

Neurobiological foundations of ethics and law



Włodzisław Duch

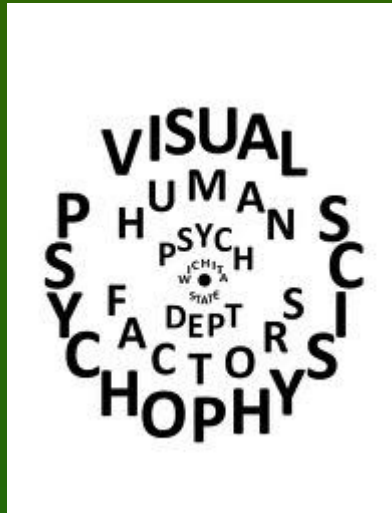
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Humboldt-Kolleg 10.5.2015

Understanding human nature

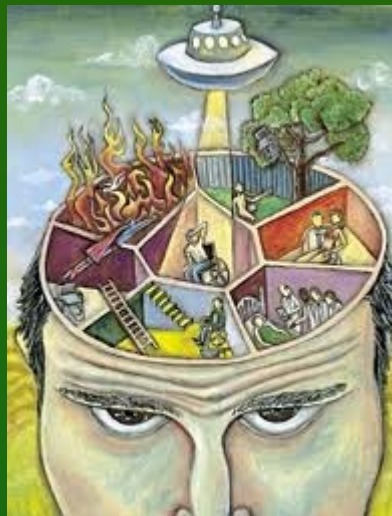
Psychophysics



Neuroscience



Psychology

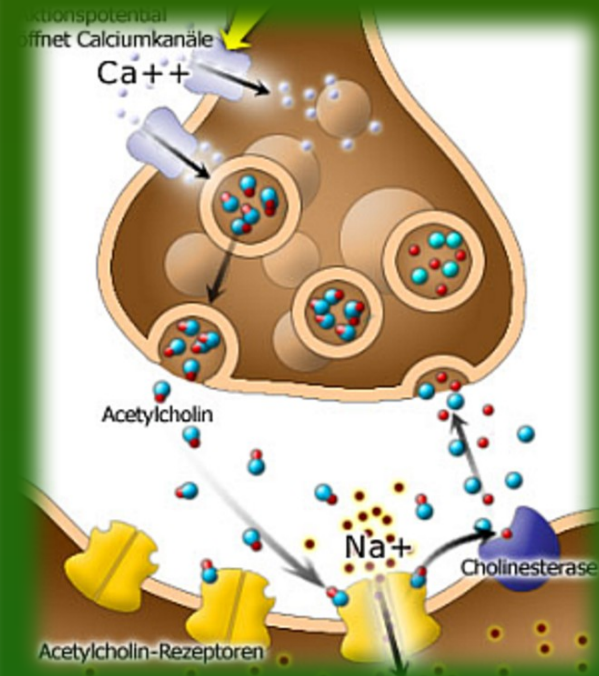
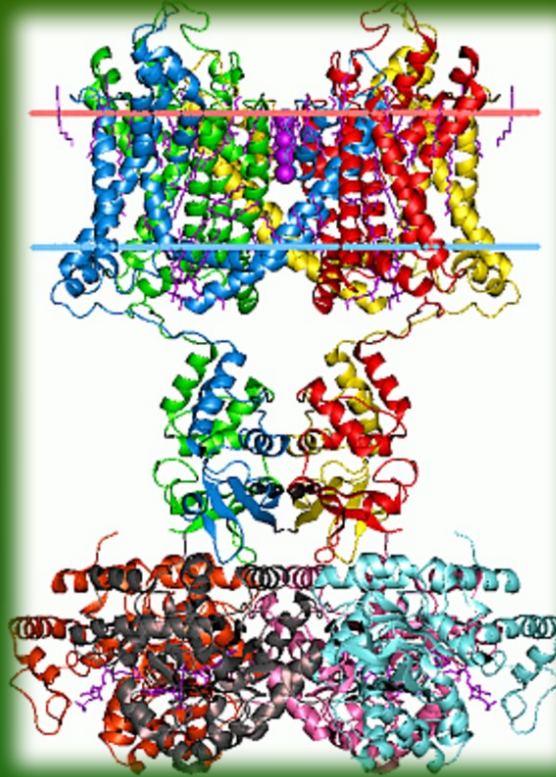
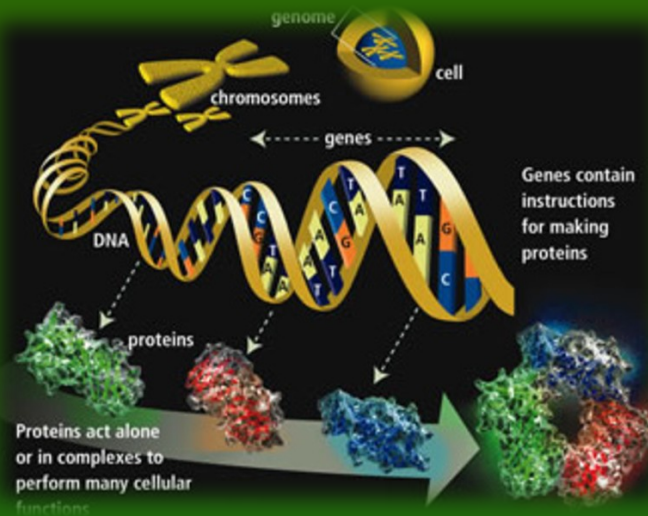


Cultural Anthropology



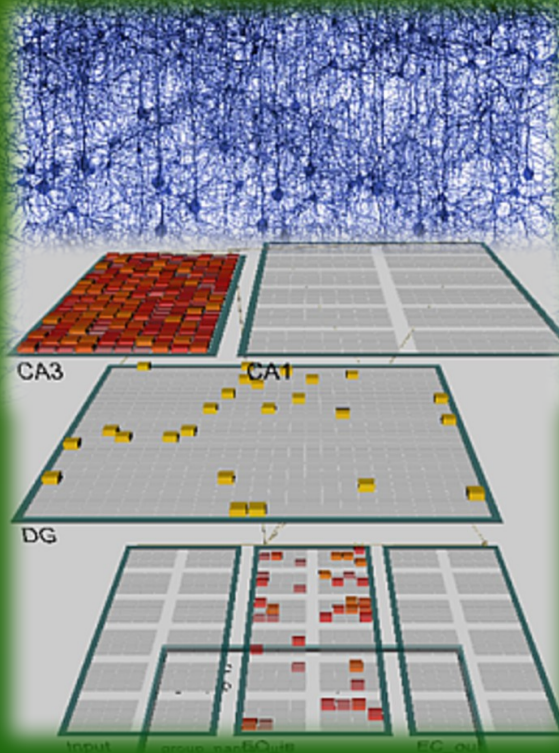
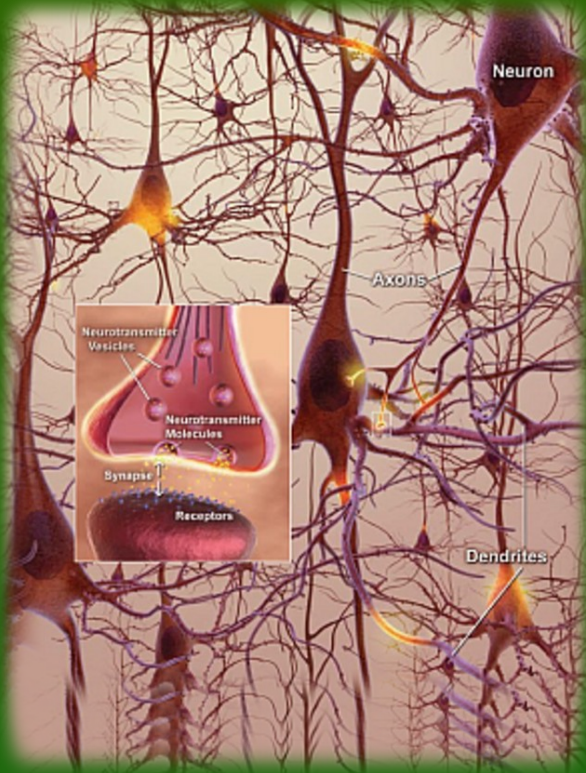
+ Philosophy+ Sociology ... => understanding human experience.

From Genes to Neurons



Genes => Proteins => receptors, ion channels, synapses
=> **neuron properties, networks, neurodynamics**
=> cognitive phenotypes, abnormal behavior, syndromes.

From Neurons to Behavior



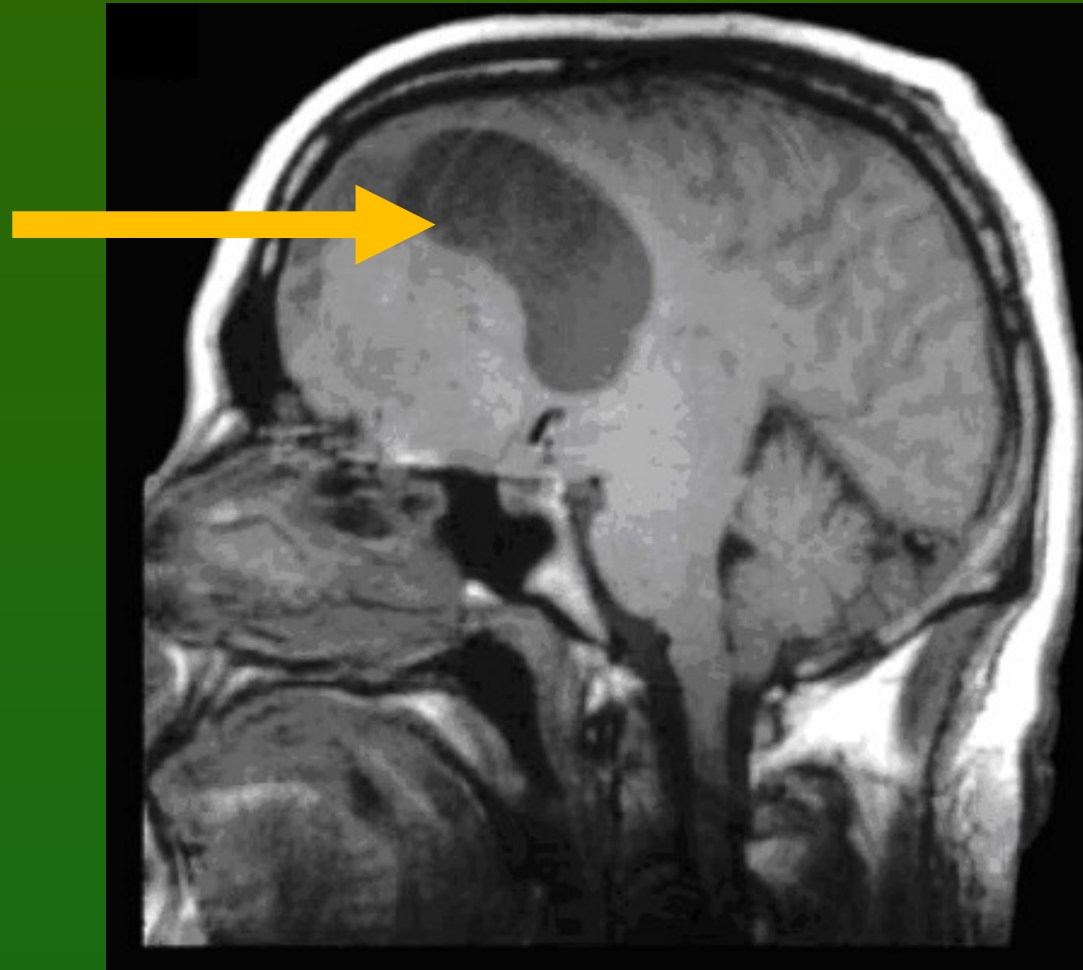
Genes => Proteins => receptors, ion channels, synapses
=> neuron properties, networks
=> **neurodynamics** => cognitive phenotypes,
moral or abnormal behavior!

Pedophilia from brain tumor

Immoral behavior is not always free choice, it could be strong inner compulsion.

Tumor pressing right orbitofrontal and ventromedial PFC cortex changed 40-year old teacher into sex maniac.

Removing the tumor cured the man, but the tumor grew back and his symptoms too.



Who is immoral?

Me or my brain?

I am addicted victim.

My brain made me do it ... suffering from disease of the will.

⇒ Cure the brain

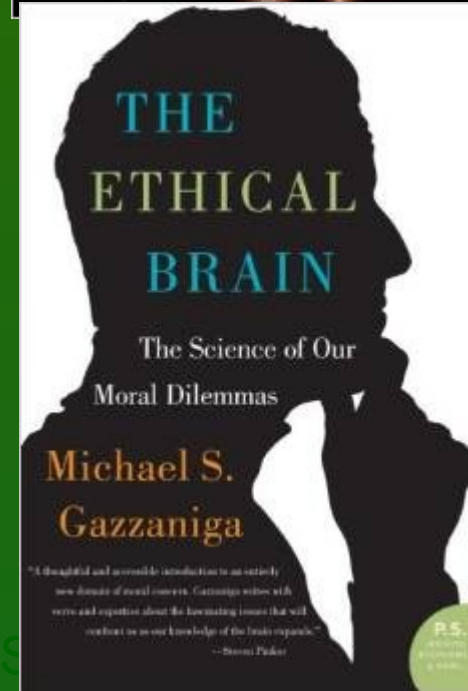
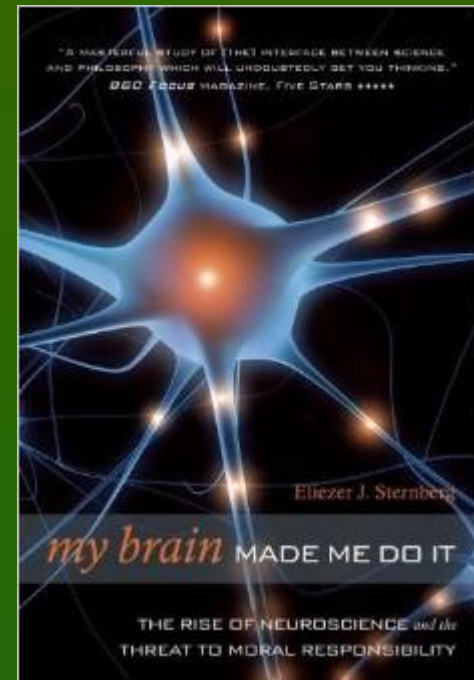
or ...

The person is to blame!

No excuses, we are always free to choose.

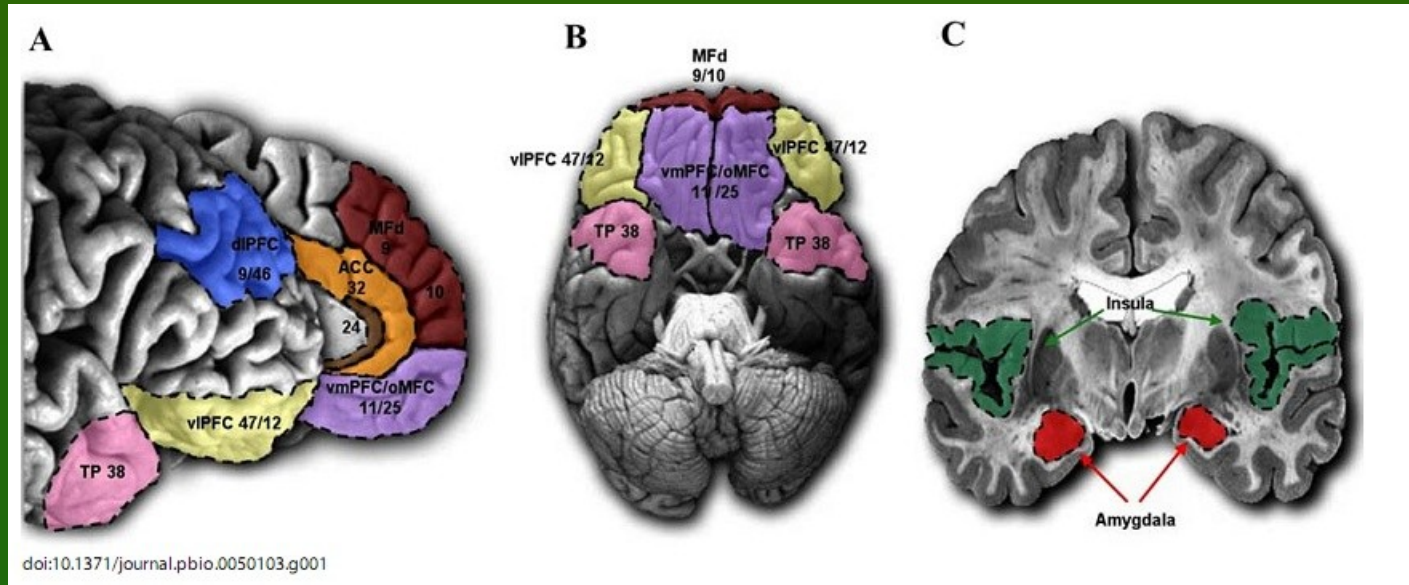
⇒ Punish him! Revenge!

Is everyone capable of ethical behavior?



Brain and antisocial behavior

Mobbs D, Lau HC, Jones OD, Frith CD, Law, Responsibility, and the Brain. PLoS Biol 5(4): e103 (2007)



Damage to prefrontal cortex (**PFC**) leads to acquired sociopathy, impulsive affective criminals.

Damage to **amygdala** leads to poor empathy and low fear, typical of psychopathic emotionless criminals.

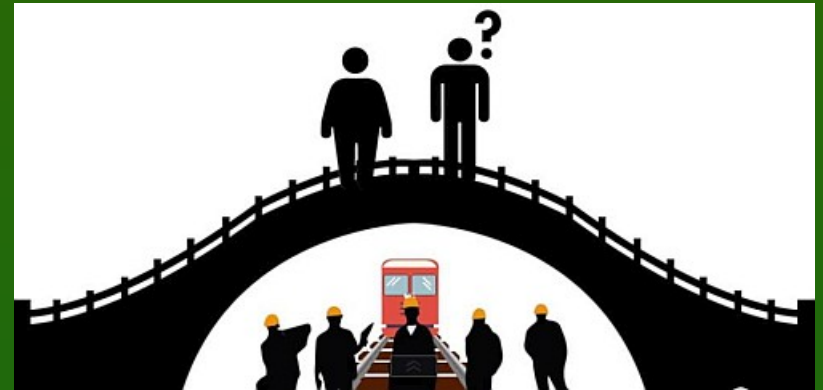
Estimation **~25% of all imprisoned in the USA** fall in these two categories, frequently due to birth complication and trauma.

Moral dilemmas

How would you react?

Press the lever to divert train and save 5 people but kill one.

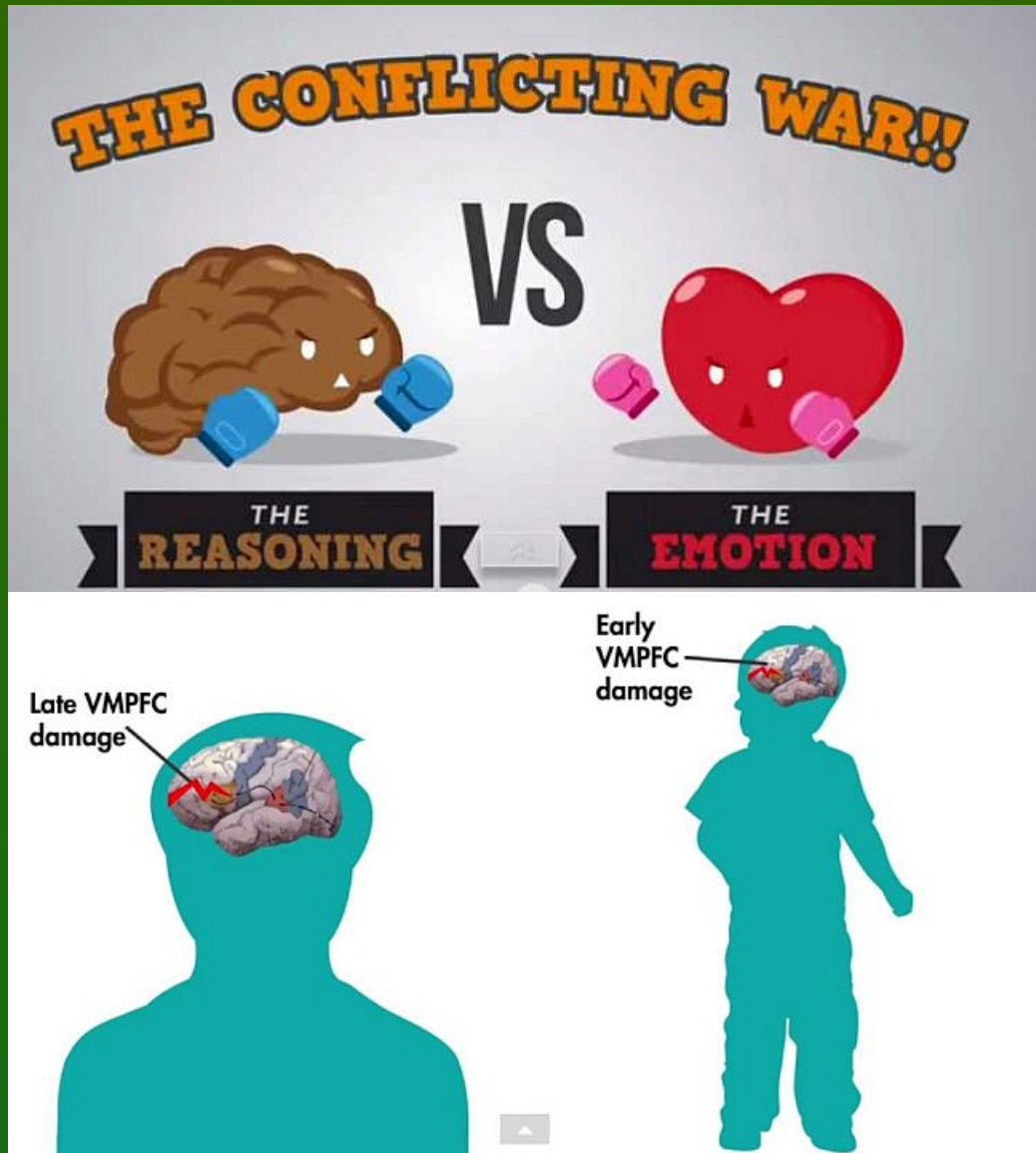
Push fat man to stop the train and save 5 people?



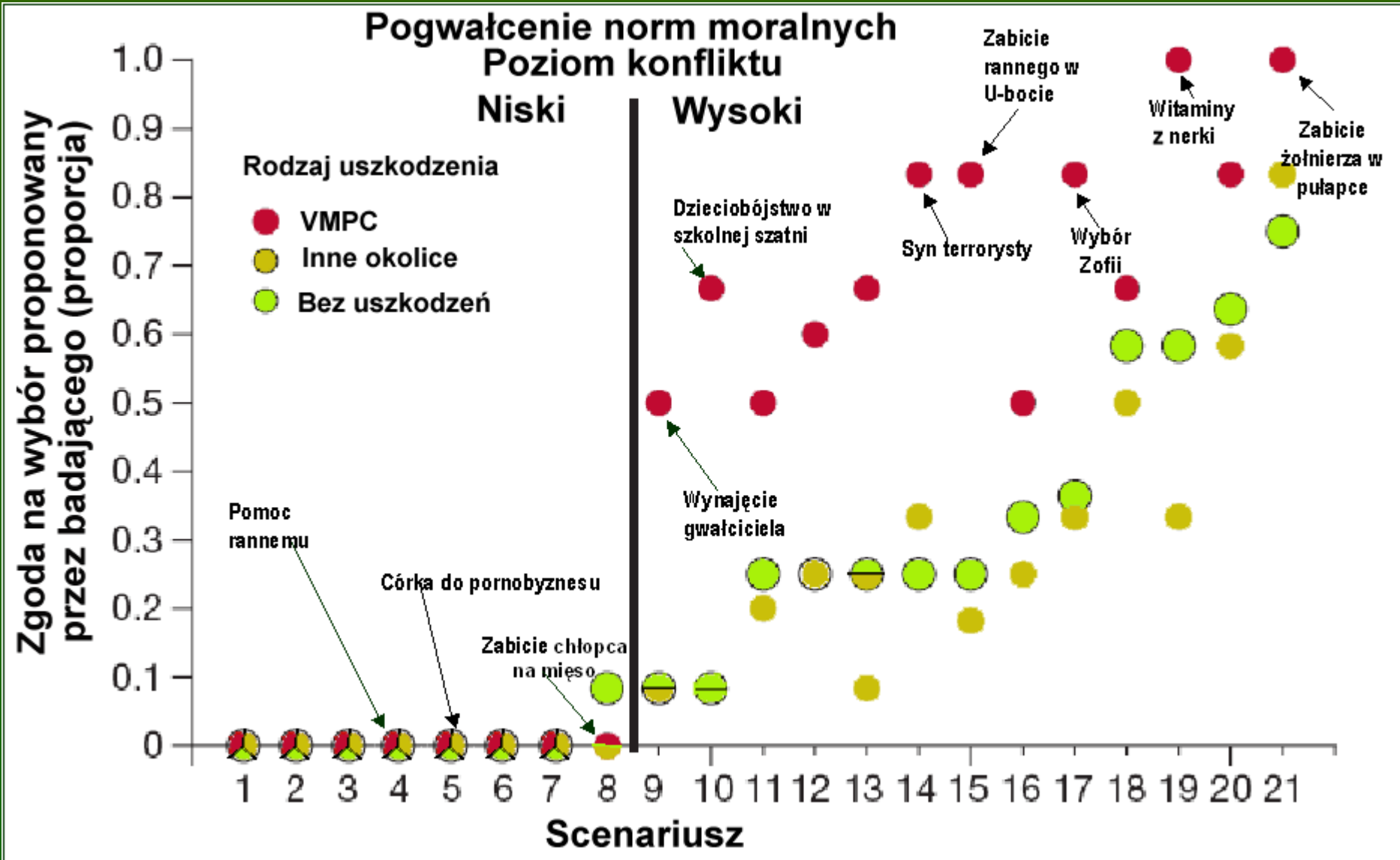
Joshua K - [Neuroscience of Morality](#)

All around the world results are similar, showing that not the 10 commandments but natural empathy is behind moral choices. But do we all experience empathy in the same way?

Reason and emotion



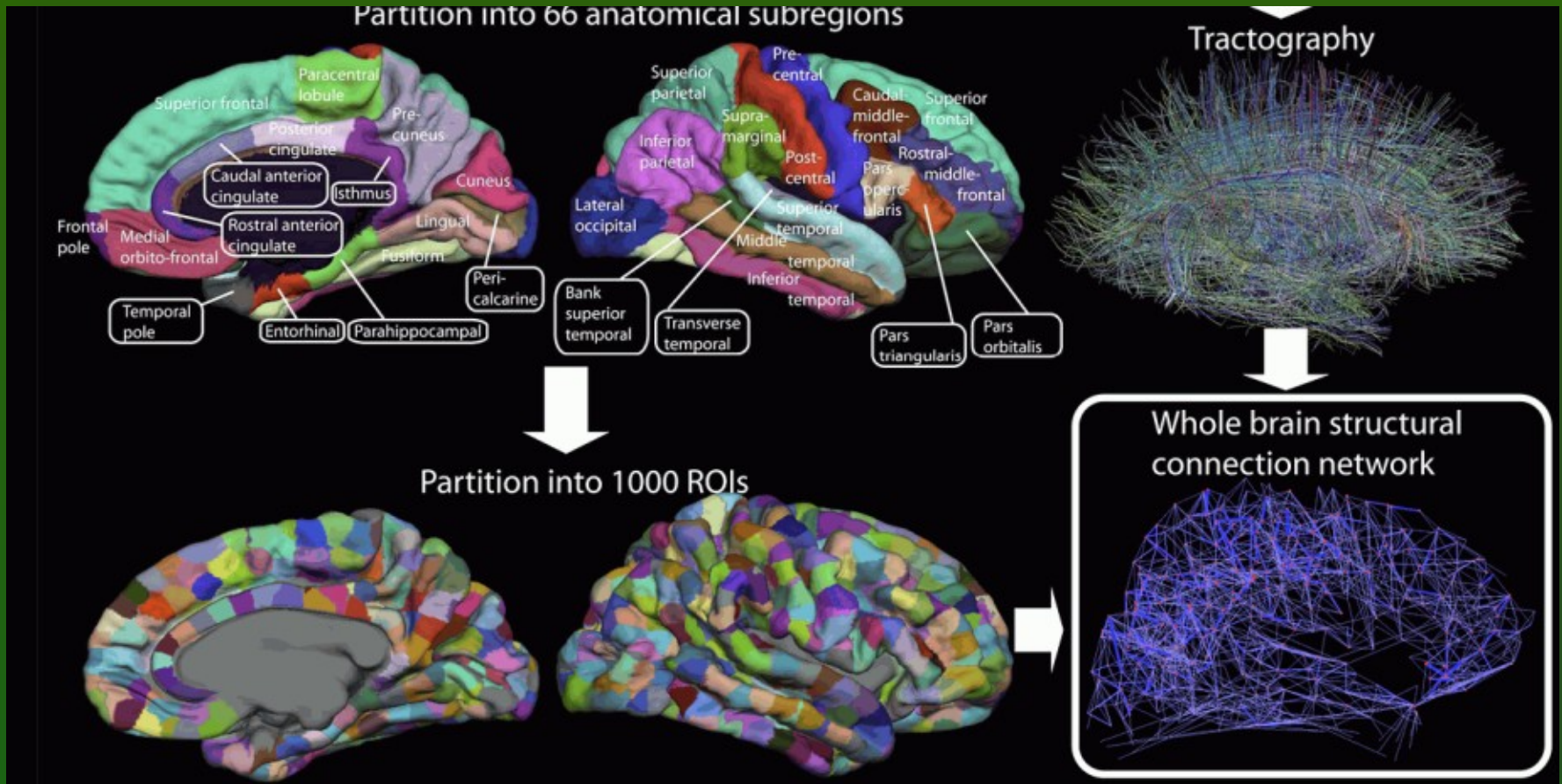
Uszkodzenia VMPC i moralność



With damage to VMPC rational decisions are normal, intuitive/affective not.

Brains are formed by experience

Each brain is unique, due to genetic and environmental factors => differences in cognition & emotion, ethical choices

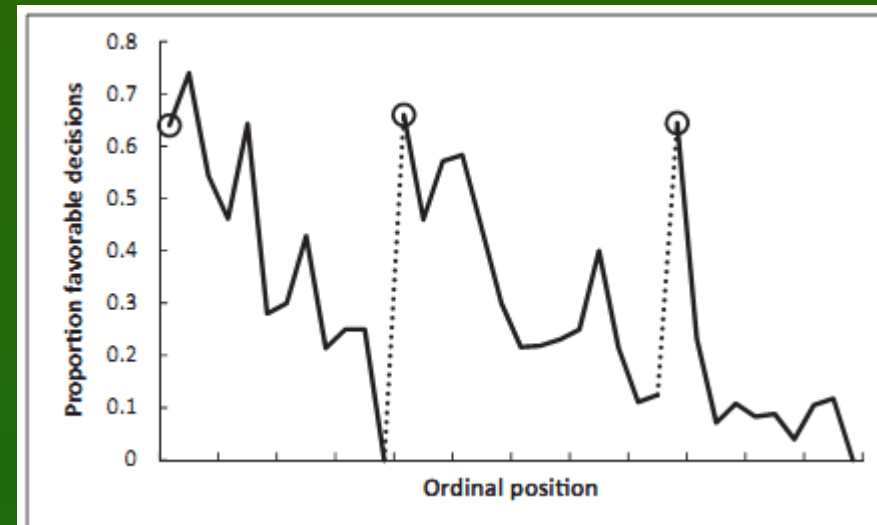


Sporns O, Tononi G, Kötter R (2005) The human connectome: A structural description of the human brain. PLoS Comput Biol 1: 245–251

Energy for thought

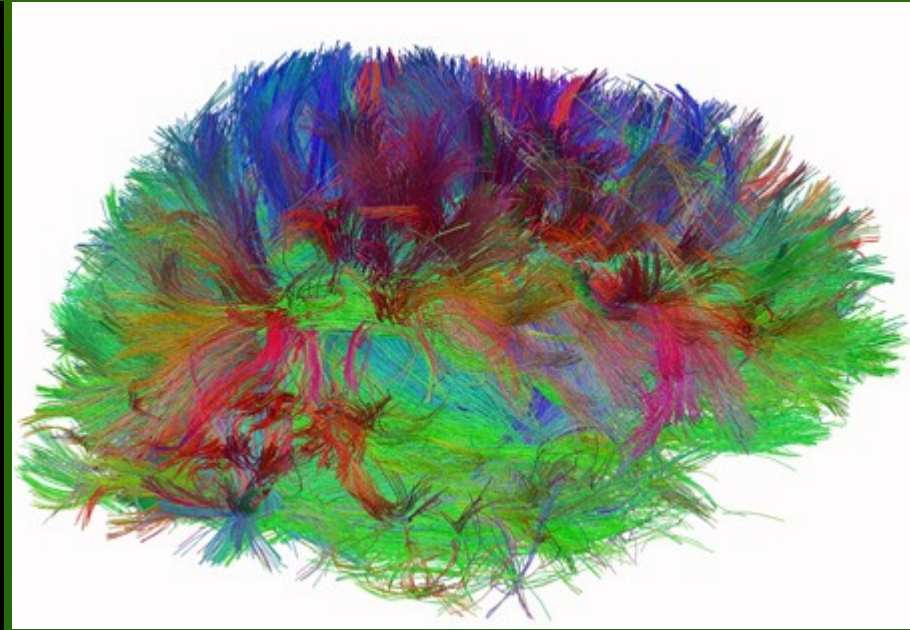
- Average frequency of granting parole during the day. 1000 decisions of 8 Israeli judges with at least 20-years experience (S. Danziger, PNAS 2011).

- When the chance goes to zero its time to feed the judge! Certain level of glucose is needed to think. Physiology rules!



- Ask for Valentine street and two times more people will be willing to help a minute later than if you ask for direction to Martin street (Baumeister i inn, 2009).
- We are not aware of the true reasons of our decisions.

Neuronal determinism



Our behavior is constraint by **genetic & neuronal determinism**.
Genetics constrains what is possible at the neural level.

Neuronal determinism: brain networks are “sculpted” by education, culture, religion, all life experiences.

Our thoughts emerge in this network as a result of neurodynamics
altruistic behaviors are correlated with brain connectivity.

Mental landscape

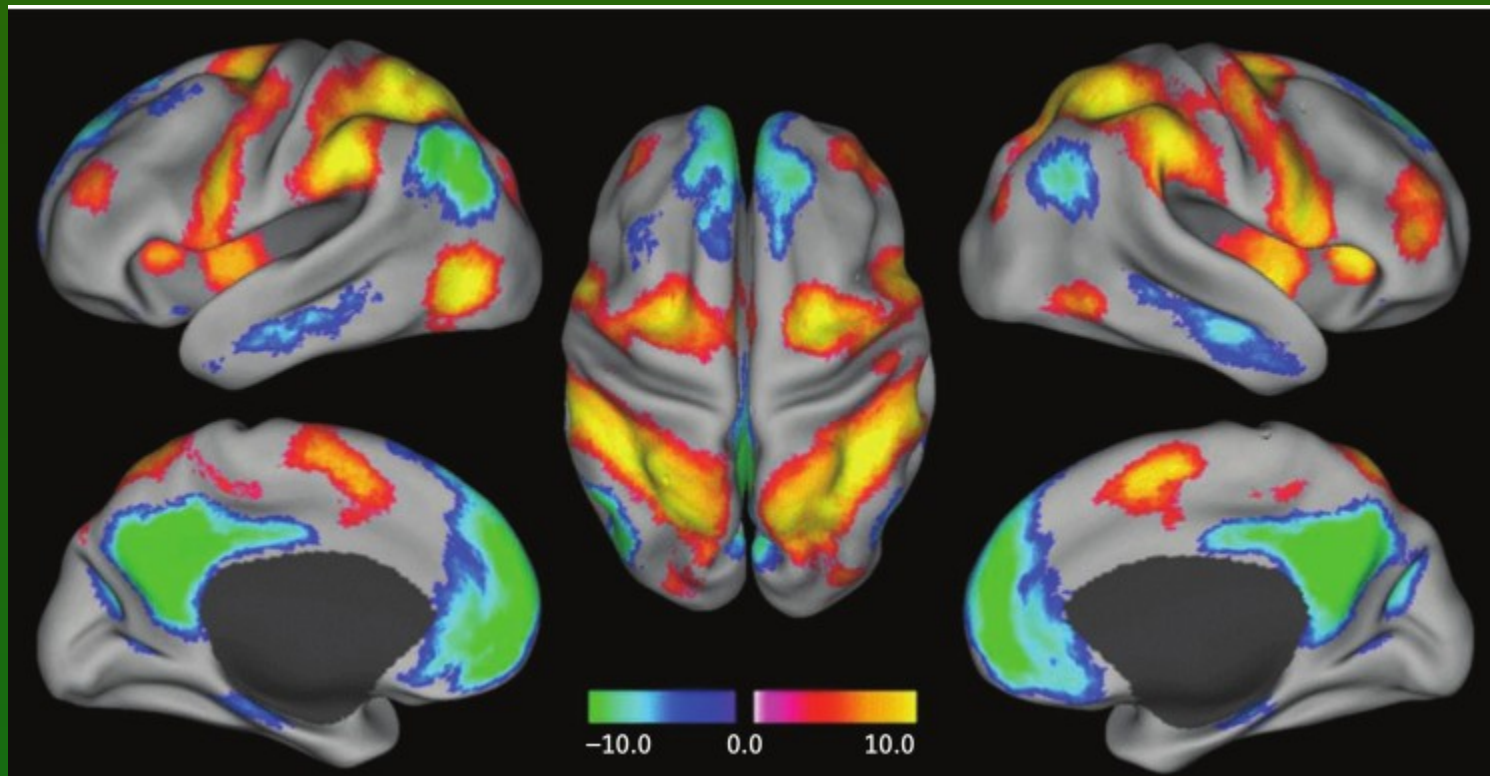


Mental life = succession of brain states, depends on brain networks. What “comes to our mind” is fully determined by the flow of neural activations, erosion of the brain pathways.

Spontaneous brain activity

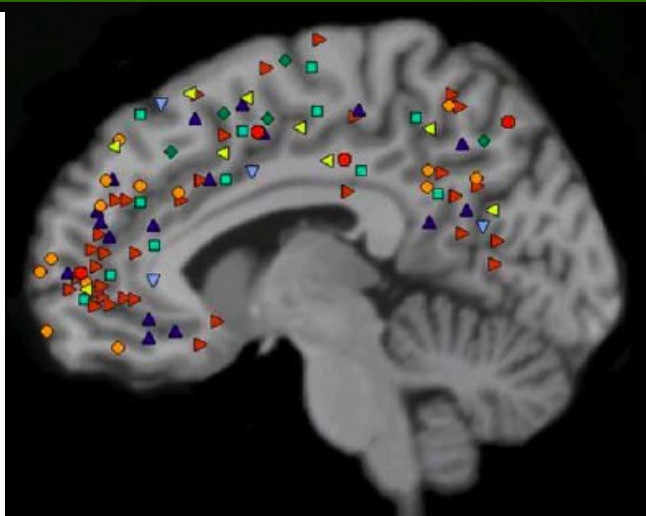
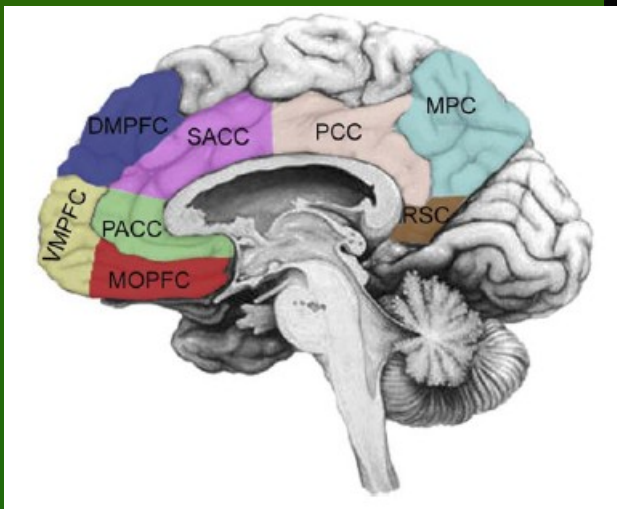
Red & yellow areas are active when there is sensory stimulation, green & blue when there is nothing to process (DMN), I emerges.

M.D. Fox et al., Proc. Natl. Acad. Sci. 102, 9673 (2005).



Where is my Self?

Northoff *et.al*, Self-referential processing in our brain.
Neuroimage 31, 440, 2006

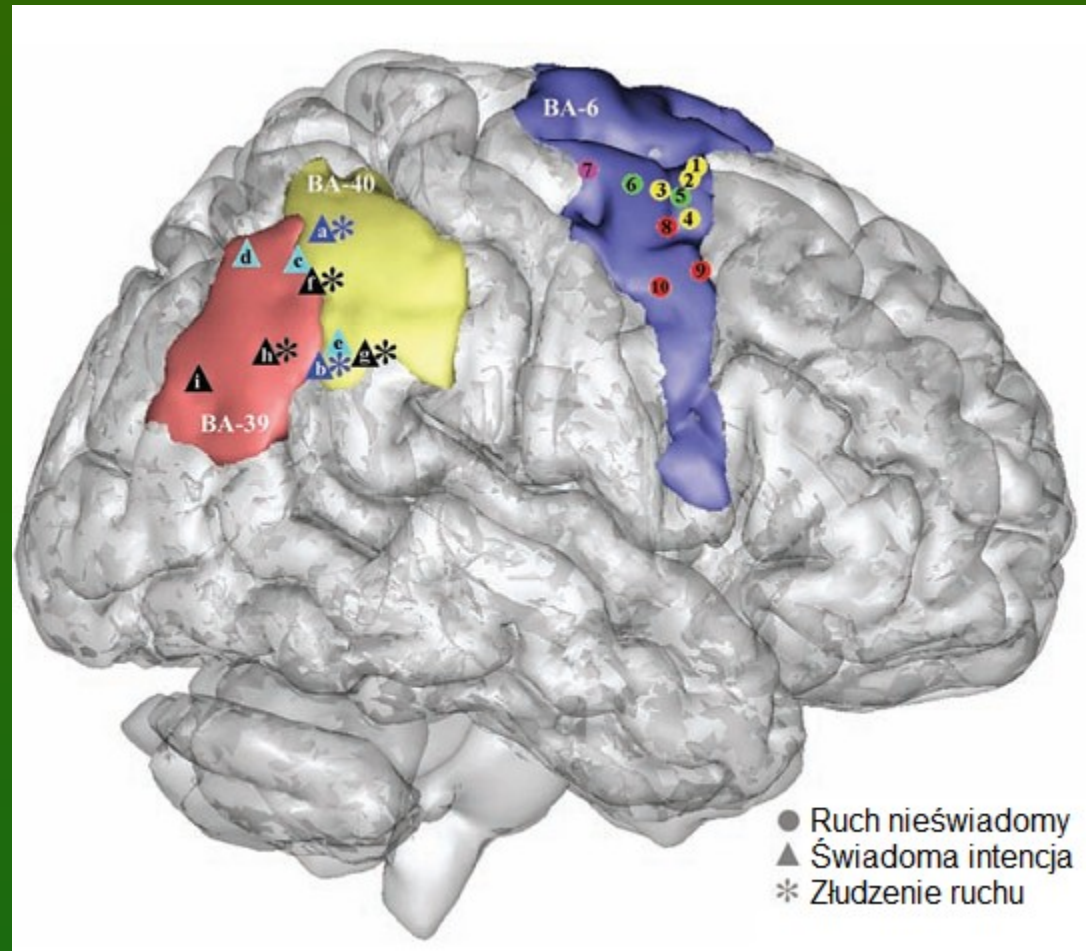


- ▲ emotional domain: self > non-self
- ▼ facial domain: self > non-self
- memory domain: self > non-self
- ◆ motor domain: self > non-self
- ◀ social domain: self ∩ other
- social domain: self > other
- ⊕ spatial domain: self > non-self
- ▶ verbal domain: self > non-self

CMS, **Cortical Midline Structures**, are all involved in the verbal, spatial, emotional and face recognition test when self and others are distinguished. Self is not a monolith. Proto-self: body, habits; autobiographical self: memory; social self: social relations.

I want?

Applying current to parietal cortex and supplementary motor cortex leads to the subjective feeling of intention to move (triangles, BA 39 & BA 40 areas), or even an illusion that the movement was made (stars).

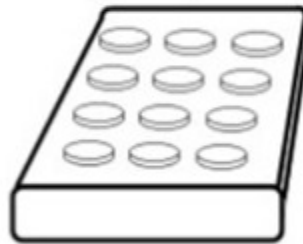


Applying current to motor cortex leads to movement of limbs without feeling of intention to act (circles, BA6 area).
M. Desmurget et al. Science 2009.

Will is just another feeling



Wegner DM: The illusion



Soon you will have TMS in your hat!

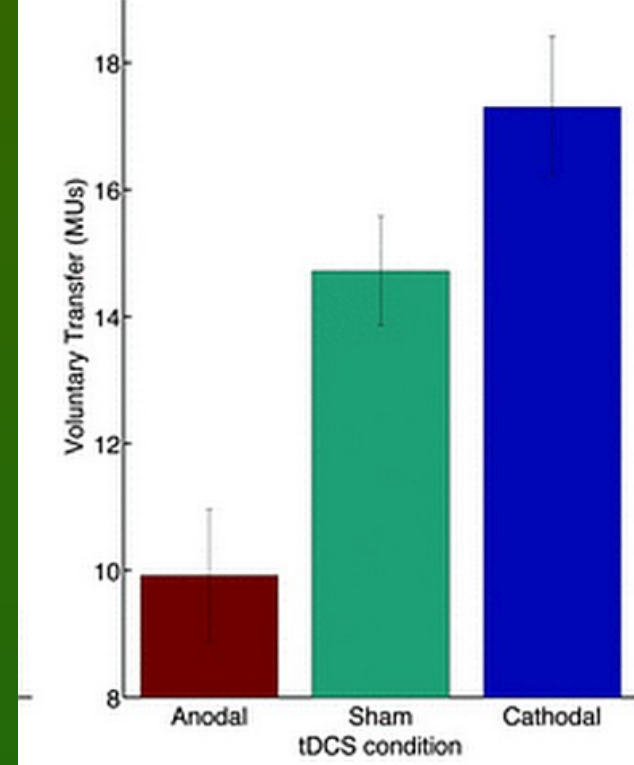
TMS stimulations: even if one side is selected 80% of times the choice is felt as free ... we could be radio controlled!

Will is just another feeling resulting from attention to the state of the pre-supplementary motor cortex (**Pre-SMA**).

Playing fair

Social order requires enforcing compliance with social norms. The right lateral prefrontal cortex (rLPFC) plays a key role in both voluntary and sanction-induced norm compliance. Transcranial Direct Current Stimulation (tDCS) changes the neural excitability of this brain region, significantly increasing or decreasing the amount of money units (MUs) transferred to other players (fairness of play) in an economic game.

C.C. Ruff et al. Changing Social Norm compliance with Noninvasive Brain Stimulation. *Science* 342, 482-484, 2013

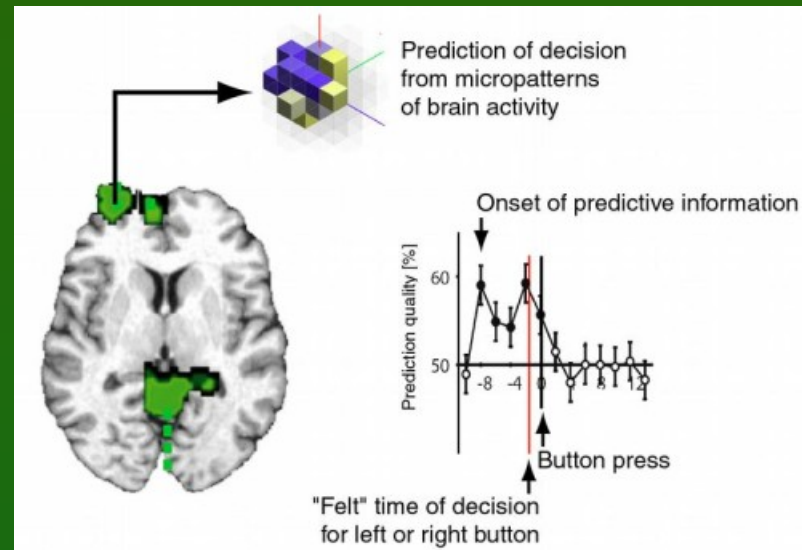


10 seconds earlier ...

C.S. Soon, M. Brass, H-J. Heinze & J-D. Haynes,
Unconscious determinants of free decisions in the human
brain. Nature Neuroscience, April 2008.

“We found that the outcome of a
decision can be encoded in brain
activity of prefrontal and parietal
cortex up to 10 sec before it
enters awareness.

This delay presumably reflects
the operation of a network of
high-level control areas that
begin to prepare an upcoming
decision long before it enters
awareness.”



Is it good for you?



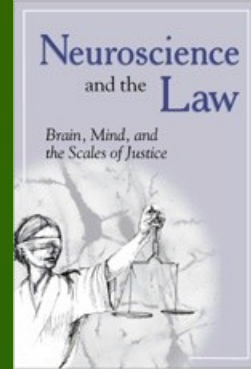
R.F. Baumeister et al. Prosocial benefits of feeling free: Disbelief in free will increases aggression and reduces helpfulness. *Personality & Soc. Psych. Bulletin* 2009.

Disbelief in free will may make behavior more reliant on selfish, automatic impulses, less socially desirable.

- Induced disbelief in free will reduced willingness to help.
- Chronic disbelief in free will was associated with reduced helping behavior.
- Induced disbelief in free will caused participants to act more aggressively than others.

Belief in free will seems to promote socially desirable and harmonious behavior, feeling of empowerment.

Neurolaw



In the USA the insanity plea requires that the accused being mental ill does not know that he did wrong.

In 1843 Daniel M'Naghten attempted to assassinate the British prime minister; at his trial, he was found to be insane. Lawyers saw the power of mounting an insanity defense, and many such claims were made.

In 1995, the Supreme Court of Georgia heard a lawyer describing violent behavior shared by several generations of men in a Dutch family. A mutated gene shared by all the violent men, predisposed his client to violence; he did not have free will and was innocent of the murder.

Should the courts take genetic/brain anatomy information as excuses? Are we able to resist our impulses?



- M. Gazzaniga
Law and Neuro

The physical world
determined, and

Humans have
self is directing
be true, because
creating the illusion that we are in charge of our actions.

Atoms and particles behave in probabilistic ways, but our mind is made of atoms and particles...



How can free will exist?

Brains are automatic, rule-governed, determined devices. Yet people are personally responsible agents, free to make their own decisions, because personal responsibility is a public concept, a relationship, interaction with other brains.

But what kind of brains are able to obey the rules?

ur Foundation)

must also be
s.



, think that thie
me. It appears to
in our left brain,
of our actions.

My Brain and I



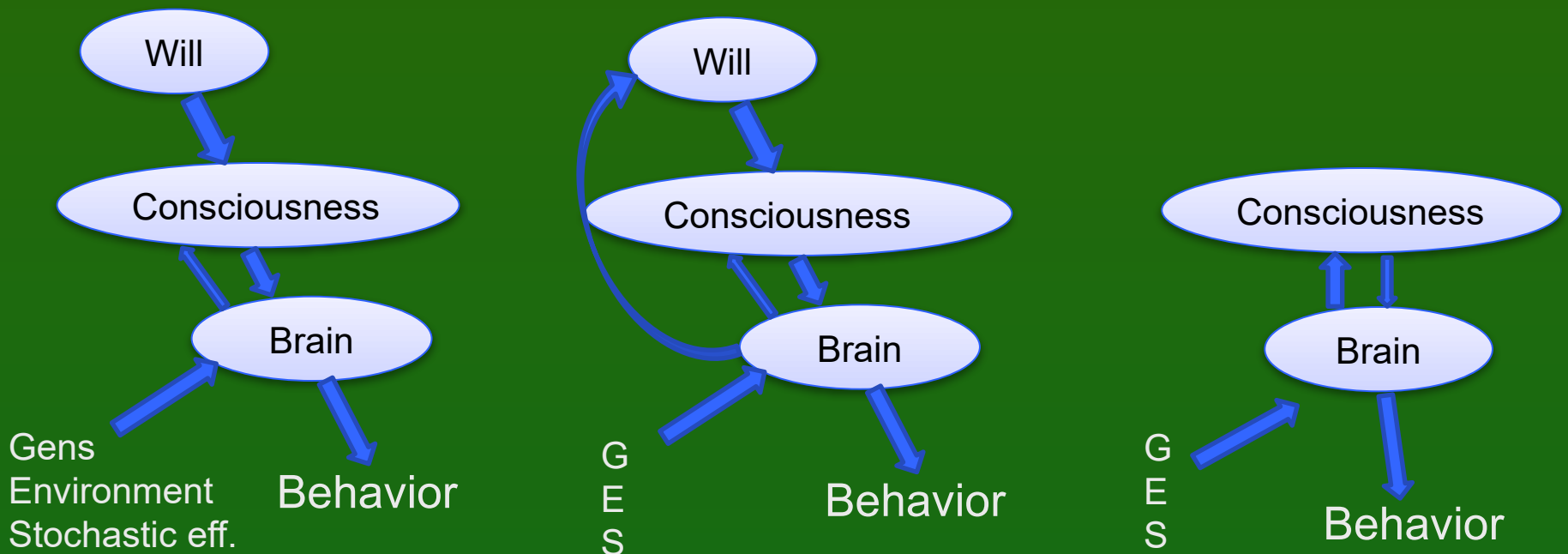
- Am I my brain? Yes & No!
I is one a subset of many brain processes.
- I fight with my neurotic impulses, reflect on them, compare with my ideals, ignore and reject them.
- How will I react in new situation? Like a prisoner or prison guard (Zimbardo)? How can I know if I have not checked myself? "We know about ourselves only as much as we have been tested" (W. Szymborska).
Tests yourself!
- Brain is just a substrate of our thoughts.
I have the power to control my brain.



Brain and will

Brain exists solely for its own survival, not to understand ourselves. Only by looking from outside we can understand the brain and draw conclusions about its nature (EO Wilson).

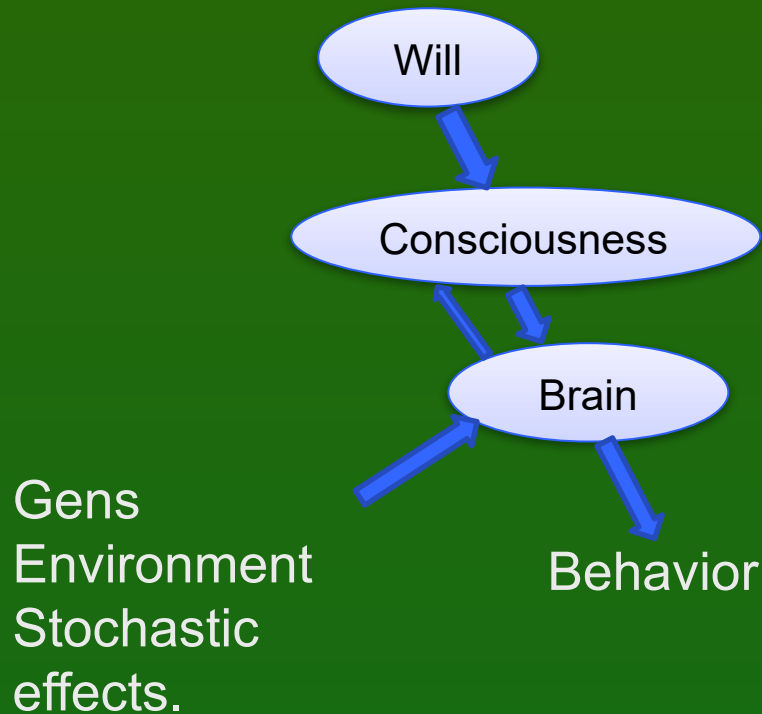
What are the options? Naive, reflexive and mechanical.



Naïve, top-down

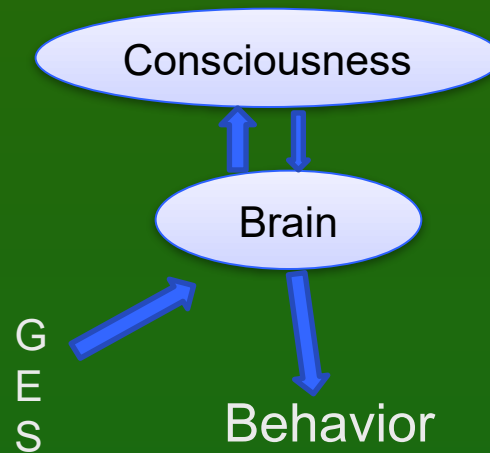
Magical I-substance (spirit? soul?) makes decisions that are transferred to consciousness that instructs the brain to take actions.

Who makes these decisions and what do they have to do with me?



Mechanical, bottom-up

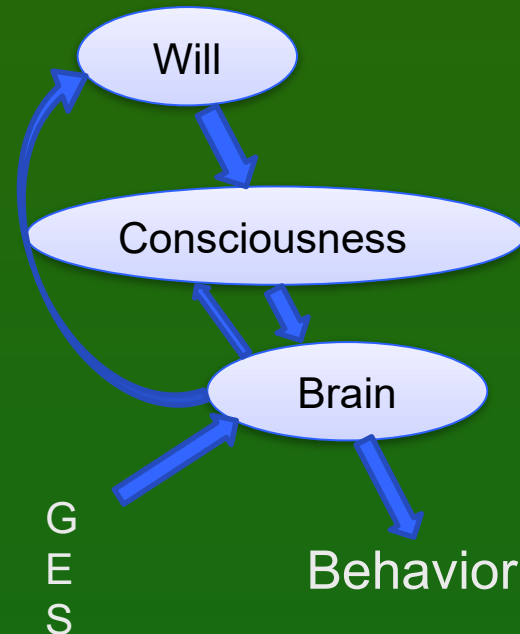
Brains take decisions, some of them are conscious but there is no space for free will, just mechanical action. Consciousness is epiphenomenal, learning about brain's decision but unable to change them.



Reflexive, emergent

Brains make various plans, create protodecisions. Conscious processes in the brain evaluate them from cognitive and emotional perspective, referring to the internalized social norms, personal world view. Conscious processes end with brain's actions in agreement with my will.

Brains provide neural space for mental activity but I cannot be reduced to physical brain.



Personal responsibility



- There is no “self” or ghost in the machine pulling the strings, self is one of many processes that brain is implementing, a small subset of them are conscious (self-reflecting) processes.
- If the brain, not the self is in control then how can I be responsible? In what sense I have a free choice?

Solution: even more responsibility?

- I am the whole person, not just my ego or self, but the brain and the rest of my organism.
- I am responsible for my actions, reactions and intentions, I should learn to “know myself” better.
- We are responsible for the development of our children, setting out good examples and role models.
- Spiritual development is our moral obligation.

"Self" without limits

Decisions are made by the whole brain/organism. I can control my behavior according to my values, but first I should make it conscious = understand myself. Free will (compatibilist style) = conscious control of behavior in accord with acquired beliefs and values.



Environmental relations
Social relations

All processes in the brain
that influence behavior



I =
model of
self

Social, big mind

Self = a complex of brain states & relations between these states. Self has no limits, all processes that are strongly coupled are a part of us.

Educational questions

Khmer Rouge children were given “leadership in torture and executions”, practicing torture on animals. How strong are influences from learned behavioral patterns (neural determinism)? What I can(not) do?

From Greece to China positive and negative behavioral patterns have been provided through legends, dramas and religious stories, helping to learn virtues and values through personifications (arete, persona, bodisatwa), helping in self-regulation of behavior.

Where is the source of values for young generation? Gone with information flood? Where are their role models? Harry Potter?



Self-control



Effective self-control is highly beneficial to individuals and to the society, but it is rather difficult to achieve.

Strong will, perseverance, can be trained as any other personality trait. In the past this was done by physical training, competition, motivation to win social approval.

In ancient Greece the concept of paidea (preserved in encyclopedia”) meant training for liberty (freedom) and nobility (the beautiful), the sum of physical / intellectual achievement to which an individual can aspire.

Self-control ability predicts academic performance better than IQ. Self-control requires mental energy that is limited! Without energy (blood glucose) ability to perform many adaptive behaviors is compromised.

Conspiracy in the brain

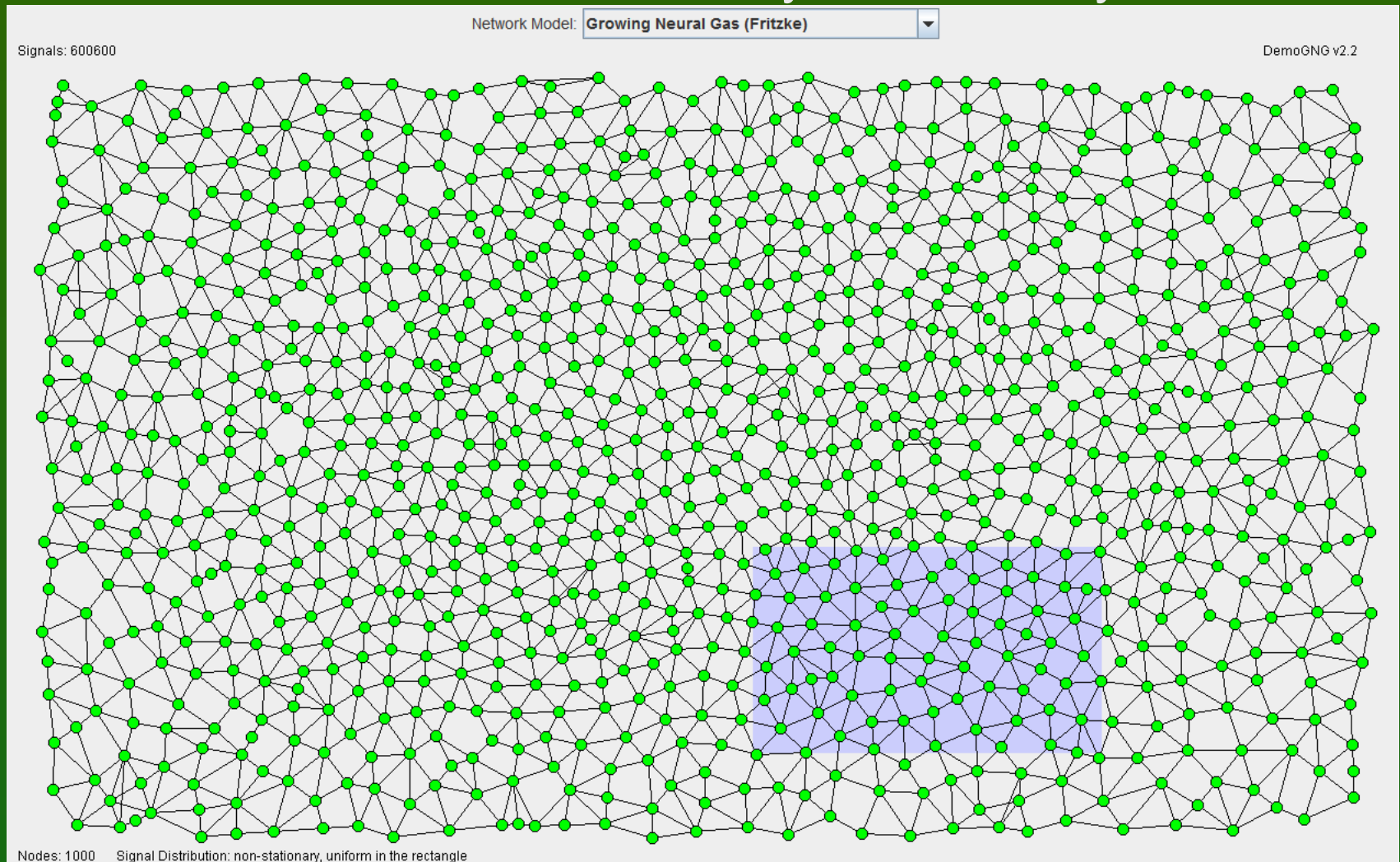


- Emotional situations => neurotransmitters => neuroplasticity => fast learning, must be important.
- Fast learning => high probability of wrong interpretation.
- Traumatic experiences, hopelessness, decrease brain plasticity and leave only strongest association.
- Conspiracy theories form around associations with frozen brain activities, that become strong attractors channeling thoughts.
- Simple associations save brain energy and rational arguments cannot change them.
- This explanation becomes so obviously obvious ...



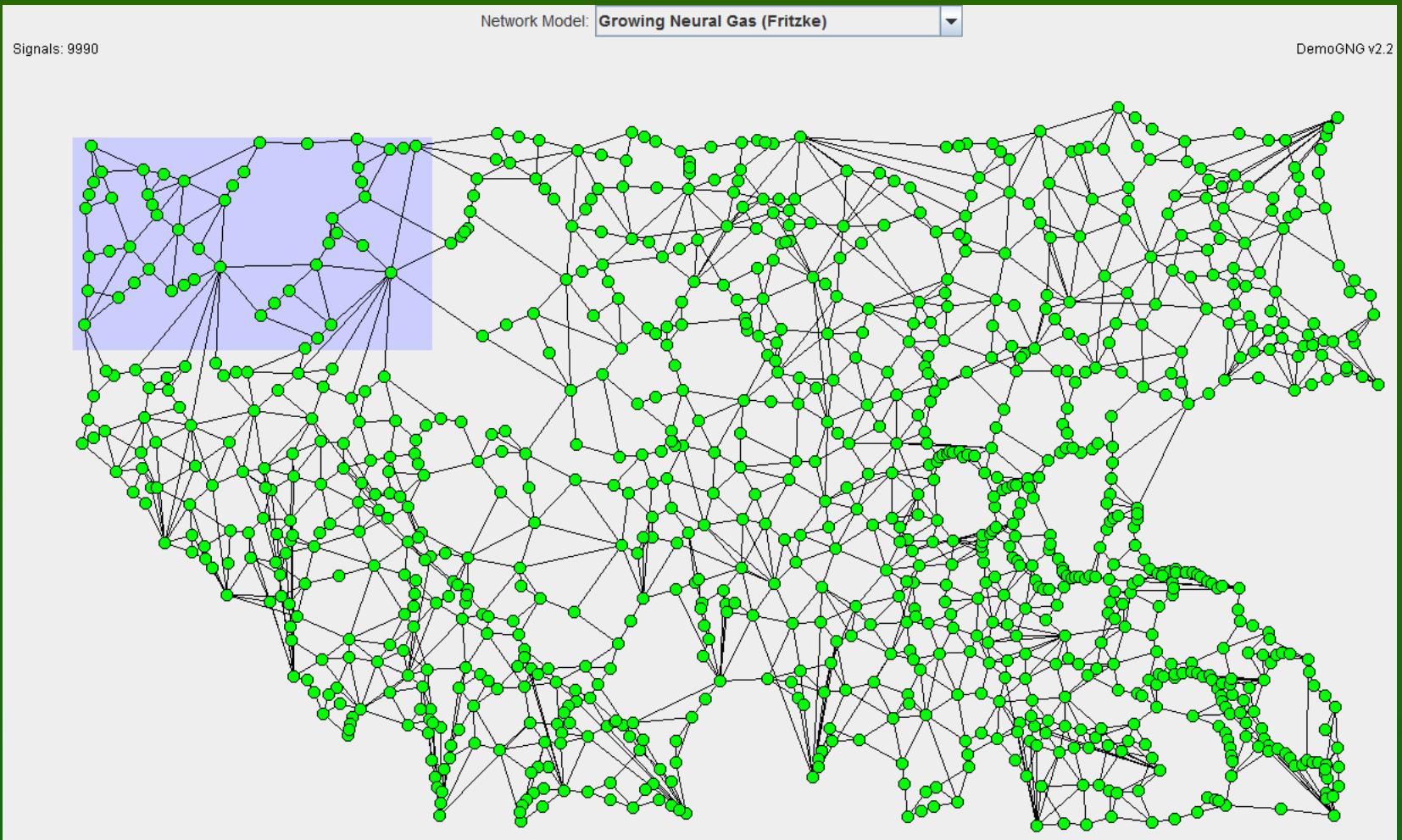
Internalization of environment

Episodes are remembered and serve as reference points, if observations are unbiased they reflect reality.



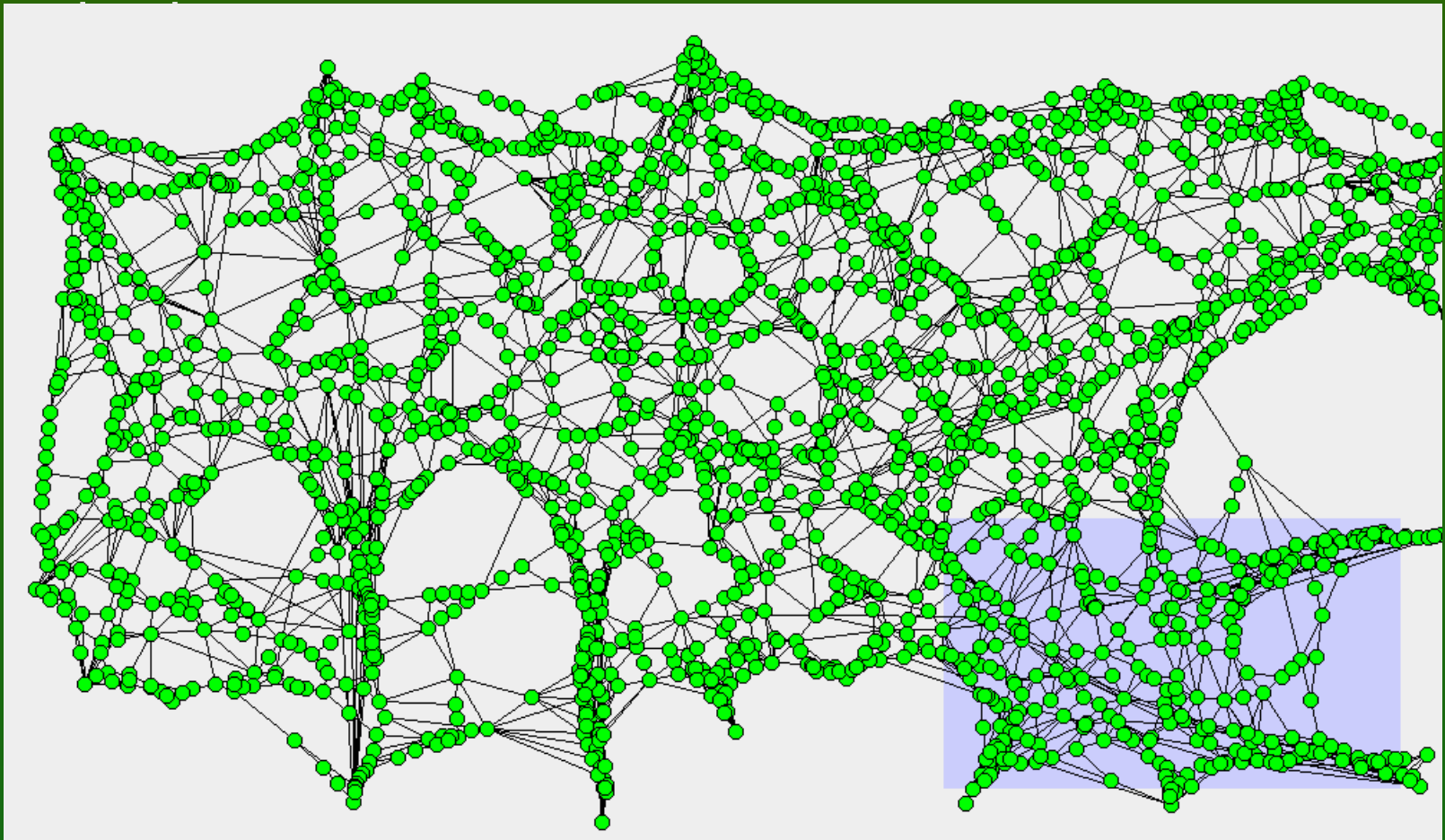
Extreme plasticity

Brain plasticity (learning) is increased if strong emotions are involved. Followed by depressive mood it leads to severe distortions, false associations, simplistic understanding.



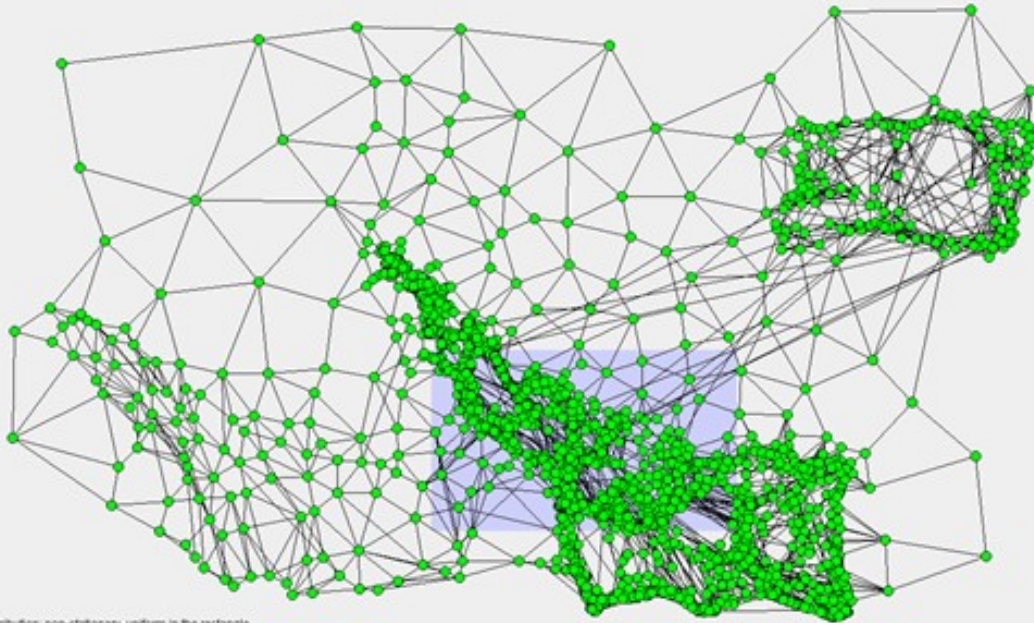
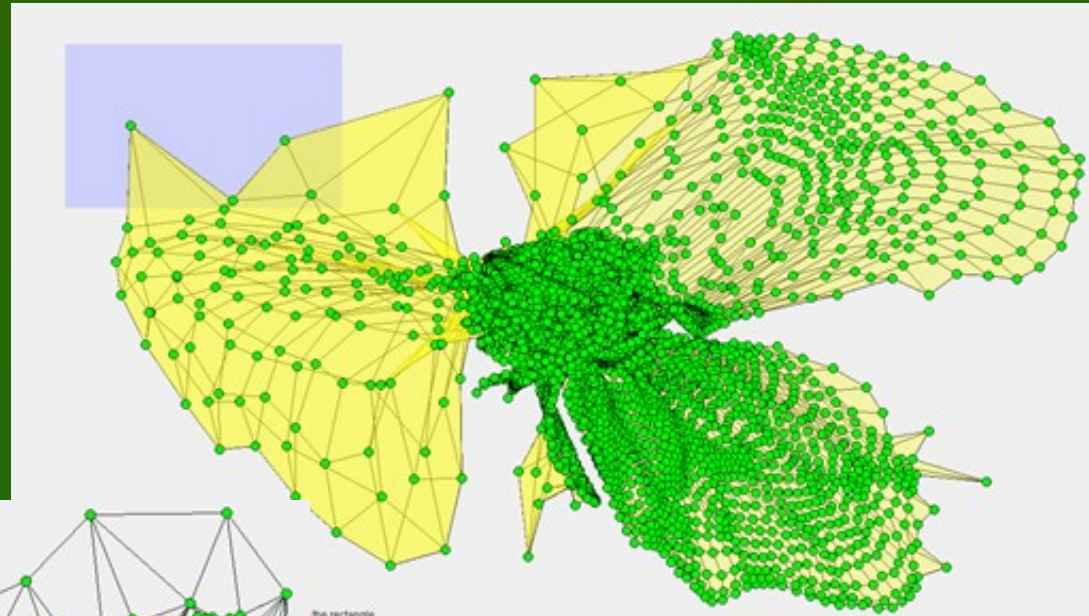
Conspiracy views

Illuminati, masons, Jews, UFOs, or twisted view of the world leaves big holes and admits simple explanations that save mental energy, creating „sinks” that attract many unrelated.



Memoids ...

Totally distorted world
view, mind changed
into a memplex ...
Ready for sacrifice.



the rectangle

Cognitivist Autumn in Toruń 2010

MIRROR NEURONS:

from action to empathy

April, 14-16 2010 Torun, Poland

Cognitivist Autumn in Toruń 2011

PHANTOMOLOGY:

the virtual reality of the body

2011 Torun, Poland



COGNITIVIST
AUTUMN IN
TORUŃ



Homo communicativus 2013
Neurohistory of art 2014,

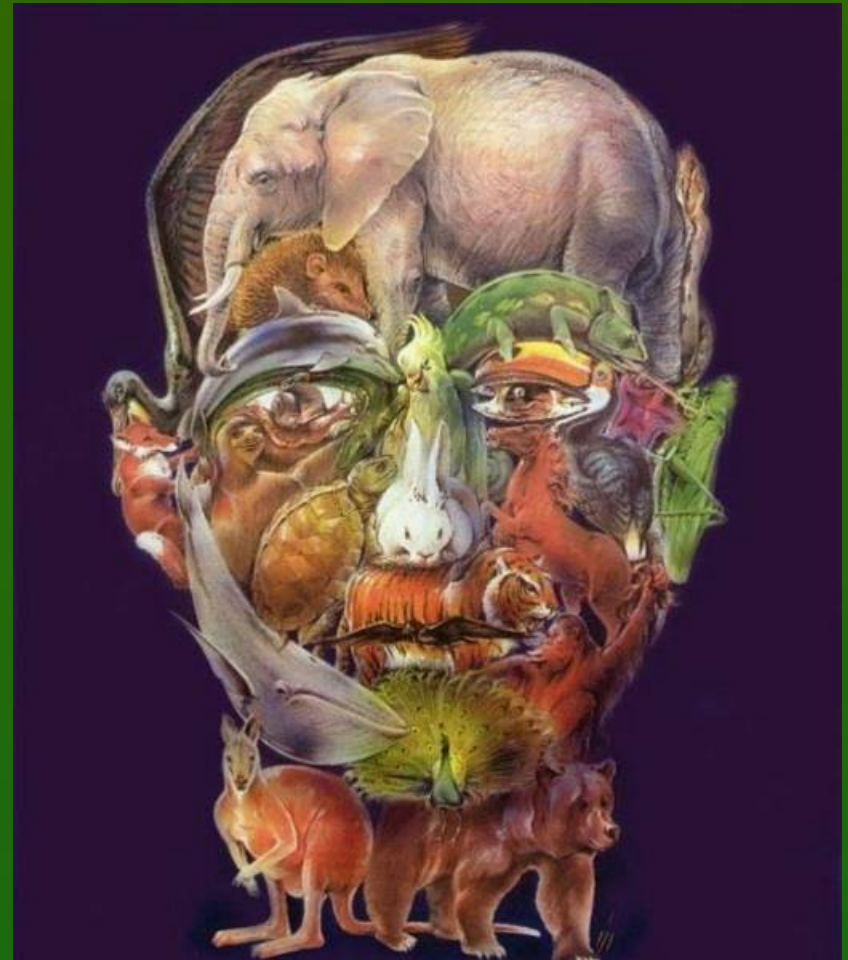
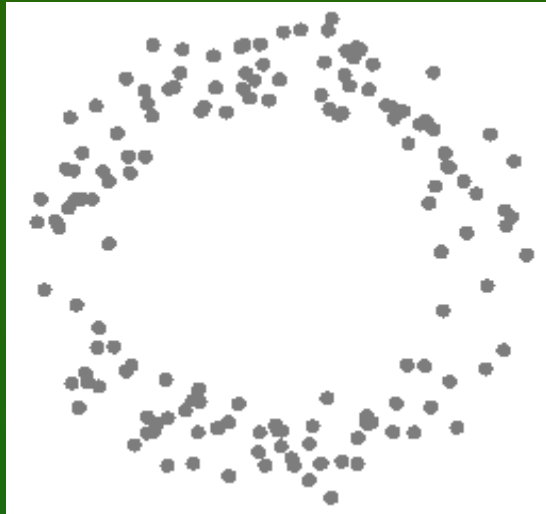
Trends in interdisciplinary
studies 2015.

Neuromania 2013-15

Umysł-Decyzje-Zachowania

<http://www.kognitywistyka.umk.pl>

Thank you for
synchronizing your
neurons!



Google: W. Duch
=> lectures, talks, papers ...