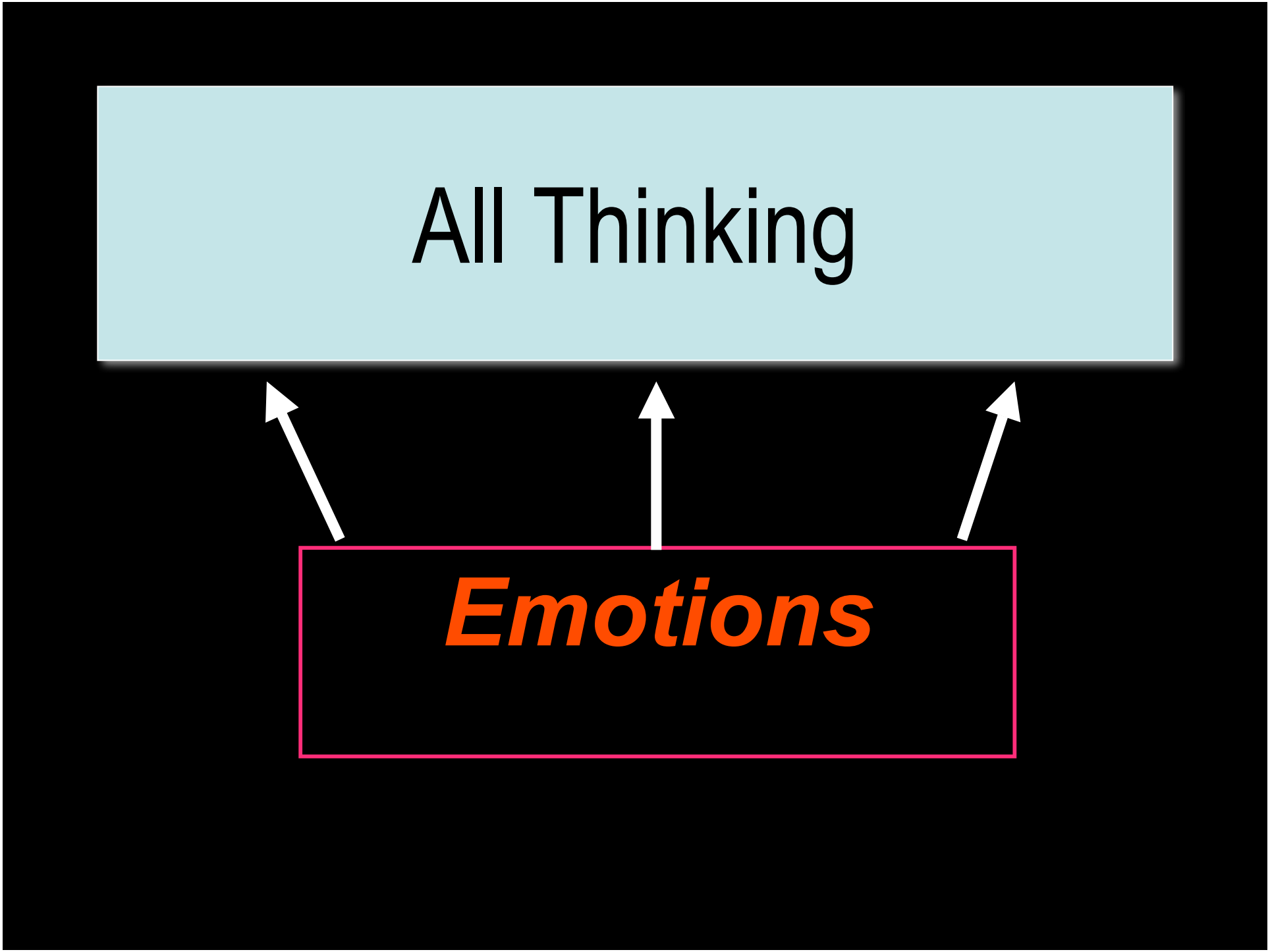
Their Perception is their reality, that affects attention, motivation & memory

Brain Break # 3

- Turn to your neighbor, describe a situation where your student's perception was different from yours on a wilderness task.
- Make a suggestion of how to change the student's perception or change the lesson.

Emotions

- Enhance Learning
- Hinder Learning


All Thinking
Emotions

Emotions

- Fear
- Surprise
- Anger
- Disgust
- Happiness
- Love
- sadness

Emotional Significance

- The Challenger blowing up, O.J.'s slow car chase?
- Do You Remember:
- Your first lead with shaky pro?
- What you did on your 21st birthday?
- The first time you made love?

Staff Training

Staff learning policies first, field experience second =
Lower personal investment by staff

Field training first, Policy second = ***dramatic improvement in staff investment***

Policies: correlation between effort and personal investment

It is important to make the connections with someone first…

then consider the actual message (Papanek & Greenleaf, 2005)

Rocking Richonda

Emotions & Memory

- Chemically made
- Quickly changed by threat/depression
- Negative state (chemicals) NOT rapidly dissipated
- New chemical state may last for hours to days (though students or staff may not show it)

Emotional Issues in the field

- Student (21) not willing to be corrected leads group on a 10 mile detour
- Student (19) hides fact he is injured, ends up being emergency evacuated with flesh-eating bacteria infection
- Youth Leader (26) unable to master self arrest skills undermines instructor leadership for the rest of the trip

To Increase Memory (*learning*) using Emotion:

- Greater personal salience in tasks
- Personally-Physically involved
- Greater personal consequences
- Increased focused attention
- Moderate stress

Picture of testing snow anchors

Using Personal Emotion & Action

Emotion + Action = Stronger Memory

(more learning)

Emotion + Attention + Action =

Memory/Leaning

ACTION - Movement

- Complex Action
- High Valence
- Personal Judgment
- Immediate Feedback
- Personal Consequence
- **Accelerated heart rate**
- **Elevated Respiration**

Better Memory

Role of Brain Growth

In Youth

- Amygdala very active (high arousal)
- Frontal lobe (reasoning & control) barely active,
  ex. Limited in anticipating consequences
- Lack of wisdom (connections aren't made because connections don't exist)
- Learned fear (patterns created) that are not appropriate: they avoid social activities, heights, avoid different ethnic groups

Emotional Management

- Frontal lobes of brain last to mature, happens during late adolescence
- Emotional Controls are LEARNED SKILLS *(a.k.a. Emotional Intelligence)*

Greater Emotional Impact

Under a *Threat*
(to their survival or well-being)

- Person is too busy scanning & monitoring
- Attention systems easily overloaded
  (example, a person cannot effectively monitor the patient and scene safety at the same time, or a person cannot monitor the patient and have a conversation at the same time)
- Attention NATURALLY oriented to self

YOUR ACTIONS

affect the teaching/emotional climate

&

Profoundly impact student learning (memory) & thinking

Your Attitude

- Off hand remarks can have more impact on the student than the lesson
- Instructor's attitude affects students' physiological ability to process information

Your Turn: Brain Break # 4
Emotional Significance

w/ motivation & Perception

- Write down how YOU are feeling about this information
- Share with a partner an example when an instructor's attitude affected students' learning.
- How are you feeling emotionally RIGHT NOW about getting more information? (We can stop and discuss or go on).

Adolescence

"Starting the engines without a skilled driver" (Dahl)

- Puberty Based Development
- Experience Based Development

Attempting to guide behavior in ambiguous environments while trying to manage strongly conflicting feelings

Adolescence

"Starting the engines without a skilled driver" (Dahl)

- Puberty Based Development
  - **Changes are frequent**
- Experience Based Development
  - **Experience is Nil**

Attempting to guide behavior in ambiguous environments while trying to manage strongly conflicting feelings

"Survivor"

Participants are essentially thrown into an adolescent reasoning session

Adult Status:

Requires developing self-control of Actions & Emotions

Experience, education, or age alone does not determine whether a person is an adult in respect to having appropriate judgment

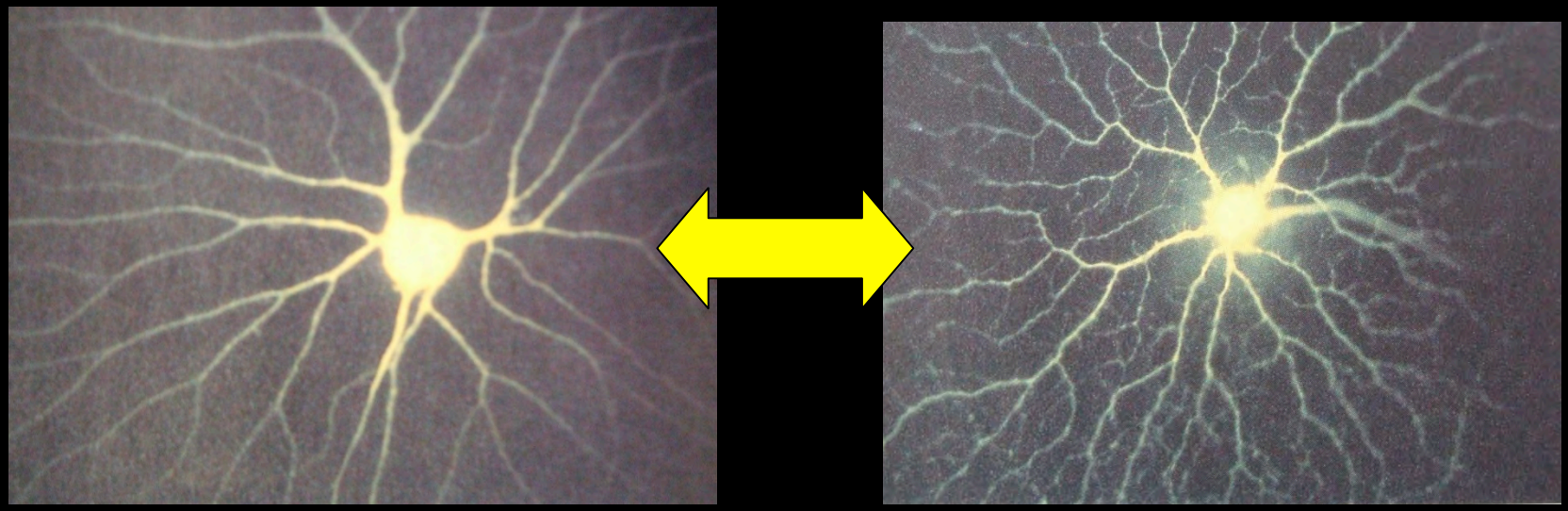
Value of Experience?

Not All Experience Is Equal

VS

Learning is the
Making of
RETRIEVABLE Memory

Use It or Lose It



3 Major Forms of Memory

- Sensory/Perceptual Memory
- Working/Short-term Memory (WM)
- Long Term Memory (LTM)

Working Memory

Temporary

Lasts 1 sec-1minute

Old info shoved out by new

Working Memory

- It is what your are thinking about RIGHT NOW!

Memory is *NOT* ACCURATE

- Not like a video camera
- Its selective
- It blends old information with new
- Can create false memories (if reinforced)

WM Overload

- Too much, Too Fast
- **Actively, mentally link it with other info.**

Overload Leaves Only The GIST of the Idea

Long Term Memory

- More Permanent
- Recognition (no details available)
- Recall (more details available)

LTM is *Organized*

- **Retrieval: is better when you know how it was organized (it doesn't let you know)**
- by **Categories: such as names & Uses**
- by **Time: (vacations, field trip)**
- by **Powerful Emotional Events: (Flash bulb memory: Kennedy assassination, Diana's funeral, Challenger blowing up**
- **by Procedures: How to do something, like shift a gear, fly casting, tying a shoe, using chopsticks**

SLEEP

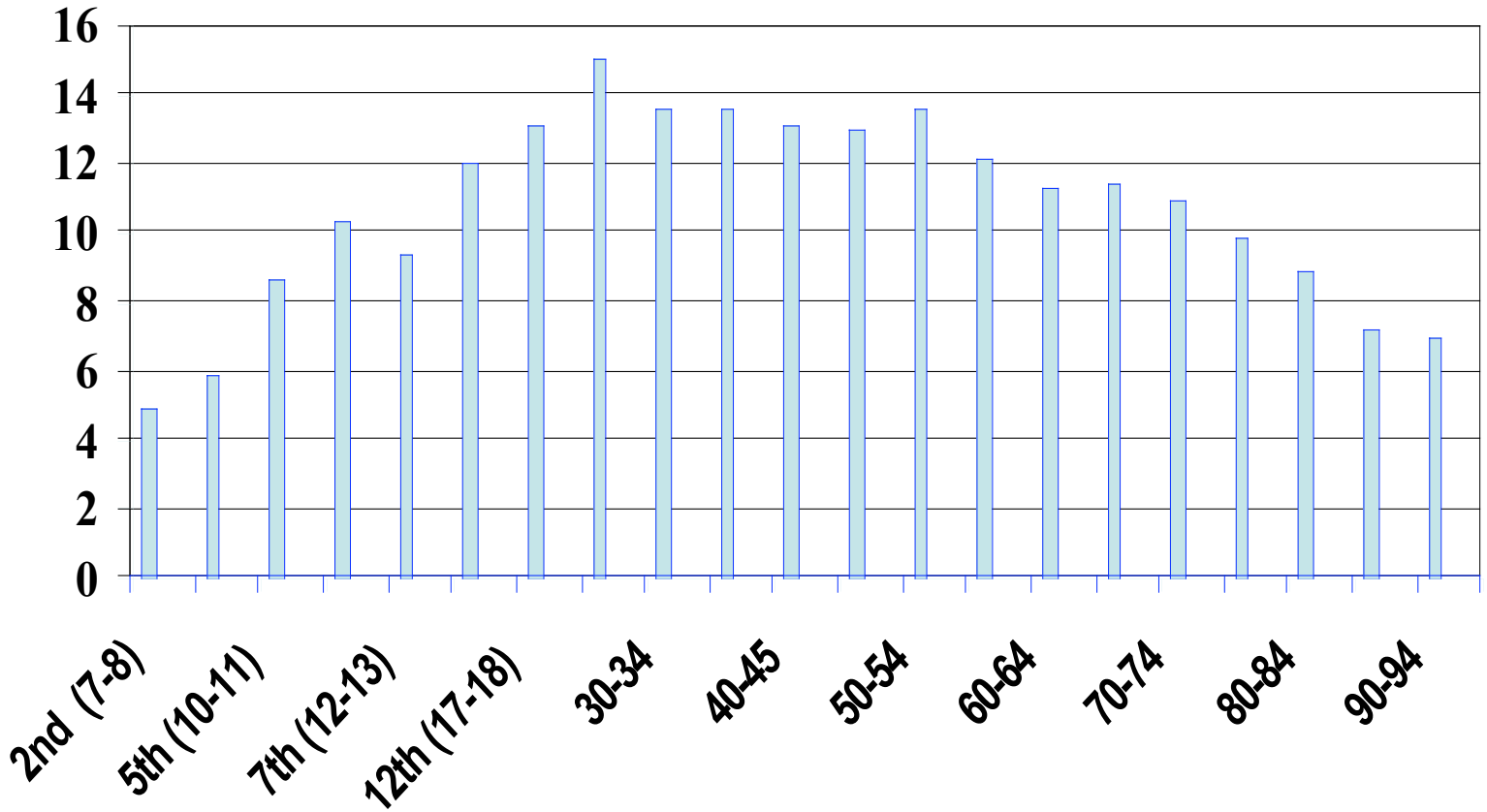
Memory Needs to Consolidate

& many students don't get enough sleep

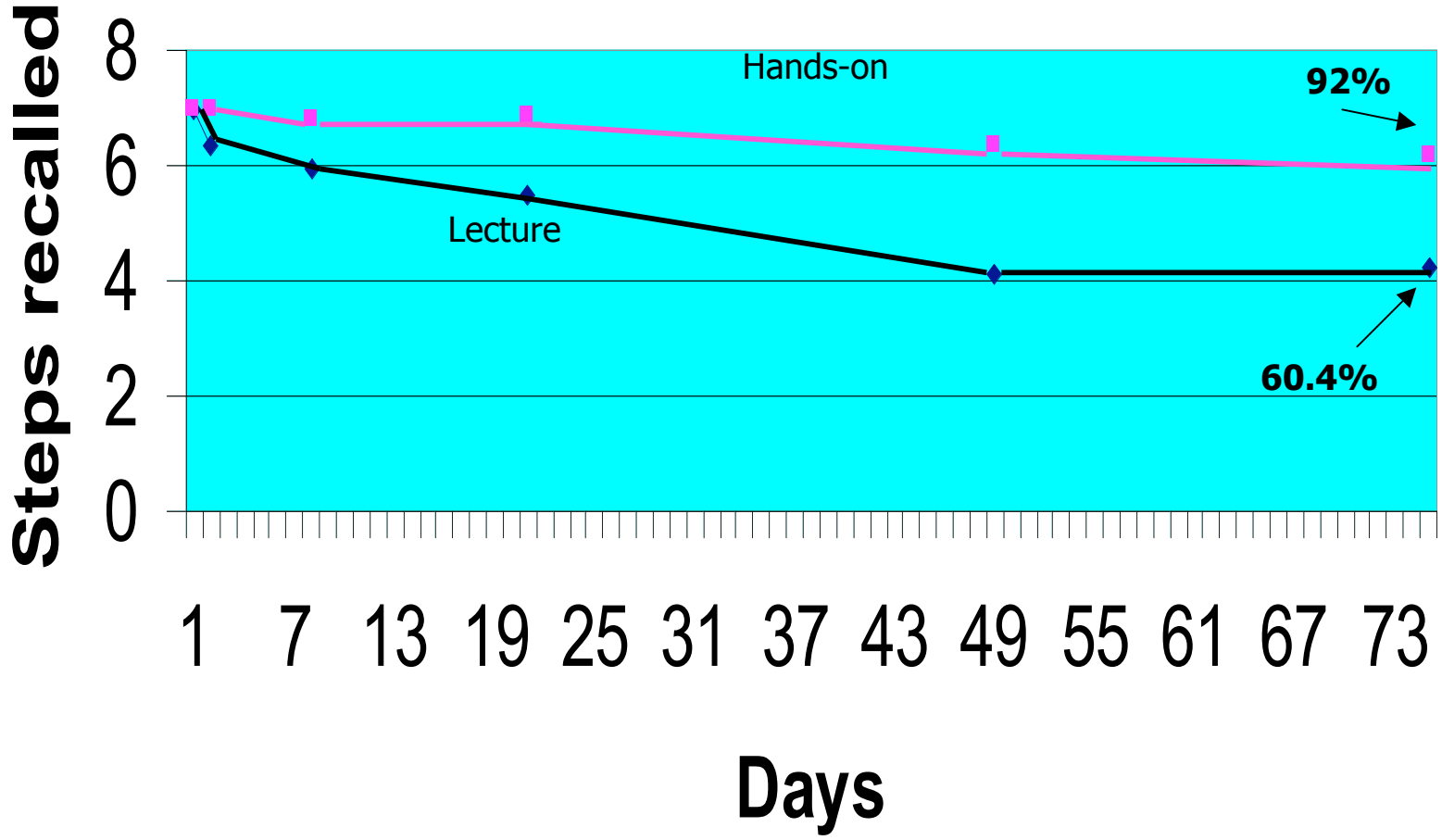
Consolidation of Memory

- Semantic Task: Overnight (sleep)
- Physical Tasks: Approx. 6 hrs.
- New Learning may wipe out earlier learning on physical tasks (if too close together).

Developmental Differences



LTM for Complex SPT
(Multi-step Hands-on)



Movement & Memory: Basic Assumptions

- Movement appears to enhance later memory
- Movement creates physiological changes in attention
- Movement w/accelerated heart rate appears to correlate w/increased attention level
- Greater attention correlates w/ greater memory performance

Brain Break # 5

In your group:

- List what you think may be the most powerful thing you've learned in this session?

ELABORORATION

- Builds LTM
- Modeling allows self-monitoring
- Modeling demonstrated they *COULD* do it!
- Becomes personal & emotionally involved
- Holds attention

Long-Term Memory Strategies

Physical—use movement, procedures, field investigations, small movement, produce a product

Visual Imagery – draw maps, draw pictures, label drawings, model, pantomime

Semantic –explain as they demonstrate, review after 5-7 items, Review Past Perfection

Social – small group work, model, review games

Sex Differences girls typically retain slightly more than boys

Review Strategies

- Personal elaborations
- Review Past Perfection
- Demonstrate or Teach others
- Same environment as test conditions
- Same cues
- Practice transfer
- Same level of difficulty—not easier!

We Learn By

- Personal significance (Emotional connection)
- Belief we can do it (Motivation)
- Physical action + personal elaboration (explanation)
  (attention & memory)

- Growing a memory

- Use It or Lose It (Using memory in dendritic spines or losing it)

- Consolidating the memory by Practicing Past Perfection
  (making the memory stable and accessible)

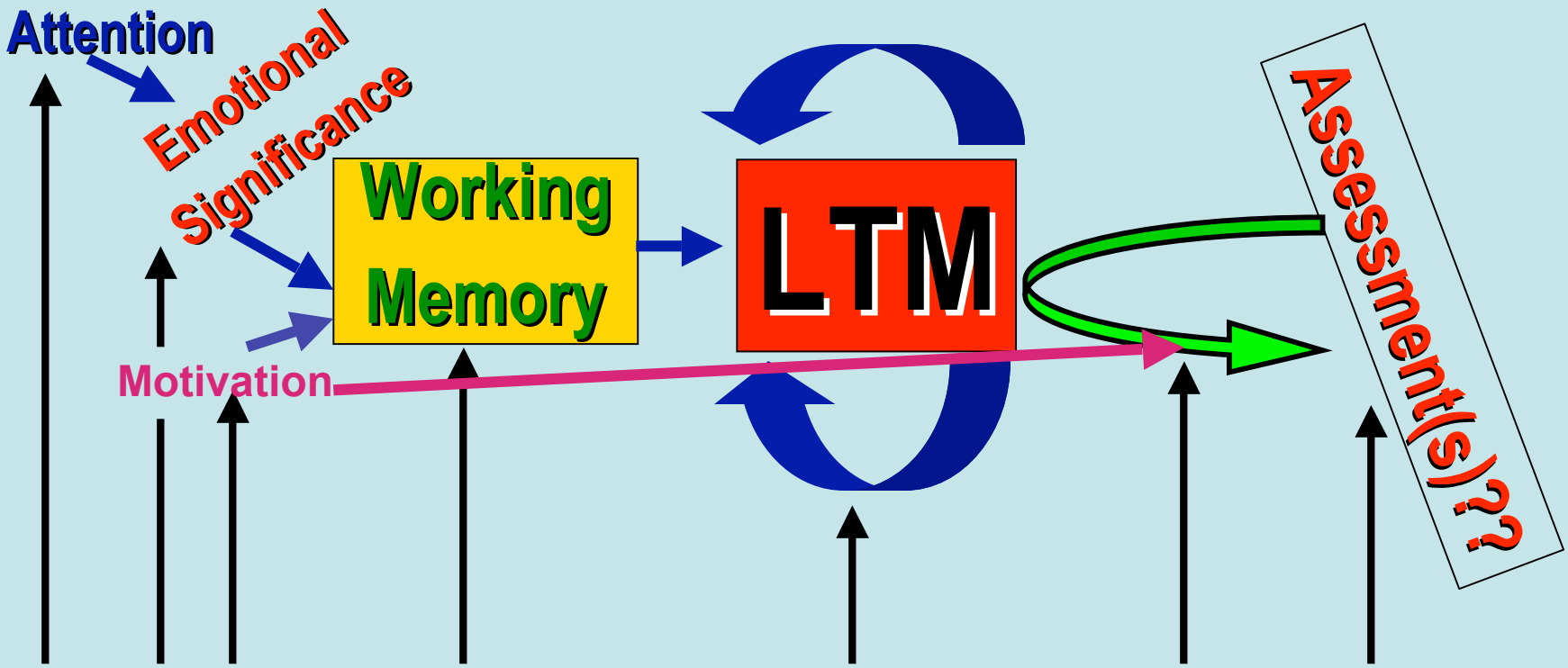
How to Improve Staff Management

Goal:

MAKE TRAINING AND WORK INTUITIVE

- Cognitively
- Spatially
- Sequentially
- Visually
- Generationally

Intervention Points



Where can we improve?

Choosing when to make it challenging

Specifically choose points of challenge and difficulty

- Minds-on
- Increases Ownership
- Increases Investment
- Increases Quality

Must have accountability on all tasks

- checklists
- reports
- peer review

Q & A

Attention

Attention

Capture it

Attention

Don’t Divide It

Help Your Students

Help Your Students

Build personal applications

Help Your Students

Find a personal, emotional connection

Motivate!

By instilling the belief that they *CAN* do it.

Motivate!

By addressing their needs to belong & not look “dumb”

Motivate!

By developing the belief they have some control (autonomy)

Working Memory

Is rapidly overwhelmed

Working Memory

Especially in lecture talks

Working Memory

Saves the gist, not details

Working Memory

Saves MORE if you go SLOWER

Build LTM

By hands-on, paired w/explaining

Build LTM

Practicing PAST perfection

Build LTM

By using multiple forms of instruction

Build LTM

By students providing their own examples

Review & practice

With same style as the assessment
& the same cues

Review & practice

At the same level of difficulty

Review & practice

Transfer

Review & practice

With realistic problems

Assess

With a ***variety*** of methods

Assess

The material actually reviewed & practiced

Assess

In the same manner as final practices

And Finally....

Continue

To Grow and Learn

For when you stop,
Your brain stops growing too.

- Jeb Schenck
- knowa@directairnet.com

- Jessie Cruickshank
- jessie@srom.org