

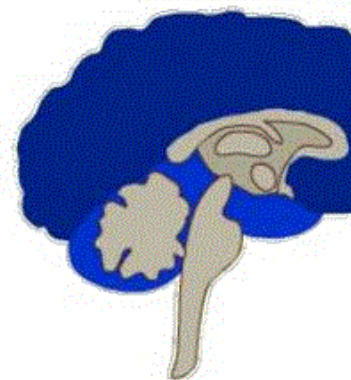
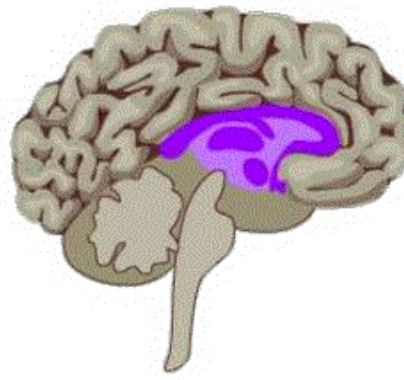
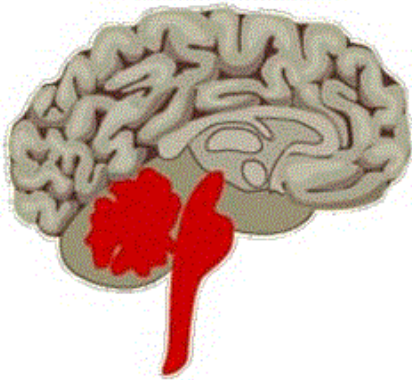
**The highest functions of nervous
system**

**Psychological and social aspects of
brain activity**

I

Triune Brain Theory

Lizard Brain	Mammal Brain	Human Brain
Brain stem & cerebellum	Limbic System	Neocortex
Fight or flight	Emotions, memories, habits	Language, abstract thought, imagination, consciousness
Autopilot	Decisions	Reasons, rationalizes



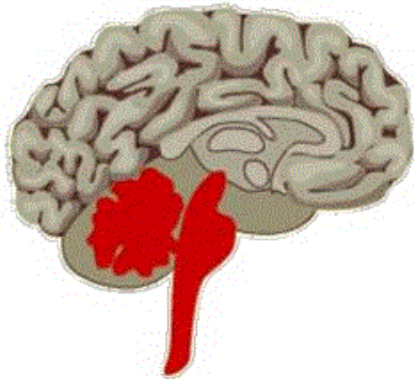
The Triune Brain in Evolution, Paul MacLean, 1960

<https://s-media-cache-ak0.pinimg.com/originals/2f/60/99/2f609962e23fdce7a008fb224d316256.gif>

https://upload.wikimedia.org/wikipedia/commons/thumb/d/d4/Paul_D_MacLean.jpg/220px-Paul_D_MacLean.jpg

Triune Brain Theory

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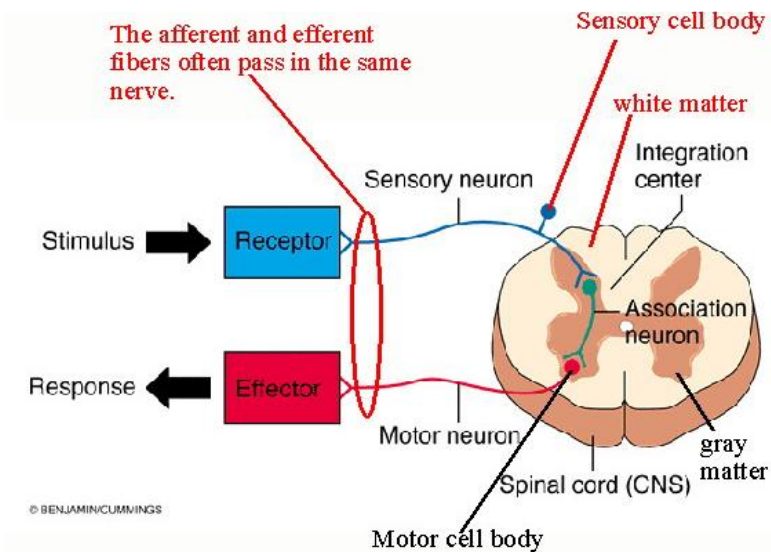


The Triune Brain in Evolution, Paul MacLean, 1960

Spinal cord and brain stem

Uniform response

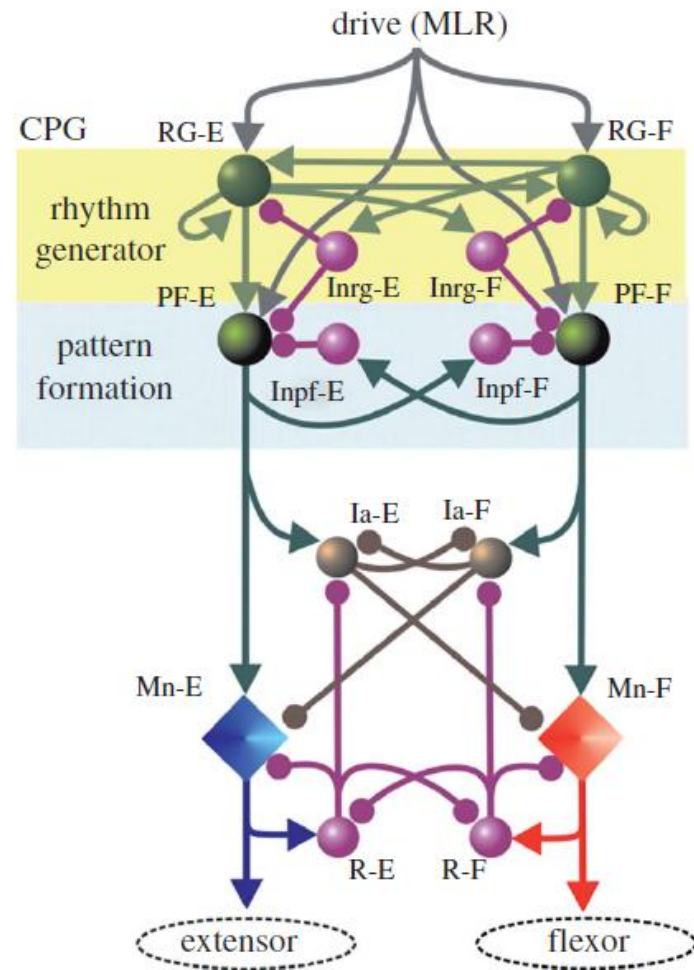
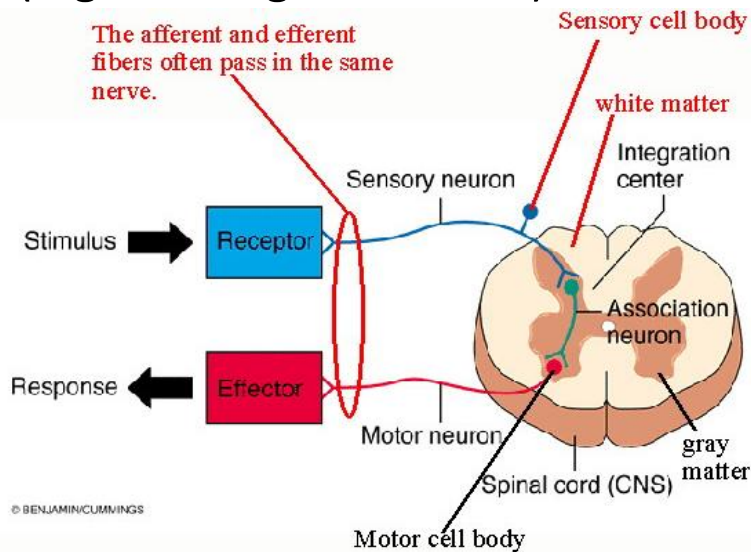
- Reflex activity – „hardware“
- Speed / economy



Spinal cord and brain stem

Uniform response

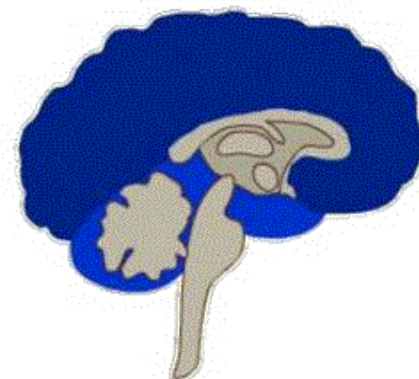
- Reflex activity – „hardware“
- Speed / economy
- Fixed action patterns (FAP) - the highest level of reflex activity
- FAP activity may be controlled if it does not threaten to bodily functions (e.g. Holding the breath)



Whelan PJ. Shining light into the black box of spinal locomotor networks. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*. 2010;365:2383–2395.

Triune Brain Theory

Lizard Brain	Mammal Brain	Human Brain
Brain stem & cerebellum	Limbic System	Neocortex
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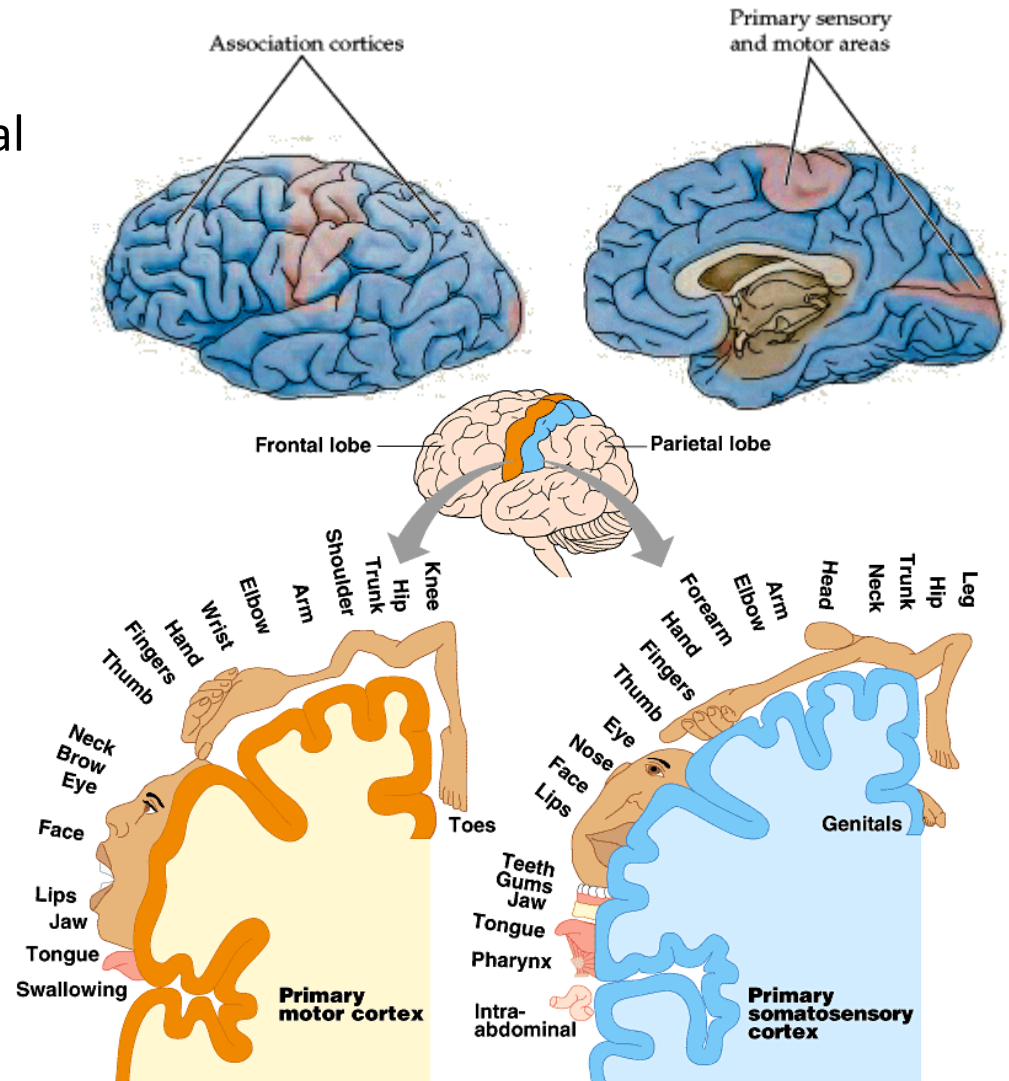


The Triune Brain in Evolution, Paul MacLean, 1960

Neocortex

„Unique“ response

- Relatively slow / non-economical
- The highest analytic functions
- The highest executive functions
- Most developed in humans

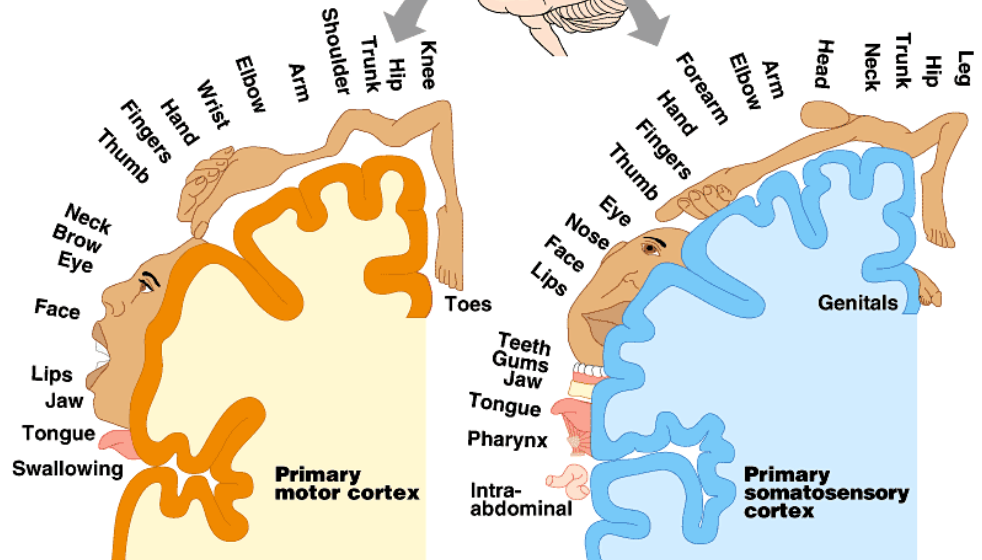
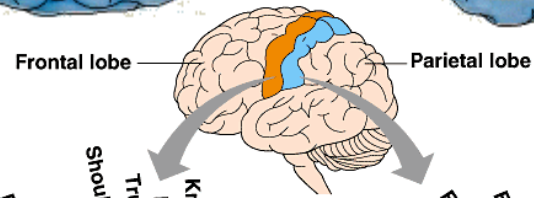
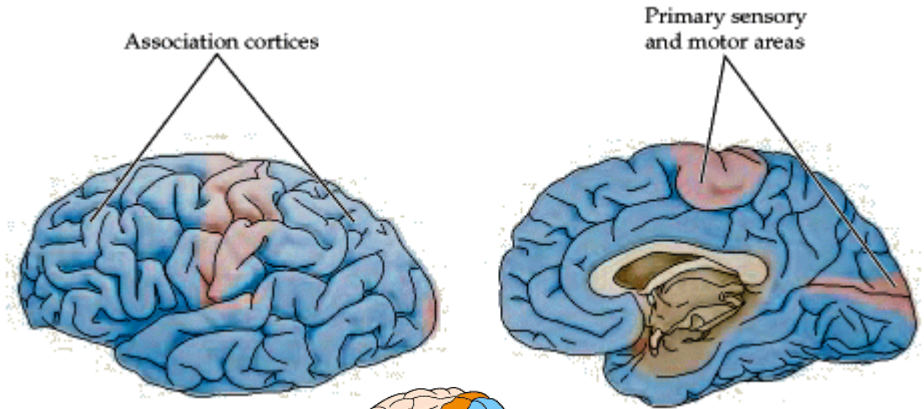


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Neocortex

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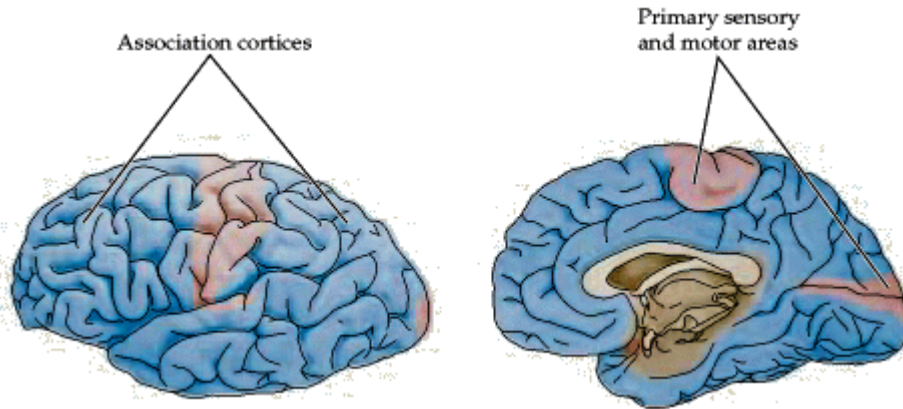
Primary areas

- ✓ Somatotopic organisation

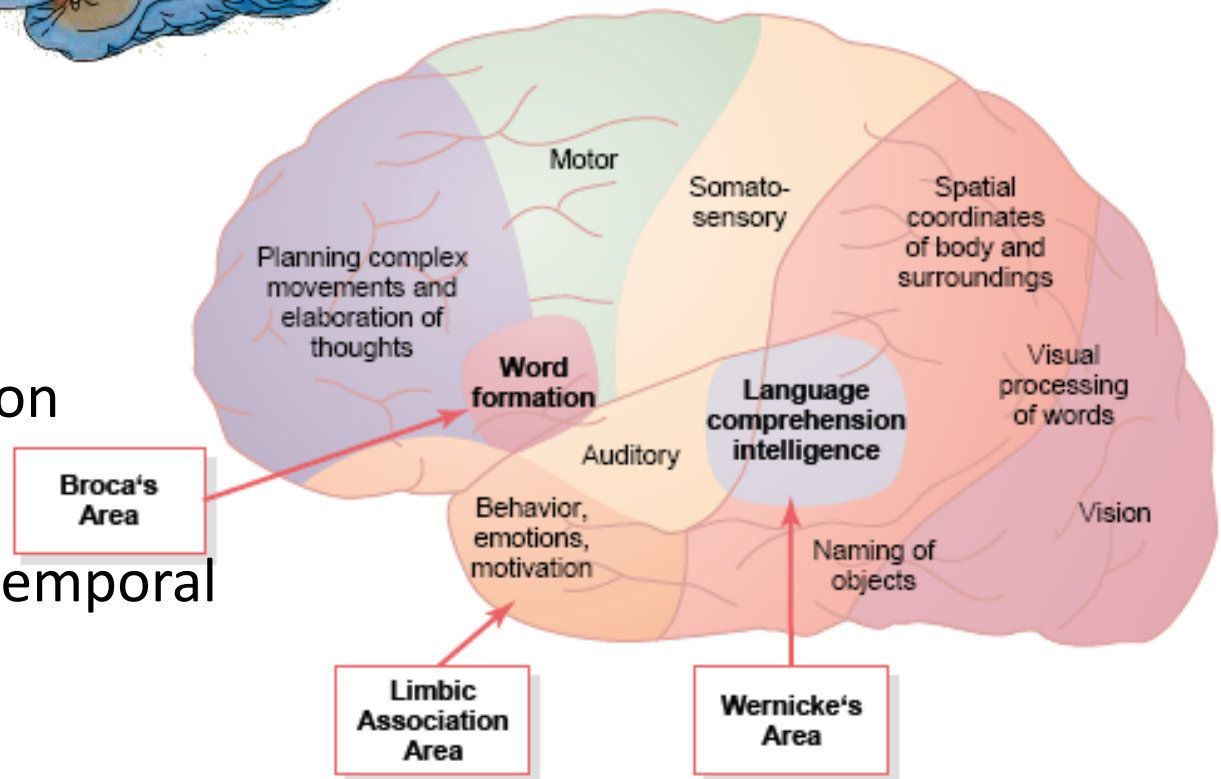
Association areas

- ✓ Do not have somatotopic organisation
- ✓ Unimodal
- ✓ Polymodal

Association areas

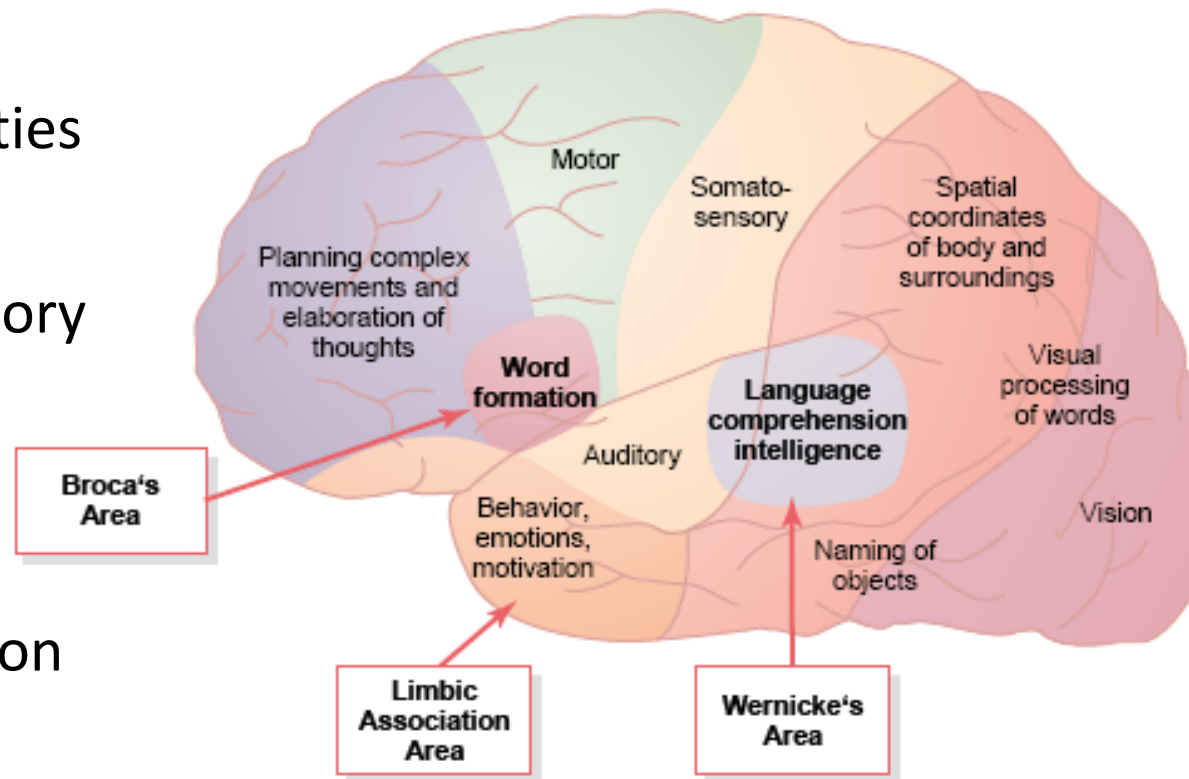


- Neither receptive
- Nor effector
- Integrative function
- Parieto-occipito-temporal
- Frontal
- Limbic

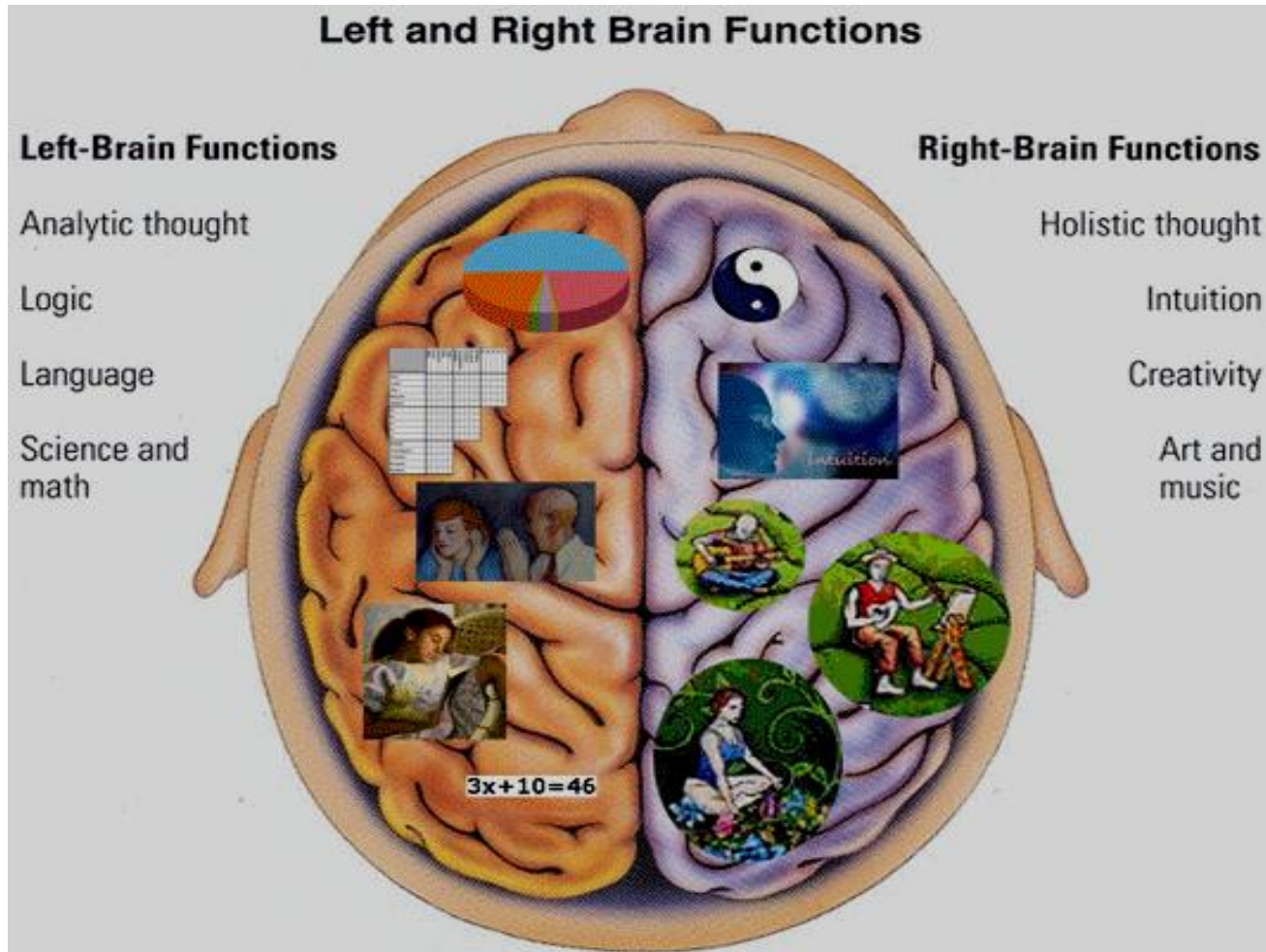


Parieto-occipito-temporal association area

- Linking and interpretation of information from several sensory modalities
- Visual – acoustic – sensory analysis
- Object recognition and categorization
- Language comprehension
- Attention



Lateralization of brain functions



Frontal association area

Executive functions

- Motor/non-motor planning/organization - strategy - anticipation
- Thinking – mental models processing

- Attention – „information filtering“

- Behavioral control
 - Facilitation of „wanted“
 - Inhibition of „unwanted“



Basal ganglia

The activity of the basal ganglia might give us a rough idea about the highest functions of the neocortex

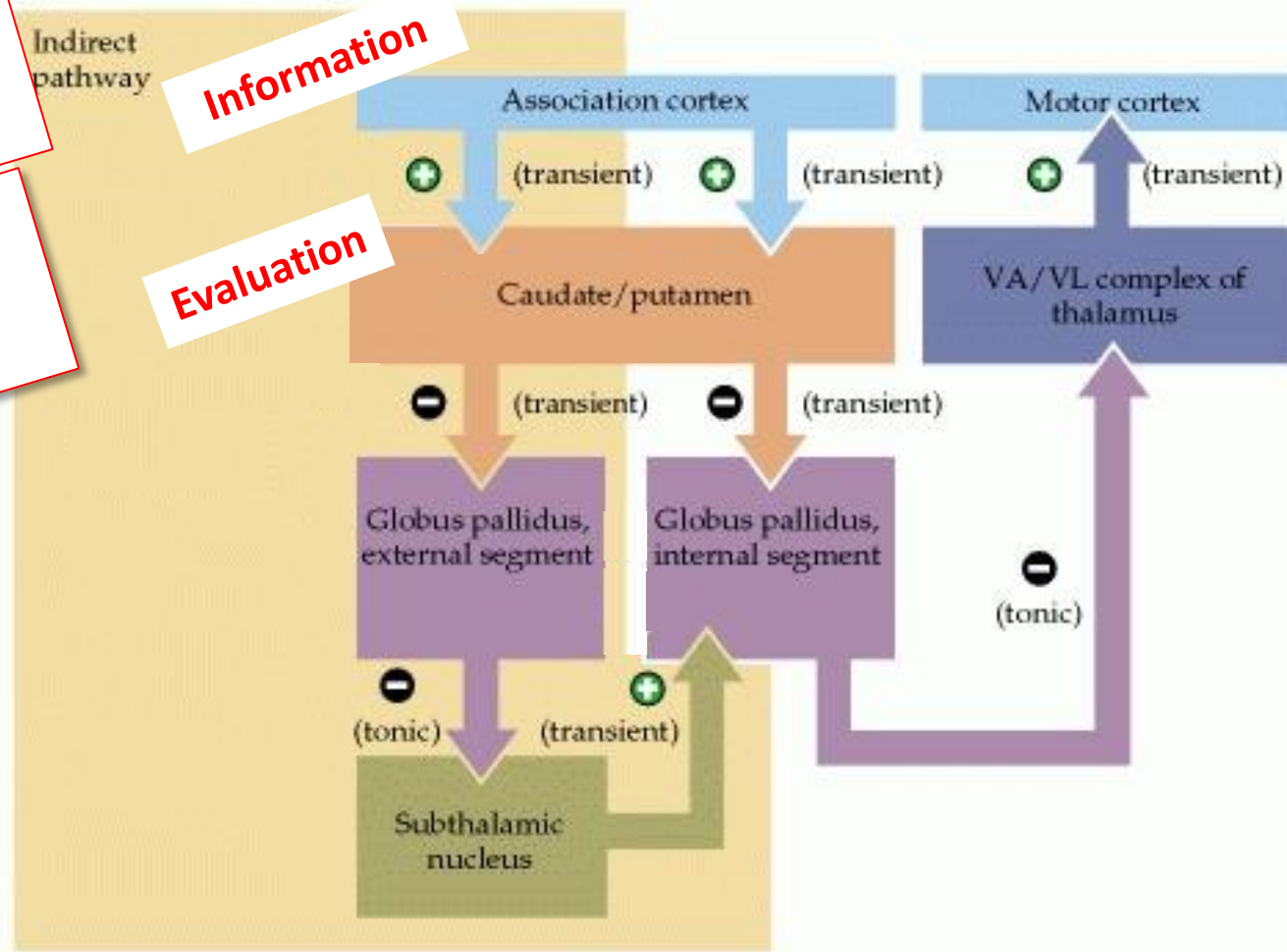
Neocortex and subcortical structures work as a one unit

Basal ganglia

The activity of the basal ganglia might give us a rough idea about the highest functions of the neocortex

Neocortex and subcortical structures work as a one unit

(B) Indirect and direct pathways

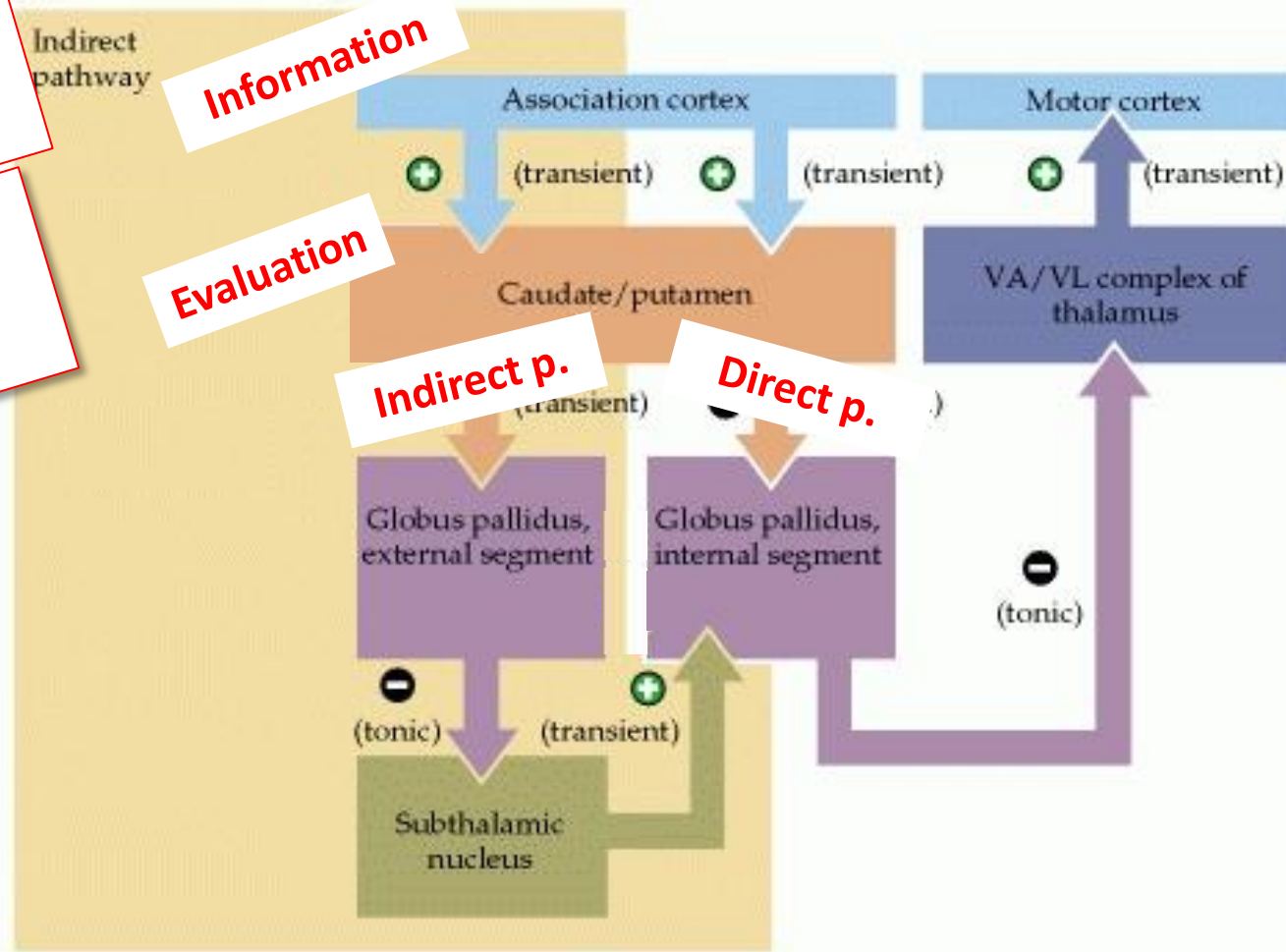


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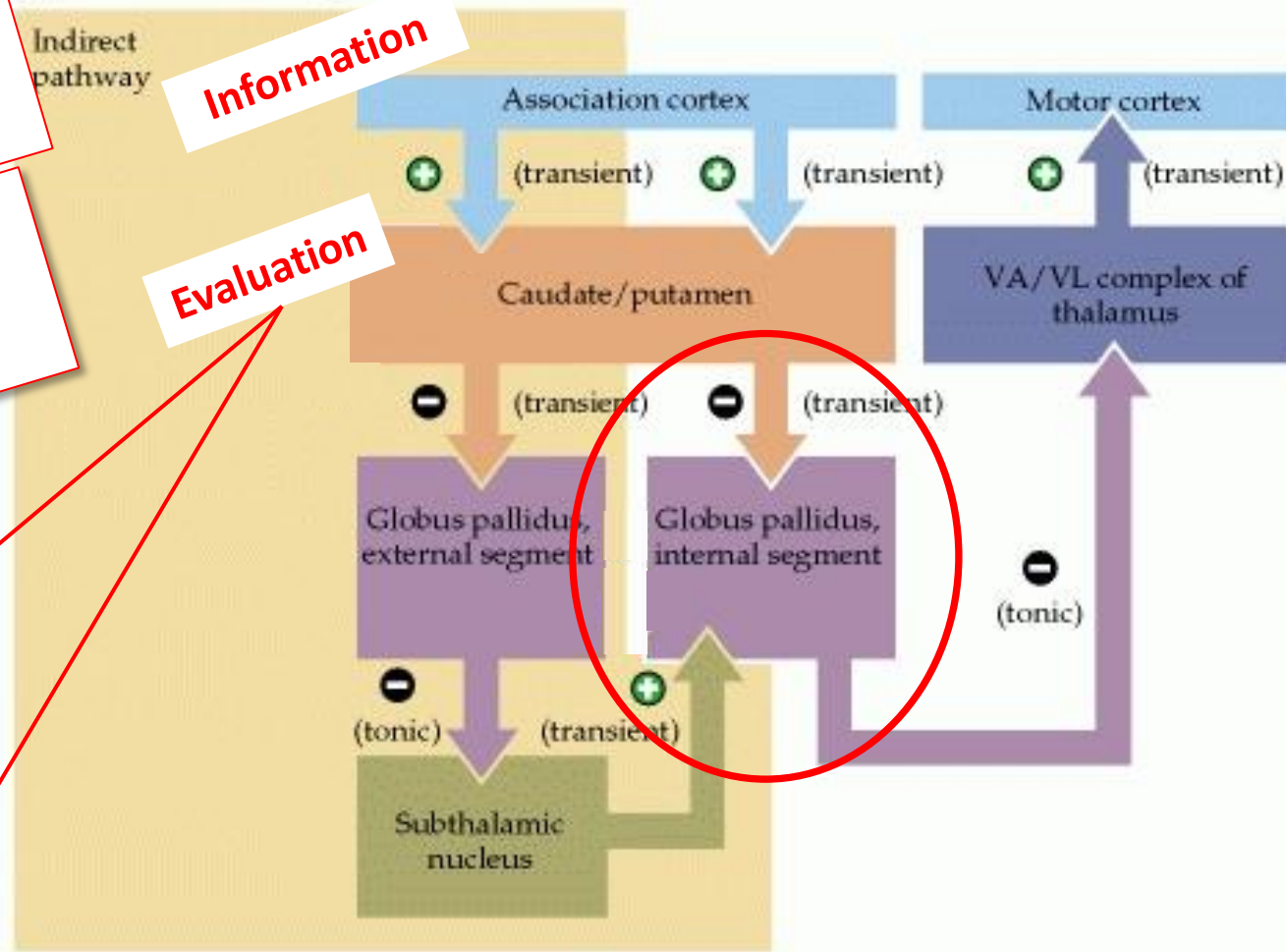


Basal ganglia

The activity of the basal ganglia might give us a rough idea about the highest functions of the neocortex

Neocortex and subcortical structures work as a one unit

(B) Indirect and direct pathways



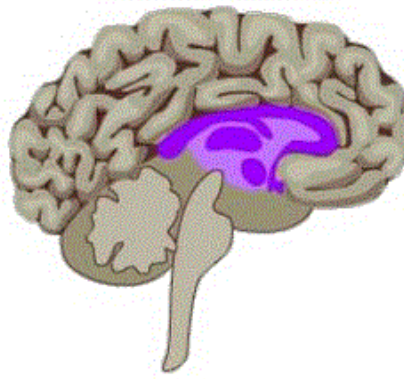
Information

Evaluation

- Direct pathway
- Motor cortex activation
- Indirect pathway
- Motor cortex inhibition

Triune Brain Theory

Lizard Brain	Mammal Brain	Human Brain
Brain stem & cerebellum	Limbic System	Neocortex
Fight or flight	Emotions, memories, habits	Language, abstract thought, imagination, consciousness
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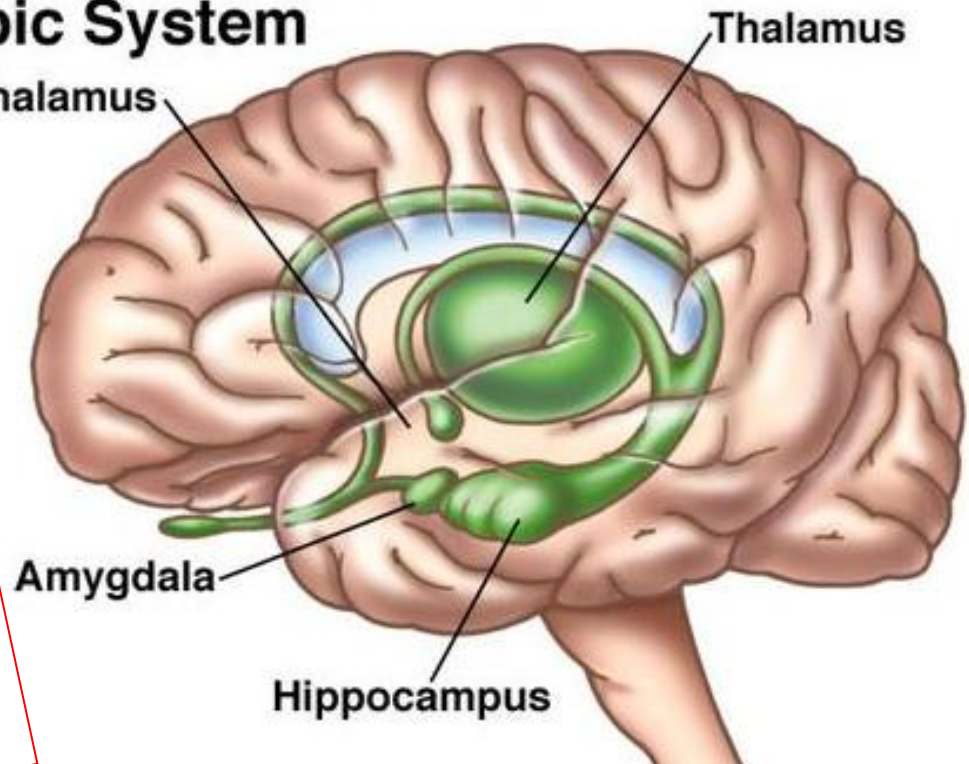


The Triune Brain in Evolution, Paul MacLean, 1960

Limbic association area

- Integration of information from inner and outer environment
- Hypothalamus
- Emotions
- Motivation
- Instinct behavior

Limbic System
Hypothalamus



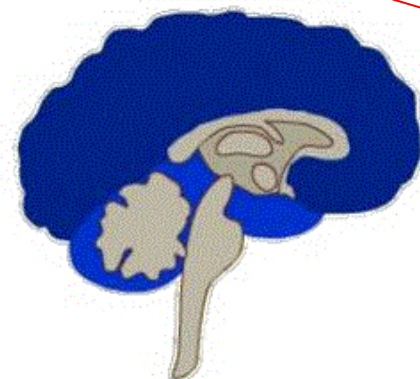
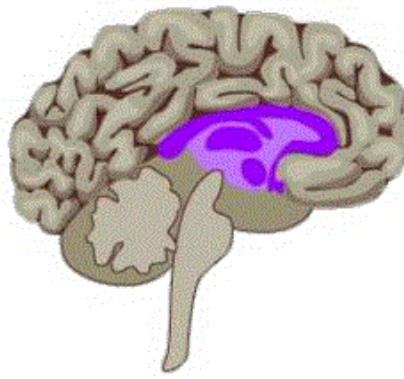
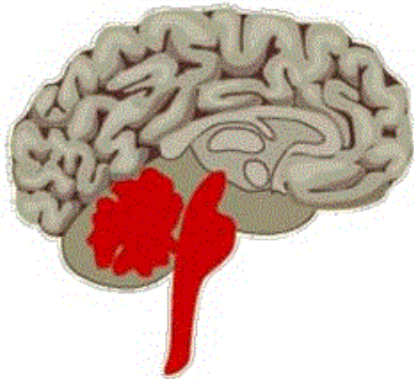
Limbic system – hypothalamus and the structures closely connected to hypothalamus

Triune Brain Theory

Lizard Brain	Mammal Brain	Human Brain
Brain stem & cerebellum	Limbic System	Neocortex
Fixed programs	Emotions, memories, habits	Learning, adaptation
Uniform ACTION	Decisions	Performance
Economy		

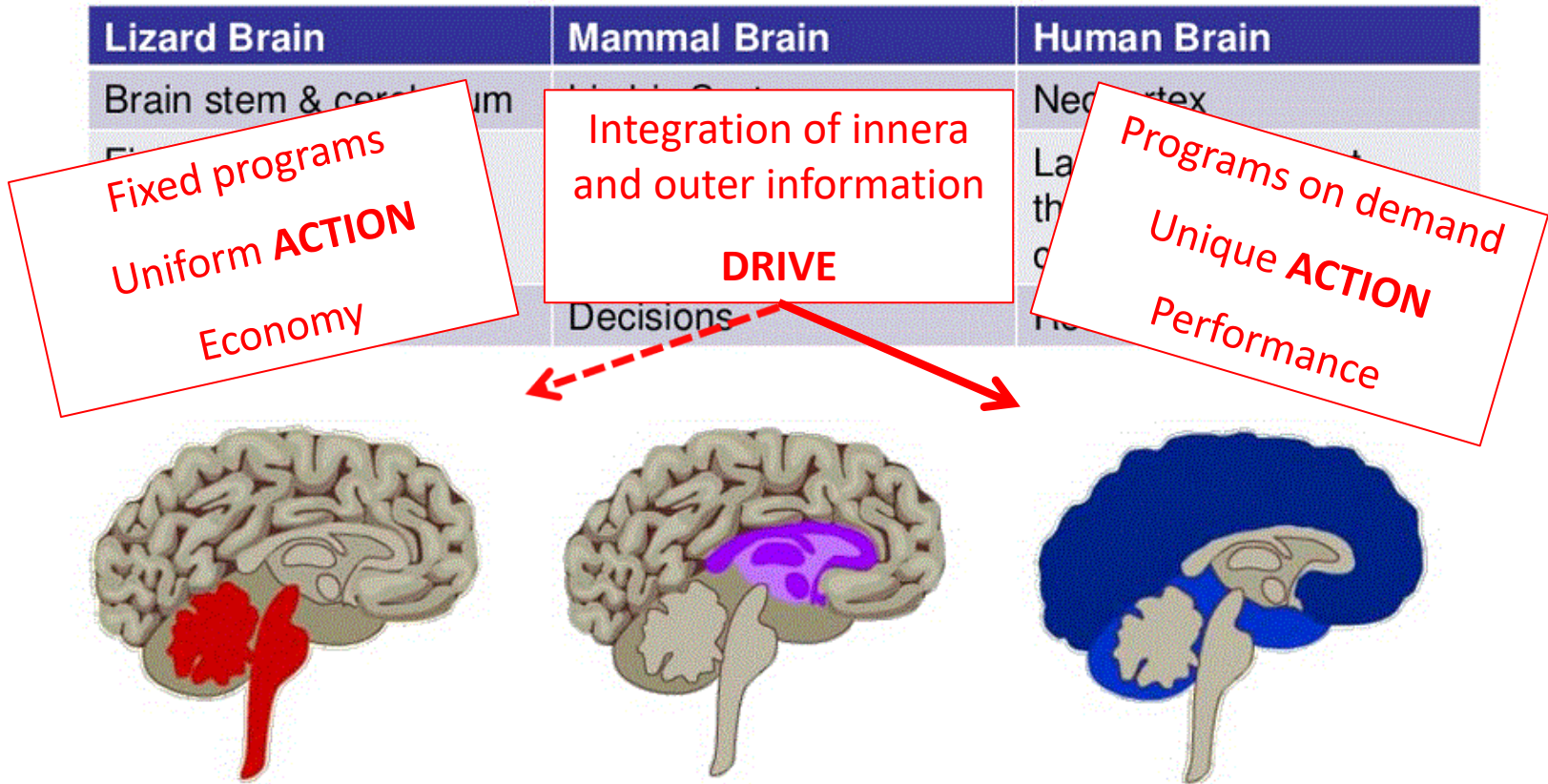
Fixed programs
Uniform **ACTION**
Economy

Programs on demand
Unique **ACTION**
Performance



The Triune Brain in Evolution, Paul MacLean, 1960

Triune Brain Theory

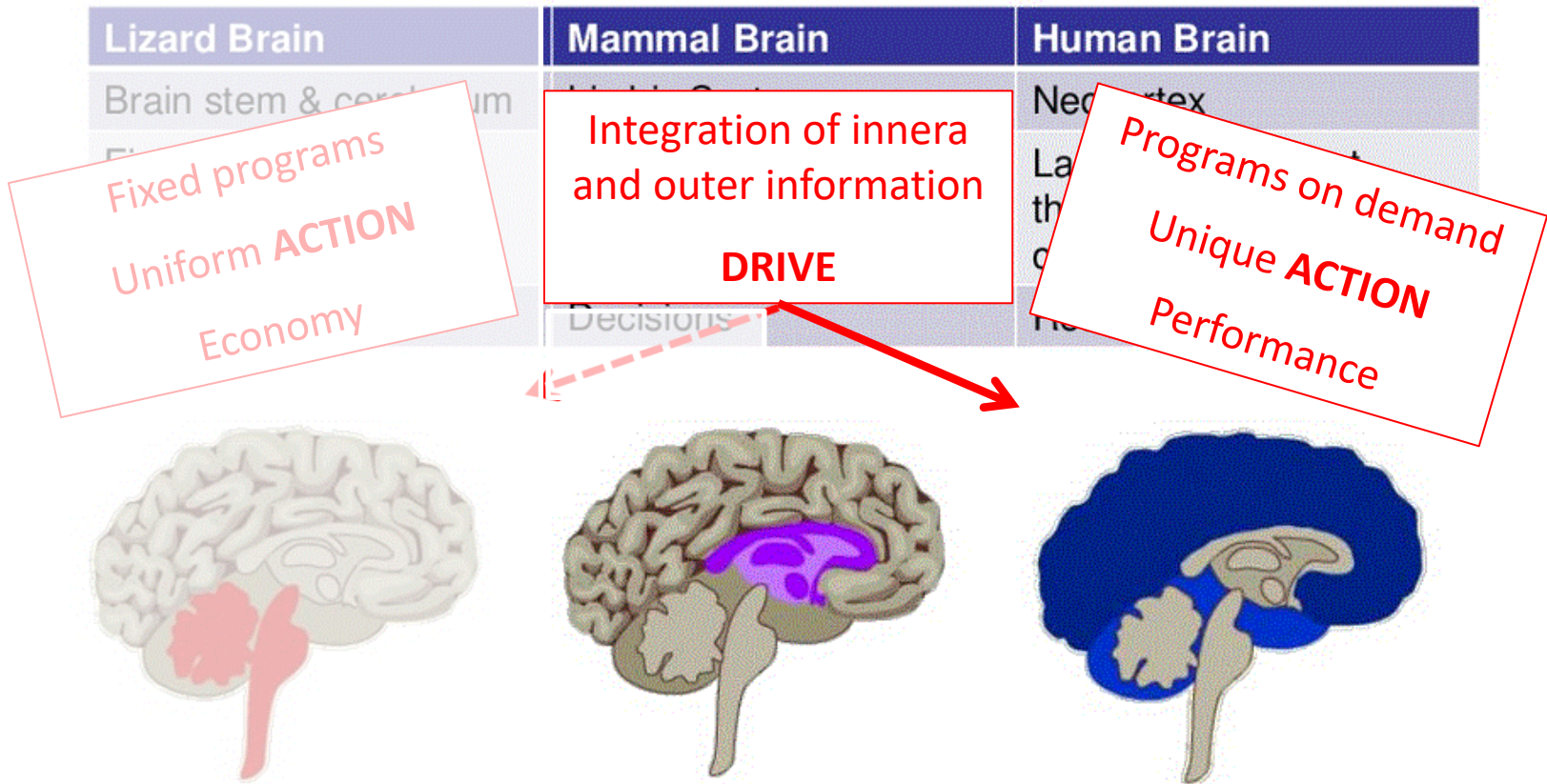


The Triune Brain in Evolution, Paul MacLean, 1960



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Triune Brain Theory

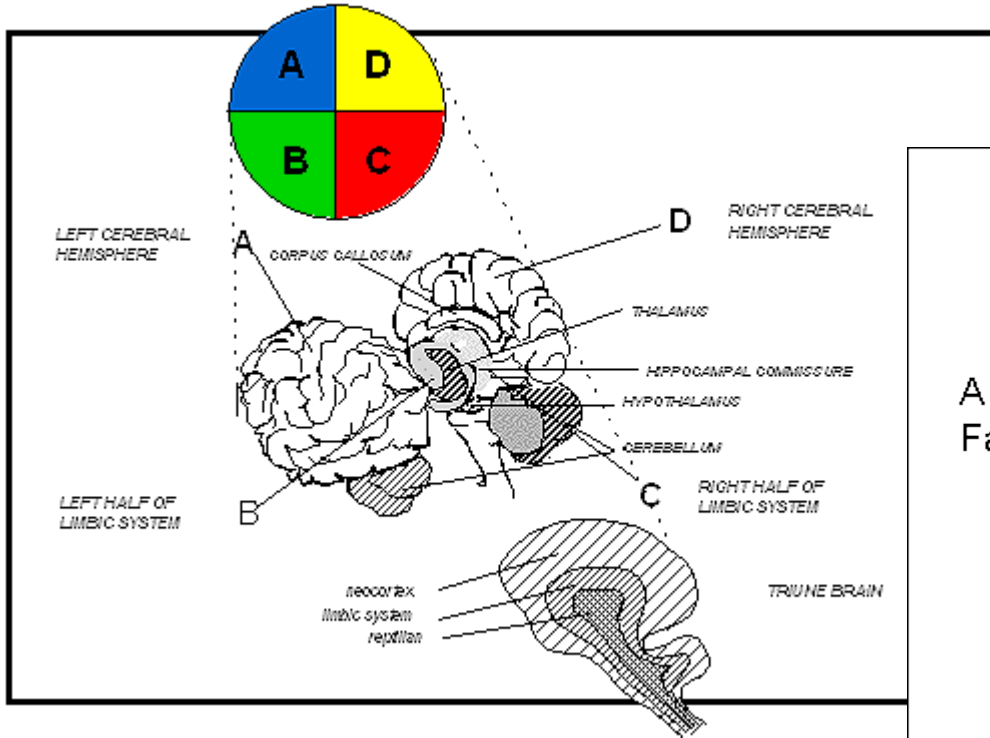


The Triune Brain in Evolution, Paul MacLean, 1960

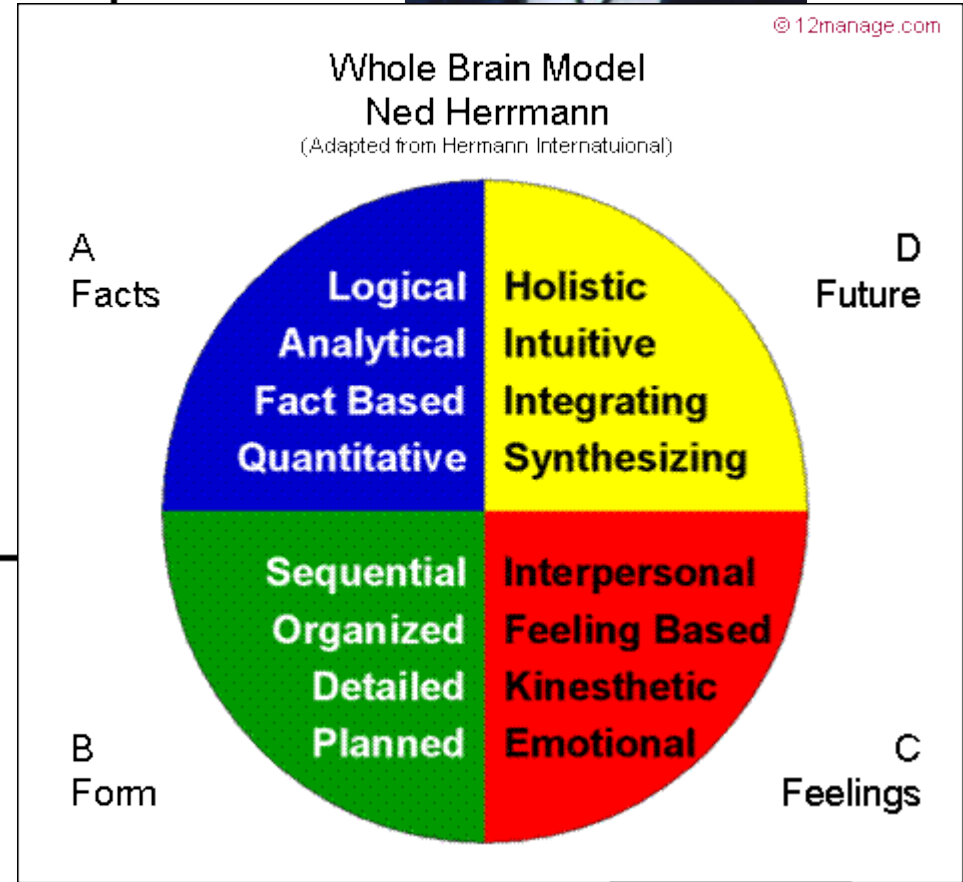
Whole brain model



http://www.azquotes.com/public/pictures/authors/86/de/86de34489a9d8daea6fd5dce6241ba20/5494c14800f1d_ned_herrmann.jpg



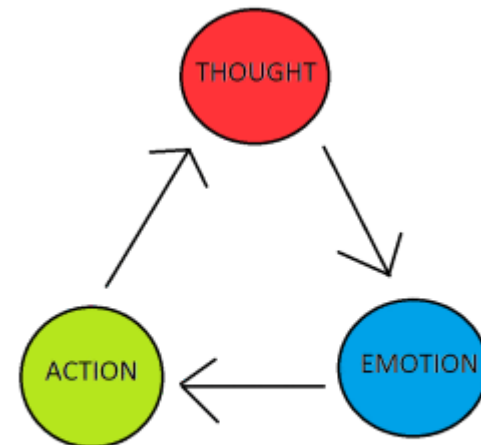
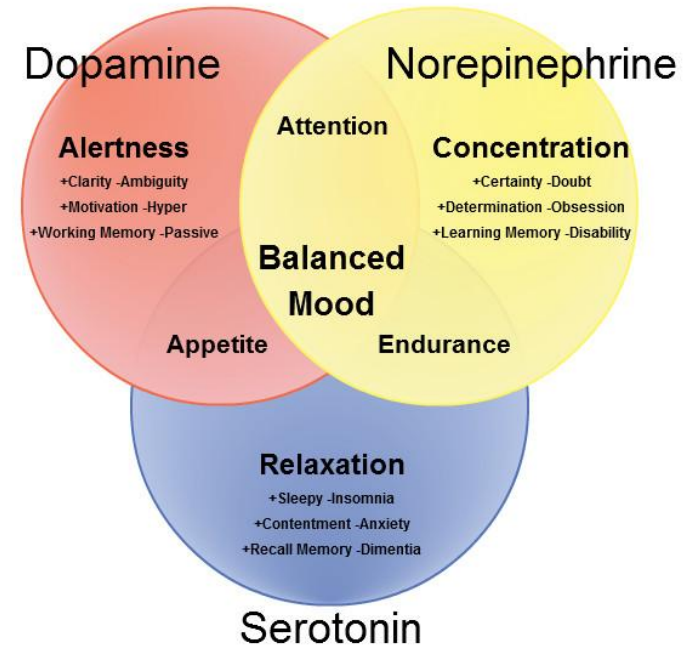
<http://www.sacsa.sa.edu.au/ATT/%7BBA2B8C52-92B6-4C17-AEEB-3A9D4F9AE8DE%7D/images/BackgroundInfo/images/image8.gif>



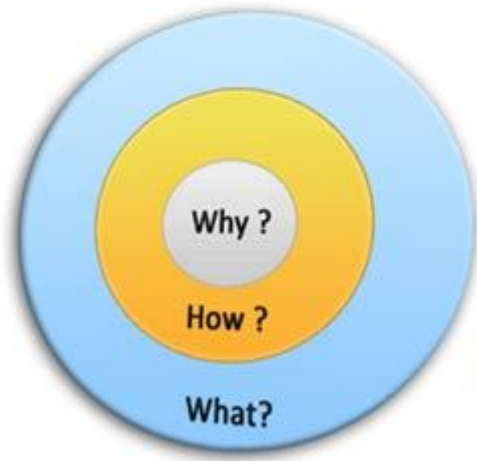
http://www.12manage.com/images/picture_herrmann_whole_brain_model.gif

Influence of hypothalamus on neocortex

- (Papez circuit)
- Via neuromodulating systems
 - Consciousness
 - Mood
- Via thalamus
 - Via nucleus mediodorsalis to orbitofrontal cortex (influence on decision making)
 - Influence gating function of other thalamic nuclei



Limbic system and neocortex



Why = The Purpose

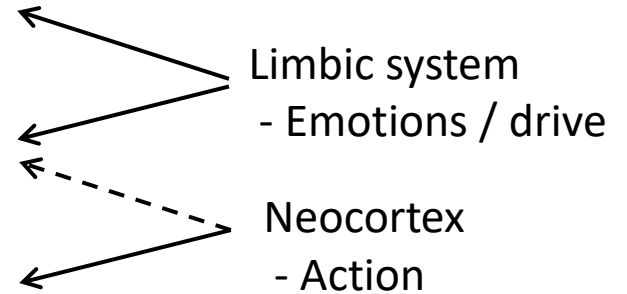
What is your cause? What do you believe?

How = The Process

Specific actions taken to realize the Why.

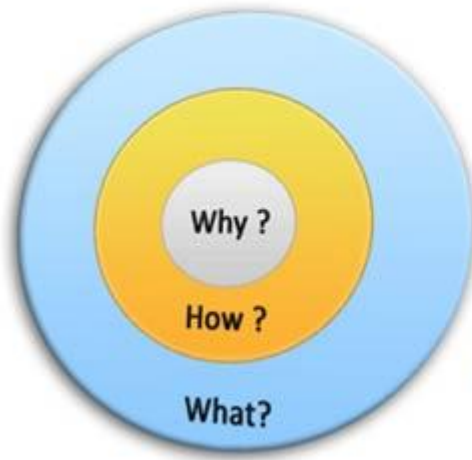
What = The Result

What do you do? The result of Why. Proof.



<https://s-media-cache-ak0.pinimg.com/originals/84/34/b1/8434b124c9fc92003051c56b088906a5.jpg>

Limbic system and neocortex



Why = The Purpose

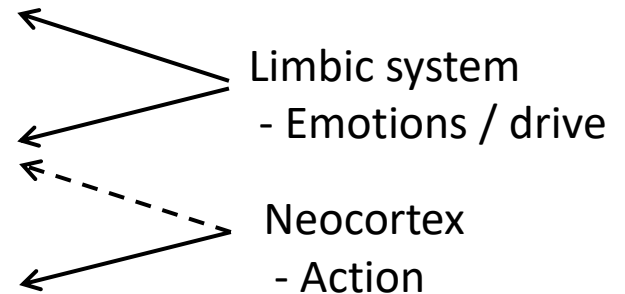
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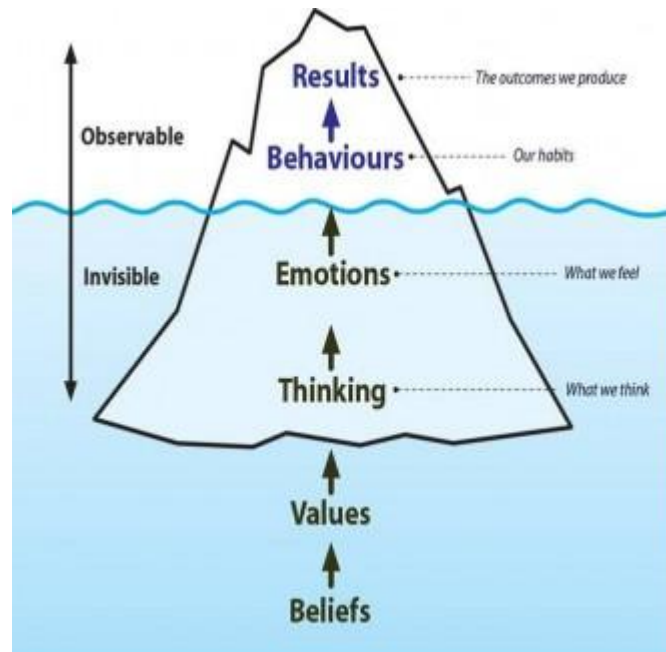
Specific actions taken to realize the Why.

What = The Result

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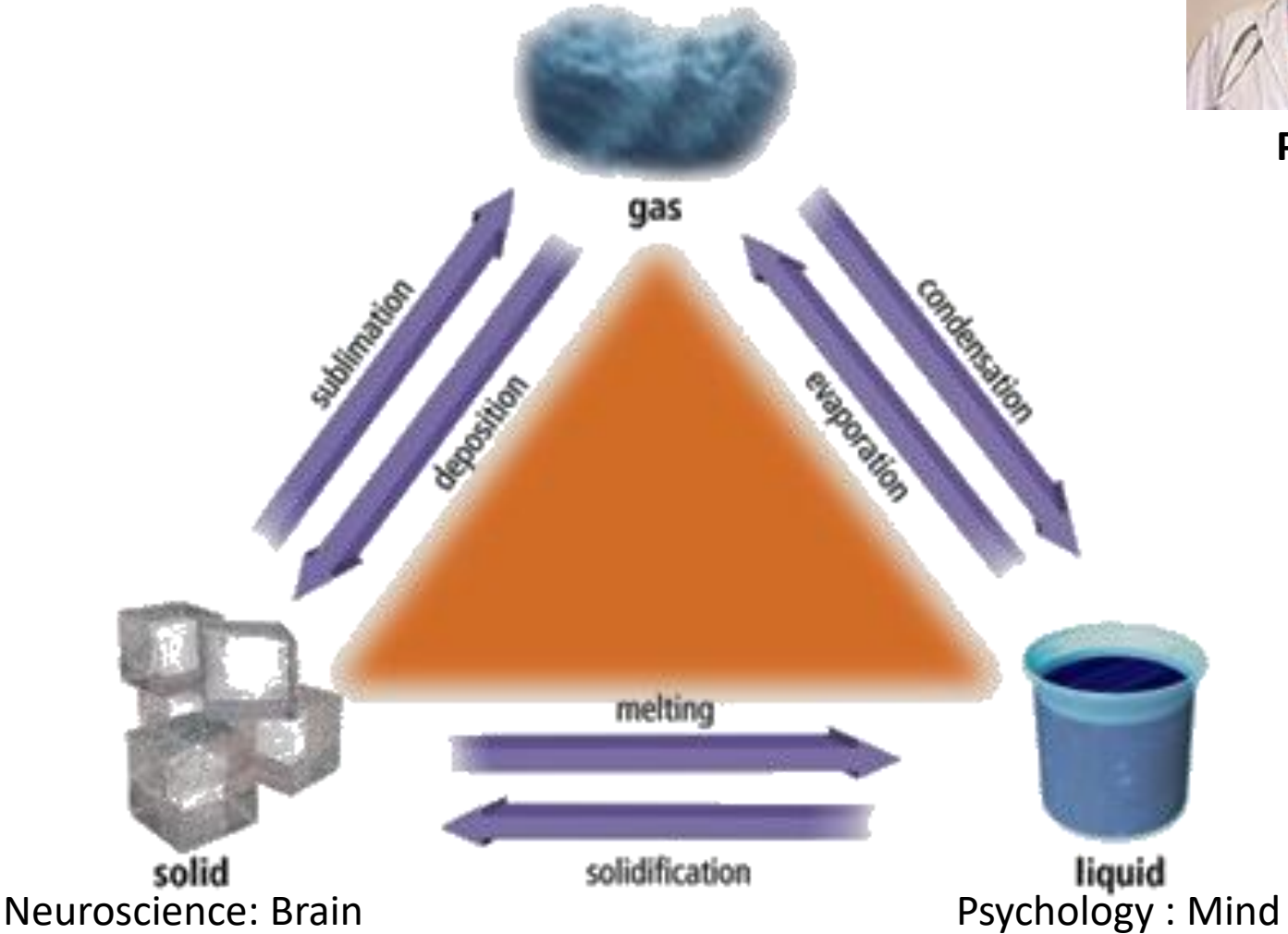
<http://www.coaching.net.nz/wp-content/uploads/2013/06/iceberg-for-blog-from-J-e1371521135440.jpg>

Three States of Cognition

Philosophy : Mind behind Mind



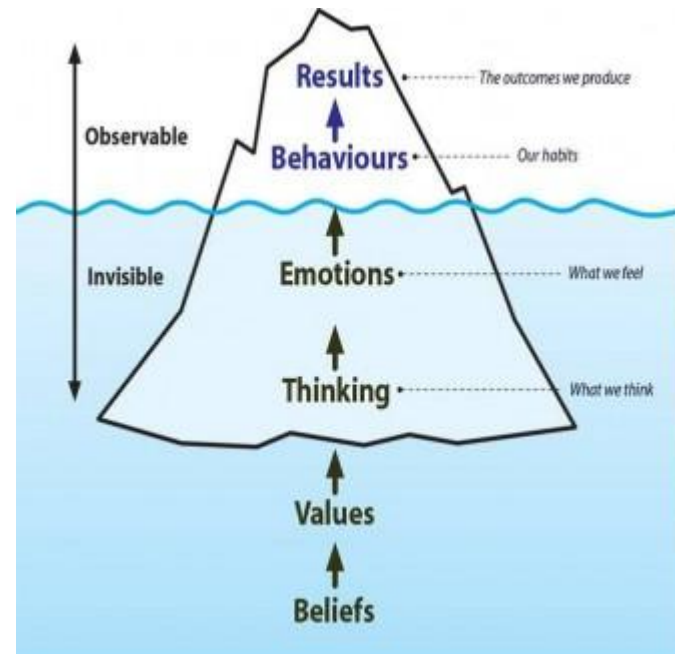
PS Deb



Limbic system and neocortex

Instinctive behavior

- Limbic system
- ✓ I see a nice thing, so why not steal it?



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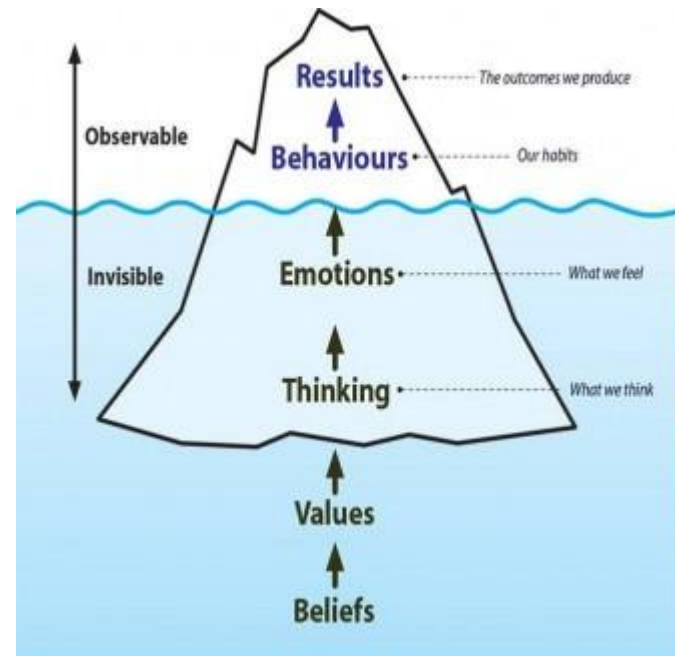
Limbic system and neocortex

Instinctive behavior

- Limbic system
- ✓ I see a nice thing, so why not steal it?

Socially enforced behavior

- Legal behavior
- Neocortex – limbic system
- ✓ Theft is a crime, and punishment may come



<http://www.coaching.net.nz/wp-content/uploads/2013/06/Iceberg-for-blog-from-J-e1371521135440.jpg>

Limbic system and neocortex

Instinctive behavior

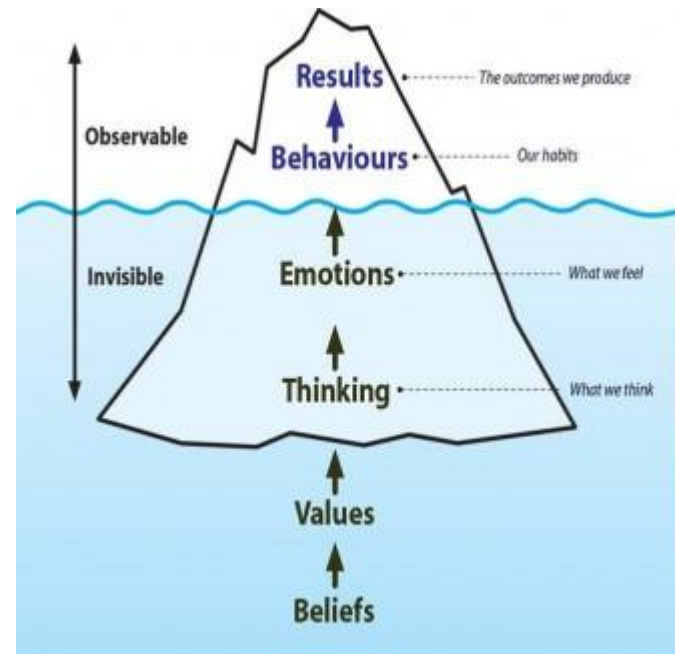
- Limbic system
- ✓ I see a nice thing, so why not steal it?

Socially enforced behavior

- Legal behavior
- Neocortex – limbic system
- ✓ Theft is a crime, and punishment may come

Moral behavior

- Legitimate behavior
- Limbic system
- ✓ Stealing is a bad thing



<http://www.coaching.net.nz/wp-content/uploads/2013/06/Iceberg-for-blog-from-J-e1371521135440.jpg>

Limbic system and neocortex

Instinctive behavior

- Limbic system
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Socially enforced behavior

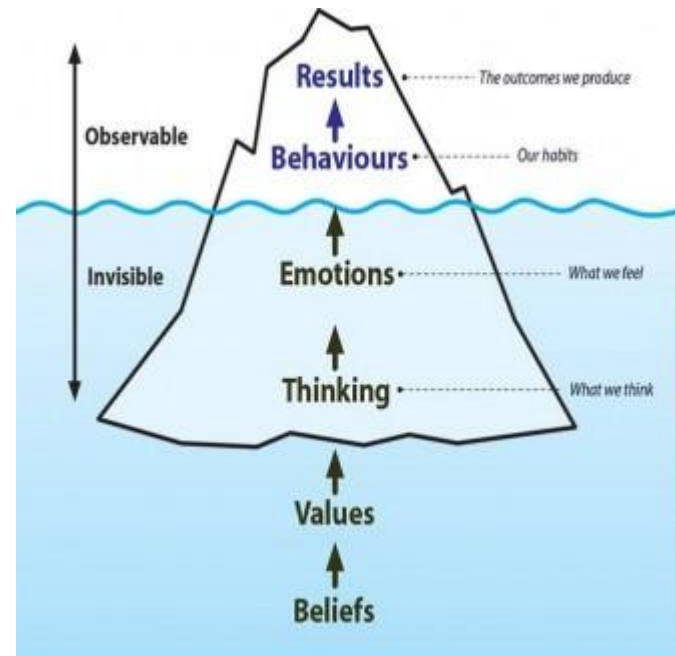
- Legal behavior
- Moral behavior system
- ✓ Moral behavior, and punishment may come

Fear of punishment

Moral behavior

- Legitimate behavior
- ✓ Moral behavior is a bad thing

Moral stance



<http://www.coaching.net.nz/wp-content/uploads/2013/06/Iceberg-for-blog-from-J-e1371521135440.jpg>

Limbic system and neocortex

Information

NEOCORTEX

VS

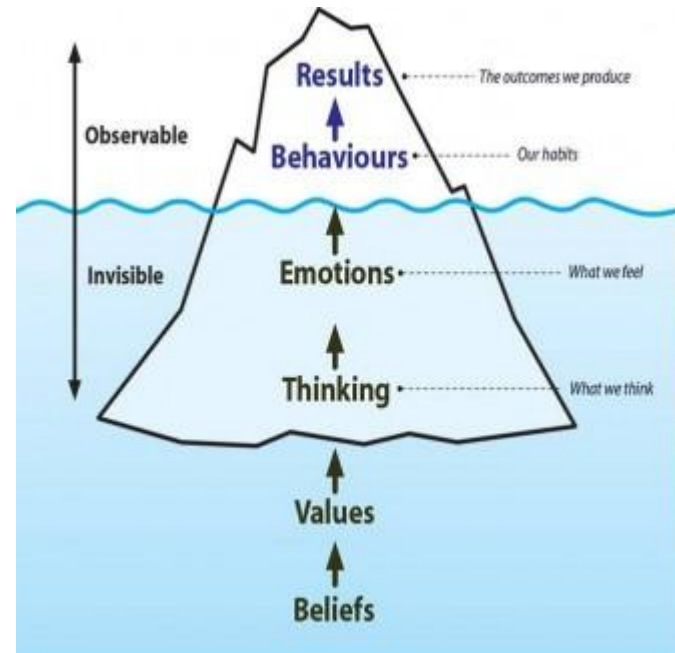
Complex information

NEOCORTEX/limbic system

VS

Values/Philosophy/Faith

Neocortex/LIMBIC SYSTEM



<http://www.coaching.net.nz/wp-content/uploads/2013/06/Iceberg-for-blog-from-J-e1371521135440.jpg>

Limbic system and neocortex

Information

NEOCORTEX

VS

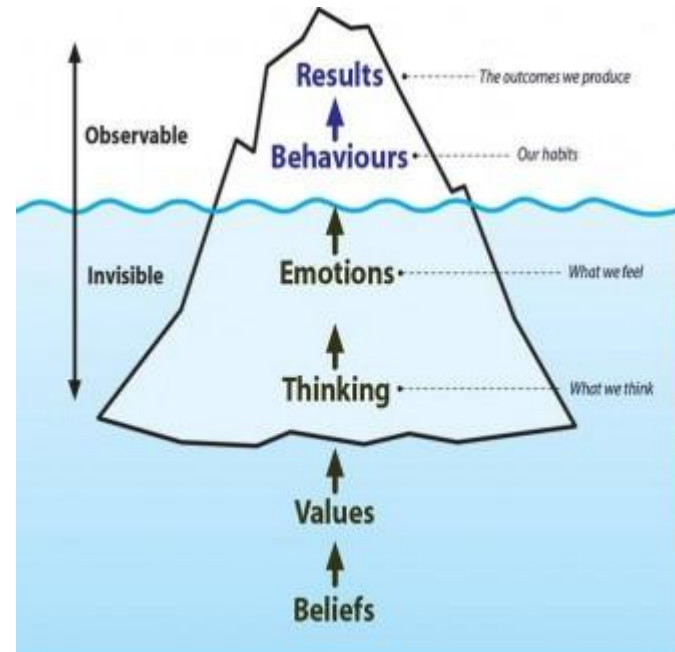
Complex information

NEOCORTEX/limbic system

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Values/Philosophy/Faith

Neocortex/LIMBIC SYSTEM



<http://www.coaching.net.nz/wp-content/uploads/2013/06/Iceberg-for-blog-from-J-e1371521135440.jpg>

„ The whole is greater than the sum of its parts“

Aristoteles

Limbic system and neocortex

Information

NEOCORTEX

VS

Complex

Brain activity
✓ Highly individual
✓ Very subjective

the outcomes we produce

Our habits

What we feel

we think

<http://www.coaching.net.nz/wp-content/uploads/2013/06/Iceberg-for-blog-from-J-e1371521135440.jpg>

“... is more than the sum of its parts“

Aristoteles

Limbic system and neocortex

Information

NEOCORTEX

VS

Complex

Brain activity

- ✓ Highly individual
- ✓ Very subjective
- ✓ Values/philosophy/faith enable coexistence within the larger group/society

“... is the sum of its parts”

Aristoteles

the outcomes we produce

Our habits

What we feel

we think

<http://www.coaching.net.nz/wp-content/uploads/2013/06/Iceberg-for-blog-from-J-e1371521135440.jpg>

Limbic system and neocortex

Information

NEOCORTEX

VS

Complex

Brain activity

- ✓ Highly individual
- ✓ Very subjective
- ✓ Values/philosophy/faith enable coexistence within the larger group/society
- ✓ These systems represent **RULES**

“... is the sum of its parts”

Aristoteles

<http://www.coaching.net.nz/wp-content/uploads/2013/06/Iceberg-for-blog-from-J-e1371521135440.jpg>

Individual / subjective character of brain activity

LIMBIC SYSTEM – IRRATIONAL

- Irrational preferences
- Irrational fear
- Phobia
 - Panic (extreme) irrational fear
 - Specific
 - Social
- <http://www.fearof.net/>



https://images.sciencedaily.com/2008/03/080320132646_1_900x600.jpg

Individual / subjective character of brain activity

LIMBIC SYSTEM

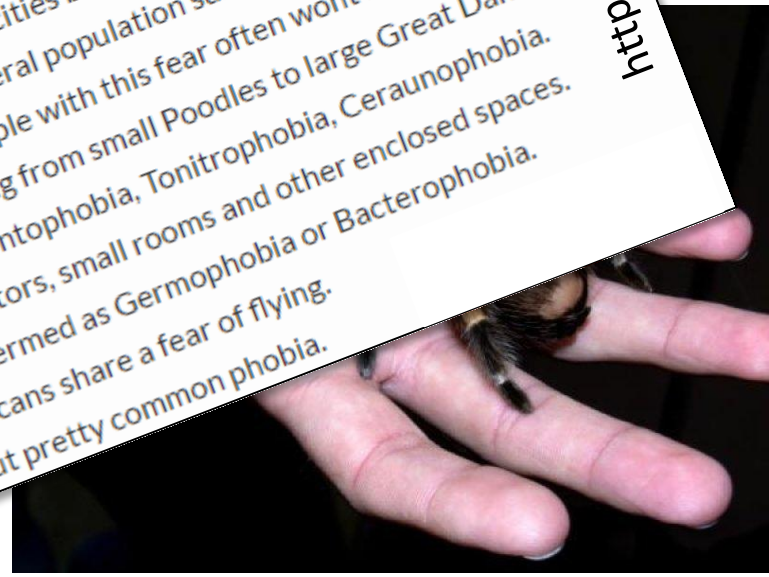
Top 100 Phobia List

These are the top 100 phobias in the world, with the most common ones listed from the top. You can click on each phobia to learn about causes, symptoms and treatments.

1. Arachnophobia – The fear of spiders affects women four times more (48% women and 12% men).
2. Ophidiophobia – The fear of snakes. Phobics avoid certain cities because they have more snakes.
3. Acrophobia – The fear of heights. Five percent of the general population suffer from this phobia.
4. Agoraphobia – The fear of open or crowded spaces. People with this fear often wont leave home.
5. Cynophobia – The fear of dogs. This includes everything from small Poodles to large Great Danes.
6. Astraphobia – The fear of thunder/lightning AKA Brontophobia, Tonitrophobia, Ceraunophobia.
7. Claustrophobia – The fear of small spaces like elevators, small rooms and other enclosed spaces.
8. Mysophobia – The fear of germs. It is also rightly termed as Germophobia or Bacterophobia.
9. Aerophobia – The fear of flying. 25 million Americans share a fear of flying.
10. Trypophobia – The fear of holes is an unusual but pretty common phobia.

<http://www.fearof.net/>

https://images.sciencedaily.com/2008/03/080320132646_1_900x600.jpg



Individual / subjective character of brain activity

NEOCORTEX – RATIONAL

- (Pseudo)rational preferences
- Imagination



Individual / subjective character of brain activity

NEOCORTEX – RATIONAL

- Imagine red car...

Individual / subjective character of brain activity

NEOCORTEX – RATIONAL

- Imagine red car...



https://www.google.cz/search?q=red+car&biw=1150&bih=492&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjBupCC_5PSAhVDbBoKHe53B98QsAQIG A#tbn=isch&q=red+car+white+background

Individual / subjective character of brain activity

NEOCORTEX – RATIONAL

- Imagine red Ferrari...



https://www.google.cz/search?q=red+car&biw=1150&bih=492&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjBupCC_5PSAhVDbBoKHe53B98QsAQIGA#tbm=isch&q=red+ferrari+white+background

Individual / subjective character of brain activity

NEOCORTEX – RATIONAL

- Imagine red Ferrari 458 from the side...



https://www.google.cz/search?q=red+car&biw=1150&bih=492&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjBupCC_5PSAhVDbBoKHe53B98QsAQIGA#tbn=isch&q=red+ferrari+458+from+side+white+background

Individual / subjective character of brain activity

NEOCORTEX – RATIONAL

- Imagine red Ferrari 458 from the side...



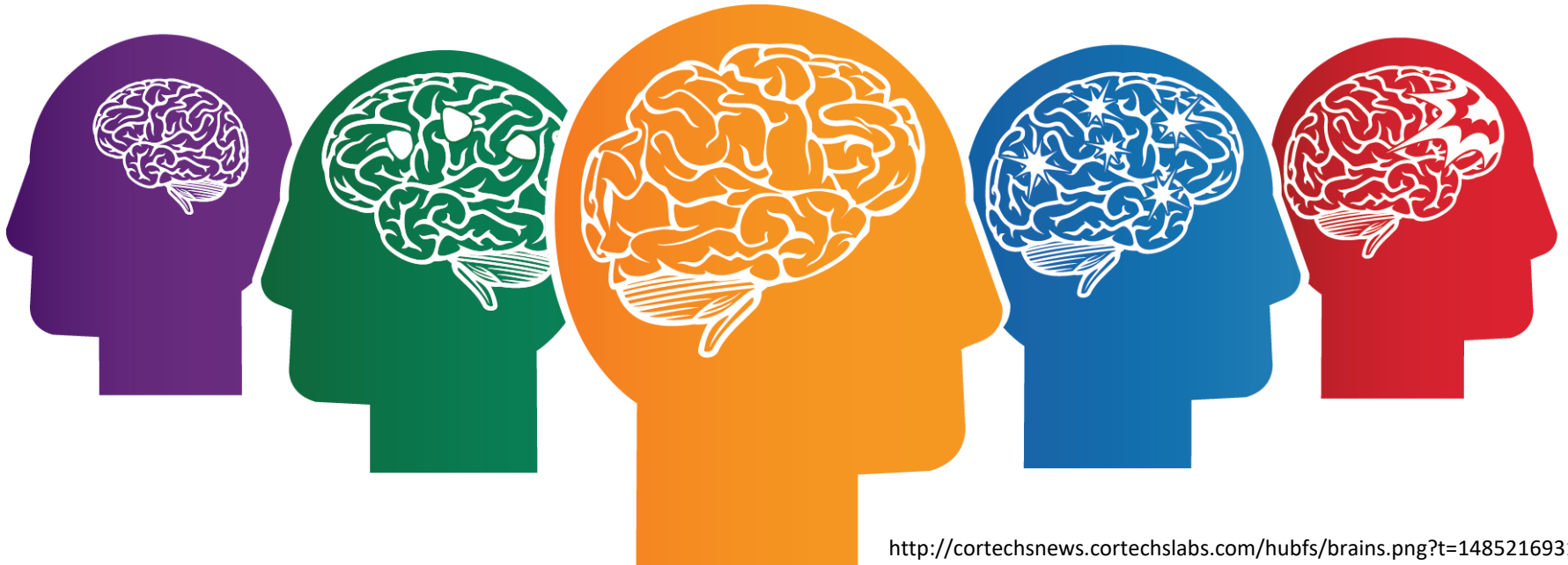
https://www.google.cz/search?q=red+car&biw=1150&bih=492&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjBupCC_5PSAhVDbBoKHe53B98QsAQIGA#tbn=isch&q=red+ferrari+458+from+side+white+background

- Closer specification (more conditions) leads us to a more consistent output, but increases the likelihood of errors
 - ✓ Random – some specifications are randomly overlooked
 - ✓ System – some specification is unknown (How does Ferrari 458 look like?)

Every brain is unique

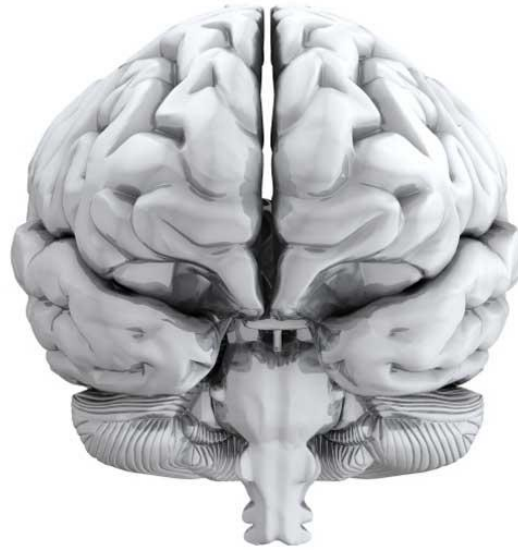
- Emotionally
 - Limbic system
- Rationally
 - Neocortex

✓ Genetics
✓ Environment



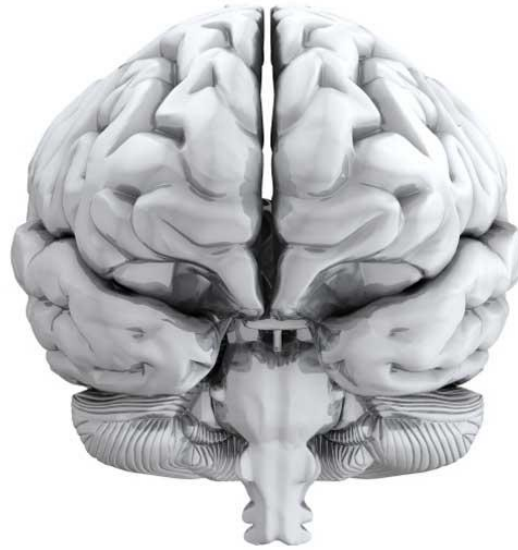
Every brain is a powerful machine...

... which is hard to control



Every brain is a powerful machine...

... which is hard to control



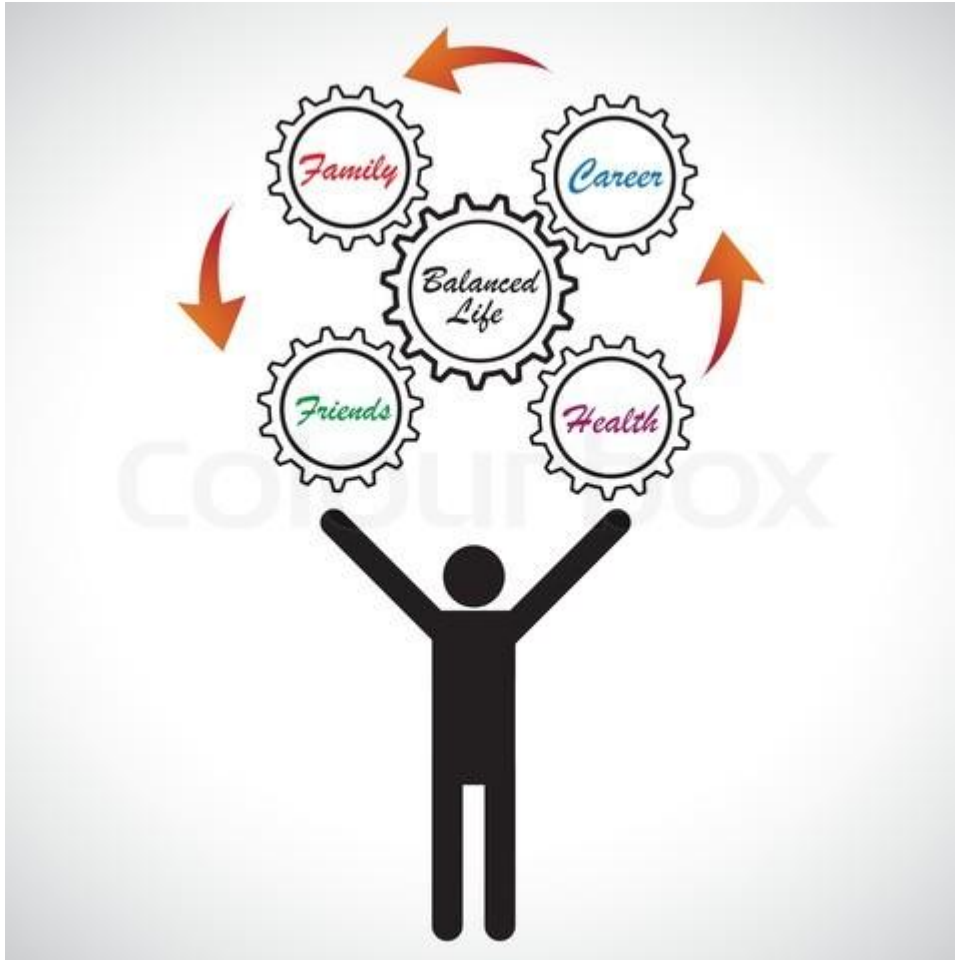
- ✓ The conflict between the limbic system and the neocortex
- ✓ The problem with effective control of the neocortex



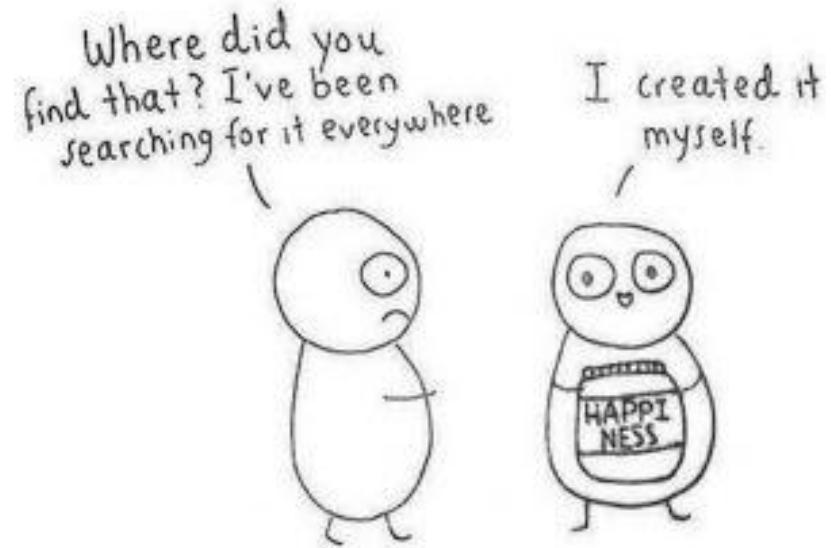
The conflict between the limbic system and the neocortex



The conflict between the limbic system and the neocortex



<http://www.terryherring2013.com/wp-content/uploads/2014/03/life-balance.jpg>



<http://thedailypositive.com/wp-content/uploads/2016/06/image1-4-300x300.jpg>

The conflict between the limbic system and the neocortex

- Predominance of the limbic system (neuromodulation)

The conflict between the limbic system and the neocortex

- Predominance of the limbic system (neuromodulation)
- Neocortical activity
 - top of neural activity
 - low influence upon lower part in case of conflict

The conflict between the limbic system and the neocortex

- Predominance of the limbic system (neuromodulation)
- Neocortical activity
 - top of neural activity
 - low influence upon lower part in case of conflict
- Reflex activity (both autonomous and somatic)
 - involuntary (with rare exceptions)
- Limbic system activity
 - almost involuntary

The conflict between the limbic system and the neocortex

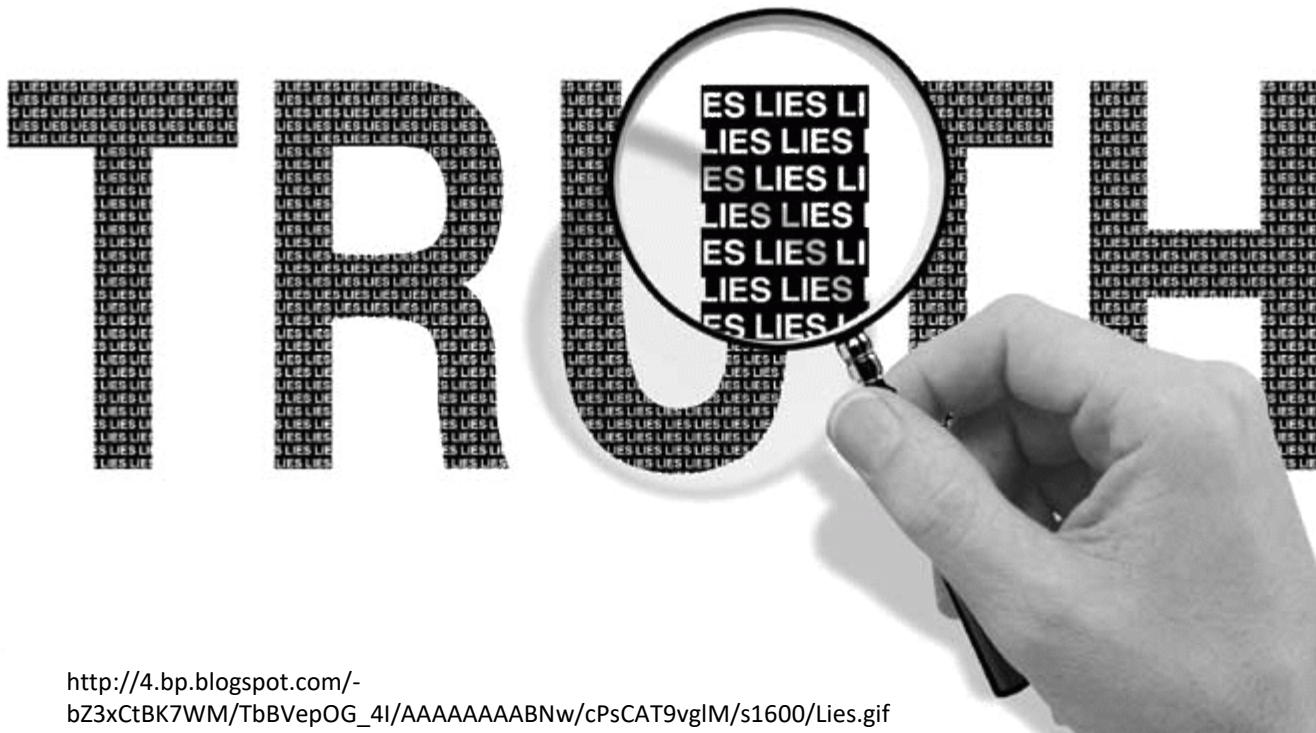
- Predominance of the limbic system (neuromodulation)
- Neocortical activity
 - top of neural hierarchy
 - involved in conscious thought
- Reflexive activity (e.g., emotions)
 - involuntary
- Limbic system activity
 - almost involuntary

**Solution of this conflict is rationalization.
Human brain is very good at finding
rational explanations of irrational
behavior....**

Rationalization

✓The problem with effective control of the neocortex

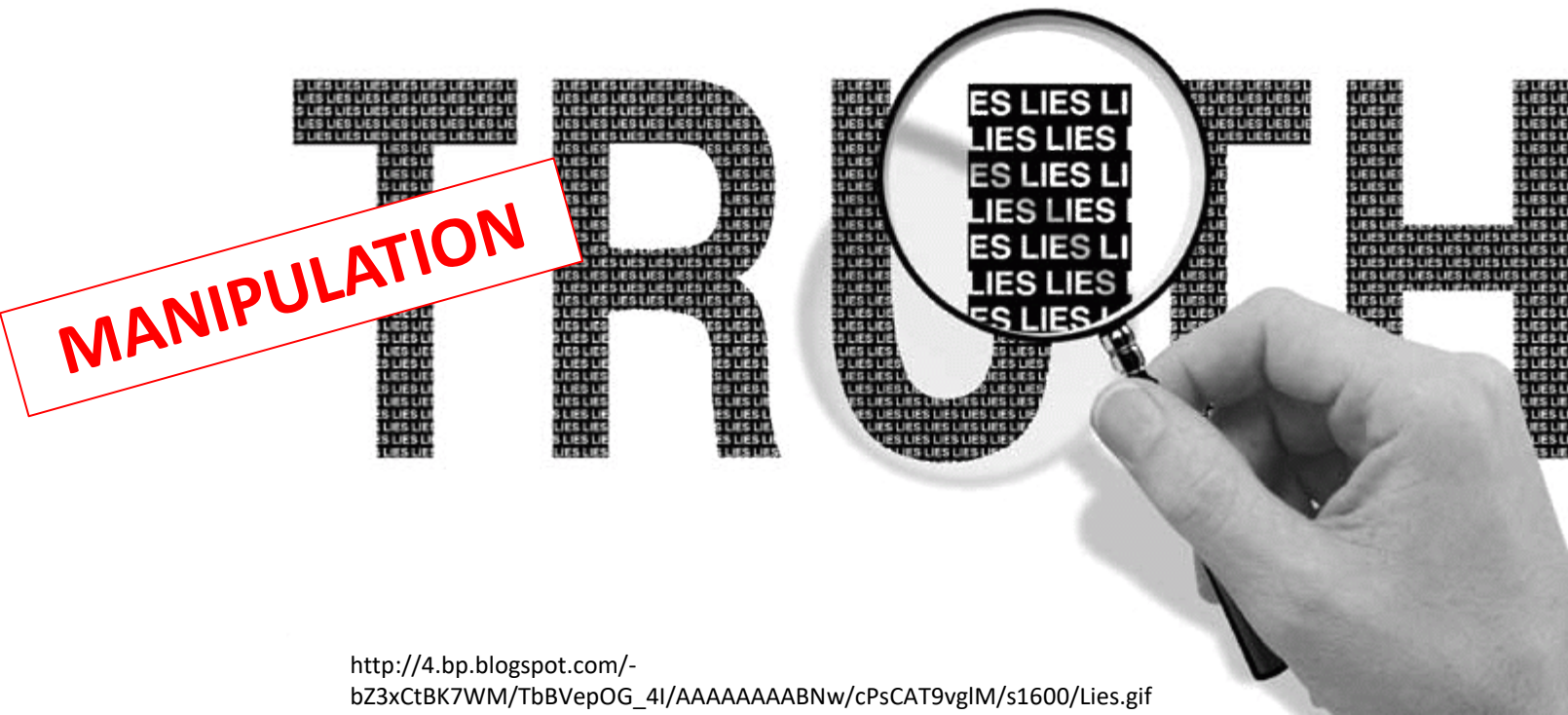
- defense mechanism in which controversial behaviors or feelings are justified and explained in a seemingly rational or logical manner to avoid the true explanation, and are made consciously tolerable—or even admirable and superior—by plausible means (wikipedia)



Rationalization

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Manipulation

✓The problem with effective control of the neocortex

- Selfmanipulation vs manipulation of others
- Intentional vs unintentional

„ Why do you look at the speck of sawdust in your brother's eye and pay no attention to the plank in your own eye? „

Matthew 7:4



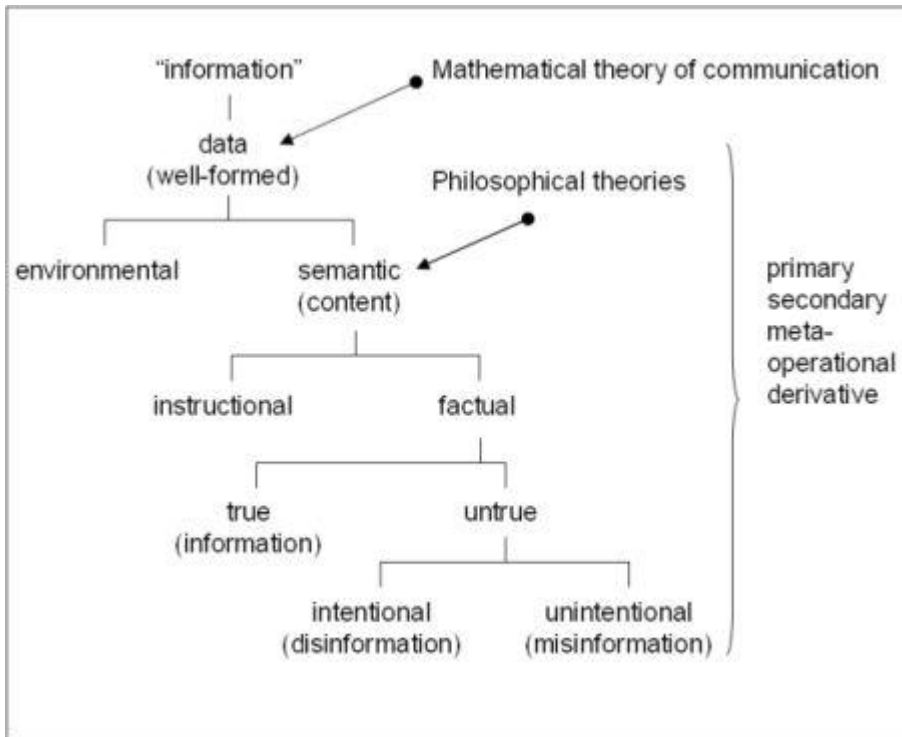
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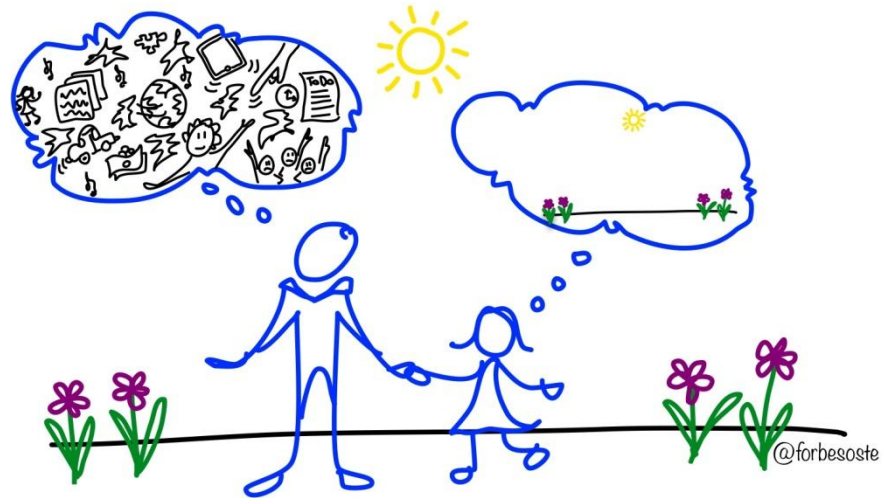
Awareness / Mindfulness

✓The problem with effective control of the neocortex

<http://cognitivetherapyonline.com/cbt4panic/wp-content/uploads/2011/03/past-future.gif>



Mind Full, or Mindful?



https://stuffthingsandopinions.files.wordpress.com/2015/12/15655214702_05c357fe29_o_d.jpg

„When you are hungry, eat; when you are tired, sleep“

Zen Buddhist quote

Awareness / Mindfulness

✓ The problem with effective control of the neocortex



UNLESS THE MOMENT IS UNPLEASANT,
IN WHICH CASE I WILL EAT A COOKIE



15 MINUTES OF CARDIO, 15 MINUTES OF WEIGHTS,
AND AN HOUR OF TALKING MYSELF INTO IT.

<http://nutritionstudies.org/wp-content/uploads/2014/01/overcoming-emotional-eating-480x250.jpg>

http://1.bp.blogspot.com/_GpQ4Y4Dn10/78WmcpUtlI/AAAAAAAAAAw/9kCQYEuoTBg/s1600/exercise-cartoon.jpg

Awareness / Mindfulness

✓ The problem with effective control of the neocortex

