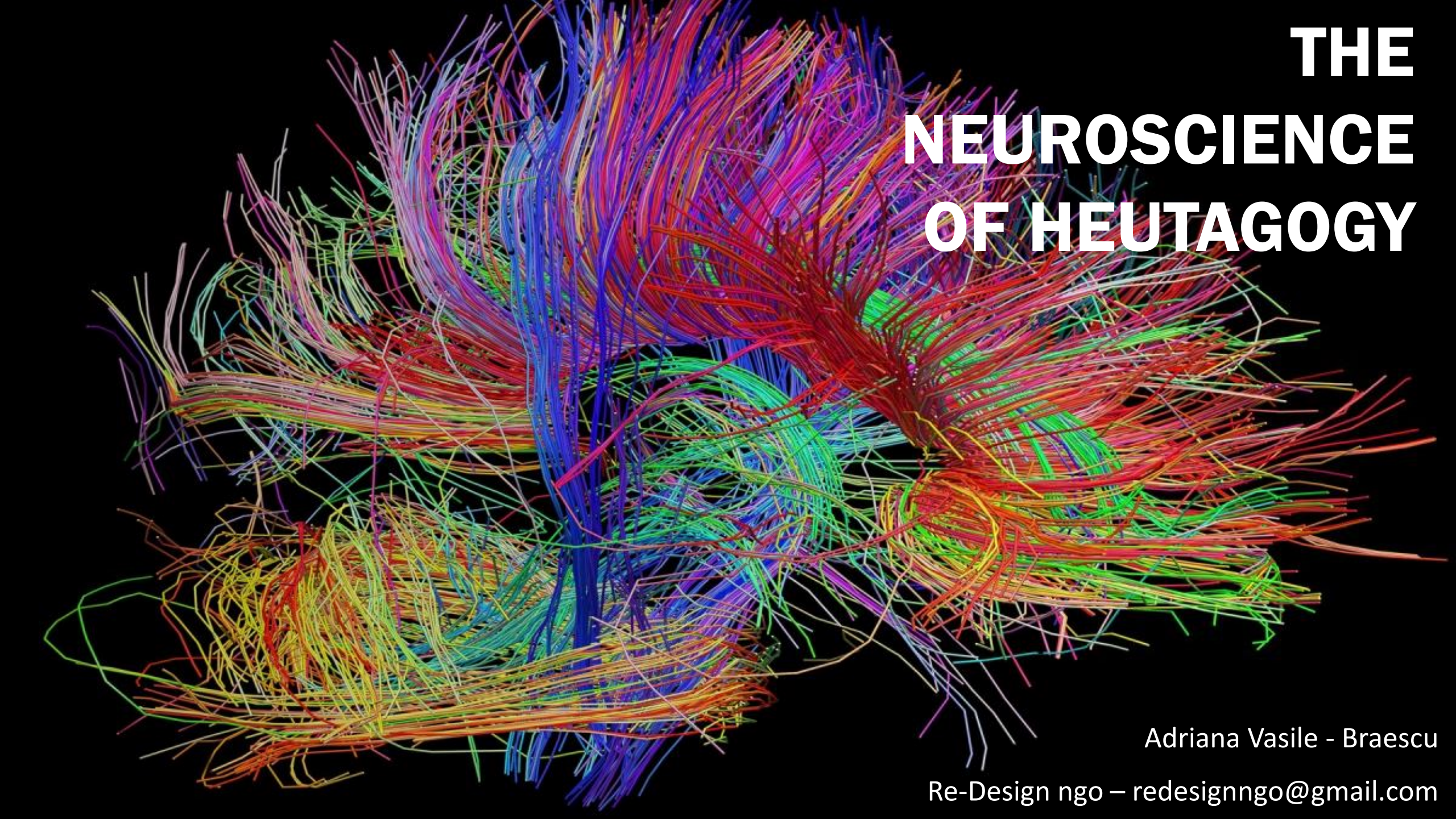


THE NEUROSCIENCE OF HEUTAGOGY

Adriana Vasile - Braescu

Re-Design ngo – redesignngo@gmail.com

WHO AM I ?

A mom of 2 unschooled kids, who tries to revive, using neurosciences, the meaning of the word “school”:

school[1]

Origin

Old English *scōl*, *scolu*, via Latin from Greek *skholē* ‘leisure, philosophy, lecture place’, reinforced in Middle English by Old French *escole* .

WHAT AM I?

- BS Biology
- MD Neurobiology
- Researcher – comparative EEG study: holistic vs cartesian education*
- Founder of Re-Design ngo, which runs CEREHARD = Re-Design ngo Resource Centre for Holistic Education, British Curriculum School in Romania. CEREHARD is a British – Romanian pilot-project designed to accomomdate the EOTAS (Education Otherwise Than At School) families. Redesignngo.com

* holism – all the properties of a given system in any field of study cannot be determined or explained by the sum of its component parts. Instead, the system as a whole determines how its parts behave.

- cartesianism – logical analysis and mechanistic interpretation of physical nature

WHY AM I ?

To promote **personalized** & **holistic education =**

Swap from the basic three R's:

Reading, Writing and Arithmetic

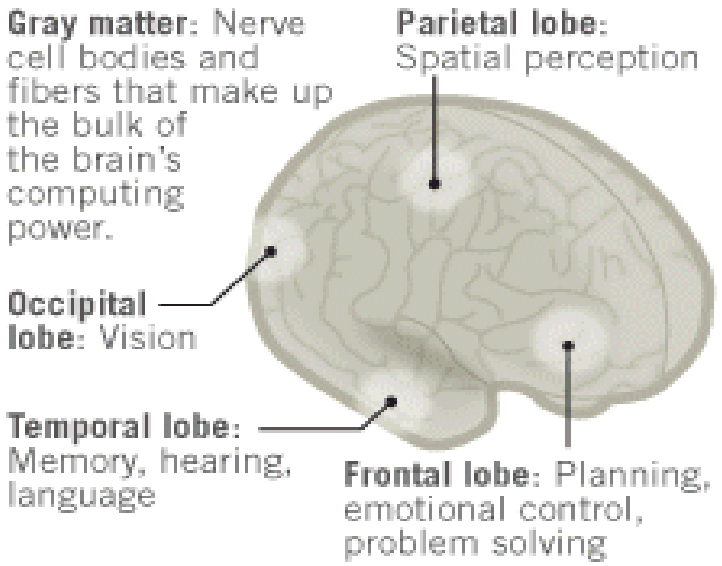
to

Relationships, Responsibility and Reverence for all life

(*Journal of Holistic Education)*

Growing a Grown-up Brain

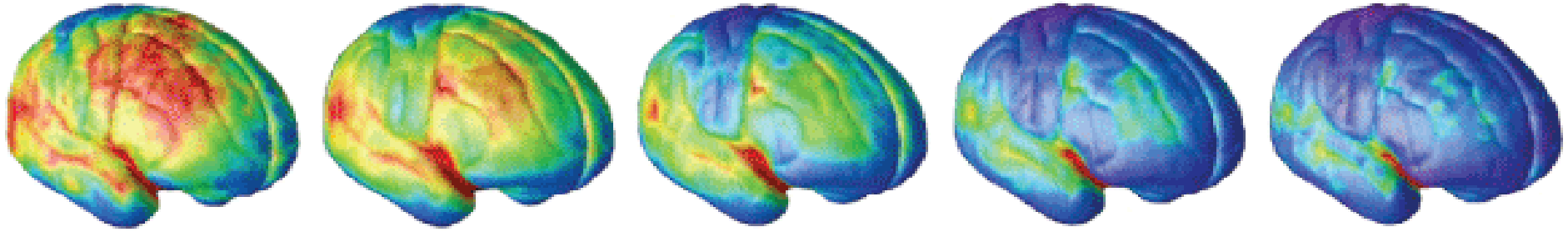
Scientists have long thought that the human brain was formed in early childhood. But by scanning children's brains with an MRI year after year, they discovered that the brain undergoes radical changes in adolescence. Excess gray matter is pruned out, making brain connections more specialized and efficient. The parts of the brain that control physical movement, vision, and the senses mature first, while the regions in the front that control higher thinking don't finish the pruning process until the early 20s.



Gray matter density

Gray matter becomes less dense as the brain matures.

More dense — Less dense



Age: 5 — Adolescence — 20

Source: "Dynamic mapping of human cortical development during childhood through early adulthood," Nitin Gogtay et al., *Proceedings of the National Academy of Sciences*, May 25, 2004; California Institute of Technology

METHODOLOGY: NEUROIMAGING

Computed axial tomography

Diffuse optical imaging

Event-related optical signal

Magnetic resonance imaging

Functional magnetic resonance imaging

Positron emission tomography

Single-photon emission computed tomography

Cranial ultrasound

Comparison of imaging types

To date, I only have access to EEG technique to compare the brain waves – some of the kids are selected from the official sytem of education, some, from the home and unschoolers who pursue apersonalized & holistic approach.

EDUCATION – HOLISTIC & PERSONALIZED VS STANDARD

Holistic and personalized education allows deeper and stronger connections between brain regions = DMN activation – Internalizing instead of „surfing" / training.

work in progress.

PORTABLE MAGNETOENCEPHALOGRAPHY

Current MEG scanner based on SQUID sensors

New MEG scanner with OPM sensors

Boto et al. (2018) *Nature*

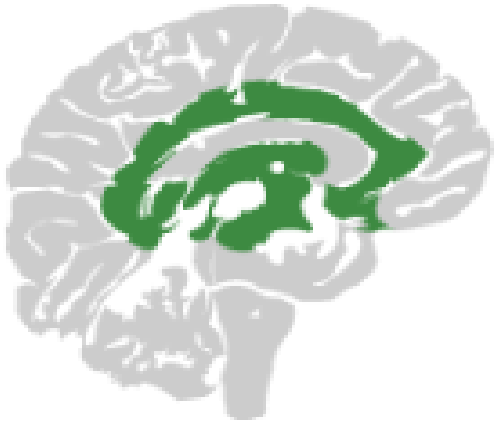
Recognition Networks
The "what" of learning

How we gather facts and categorize what we see, hear, and read. Identifying letters, words, or an author's style are recognition tasks.

Strategic Networks
The "how" of learning

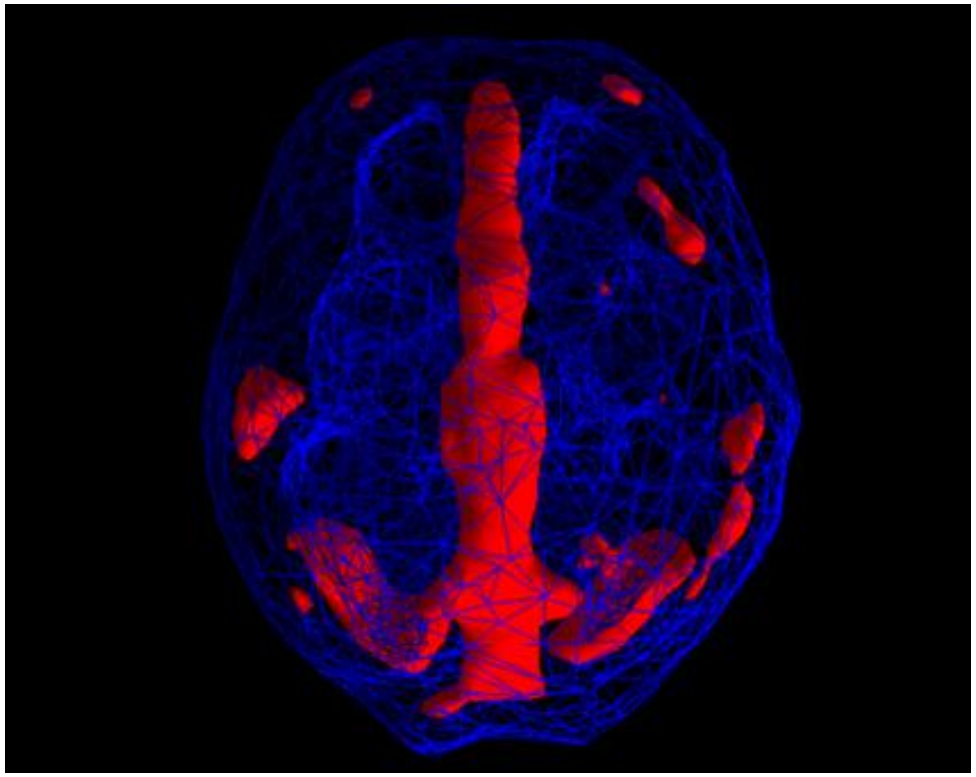
Planning and performing tasks. How we organize and express our ideas. Writing an essay or solving a math problem are strategic tasks.

Affective Networks
The "why" of learning



How learners get engaged and stay motivated. How they are challenged, excited, or interested. These are affective dimensions.

Source: http://www.cast.org/udl/index.html



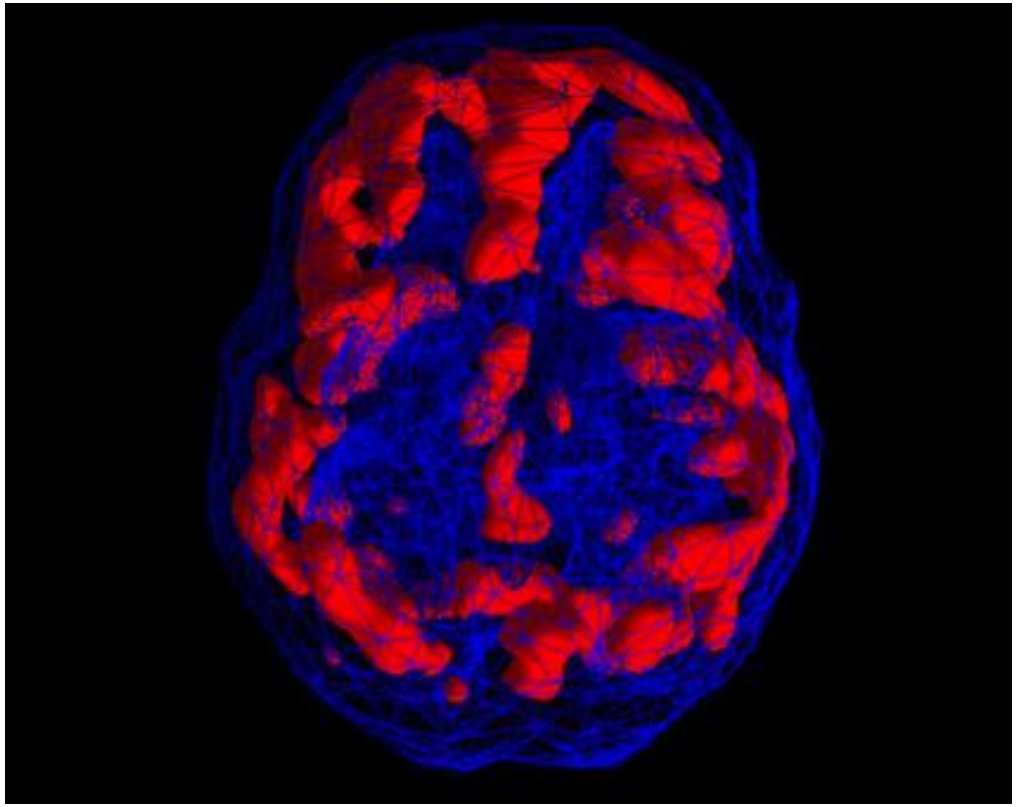
Overfocused

= too much activity in the anterior cingulate gyrus (the brain's “gear shifter”).

Being flexible / shifting from thought to thought / task to task is very difficult.

- symptoms: getting stuck into negative thought patterns or behaviors, as a result of a deficiency of serotonin and dopamine in the brain.

Source: https://www.slideshare.net/danielgamen/healing-add-see-and-heal-the-7-types



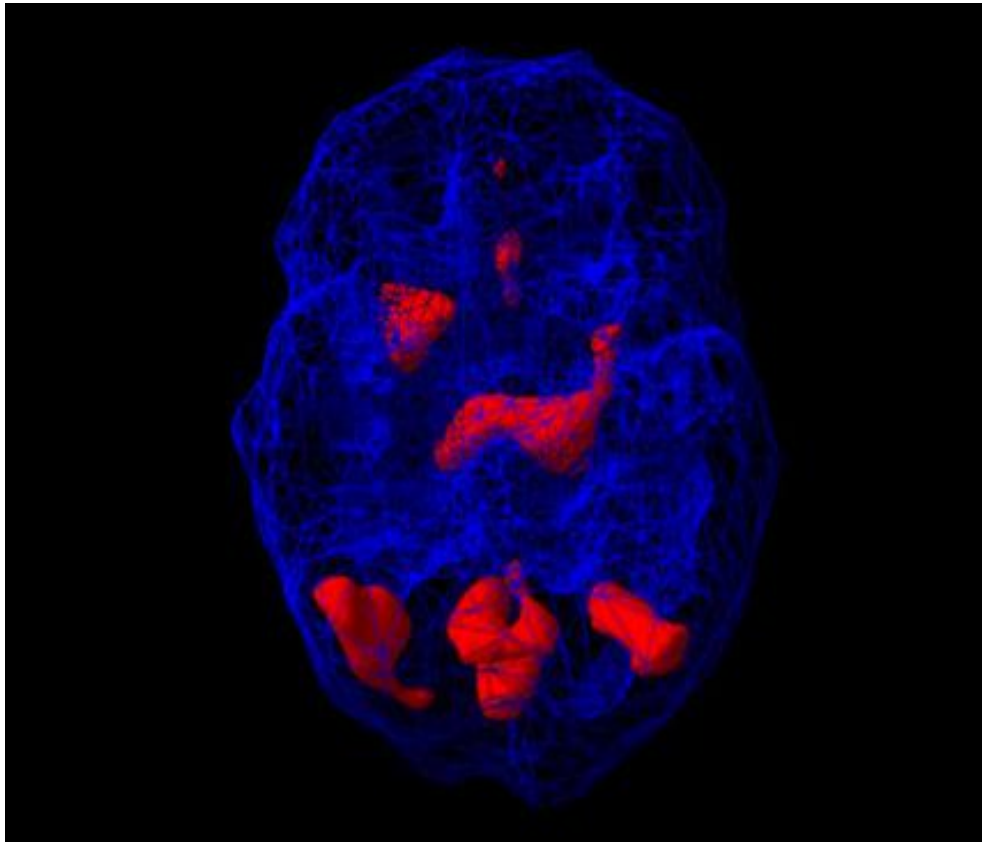
Ring of fire

The entire brain is overactive =

too much activity across the cerebral cortex and many of the other parts of the brain.

- symptoms: sensitivity to noise, light, touch; periods of mean, nasty / unpredictable behavior; talking fast; anxiety and fearfulness.

Source: https://www.slideshare.net/danielgamen/healing-add-see-and-heal-the-7-types



Limbic ADD

- too much activity in the limbic part of the brain (the mood control center) and decreased prefrontal cortex activity, whether concentrating on a task or at rest.

- symptoms: moodiness, low energy, feelings of helplessness / excessive guilt, chronic low self-esteem. It is not depression.

Source: https://www.slideshare.net/danielgamen/healing-add-see-and-heal-the-7-types

NEUROMYTHS
(as accepted by OECD / EOCD)

"People are either right or left brained" /

people are either logical, or creative

- What means "logical" or "creative"?
- How do you measure creativity?

NEUROMYTH 2

"The first three years of a child are decisive for later development and success in life, because the brain is only plastic for certain kinds of information during specific critical periods"

- Source - Konrad Lorenz's studies on critical period of imprinting in birds.

NEUROMYTH 3

"Enriched environments enhance the brain's capacity for learning"

= if a child has not been fully exposed to an "enriched environment", it will not recover later on in life and those capacities that could be accomplished early in life are lost.

NEUROMYTH 4

"There is a visual, auditive and a kinaesthetic type of learning"

= learning occurs through different 'channels of perception', and the type of learner – biologically determined – can be characterized by the predominant use of one channel of perception.

Another “Cartesian” approach is Howard Gardner’s theory of multiple intelligences – although useful in stimulating people to “unpack their gifts”, it may block the fully manifestation of the intelligence itself, as a result of the whole human potential.

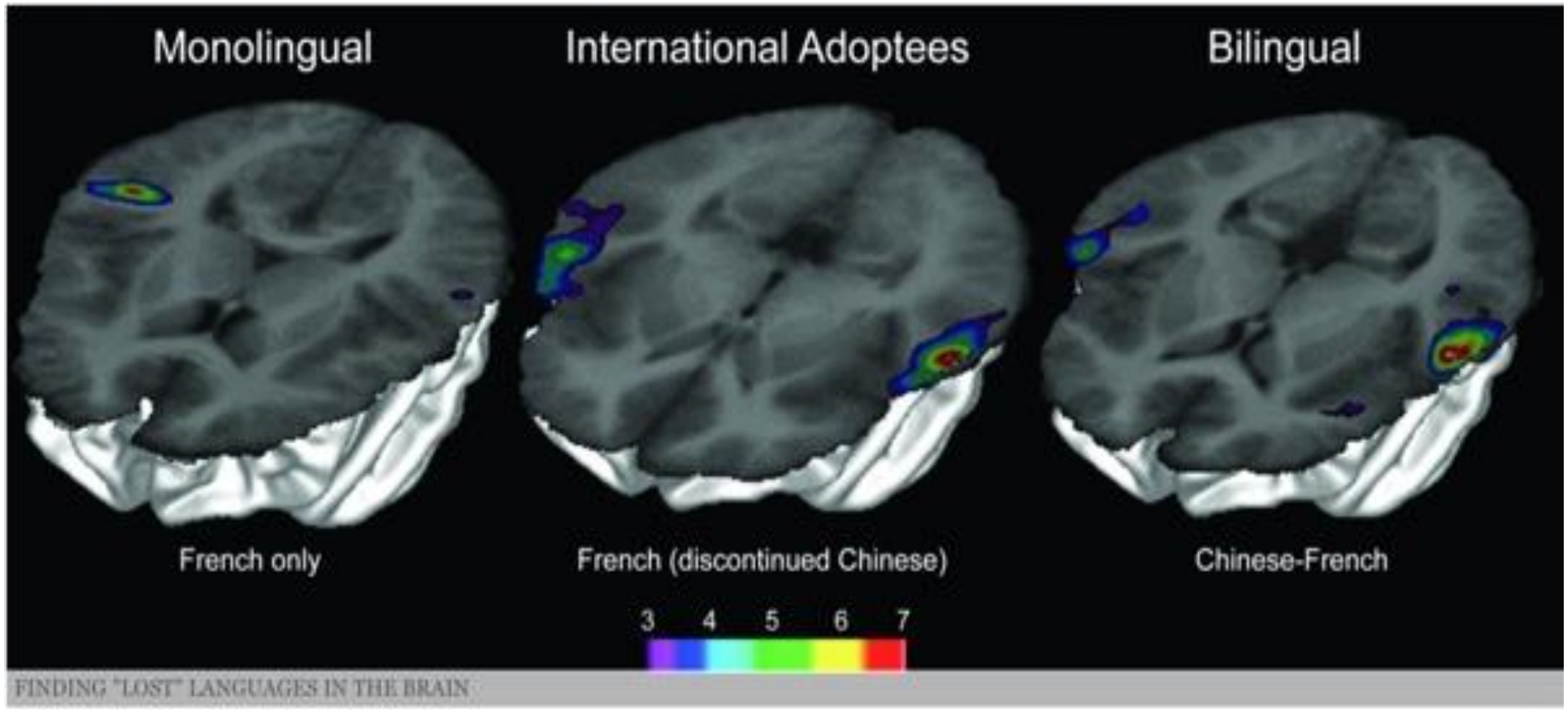
NEUROMYTH 5

"We only use 10% of our brain"

- one of the most stated brain myths, is still in use.
  Actually, we use a 100% of our brains.

NEUROMYTH 6

"Two languages compete for resources – the more one language is learnt, the more the other language is lost; knowledge, acquired in one language, is not accessible in the other language – the two languages lie next to each other in separated brain areas, with no points of contact; knowledge acquired in one language cannot be transferred to the other language; the first language must be spoken well, before the second language is learnt".


Monolingual
International Adoptees
Bilingual
French only
French (discontinued Chinese)
Chinese-French
3 4 5 6 7
FINDING "LOST" LANGUAGES IN THE BRAIN

We are more than our brains…

Most of our lives occur beyond our mind, beyond “control”

PLUTCHIK THEORY OF EMOTIONS

8 primary bipolar emotions:

- joy / sadness;
- anger / fear;
- trust / disgust;
- surprise / anticipation.

These 'basic' emotions are biologically primitive and have evolved in order to increase the reproductive fitness. Each emotion is the trigger of a behaviour with high survival value (e.g. fear and the fight-or-flight response).

COMPONENTS OF AN EMOTION

- A subjective experience = a cognitive appraisal
- A physiological reaction = bodily symptoms
- A tendency to action = motor response
- An expressive component (like a facial expression)
- A behavioural component

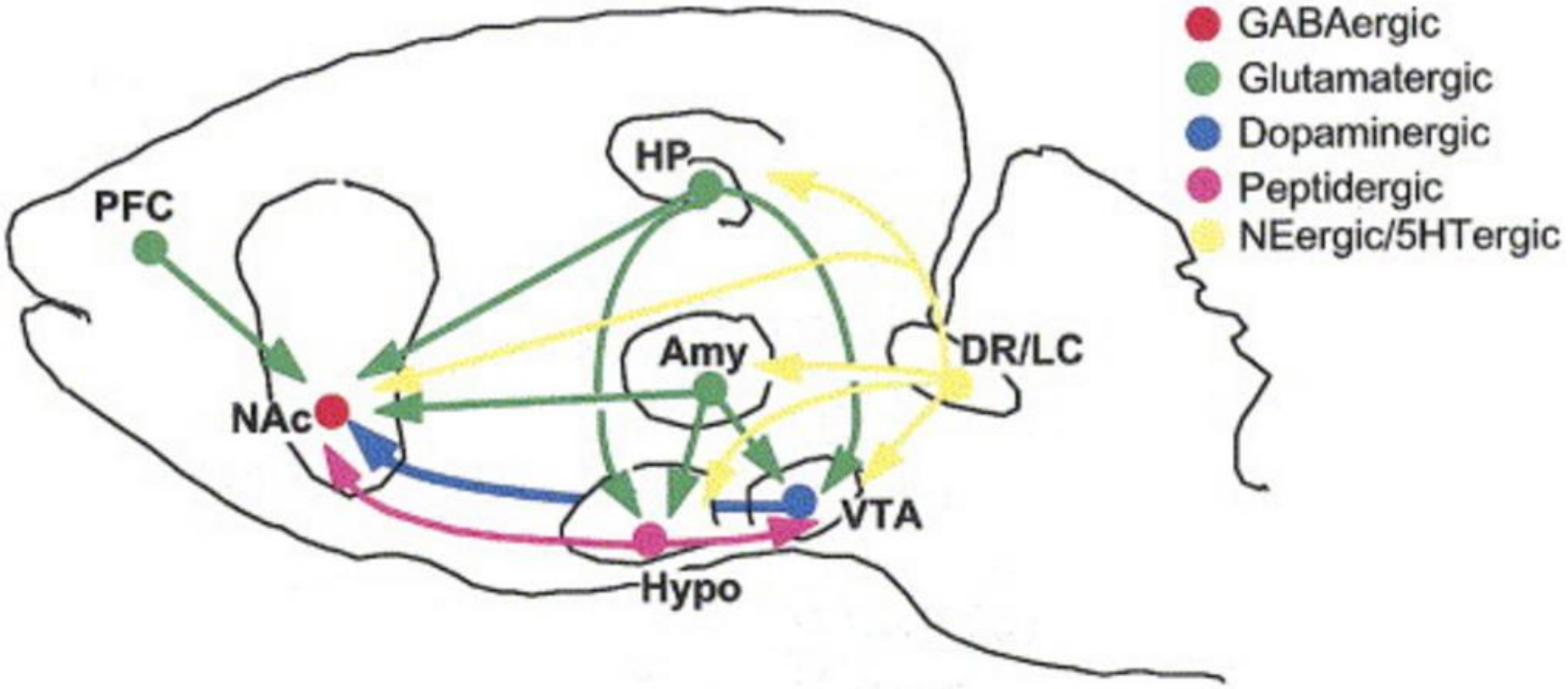
e.g. Fear = the subjective experience + sympathetic nervous system activation + characteristic facial expression + fight-or-flight response

PRIMARY (INNATE) / SECONDARY EMOTIONS

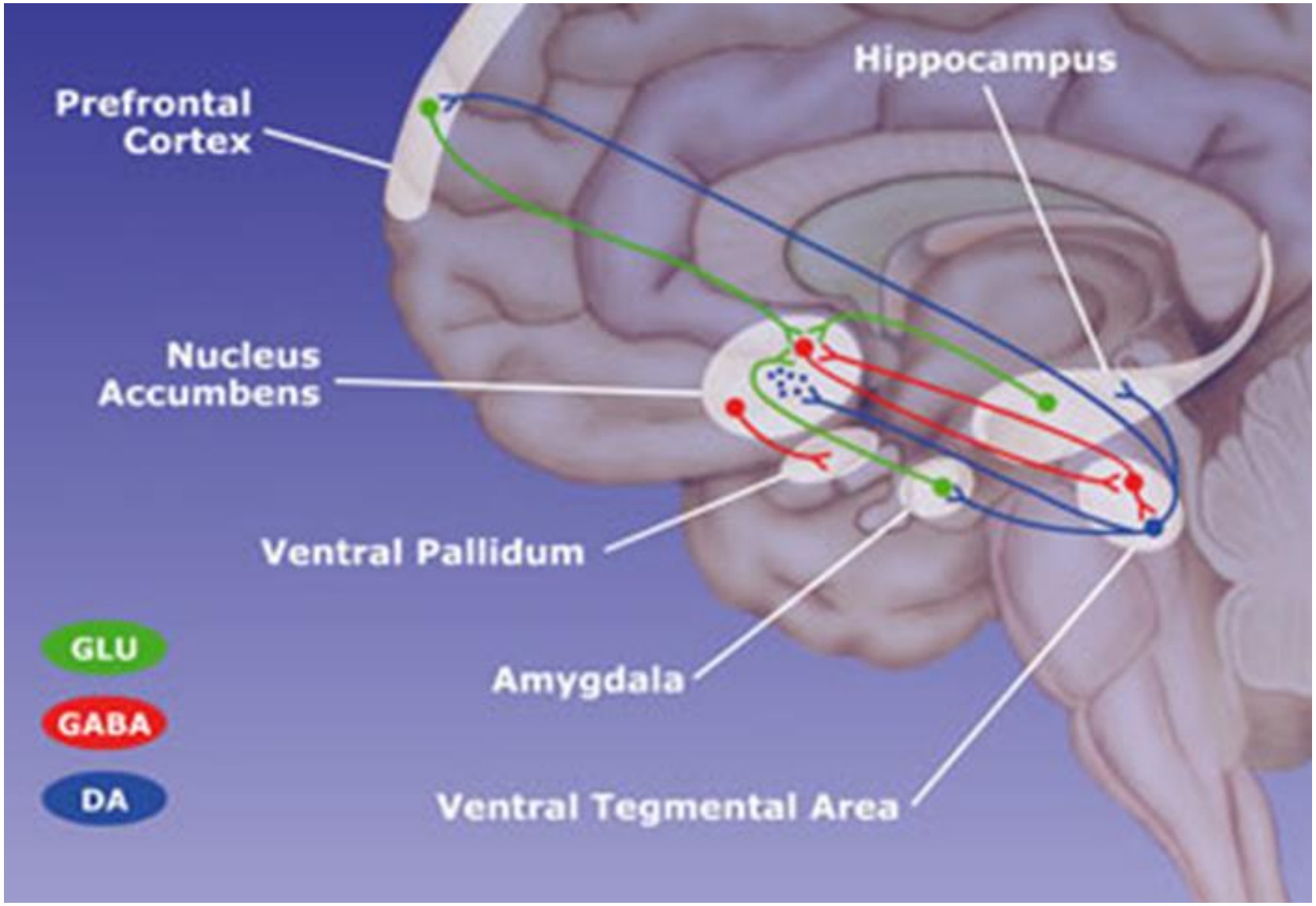
- Primary emotions depend on limbic system connectomes

- Secondary emotions are generated with the inputs from prefrontal and somato-sensory cortices. Each thought is accompanied by an emotion...

REWARD CONNECTOME
NESTLER & CARLEZON (2006)

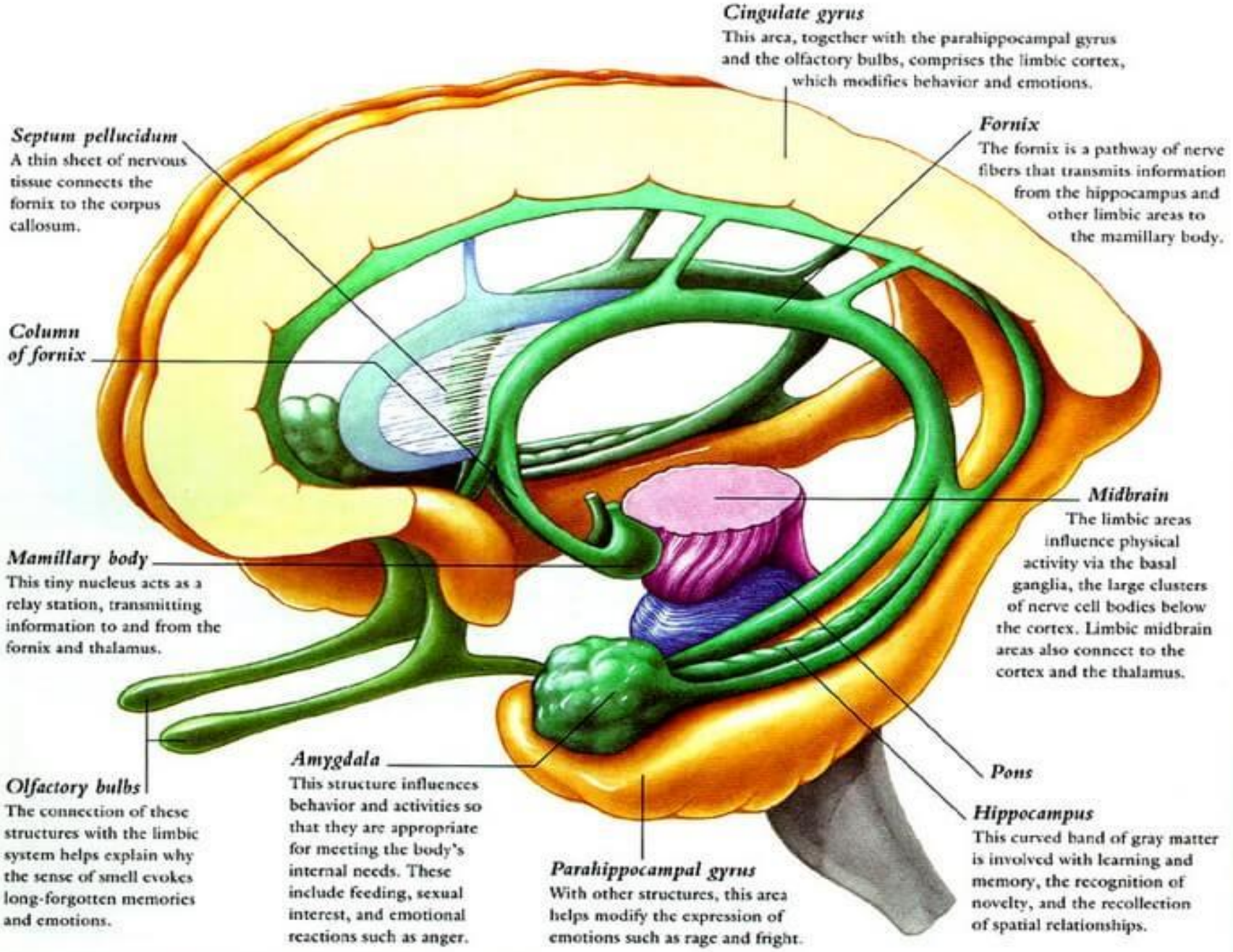


DR / LC = Dorsal Raphe Nucleus / Locus Coeruleus
PFC = prefrontal cortex

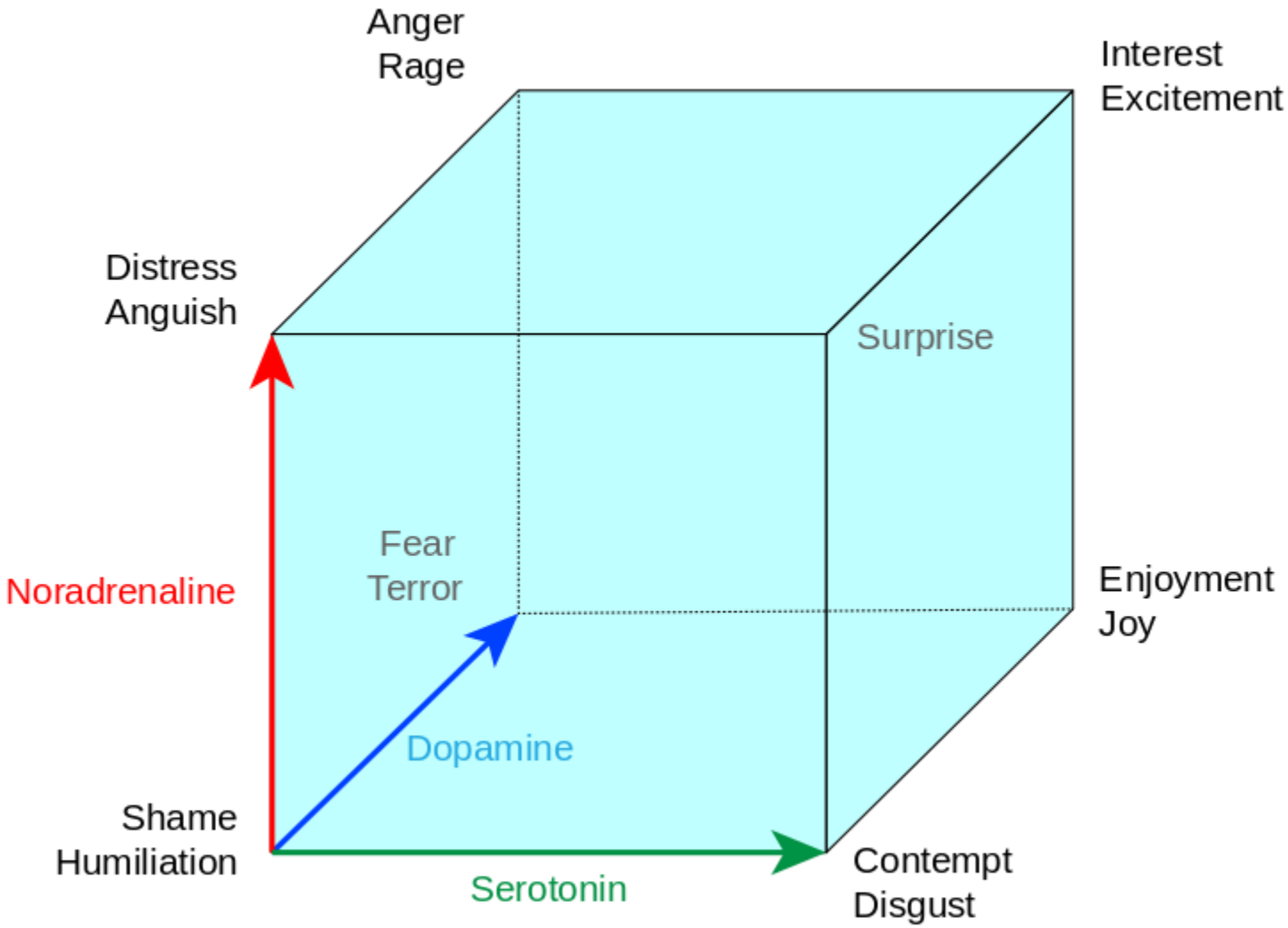


Nucleus Accumbens
(deep in the frontal lobe)
and Ventral Tegmental Area
(part of the midbrain)
both release and mediate
the neurotransmitter dopamine,
which specifically
produces and mediates
sensations of pleasure
and relaxation.

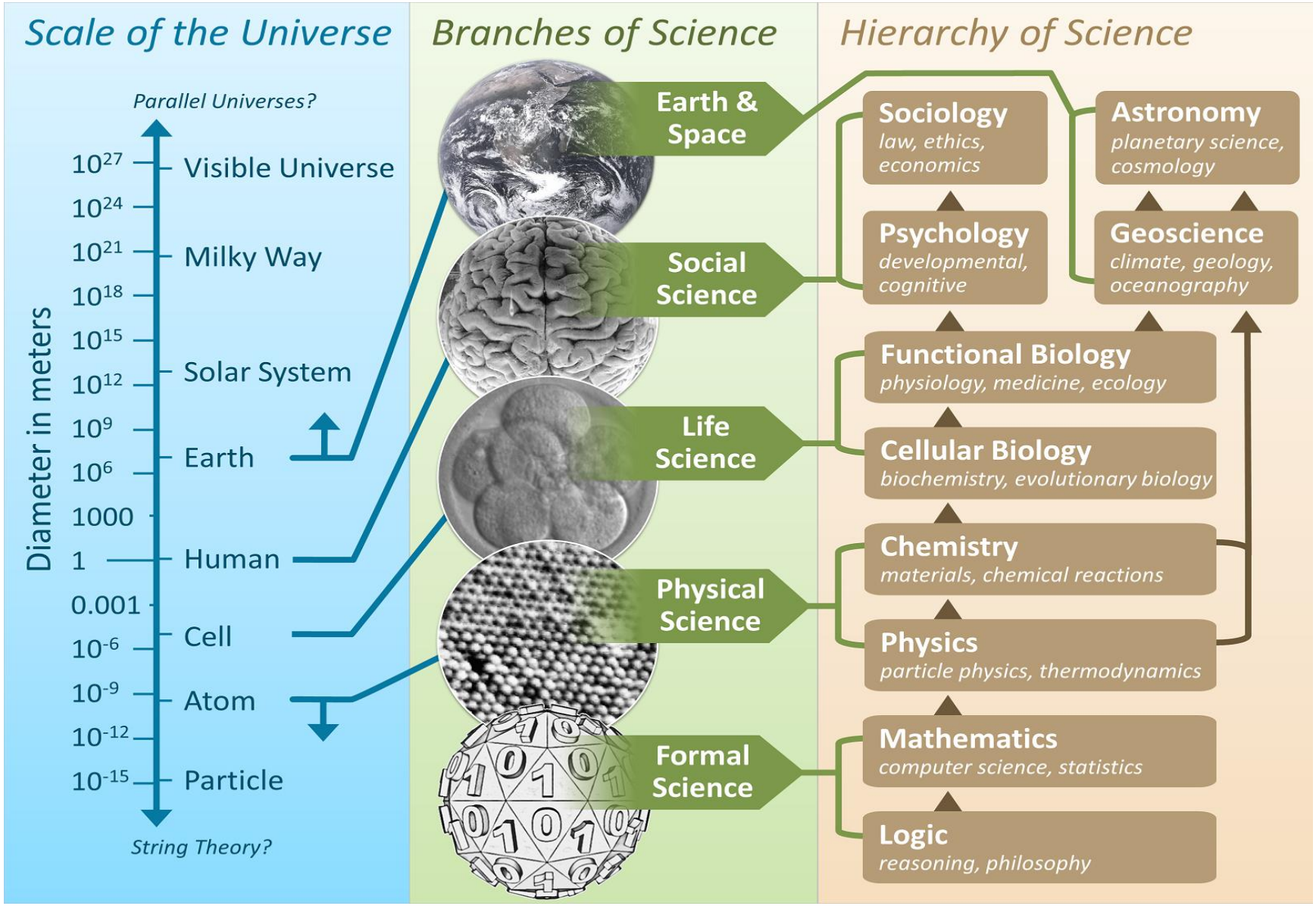
Source: http://antranik.org/wp-content/uploads/2011/11/
the-reward-circuit-nucleus-accumbens-ventral-pallidum-ventral-tegmental-area-and-amygdala.jpg


Cingulate gyrus
This area, together with the parahippocampal gyrus and the olfactory bulbs, comprises the limbic cortex, which modifies behavior and emotions.
Septum pellucidum
A thin sheet of nervous tissue connects the fornix to the corpus callosum.
Fornix
The fornix is a pathway of nerve fibers that transmits information from the hippocampus and other limbic areas to the mamillary body.
Column of fornix
Midbrain
The limbic areas influence physical activity via the basal ganglia, the large clusters of nerve cell bodies below the cortex. Limbic midbrain areas also connect to the cortex and the thalamus.
Mamillary body
This tiny nucleus acts as a relay station, transmitting information to and from the fornix and thalamus.
Amygdala
This structure influences behavior and activities so that they are appropriate for meeting the body's internal needs. These include feeding, sexual interest, and emotional reactions such as anger.
Olfactory bulbs
The connection of these structures with the limbic system helps explain why the sense of smell evokes long-forgotten memories and emotions.
Pons
Hippocampus
This curved band of gray matter is involved with learning and memory, the recognition of novelty, and the recollection of spatial relationships.
Parahippocampal gyrus
With other structures, this area helps modify the expression of emotions such as rage and fright.

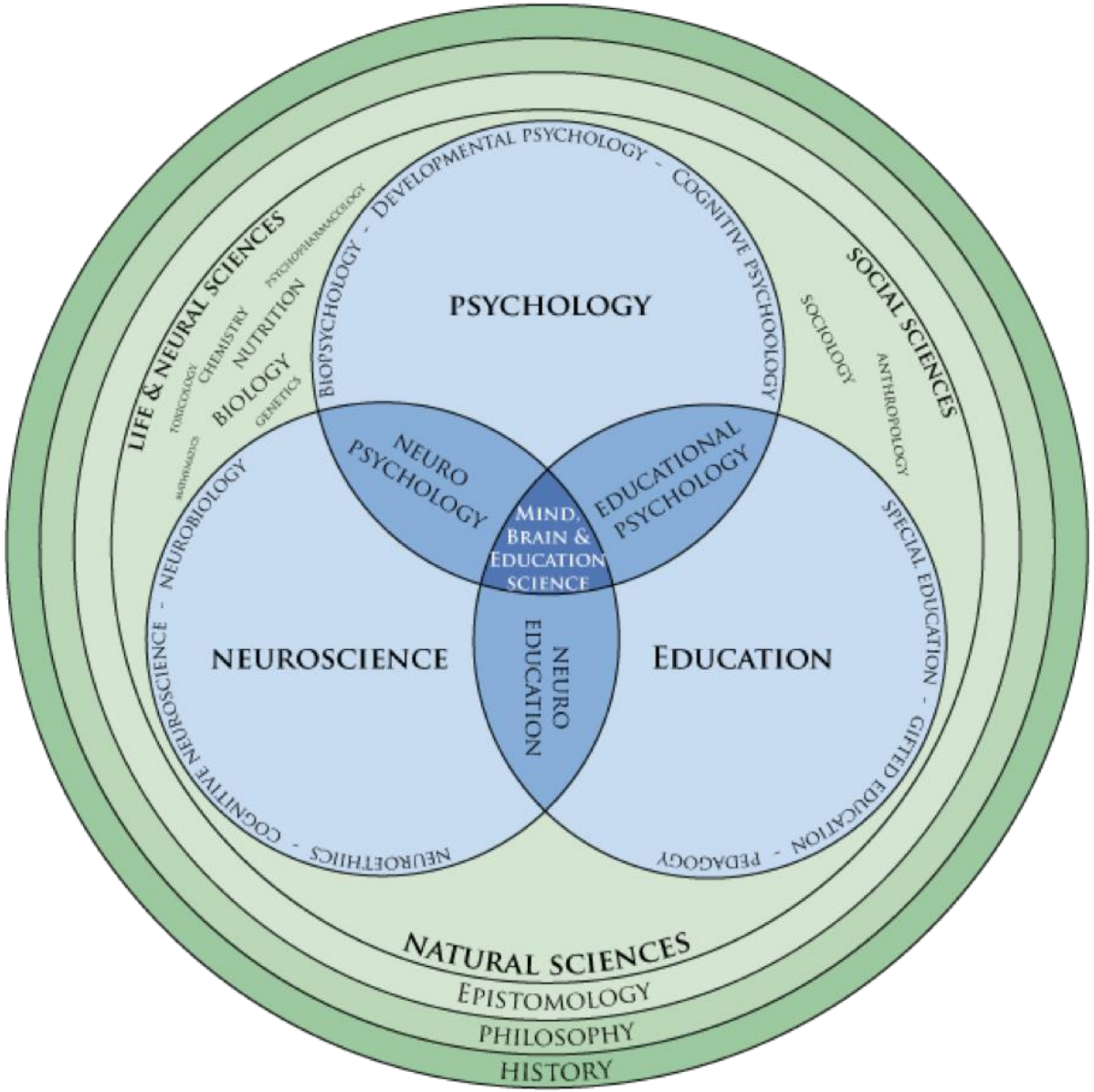
LÖVHEIM CUBE OF EMOTION (2012)



the three neurotransmitters - serotonin, dopamine and NORA are correlated with the eight basic emotions, labeled according to the affect theory (Silvian Tomkins)

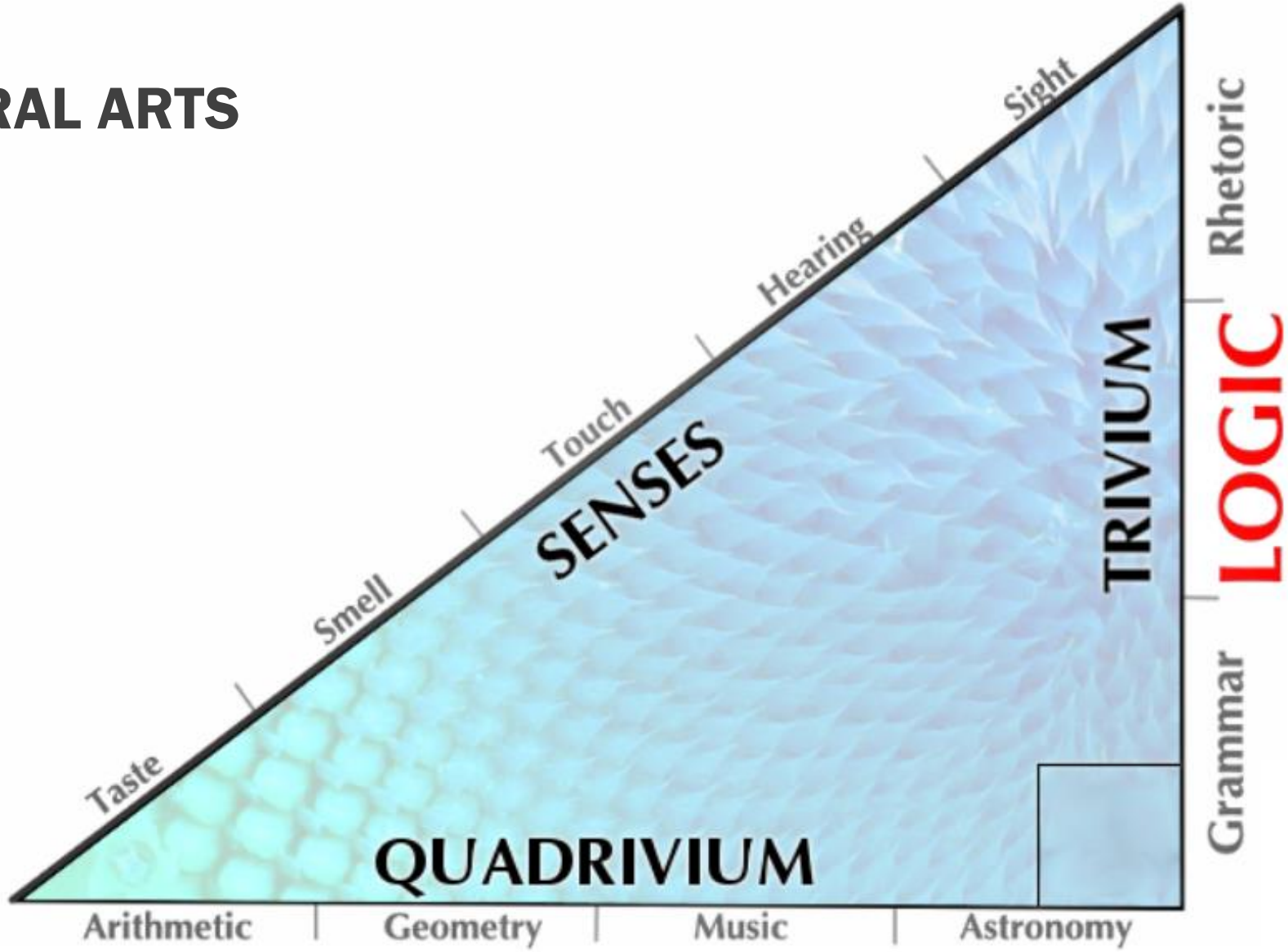


This image is the original work of Eric Fisk

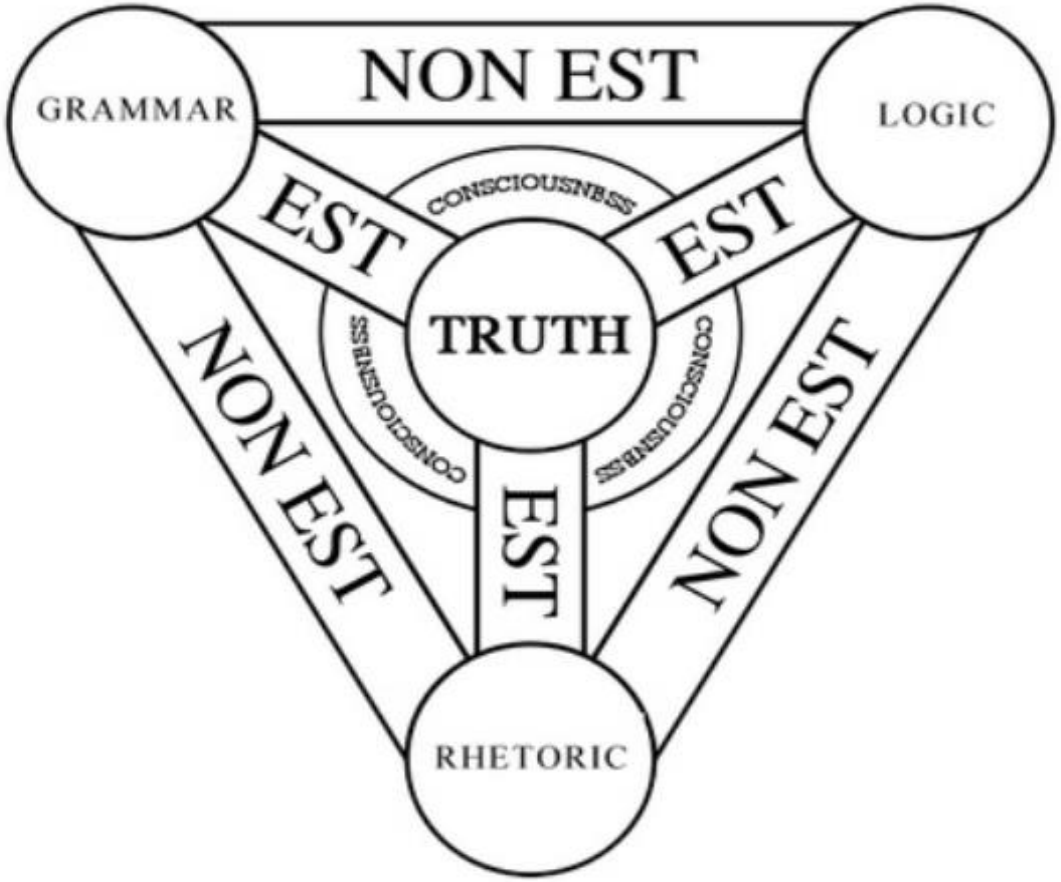


Source: Bramwell for Tokuhama-Espinosa

THE 7 LIBERAL ARTS



THE HUMANITIES (TRIVIUM)



QUADRIVIUM

1	Arithmetic	Air	The study of quantity involving the combination of numbers through addition, subtraction, multiplication, and division. (pure construct, abstraction)
2	Geometry	Earth	A branch of mathematics concerned with shape, size, relative position, and the properties of space. (Arithmetic of Space)
3	Music	Water	An art form which employs vibration, rhythm, dynamics, and the interplay between sound and silence as its mediums for expression. (Arithmetic of Time)
4	Astronomy	Fire	A natural science that deals with the study of celestial objects such as stars, planets, comets, nebulae, and galaxies. (Arithmetic of Time and Space)

DRIVERS OF CHANGE

- Increasing global lifespan
- Rise of smart machines and systems
- Computational world
- New-media ecology
- Supercomplex organizations
- Global connectivity

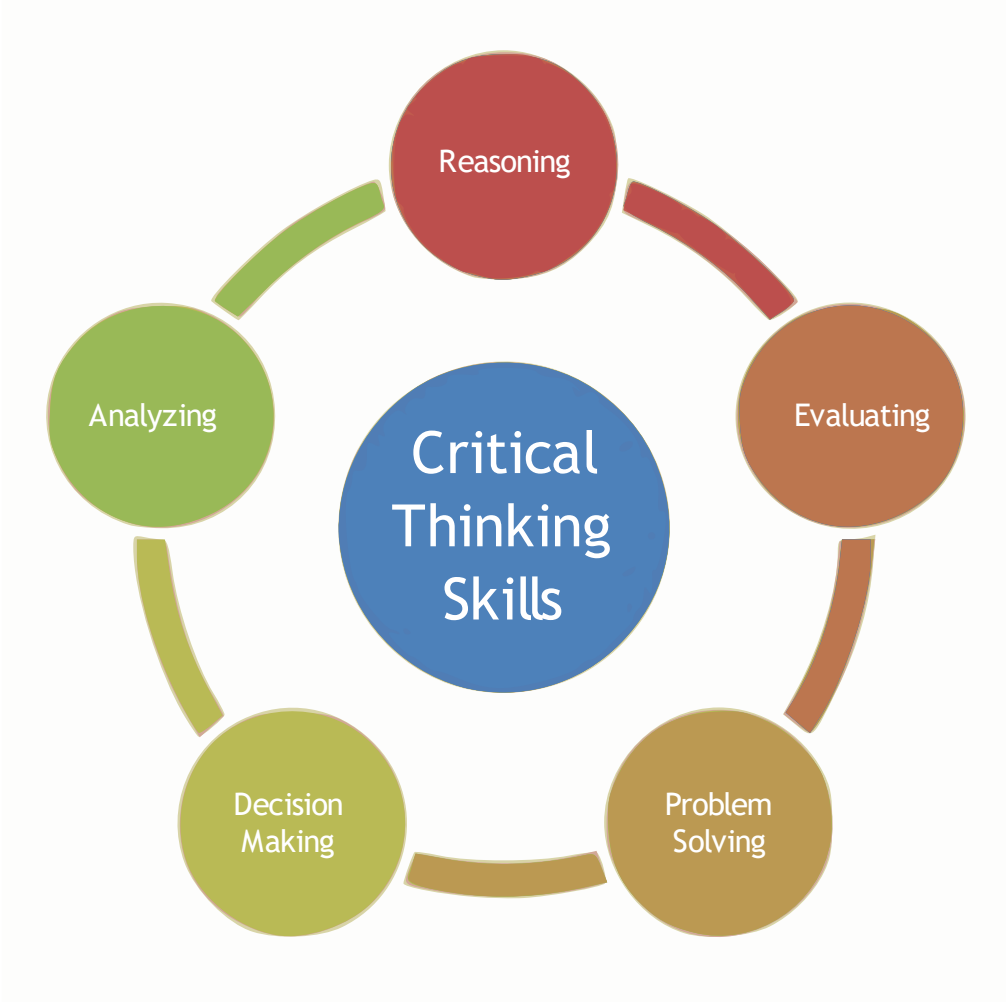
FUTURE WORKING SKILLS

- Critical thinking / Sense making
- Social intelligence
- Adaptative thinking
- Cross-cultural competency
- Computational thinking
- New-media literacy
- Transdisciplinarity
- Design mindset
- Cognitive load management
- Virtual collaboration

CRITICAL THINKING / SENSE MAKING

= ability to determine the deeper meaning or significance of what is being expressed

- It will be highly appreciated in the permanent negociation the human / machine division of labour.



Source: Wikimedia Commons

SOCIAL INTELLIGENCE

= ability to connect to others in a deep and direct way, to sense and stimulate reactions and desired interactions.

- Allows to quickly assess the emotions of those around them and to adapt their words, tone and gestures accordingly.

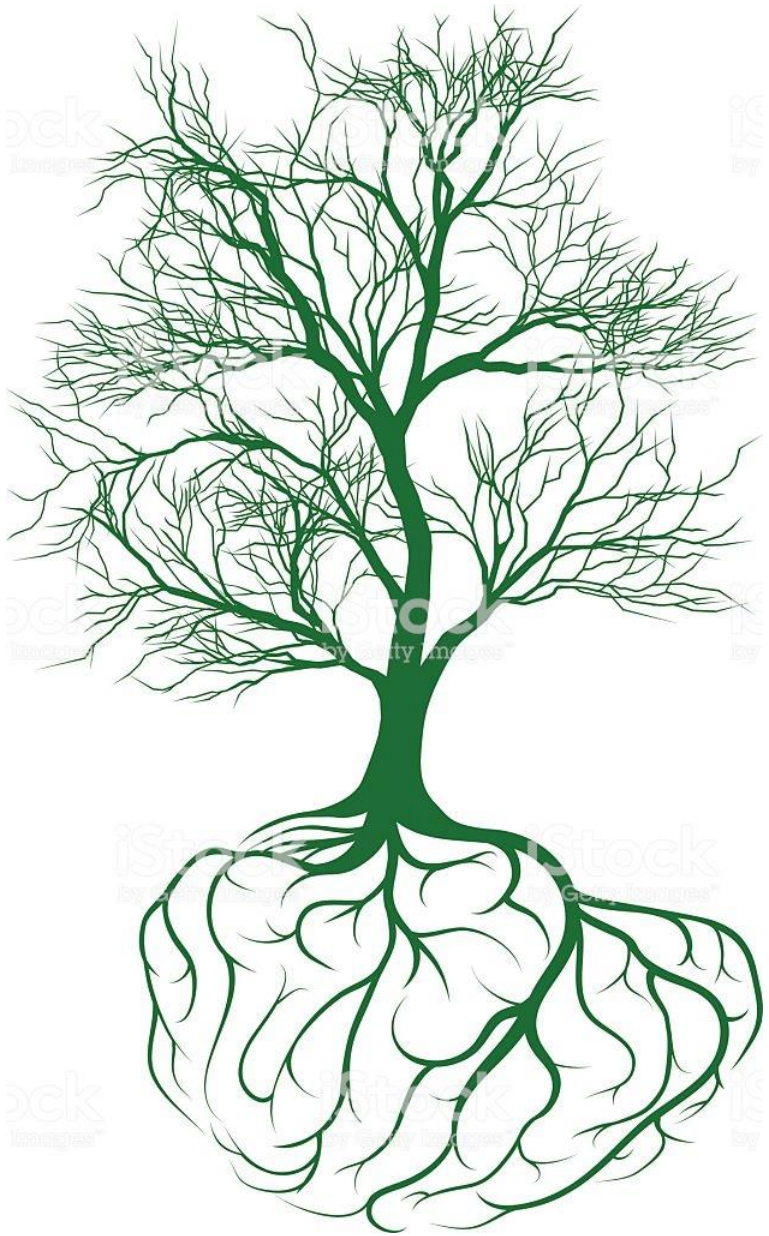
Goleman model

Source: businessballs.com

ADAPTATIVE THINKING

= proficiency at thinking and coming up with solutions and responses beyond tht which is rote or rule-based.

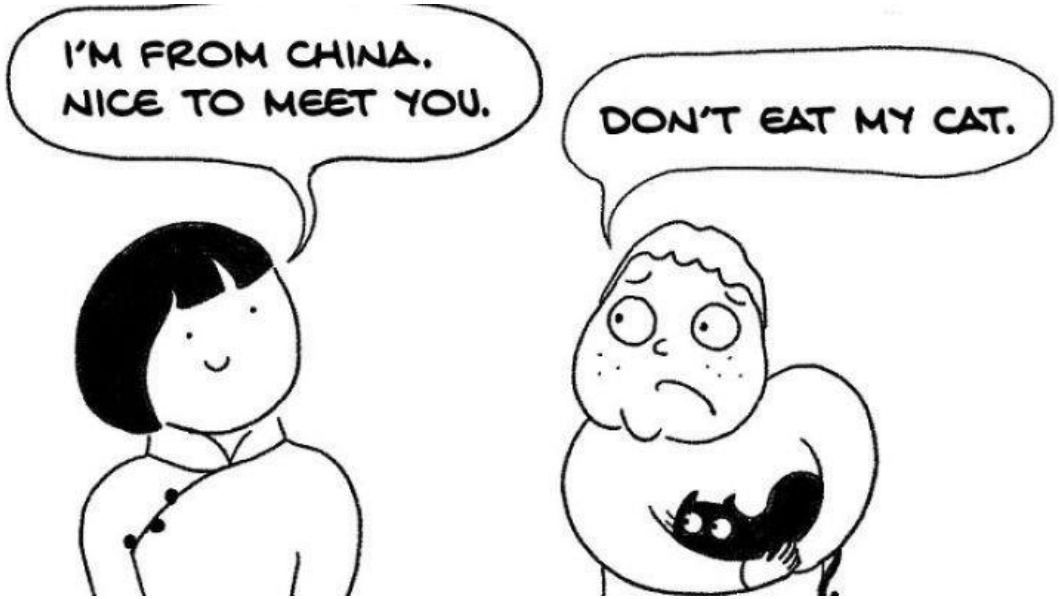
- the ability to respond to unique unexpected coricumstances at the moment.



CROSS-CULTURAL COMPETENCY

= ability to operatein different cultural settings.

- what makes a group truly intellingent & innovative is the combination of different ages, skills, disciplines, and wotking & thinking systems of its members. Diversity will become a core competency.

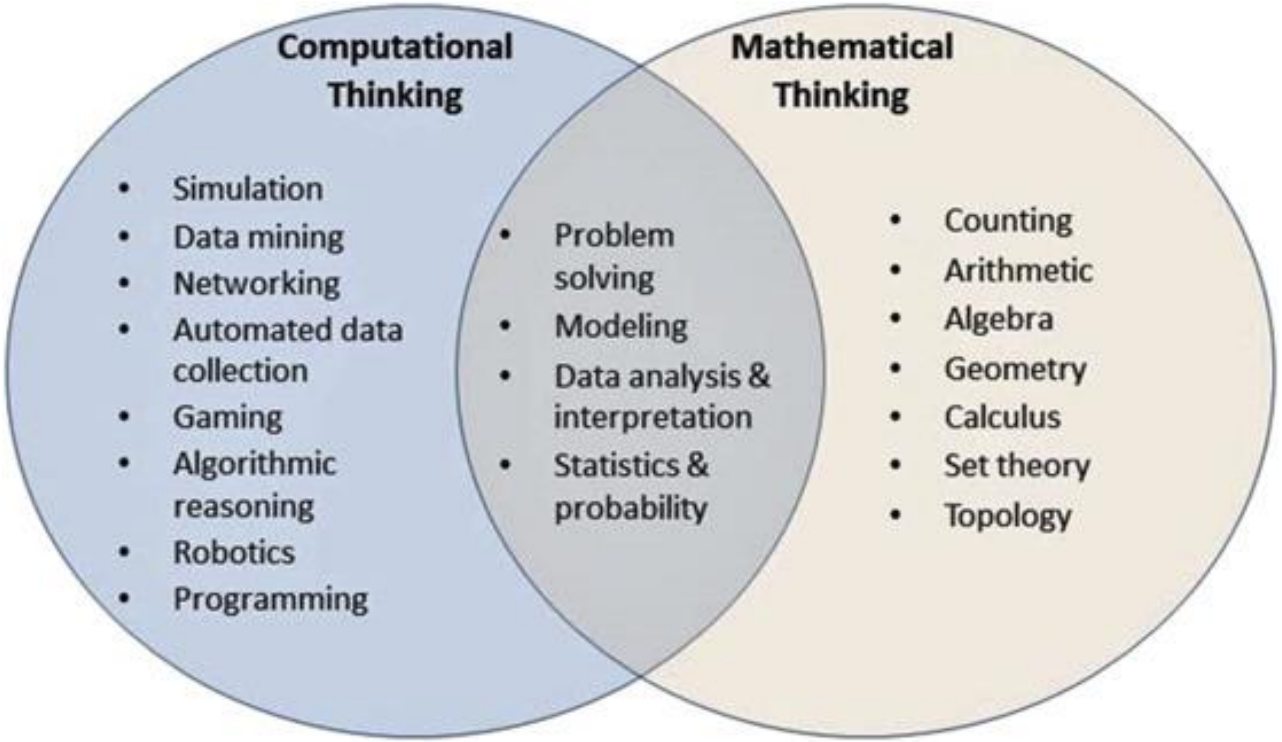


Source: thebeijinger.com

COMPUTATIONAL THINKING

= ability to translate vast amounts of data into abstract concepts and to understand data-based reasoning.

- the use of simulations, statistical analysis and quantitative reasoning will become core expertise



Source:
https://www.sciencedirect.com/science/article/pii/S1747938X17300350

NEW-MEDIA LITERACY

= ability to critically assess and develop content that uses new media forms, and to leverage these media for persuasive communication.

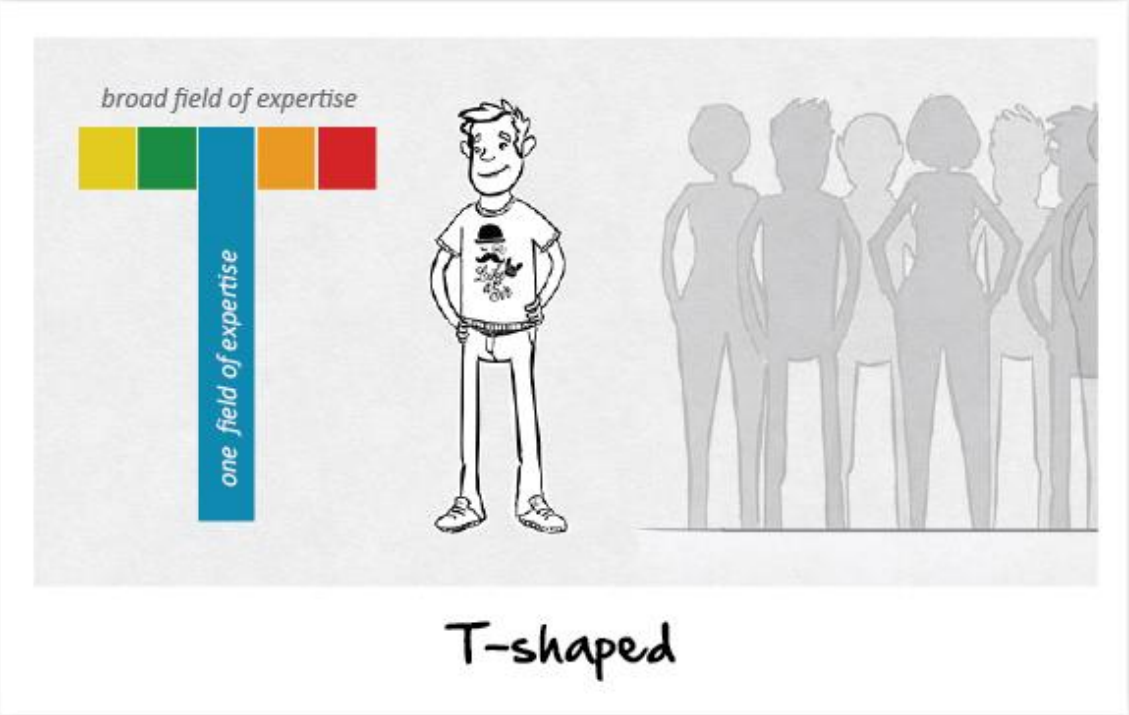
- the immersive and visually stimulating presentation of information becomes the norm.

Source: edWeb

TRANSDISCIPLINARITY

= literacy in and ability to understand concepts across multiple disciplines.

- transdisciplinarity goes beyond bringing together reserchers from different disciplines to work in multidisciplinary teams. The ideal citizen is T-shaped – they bring deep understanding of at least one field, but have the capacity to converse in the language of a broader range of disciplines.

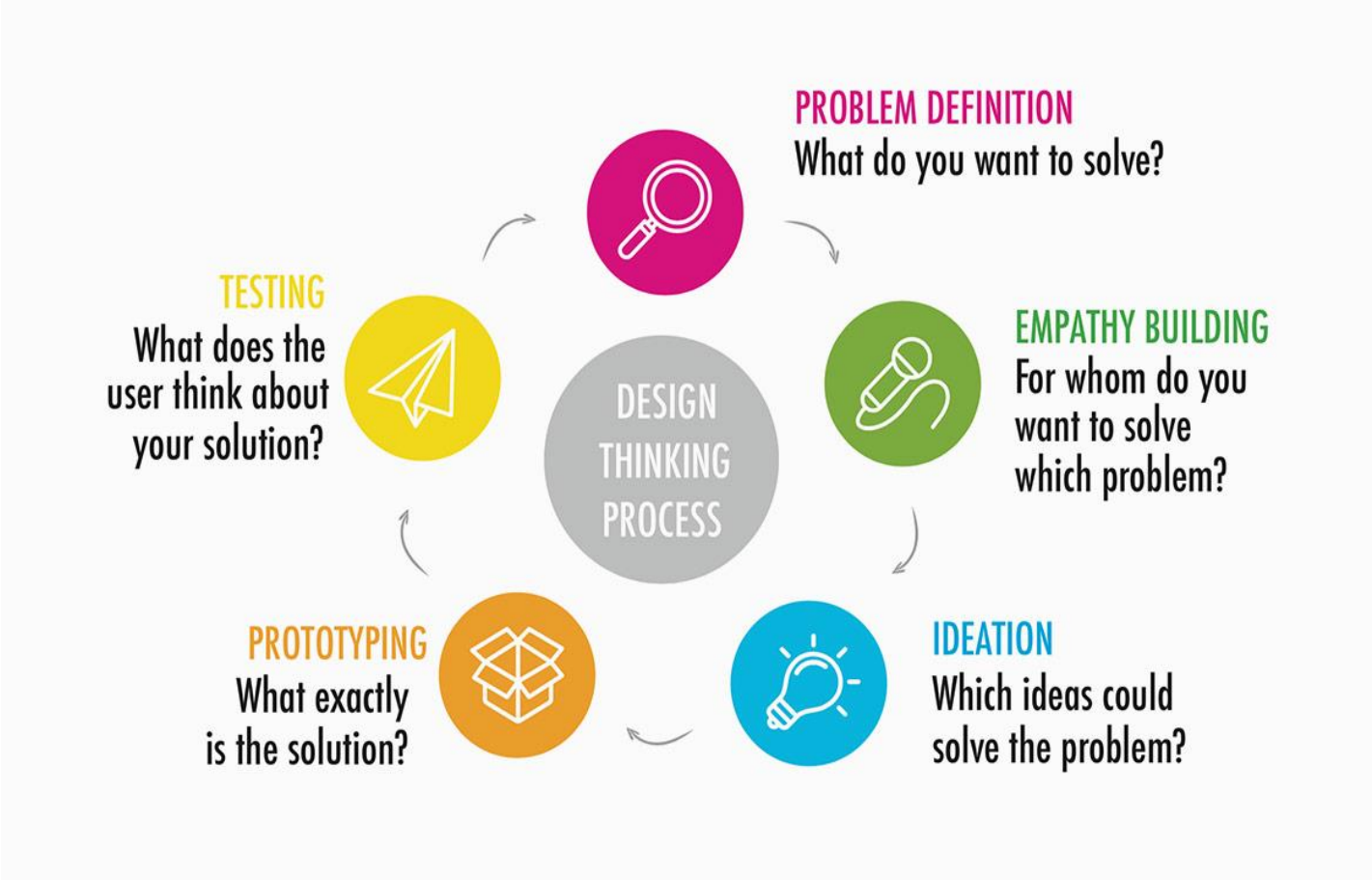


Source: https://www.catalysts.cc/en/the-catalysts-way/9-1-i-grow/

DESIGN MINDSET

= ability to represent and develop tasks and work processes for desired outcomes

- people need to recognize the kind of thinking that different tasks require and make the adjustments to their work environments, that enhance their ability to accomplish these tasks.

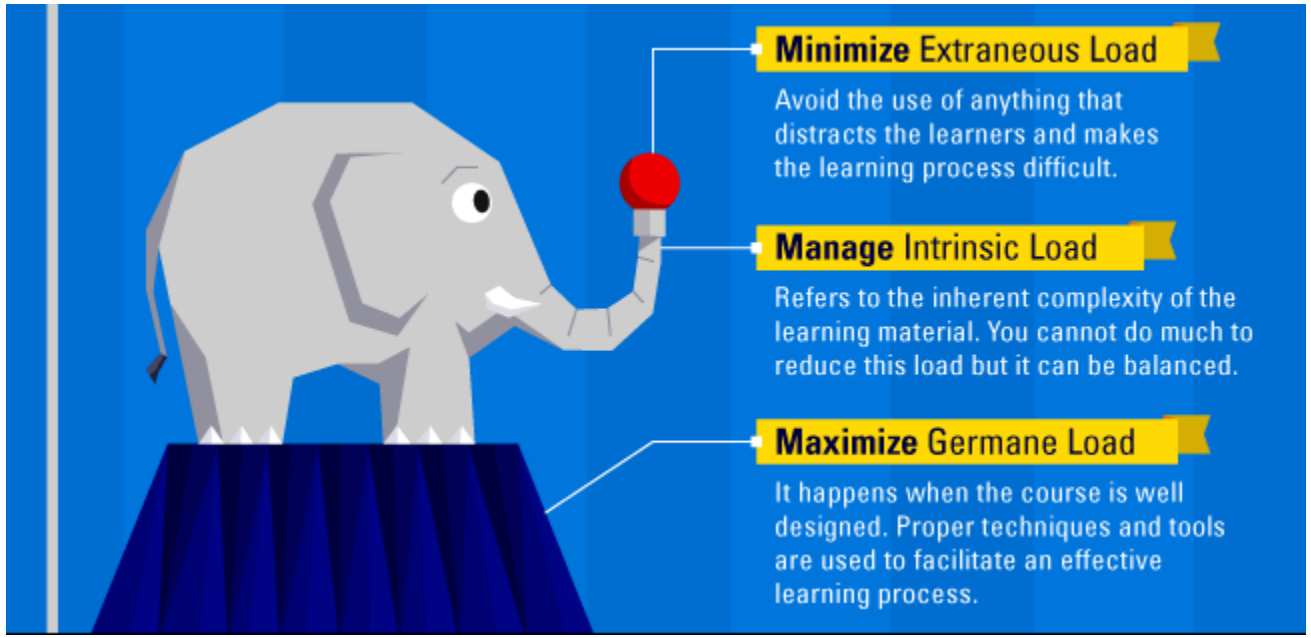


Source: playroom.rocks

COGNITIVE LOAD MANAGEMENT

= ability to discriminate and filter information for importance, and to understand how to maximize cognitive functioning using a variety of tools and techniques.

- for example, the practice of social filtering – ranking, tagging, or adding other metadata to contect helps higher-quality or more relevant information to rise above the „noise”



Source: e-Learning.infographics

VIRTUAL COLLABORATION

= ability to work productively, drive engagement, and demonstrate presence as a member of a virtual team.

- a community that offers ambient sociability can help overcome isolation that comes from lack of access to a central, social workplace. This workplace could be virtual.

Source:

https://www.aperianglobal.com/tools-apps-for-effective-virtual-collaboration/

HEUTAGOGY

Comparison of Pedagogy, Andragogy & Heutagogy

	Pedagogy	Andragogy	Heutagogy
Dependence	Learner is dependent	Adults are independent	Learners are interdependent
Learning Resources	Teacher-driven and controlled	Adult and Teacher controlled	Teacher and learner provided. Learner negotiates path
Learning Reasons	Gaining next level	Drive to increase performance	Learning potential, unplanned, non-linear
Learning Focus	Subject-centred, prescribed	Task- or problem-centred	Proactive and problem-oriented
Motivation	External motivation	Internal motivation	Self-efficacy driven
Teaching Role	Process-designer, imposer, knowledge-holder & director	Enabler, collaborator	Capability-builder

http://www.samyoung.co.nz/2018/03/heutagogy-art-of-self-directed-learning.html

- No need of instructor – learning is facilitated instead of delivered / imposed.
- Focus on process, instead of content.
- Humans are naturally–born learners, like any form of life.

"*Heureskein* is the Greek verb to discover and underlies the etymology of the word *heuristic* that is defined as a method of teaching by allowing students to discover for themselves. Deriving from the same Greek root, the term *heutagogy* was coined in 2000 by Hase and Kenyon to describe self learning independent of formal teaching. This adds yet another learning theory to the established fields of pedagogy (child learning), andragogy (adult learning), and arguably mystagogy (tertiary student learning"

(Graham R. Parslow)

https://iubmb.onlinelibrary.wiley.com/doi/full/10.1002/bmb.20394