

Dialectic Neuroscience: Principles of Centralized Dialectics and Their Application to Psychiatric Disorders

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Centralized Dialectics & Dialectic Neuroscience

My invention

- ▶ (1) **Centralized dialectics** is a “new” form of dialectics, which can be applied to decipher a wide range of complicated problems, such as psychiatry (Current Psychology 2025).
- ▶ (2) **Dialectic Neuroscience** is the application of centralized dialectics to brain science issues, e.g. , major depressive disorder (MDD), bipolar disorder (BD), autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), and obsessive-compulsive disorder (OCD; MDD & ASD parts published).
- ▶ In contrast to today’s dominant computational trend without proper guiding hypothesis

What are the neural abnormalities underlying a (or any) psychiatric disorder?

Applying various paradigms in neuroimaging research almost invariably reveals brain abnormalities across broad domains such as attention, working memory, emotion, executive function, reward processing, learning, inhibition, memory, social cognition, and so on.

Too complicated — impossible to make sense of the messy results.



How could that happen — abnormalities in nearly every system?





I give up — let's leave the difficult results to machine learning/AI.



Becoming a dominant engineering trend in psychiatric brain research.



No big deal — let's tackle the complexity through centralized dialectics.



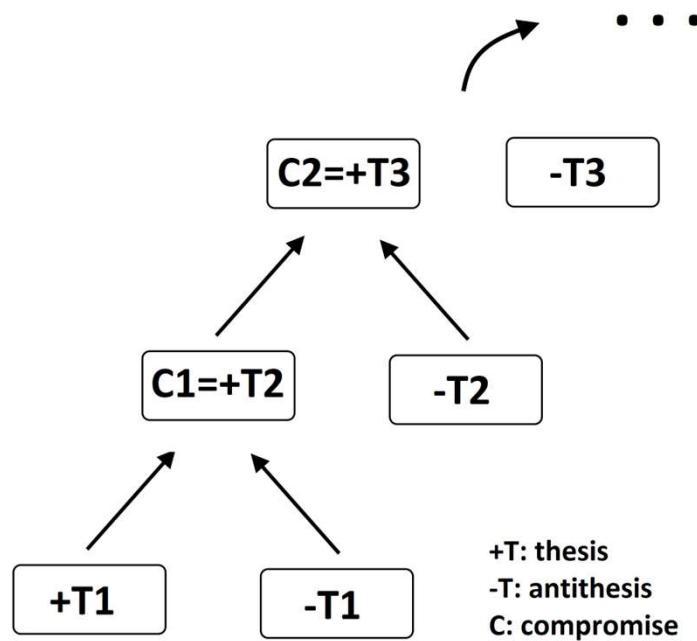
Applying dialectic neuroscience to pinpoint the core neuropathology.

A novel form of dialectics informed by psychiatry and brain science: centralized dialectics

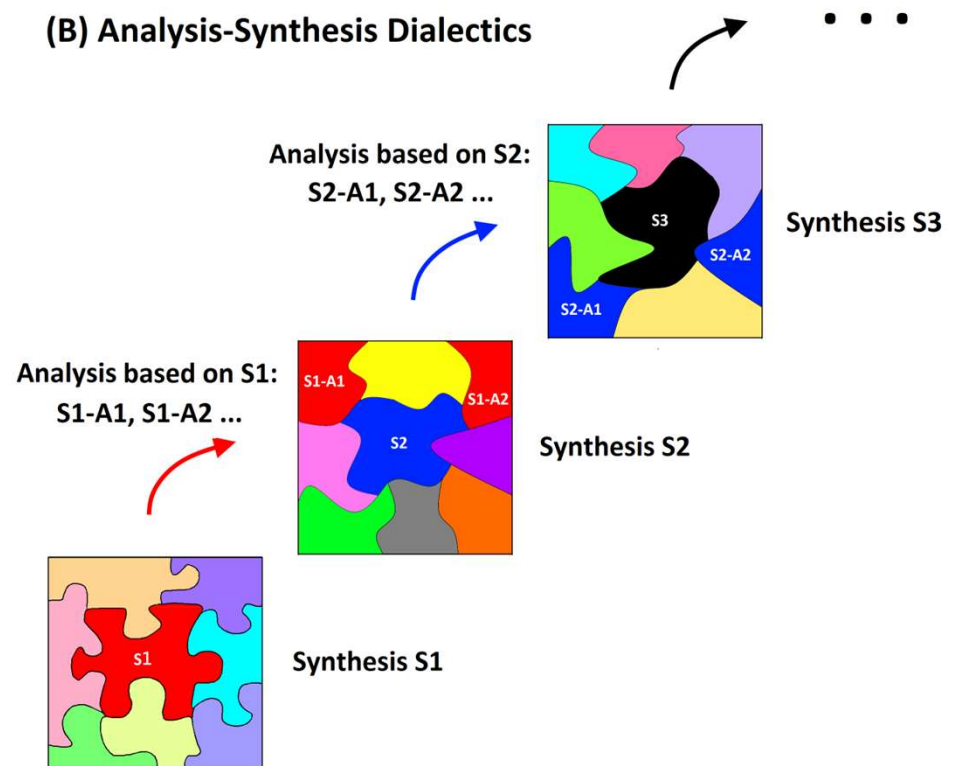
Current Psychology

<https://doi.org/10.1007/s12144-025-07481-z>

(A) Thesis-Antithesis Dialectics



(B) Analysis-Synthesis Dialectics




Examples of the disciplines heavily relying on centralized dialectics (they may be not aware of it)

- ▶ Archeology and anthropology: Archeologists and anthropologists always take the synthetic attitude to integrate relics, literature, ecofact, landscape, and architect together (analyses) to reconstruct history and to build up theory (synthesis).
- ▶ Ancient history reconstruction: Similar to the above, historians deduce what occurred (synthesis) by examining fragmented literature records and excavated material evidence (analyses) from ancient periods. It's another example of analysis–synthesis process (e.g., The Mysteries of Qin Dynasty).
- ▶ Forensics: The forensic officers collected and analyzed the evidence and micro-evidence (analyses). However, only a synthetic attitude may integrate all the pieces of information together to reconstruct what could happen at the crime scene and who the suspect is (also detective movie ...).
- ▶ Cosmology: The origin of the cosmos is a hot topic in physics. Even though it might have happened 13.8 billion years ago, the **Big Bang theory** was raised based on the observation of redshift that was correlated with distance. The dialectic process has repeated itself several times to sophisticate and perfect the Big Bang theory. The validity lies in its plausibility (based on physics laws) and ample accountability (**abundance of light elements, the radial velocity of extra-galactic nebulae, cosmic microwave background, redshift, and so on**).

Modern Physics

- ▶ The theory of **special relativity**: In the late 19th century, **Maxwell's equations** showed that **light travels at a constant speed**, independent of the observer. However, this contradicts classical mechanics based on **Newton's laws of motion**, which predicts that the measured speed of light should differ between observers in relative motion. In 1905, Albert Einstein resolved this conflict with special relativity by abandoning absolute space and time and postulating that the speed of light is invariant in all inertial frames. This leads to the Lorentz transformation, under which electromagnetism remains valid, and classical mechanics becomes a low-velocity approximation.
- ▶ The theory of **general relativity**: While Isaac **Newton's theory of gravity** successfully explained the motion of celestial bodies, it could not account for **gravitational lensing**, where the gravitational field of a massive object, such as a star, bends the path of nearby light rays. Albert Einstein's theory of general relativity not only refined Newton's theory but also explained gravitational lensing, showing that gravitational effects arise from the curvature of spacetime. In this example, the analytic facts are Newton's theory of gravity, **special relativity**, and the phenomenon of gravitational lensing, whereas the synthetic result is the theory of general relativity. It demonstrates the process of dialectical synthesis, where the integration of the old theory with new observations creates a novel theory capable of explaining a broader range of phenomena and offering a more comprehensive understanding of the underlying physical laws.
- ▶ The discovery of the **Higgs boson**: For a long time, physicists had been working on the **Standard Model**, which explained the fundamental particles and forces in the universe (analysis). However, a major limitation of the Standard Model was its inability to explain the **origin of particle masses**. Through the observation of **Cooper pairs** in the superconducting state, it was discovered that photons could acquire mass, leading to the suppression of their emission and the conservation of energy (analysis). In the 1960s, physicist Peter Higgs proposed a new theory that hypothesized the existence of a particle, now known as the Higgs boson, which was responsible for giving other particles their masses (synthesis). This theory, known as the Higgs mechanism, was eventually confirmed in 2012 with the discovery of the Higgs boson at CERN's Large Hadron Collider.

- ▶ Prediction of **neutrinos**: Early experiments on **beta radioactive decay** observed that **energy and angular momentum did not appear to be conserved** (analyses). Physicists at the time were reluctant to postulate the existence of a new particle to explain this phenomenon. To resolve this issue, Wolfgang Pauli hypothesized the existence of neutrinos, suggesting that in the process of beta decay, an electrically neutral and nearly massless particle, called the neutrino, is emitted along with the beta particle (synthesis). According to Pauli's neutrino hypothesis, these neutrinos carry away a portion of the energy and angular momentum, thereby ensuring the conservation in the beta decay process (synthetic explanation).
- ▶ **Quantum mechanics**: In the early 1900s, scientists attempted to understand the fundamental nature of light. They discovered that light exhibited both **wave and particle properties**, which contradicted the **classical physics theories** of the time (analyses). To resolve this contradiction, physicists like Max Planck and Niels Bohr proposed revolutionary ideas that unified the wave and particle characteristics of light (synthesis), laying the foundation for quantum mechanics.
- ▶ Theory of **quantum turbulence**: In the past, quantum mechanics failed to account for the peculiar behavior of **liquid helium** when subjected to **low temperatures**. As per **classical statistical mechanics**, the liquid was assumed to solidify and lose its ability to flow when the temperature approached absolute zero (analyses). However, experiments showed that liquid helium exhibited an exceptional phenomenon known as **superfluidity** and could still flow at extremely low temperatures (analysis). Theoretical physicists reconciled the contradiction by introducing the concept of quantum turbulence. As per this theory, superfluidity occurs due to microscopic turbulent motions in liquid helium induced by quantum effects (synthesis). This microscopic turbulence disturbs the ordered lattice structure, facilitating the liquid to flow smoothly without solidifying.



Two Big Questions: (1) How can modern physics harness **creative & nonlinear thinking** in scientific exploration while **preserving scientific rigor**?
(2) Is it feasible that brain science apply similar strategies to address its own unique challenges, e.g., unraveling the mystery of psychiatry?

This work is situated in the philosophy of science and offers potential to complement existing scientific standards for **grounded theory development**, especially in domains where mathematics is not the primary focus.

Let's have some bird view and review



**Tendency of being
Analytical and Zoom in**

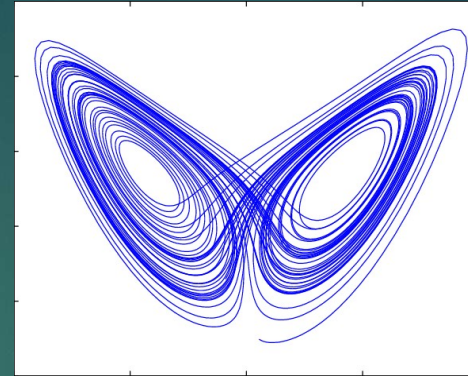
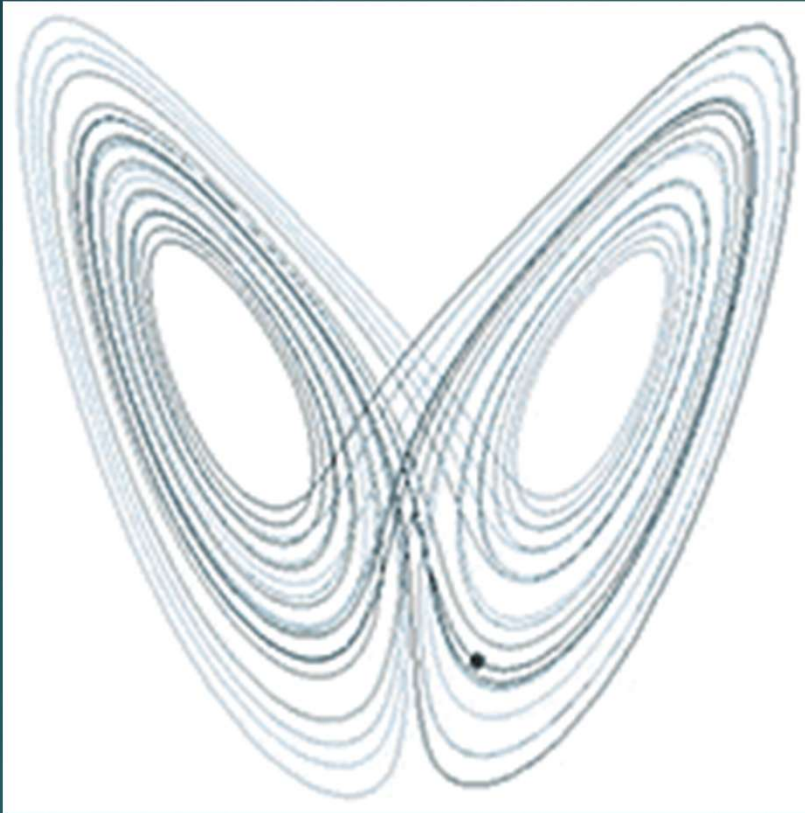


爱给

A thought experiment: Starting from operational definition of **bad luck**



It is broadly acknowledged that MDD is a complex psychiatric condition, with its lifetime prevalence reaching 7 to 21% => **something unusual**



$$\begin{aligned}\frac{dx}{dt} &= \sigma(y - x), \\ \frac{dy}{dt} &= x(\rho - z) - y, \\ \frac{dz}{dt} &= xy - \beta z.\end{aligned}$$

Duality: coexistence of complicatedness and simplicity are two sides of the same coin, from Newtonian mechanics to complexity system; from DNA nucleotide bases (A, T, G, C) to standard amino acids, among many others.

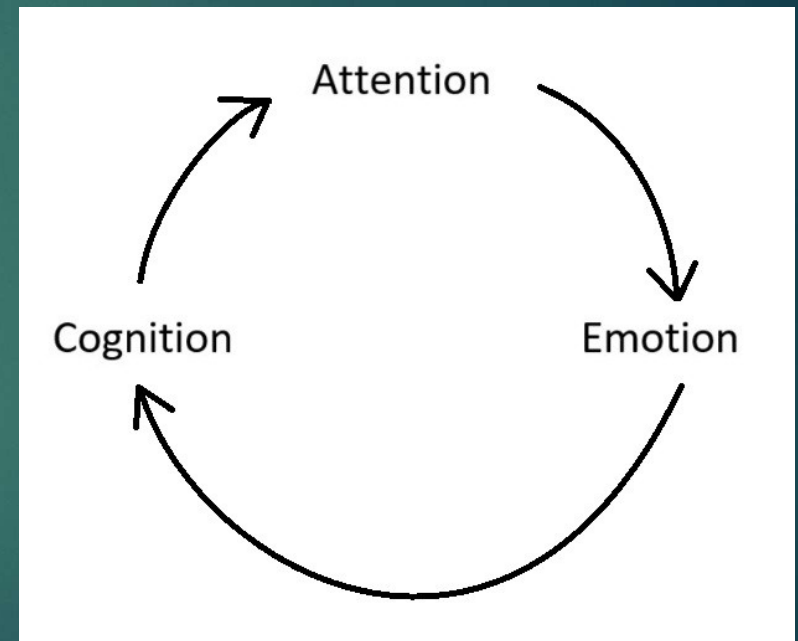
A demonstration of an inappropriate and superficial integration

Taking major depression as an example

Emotion -> Cognition -> Attention

Cognition -> Attention -> Emotion

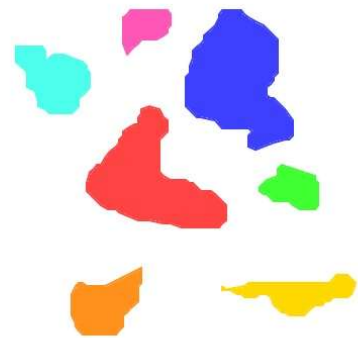
Attention -> Emotion -> Cognition



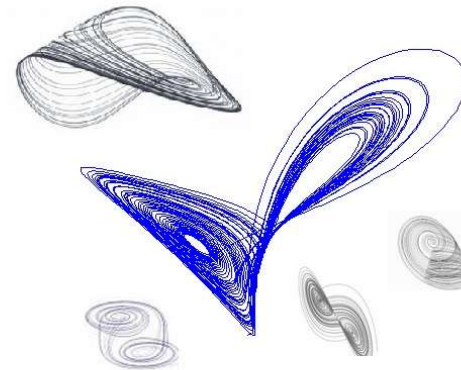
mental state, psychological function



psychological primitives



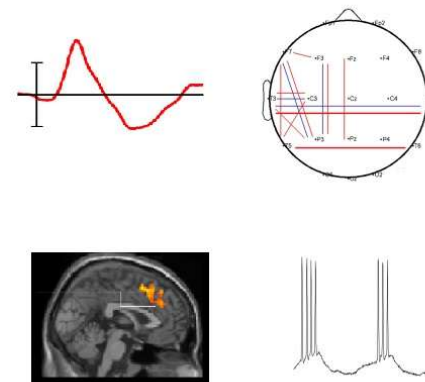
virtual brain space



EIB-OA



neural features



Emotion research
Animal (K-III)
SVM of fMRI
Spatial neglect

Analytical
Complicatedness
Zoom in
Virtual

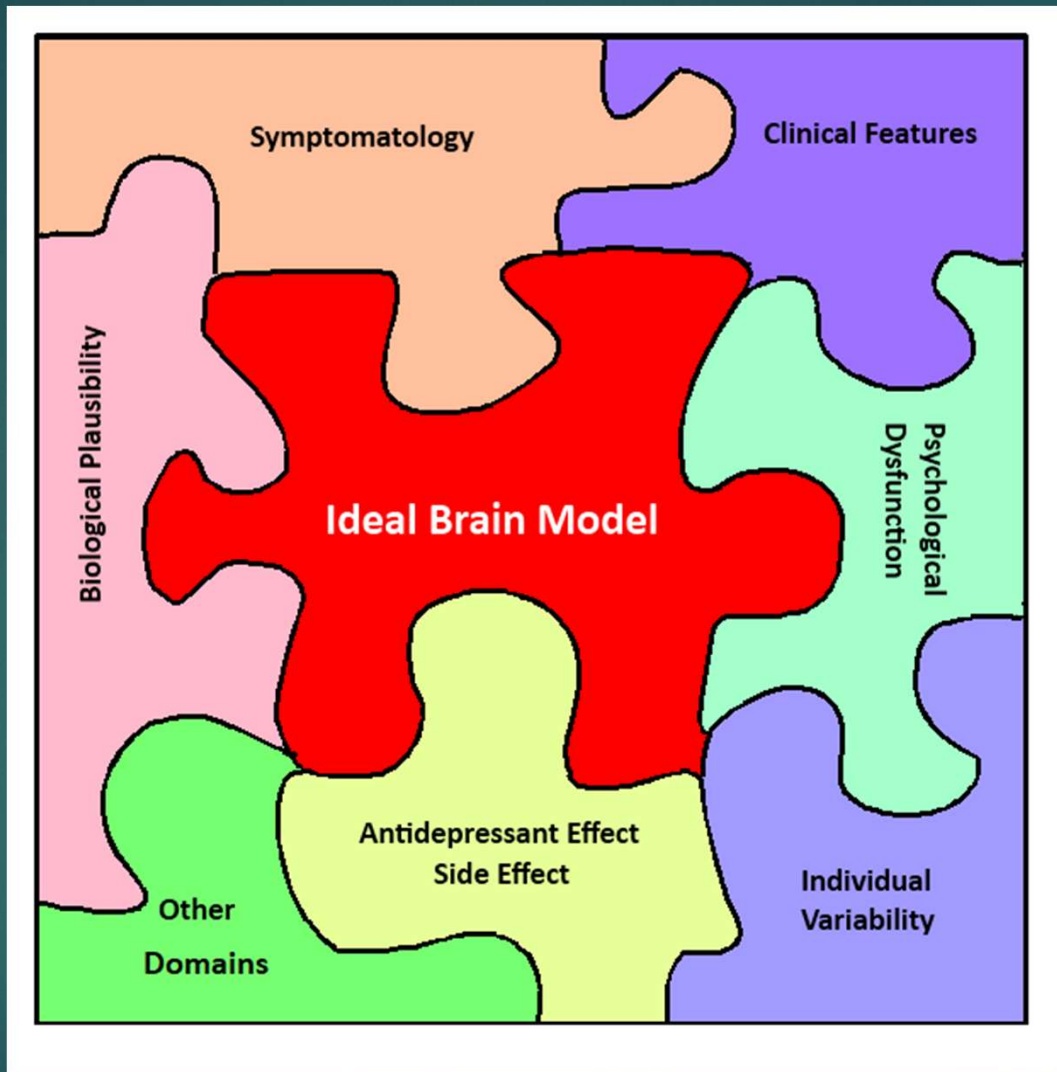
Good news: previous efforts are not futile. The more we have clarified the complexity side, the more hints we now have about what the simplicity side should look like.



The real question is: how can prior research be leveraged to disclose the other side of the same coin?

The key lies in **bracketing (epoché)** and **re-interpretation**.

Note: in phenomenology (Edmund Husserl), epoché means **suspending** preconceptions to observe experience in its pure form.



Form and Bayesian (probability)

Form in Theory Building in Dialectic Neuroscience

- ▶ **Introduction:** a broad review (clinical, brain science and neurophysiological understanding)
- ▶ **Methods and Materials:** two phases (see next slide)
- ▶ **Results:** two phases (see next slide)
- ▶ **Discussion:** elaborate on how the proposed theory may account for the cardinal features of the target issue

Take MDD as an example

Methods/Materials section

Results section

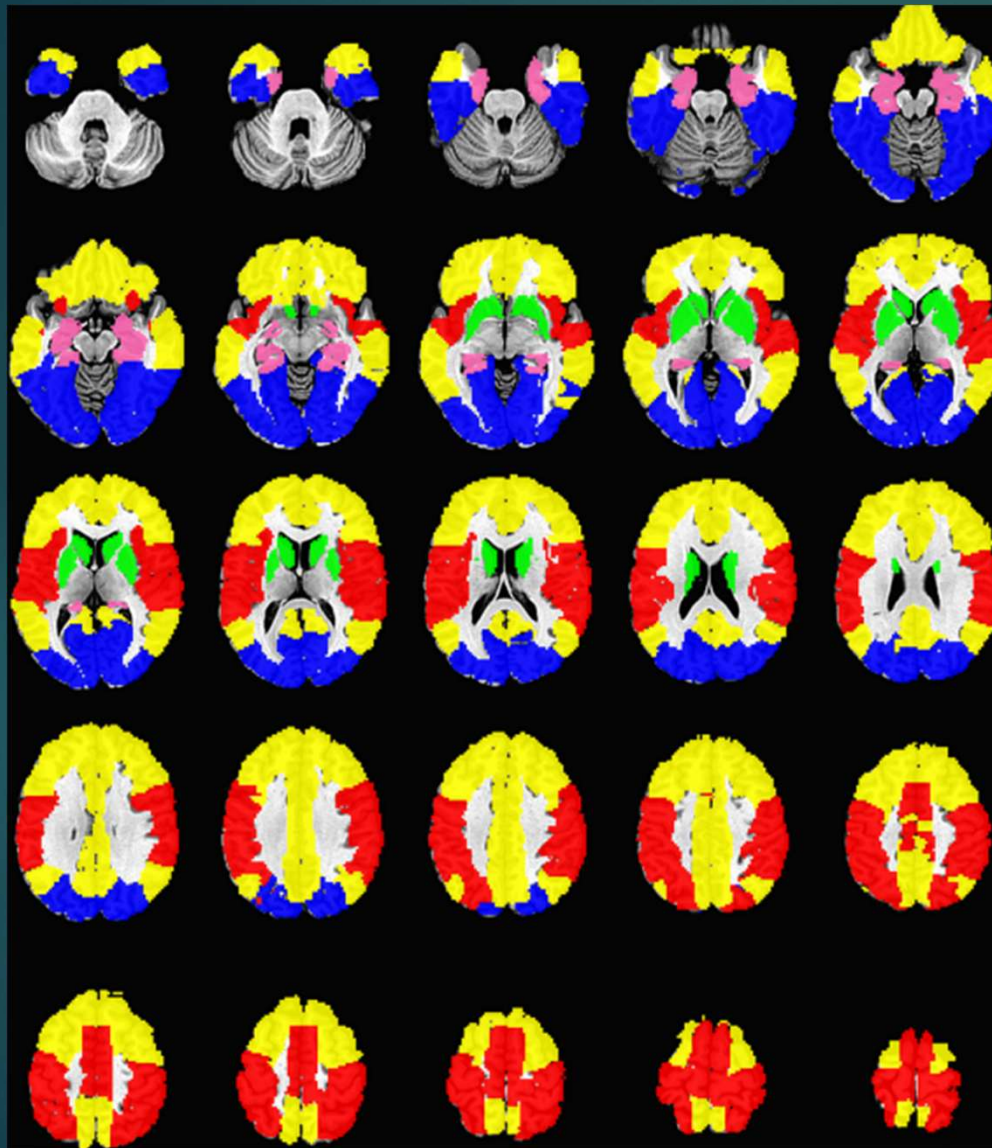
Phase I:
Summarized
knowledge

Phase II:
Cardinal features of
the target issue

Phase I:
Synthesized theory or
solution (**plausibility
and parsimony**)

Phase II:
How the synthetic
theory may explain
the cardinal features
(**accountability**)



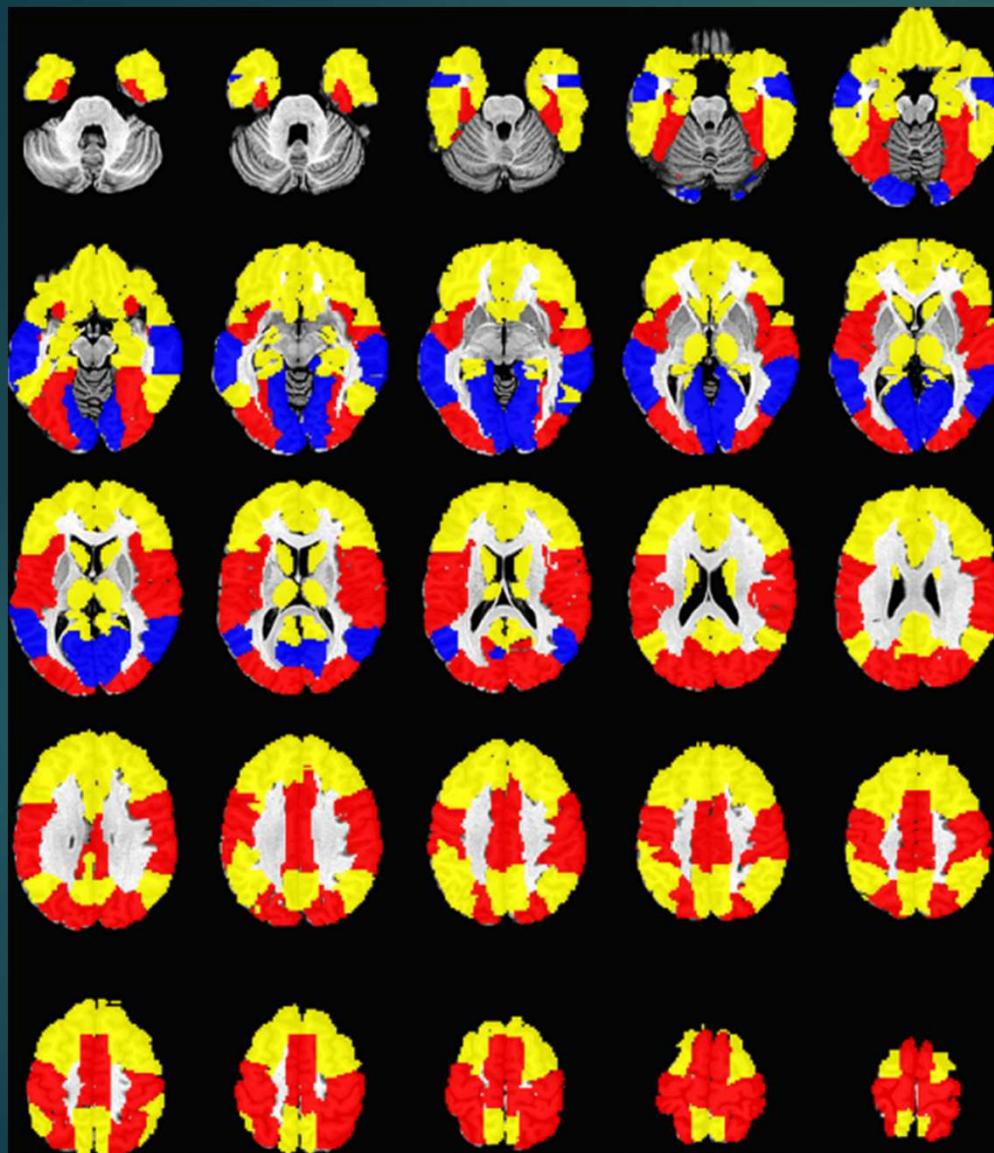


Neural Pattern 1:

Blue: visual associative areas;
Red: sensory–motor regions;
Green: basal ganglia;
Pink: temporal limbic regions;
Yellow: midline and default mode structures.

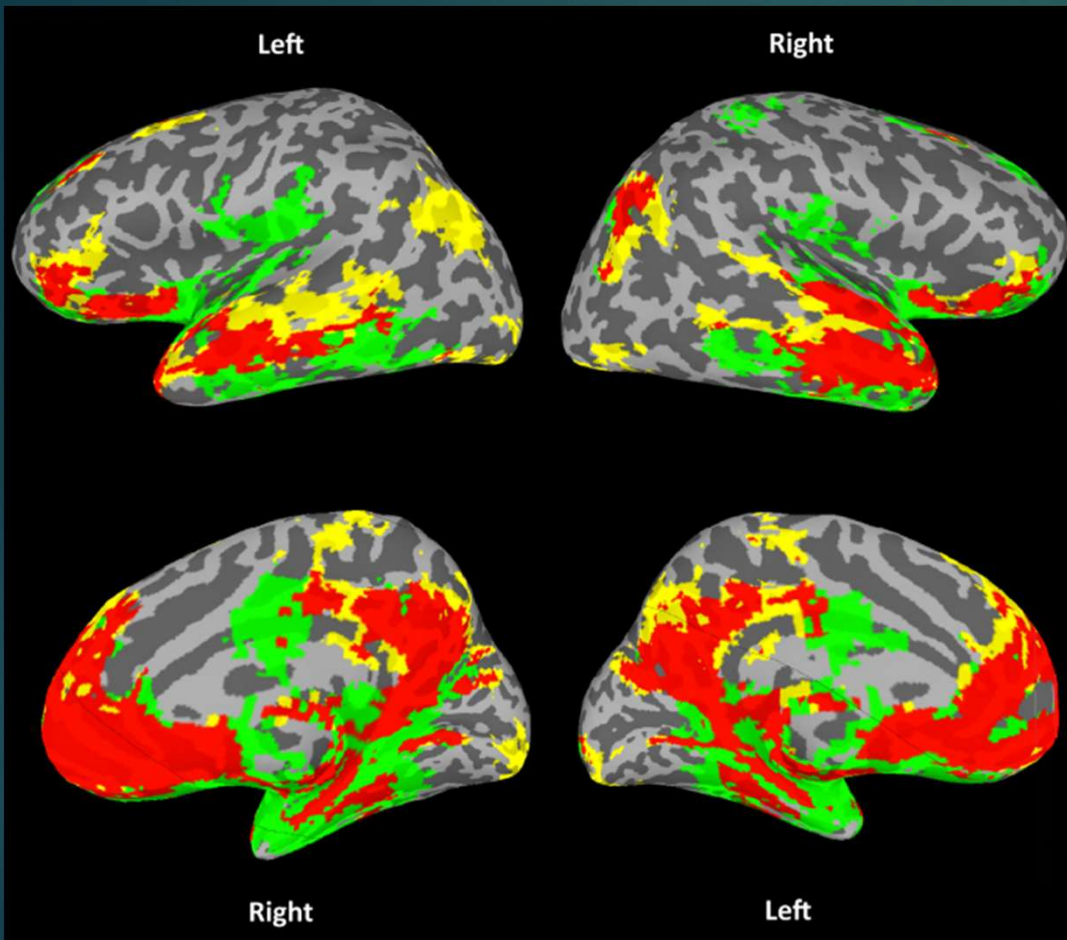
Full connectivity was set as the property to define thresholds of the adjacency matrix.

Resting network is composed of more than one neural pattern: An fMRI study, 2014.

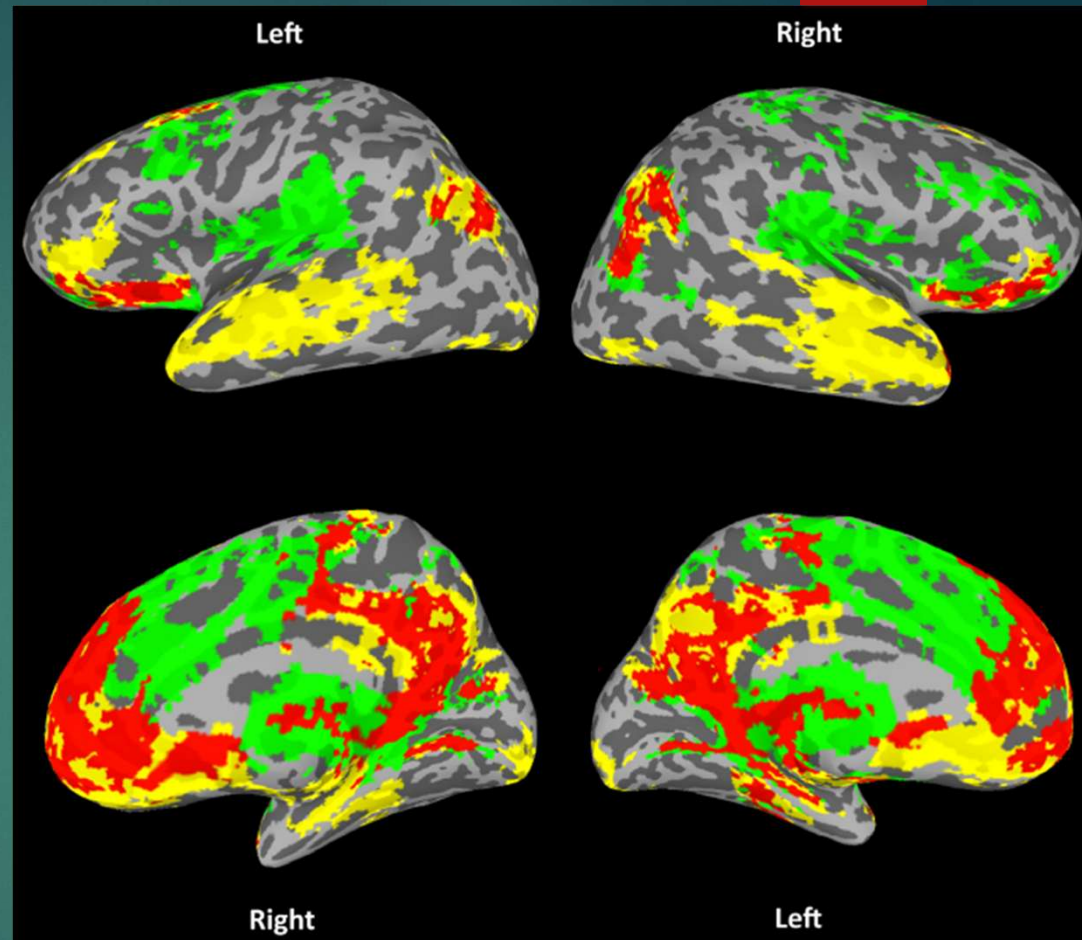


Neural Pattern 2: The two modules were color-coded in yellow and red, and their overlapped regions are indicated by blue color (They are partly overlapped at calcarine, lingual and middle temporal cortices).

This is the first resting-state fMRI study providing empirical evidence for these two neural entities. Please note that this work was conducted in a “task-negative” condition (resting state).



Hippocampus- vs PCC-seeded (Red: conjunction)



Thalamus- vs PCC-seeded (Red: conjunction)

Functional connectivity maps based on hippocampal and thalamic dynamics may account for the default-mode network, 2018. (PCC: posterior cingulate cortex; DMN: default-mode network)

Cognitive evaluation may attenuate emotional response

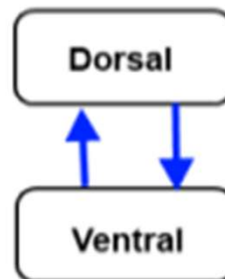
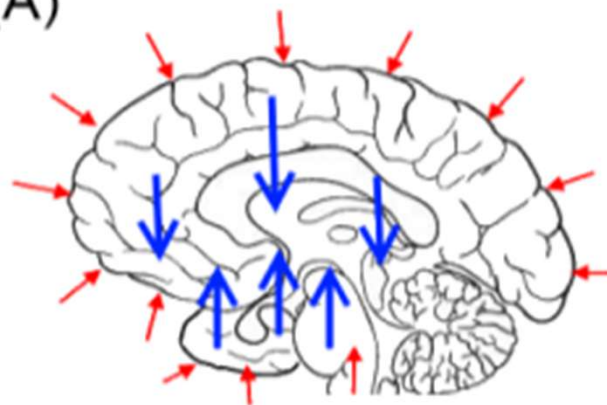
- ▶ Simple affect labeling of viewed emotional material reduces amygdala activation and skin conductance (Hirari et al., 2000).
- ▶ Rating the subjective pleasantness/unpleasantness of emotionally salient stimuli down-regulates neural activity in the insula and amygdala (Taylor et al., 2003).
- ▶ The absolute magnitude of judged emotional intensity correlates positively with dorsolateral/medial prefrontal (PFC), and anterior/middle cingulate activities (ACC/MCC), but negatively with amygdala and medial temporal lobe activity (Posner et al., 2009).

Automatic interaction between cognition and emotion networks

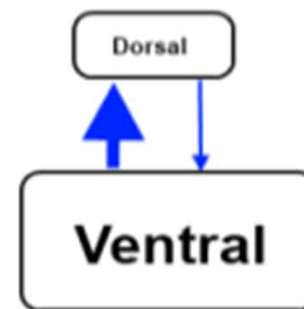
Emotional engagement may interfere with cognitive processing

- ▶ Emotional distractors during working memory tasks activate ventral affective circuits (amygdala, vIPFC) while suppressing dorsal working-memory circuits (dlPFC, parietal), impairing cognitive performance (Dolcos & McCarthy, 2006; Krause-Utz et al., 2012).
- ▶ Emotional Stroop: emotionally salient words slow responses compared to neutral words (Dresler et al., 2009).
- ▶ Emotional priming can attenuate neural activity in regions including PFC, insula, and cingulate gyrus during cognitive control tasks (Hart et al., 2010).

(A)

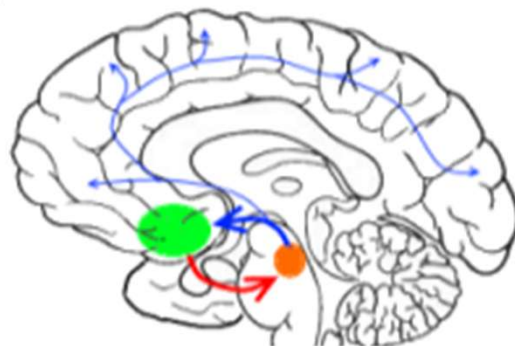


Homeostasis



Depression

(B)



Methods/Materials section

Results section

Phase I:

Summarized
knowledge

Phase I:

Synthesized theory or
solution (**plausibility
and parsimony**)

Phase II:

Cardinal features of
the target issue

Phase II:

How the synthetic
theory may explain
the cardinal features
(**accountability**)



How to ensure rigor of guiding theory development using dialectic neuroscience (in non-mathematical scenarios)?

Apply centralized dialectics to non-mathematical contexts: **conceptually Bayesian** (posterior probability): M is model (**central missing piece**), O is observation set (**peripheral pieces of evidence**).

$$P(M_i|O) = P(O|M_i) \cdot \frac{P(M_i)}{P(O)}$$

penalty term (determined by set size of M_i)

Rationality/plausibility: $P(M_i)$

Accountability or explanatory power: $P(O|M_i)$

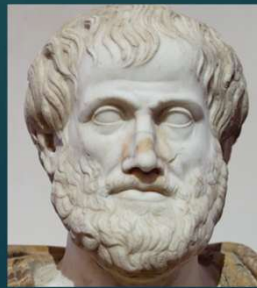
Parsimony/regularization: the number of i ; **O: complexity, M: simplicity**

Based on **Fisher's combined probability test** (a meta-analysis, 1925), the likelihood of all 5 observations ($p=0.05$) being contemporaneously valid by chance in a single study is approximately 0.001 (*chi-square* = 29.96, *d.f.* = 10).

The scale to evaluate the performance of a synthetic model: 1–2 explained observations is poor, 3–4 is fair, 5–7 is good, 8–10 is very good, and >10 is excellent.

Using a structured form, the quality of a synthesis can be evaluated, and it also facilitates communication within the scientific community (novel variant of review/hypothesis article): **two phases in Methods and in Results sections.**

The power of form was addressed by Aristotle 2400 years ago, e.g., form and epistemology. With **Form and Bayesian**, all 4 pitfalls introduced earlier are addressed.



A novel form of dialectics informed by psychiatry and brain science: centralized dialectics

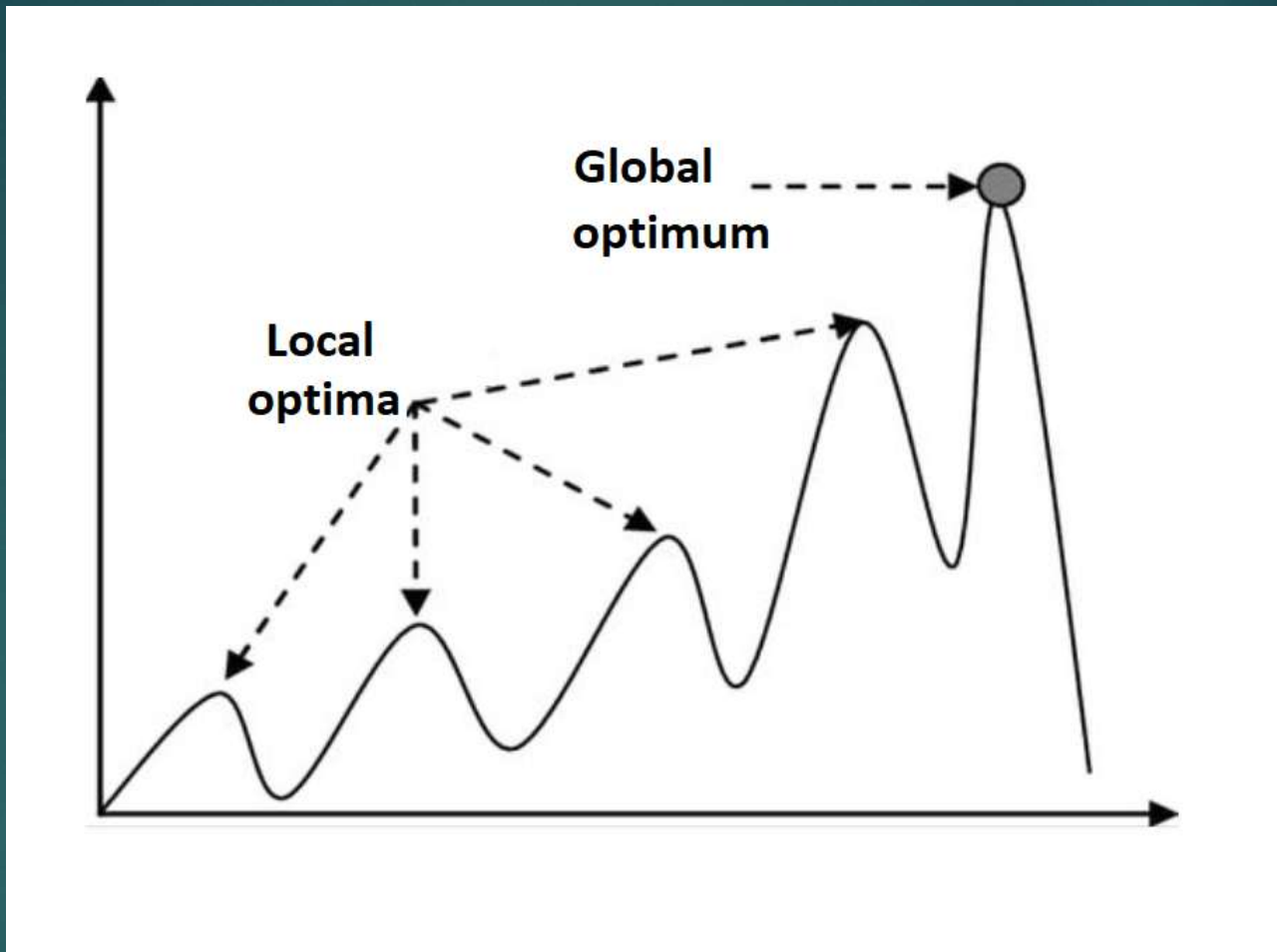
Current Psychology

<https://doi.org/10.1007/s12144-025-07481-z>

This work is situated in the philosophy of science and offers potential to complement existing scientific standards for **grounded theory development**, especially in domains where mathematics is not the primary focus.

Albert Einstein: "The significant problems we have cannot be solved at the same level of thinking (with which we created them)."

F. Scott Fitzgerald: "The test of a first-rate intelligence is the ability to hold two opposed ideas in mind at the same time and still retain the ability to function."



Facing the machine-learning and AI era

Debate resolving process ...



Hegel's thesis vs anti-thesis

Compromise may not come from true resolution and sometimes can be determined or biased by hierarchy, attitude, or personal interests.



Hand out respective synthesis

Committee may vote on which synthesis makes more sense, assign confidence score (probability) to each explained features then get summative index, or even decline both.

Summary of the core neuropathology of several major psychiatric disorders derived from dialectic neuroscience

- ▶ (1) A **compartment-level imbalance** between the fronto-parietal and the limbic systems as the core neuropathology of MDD.
- ▶ (2) **Overactive ventral tegmental area (VTA)** as the core neuropathology of BD.
- ▶ (3) **Left frontal lobe** developmental deviation is derived as the core neuropathology of ASD (**lobar disorder**, like compartment-level disorder MDD).
- ▶ (4) Miswiring of the **prefrontal cortex to the caudate/putamen** as the core neuropathology of OCD (**subsequent dysregulated influence from the limbic system**, especially insula and OFC).
- ▶ (5) Miswiring of the **prefrontal cortex with the ventral tegmental area** as the core neuropathology of ADHD (**subsequent neural cascade to influence nucleus accumbens**).

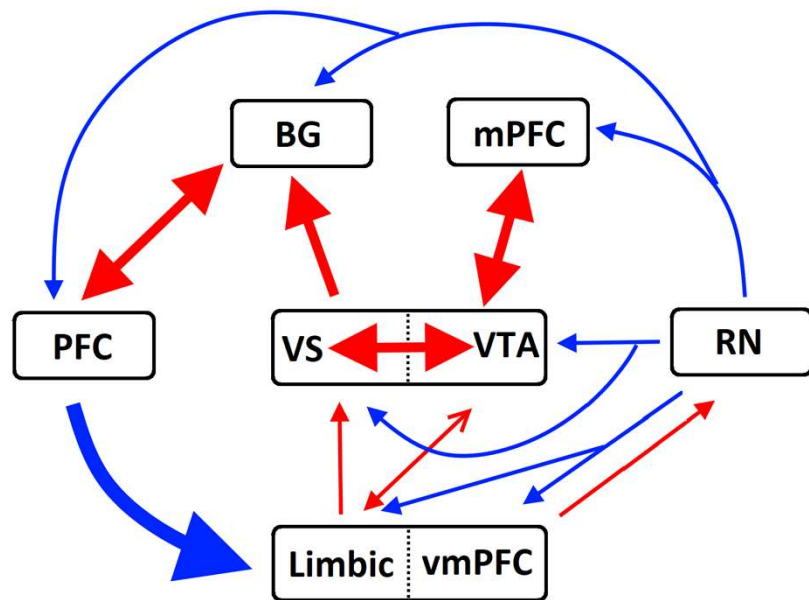
Next Step: provides empirical evidence/support

VTA as the Core Pathophysiological Hub of Bipolar Disorder

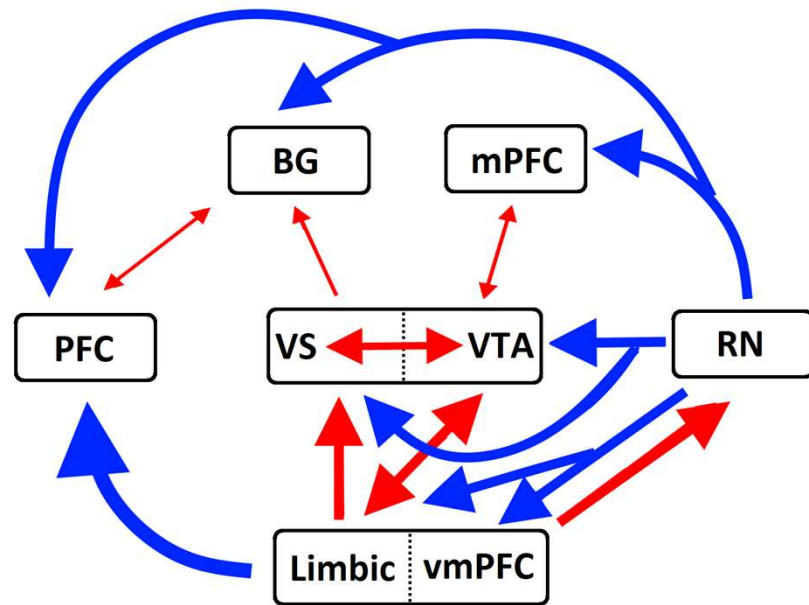
From a brain science perspective, the complicated manifestations of BD can be distilled into several key features. Consistent findings include:

- (1) a hyperdopaminergic state, reflected in abnormal reward processing, along with bipolarity;
- (2) in euthymic and depressive states, limbic hyperactivity and hypofrontality;
- (3) in the manic state, enhanced activity in the basal ganglia and prefrontal cortex;
- (4) mood stabilizers as the first-line treatment, which may attenuate neural firing;
- (5) many others, such as mixed type, etc.

Brain science literature of BD appears highly complex and spans broad brain regions. If we approach it from a purely psychological paradigm or an engineering perspective, a coherent solution is unlikely to emerge. Most psychological paradigms reveal abnormalities—whether in attention, executive control, working memory, reward processing, or emotional processing.



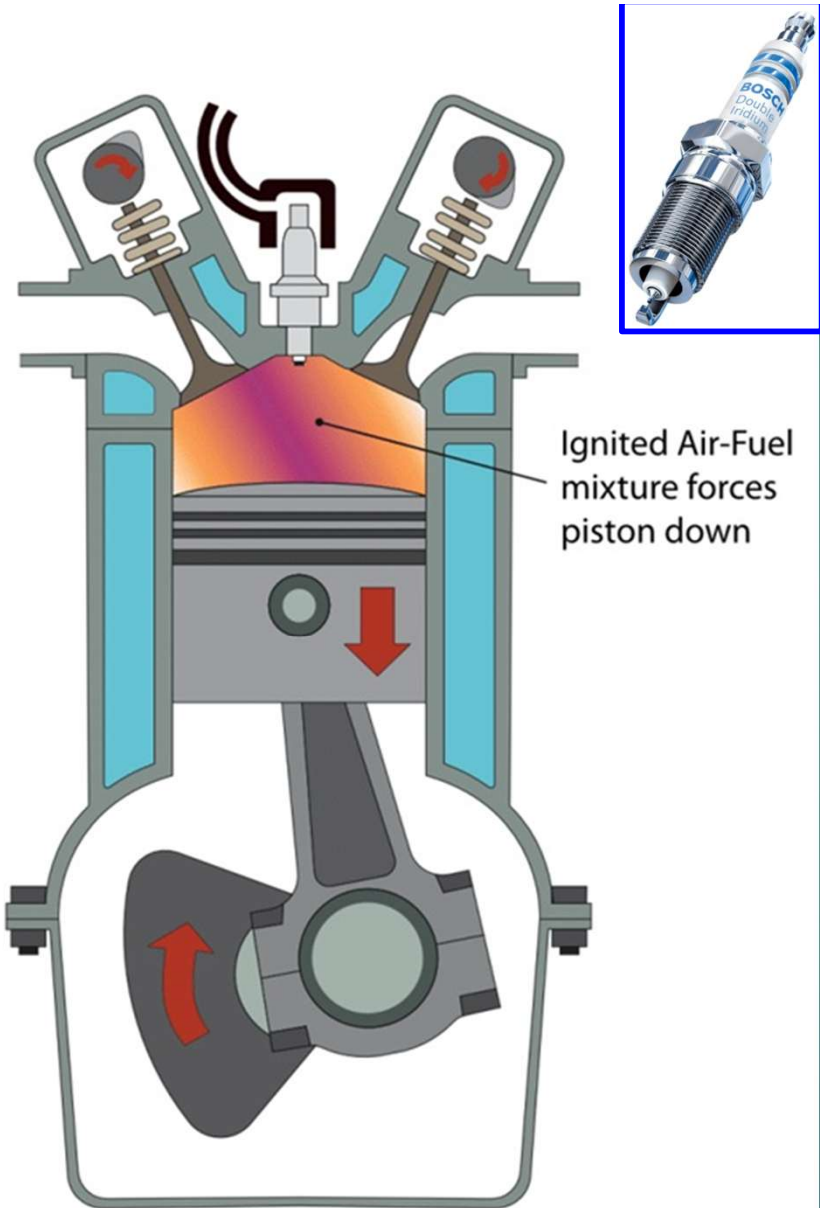
manic phase



depressive phase

The origin of BD may start from a **sustained working state/mode in humans**. Some other higher-order animals tend to operate in bursts (hunting or working efficiently), followed by extended periods of rest, interspersed with play and social interactions.





Conjecture: VTA may function like a **spark plug** (dopaminergic neurons in the **VTA** fire spontaneously in a **pacemaker-like** manner)

At ~60 mph, an engine typically runs at around 2000–3000 rpm, meaning a spark plug fires **tens of times per second** in each cylinder.

Questions: after identifying overactive VTA as the core neuropathology of BD

1. What are the molecular and cellular mechanisms underlying this overactivity?
2. Which circuits sustain this self-reinforcing dynamics?
3. Does bipolarity emerge even within subpopulations of VTA neurons?
4. Many others ... **moving us closer to the fundamental nature of the disorder.**

Left frontal lobe developmental deviation as the core pathology of ASD

Accountability: impairments in language, executive function, central coherence, social cognition, theory of mind, predictive coding, along with intellectual disability, abnormal sensory sensitivities, motor planning difficulties, response inhibition, attention regulation, restricted interests, and “extreme male brain”. In high-functioning ASD, deficits in pragmatic and expressive language are often more pronounced than in receptive language.

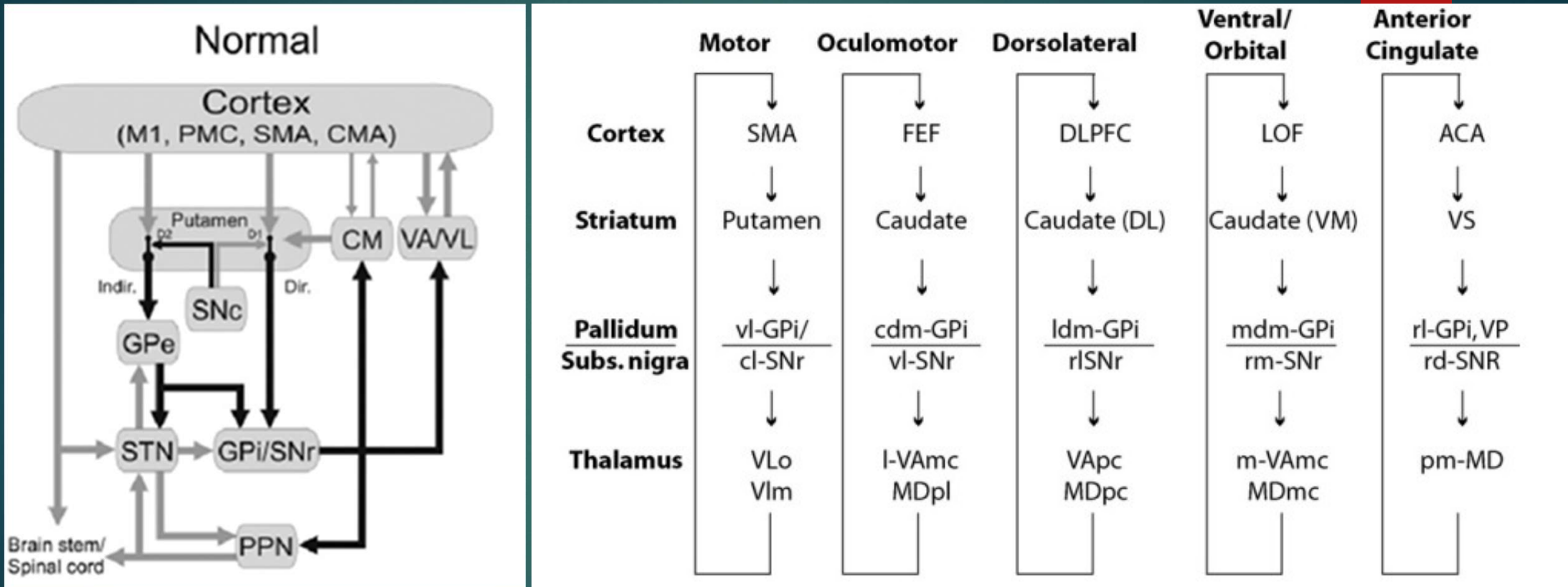
Plausibility: 1. the cortical development follows a posterior-to-anterior progression, with the perceptual and motor functions maturing first, followed by the frontal lobe, where the left side matures later than the right (Gerván et al., 2017), concordant with the suspected risk factors of ASD during the second and third trimesters (Gardener et al., 2009). 2. the frontal lobe exerts widespread top-down modulatory influence and shows gender differences in lateralization. The left frontal lobe may affect the right frontal lobe through interhemispheric rivalry.

Two caveats:

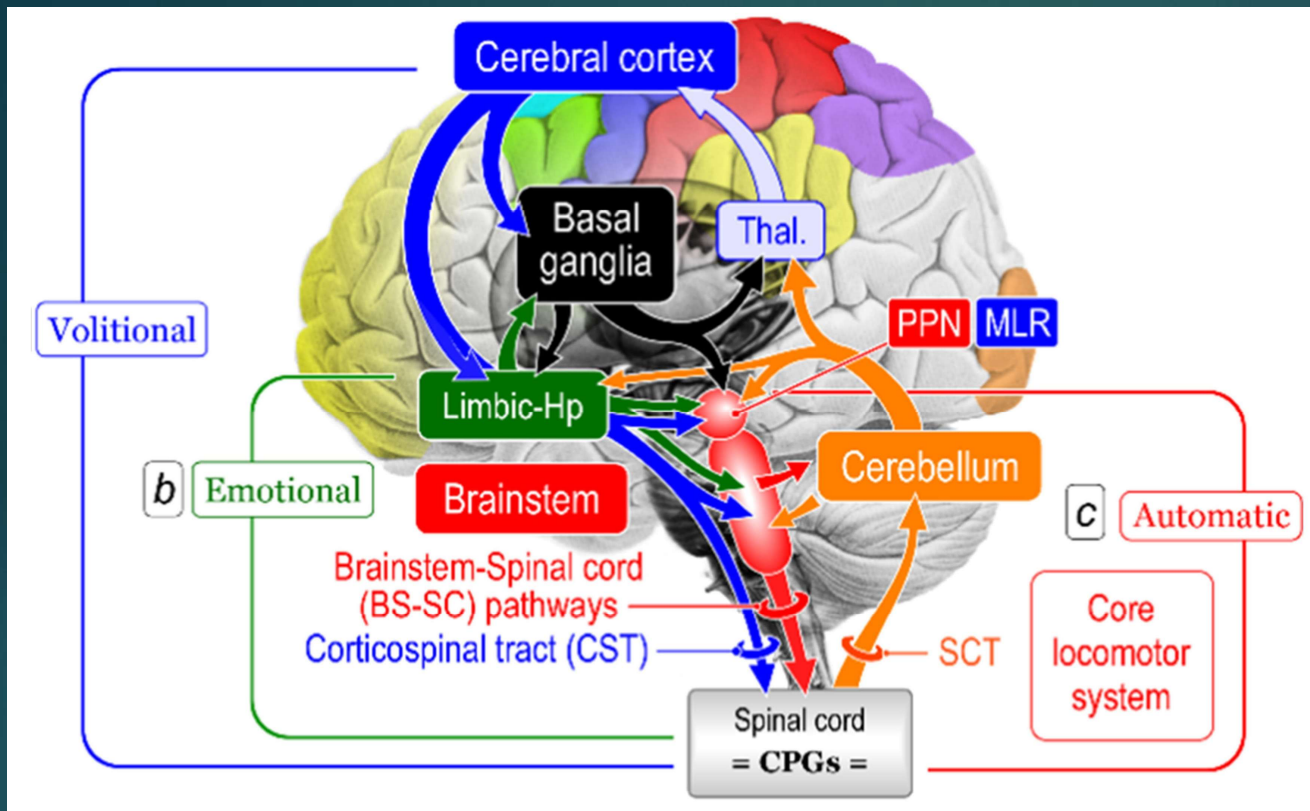
1. Flip the question: what neuropsychiatric disorder most likely reflects developmental vulnerabilities in the frontal lobe, given its shorter evolutionary refinement?
2. Current literature seems biased toward social cognition.



Directional weakening of frontal–caudate coupling in OCD



- (1) Frontal to caudate projection is prone to errors (developmental vulnerability),
- (2) caudate function is heavily influence by the limbic system (learning) but lacks design for direct feedback regulation (design bug, OC symptoms),
- (3) **interaction** is expected at the **caudate**.

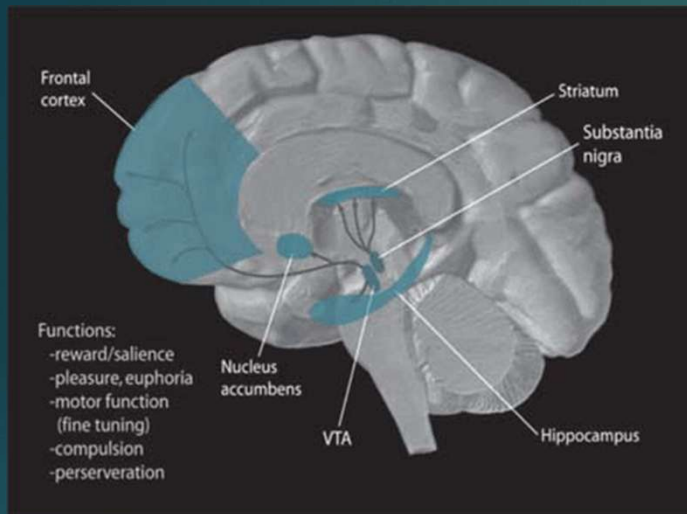


Current fiber tracking techniques work well for large, well-myelinated bundles, but delineating the thinner cortico-striatal white matter fibers remains challenging. To test the theory, I used **directional neural metrics with fMRI**, and I'll explain the details in a moment.

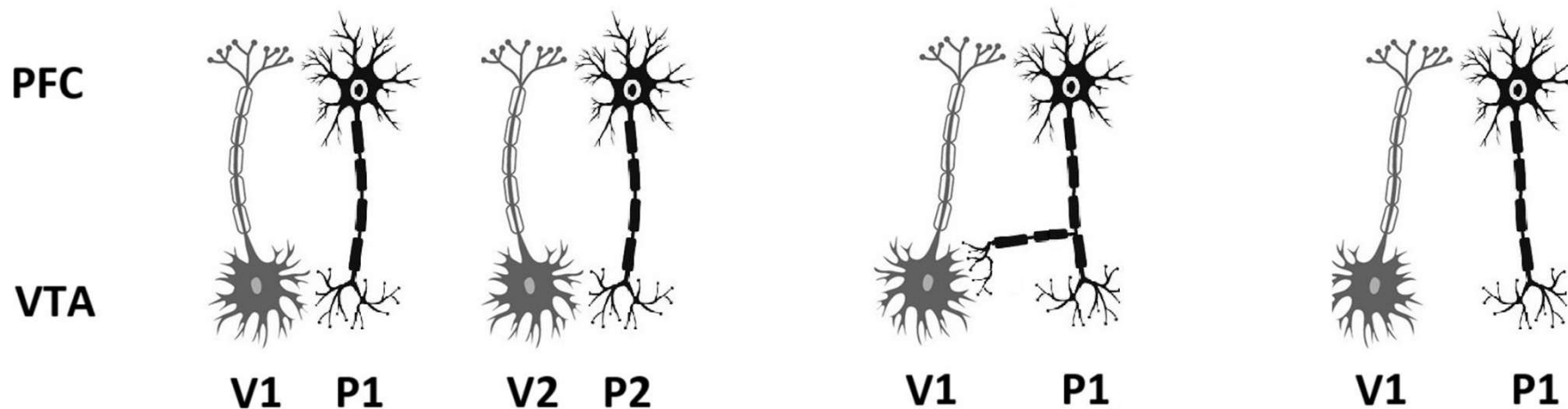
Adapted from Takakusaki et al., 2024, *Ageing and Neurodegenerative Diseases*

Thalamocortical and corticothalamic connections represent some of the earliest-developing circuits in the embryonic brain (Grant et al., 2012). The PFC–mediodorsal thalamus pathway is an evolutionarily conserved projection with tightly regulated developmental guidance, involving molecules such as ephrins, semaphorins, and netrins (Braisted et al., 2000). Key developmental boundaries, such as the pallial-subpallial boundary and the diencephalon-telencephalon boundary, play crucial roles in guiding axonal pathfinding and regional differentiation during brain development, helping **ensure proper wiring** between the thalamus and cortex.

Asymmetrical frontal–VTA aberrations in ADHD



The prevalence of ADHD (6–7%) is higher than that of OCD (1.2%). This disease model explains co-morbidity. Special considerations for ADHD: 1. bidirectional close loop, 2. neural consequence of nucleus accumbens (NAc) to hypodopaminergic VTA (tonic vs phasic) 3. **Interaction** effect is expected at the **NAc** (but the direction is opposite to that of the caudate).



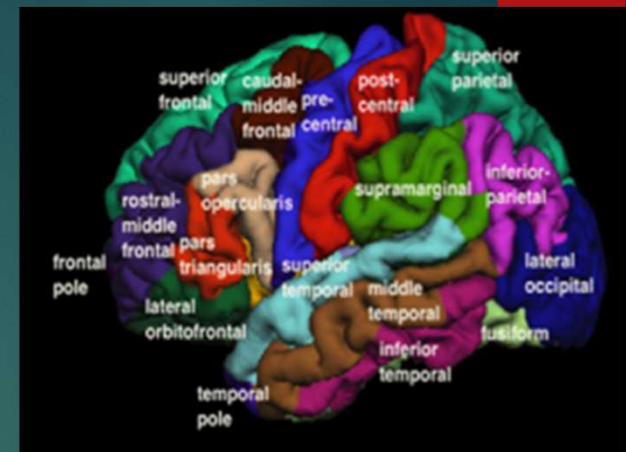
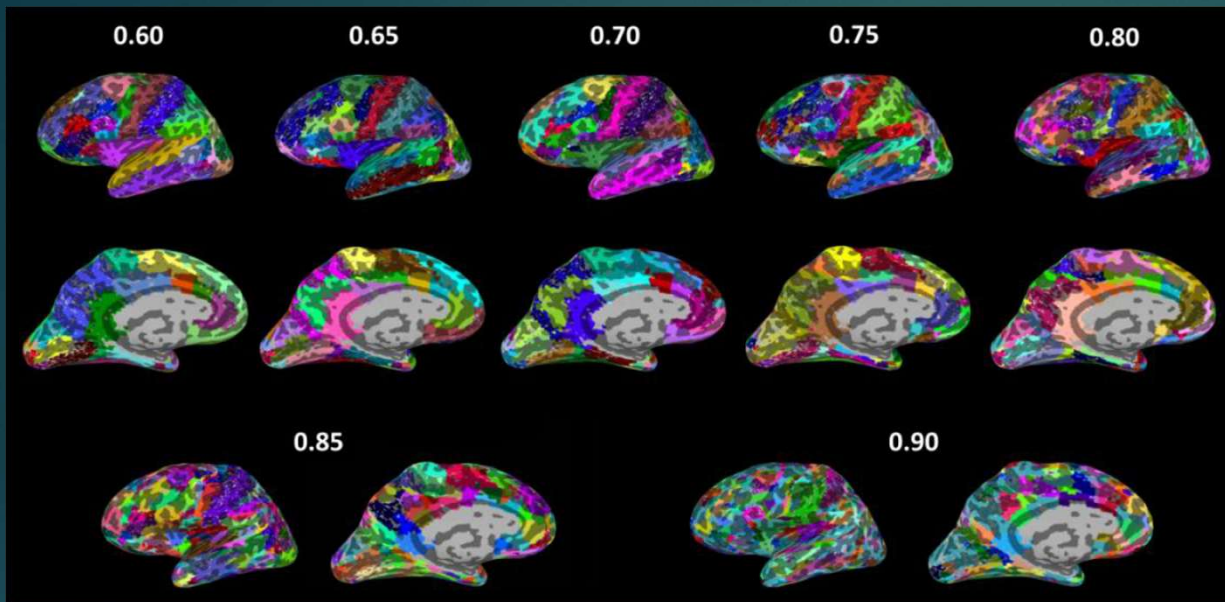
Fulfill functional parcellation (FP) of fMRI data by “modular analysis and similarity measurements” (MOSI)

Regarding fMRI data, cortical parcellation is the pre-requisite for studying large network property or exploring the whole brain as a system (in contrast to circuit-based or ROI-based approach) given that there are **tens to hundreds of thousands of voxels**.

Anatomy atlas-informed parcellation is still the mainstream. MOSI differs from the current network parcellation methods in two critical aspects – multi-scale parcellation and allowing individual variation in parcellation.

Aims Neuroscience, 2021

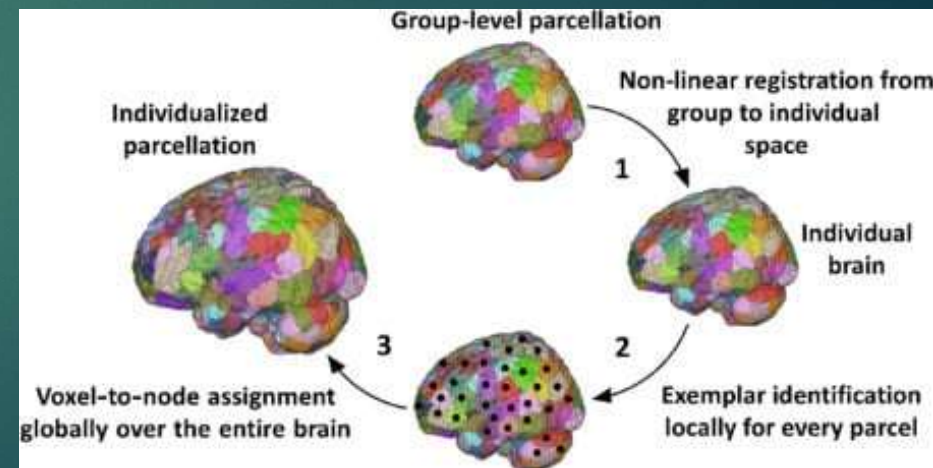
Novel method means an opportunity to provide novel insights ...

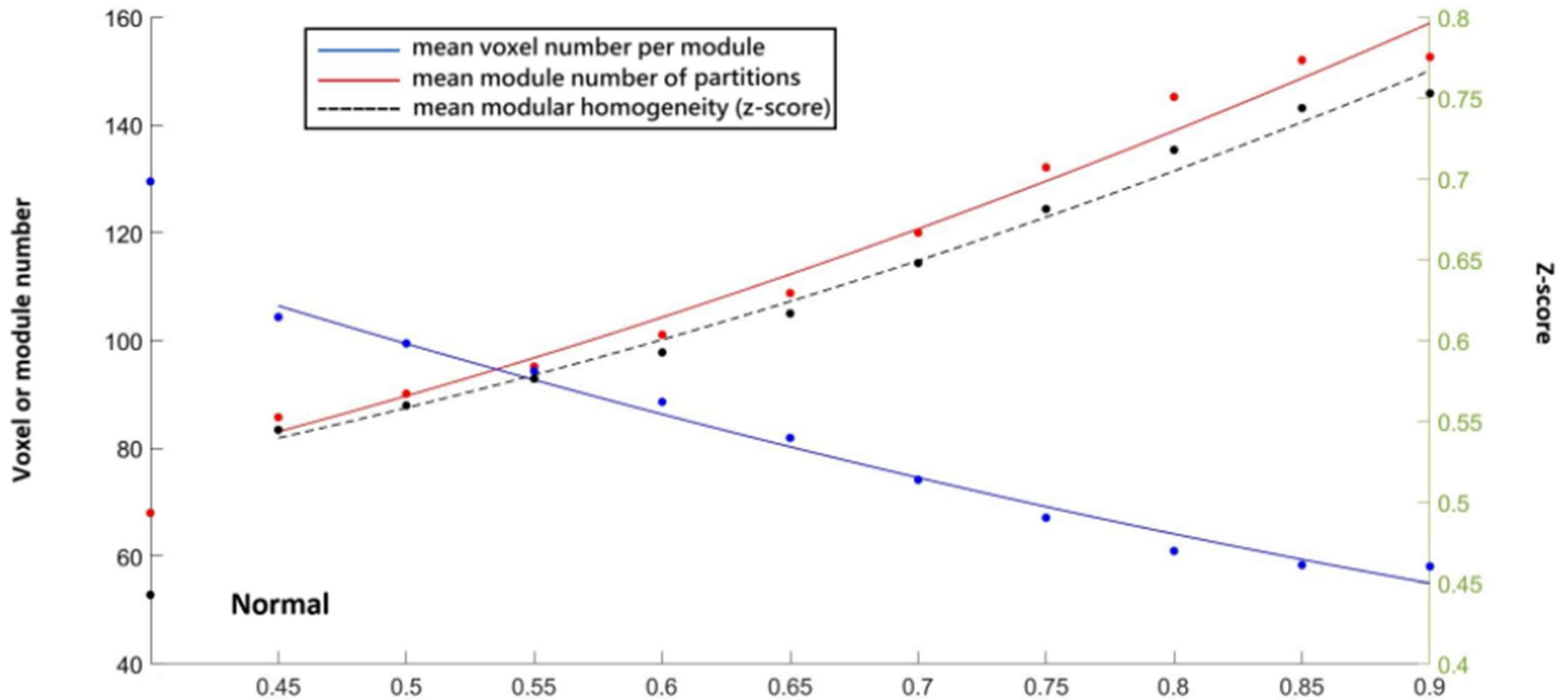


Desikan-Killiany atlas

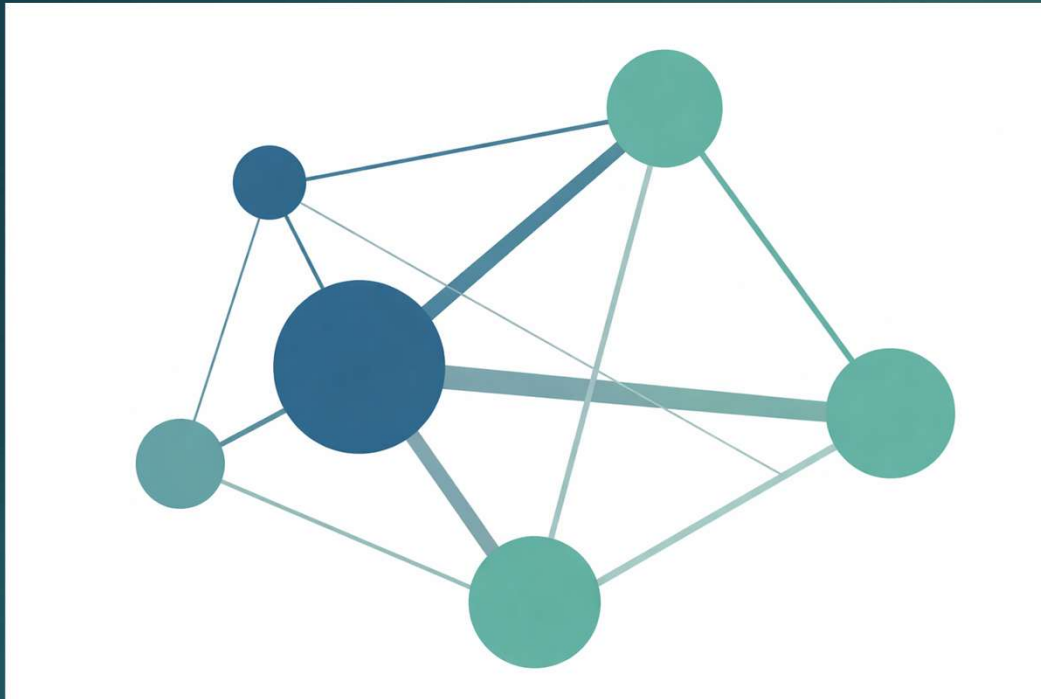
Left: MOSI

Bottom: another FP algorithm





Unique features of MOSI: (1) it is an individualized analysis feasible for the heterogeneity in neuropsychiatric conditions; (2) it lays out a plausible foundation for subsequent network analysis; (3) it enables a multi-resolution approach to investigate brain informatics at different scales.



In contrast to circuitry-based approaches, this study examines large compartments—or the entire cortex—to explore the relationship between **nodal strength** and **nodal power** (amplitude of low-frequency fluctuation, ALFF).

$$\left(\prod_{i=1}^n x_i \right)^{\frac{1}{n}} = \sqrt[n]{x_1 x_2 \cdots x_n}$$

\prod = geometric mean

n = number of values

x_i = values to average

Inverse relationship between nodal strength and nodal power in the cortex: Insights from separate resting fMRI and EEG datasets, 2025

novel causality: within network/compartment interaction

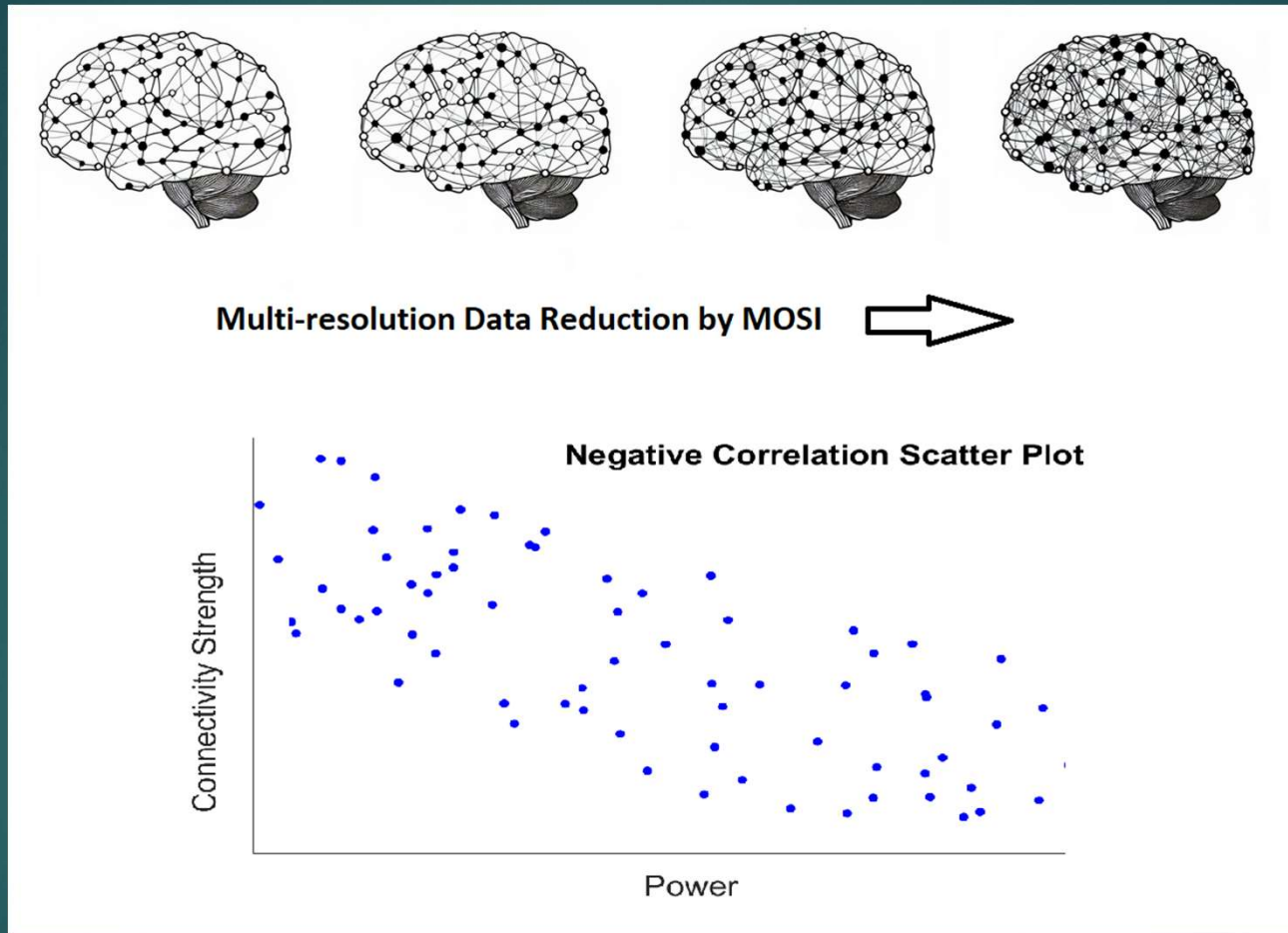
Table 1 Statistics of the correlation between ALFF and node strength across different gamma values (from NKI fMRI)

Gamma	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90
CC	-0.37	-0.36	-0.34	-0.34	-0.32	-0.30	-0.28	-0.25	-0.21	-0.21
Mean_Z	-0.36	-0.34	-0.33	-0.32	-0.31	-0.29	-0.27	-0.24	-0.21	-0.21
Std_Z	0.18	0.18	0.18	0.18	0.17	0.16	0.15	0.14	0.14	0.14
t stat	-11.80	-11.34	-10.91	-10.93	-10.70	-10.70	-10.84	-10.59	-8.77	-8.86
<i>P</i> value	All <i>P</i> values are less than 0.005, ranging from 2.32E-10 to 9.39E-14.									
<i>Pg</i> value	4.07E-05	5.63E-05	7.49E-05	5.27E-05	6.60E-05	6.94E-05	1.09E-04	1.98E-04	6.37E-4	7.19E-4

Table 2 Statistics of the correlation between ALFF and node strength across different gamma values (from BrainCode fMRI)

Gamma	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90
CC	-0.42	-0.41	-0.41	-0.41	-0.40	-0.39	-0.38	-0.35	-0.33	-0.32
Mean_Z	-0.45	-0.44	-0.43	-0.44	-0.42	-0.41	-0.40	-0.37	-0.34	-0.33
Std_Z	0.19	0.19	0.18	0.18	0.18	0.16	0.15	0.14	0.14	0.15
t stat	-27.16	-26.63	-25.70	-26.01	-23.87	-25.79	-23.85	-24.30	-23.41	-24.46
<i>P</i> value	All <i>P</i> values are less than 0.005, ranging from 1.11E-24 to 5.20E-30.									
<i>Pg</i> value	2.53E-05	2.52E-05	1.70E-05	8.76E-06	6.96E-06	4.18E-06	3.14E-06	4.39E-06	1.05E-5	1.57E-5

Low frequency interaction may carry more information about **inhibitory coupling**

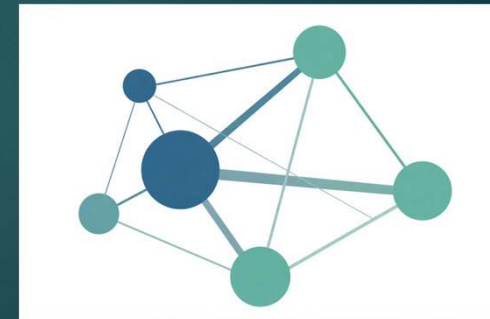
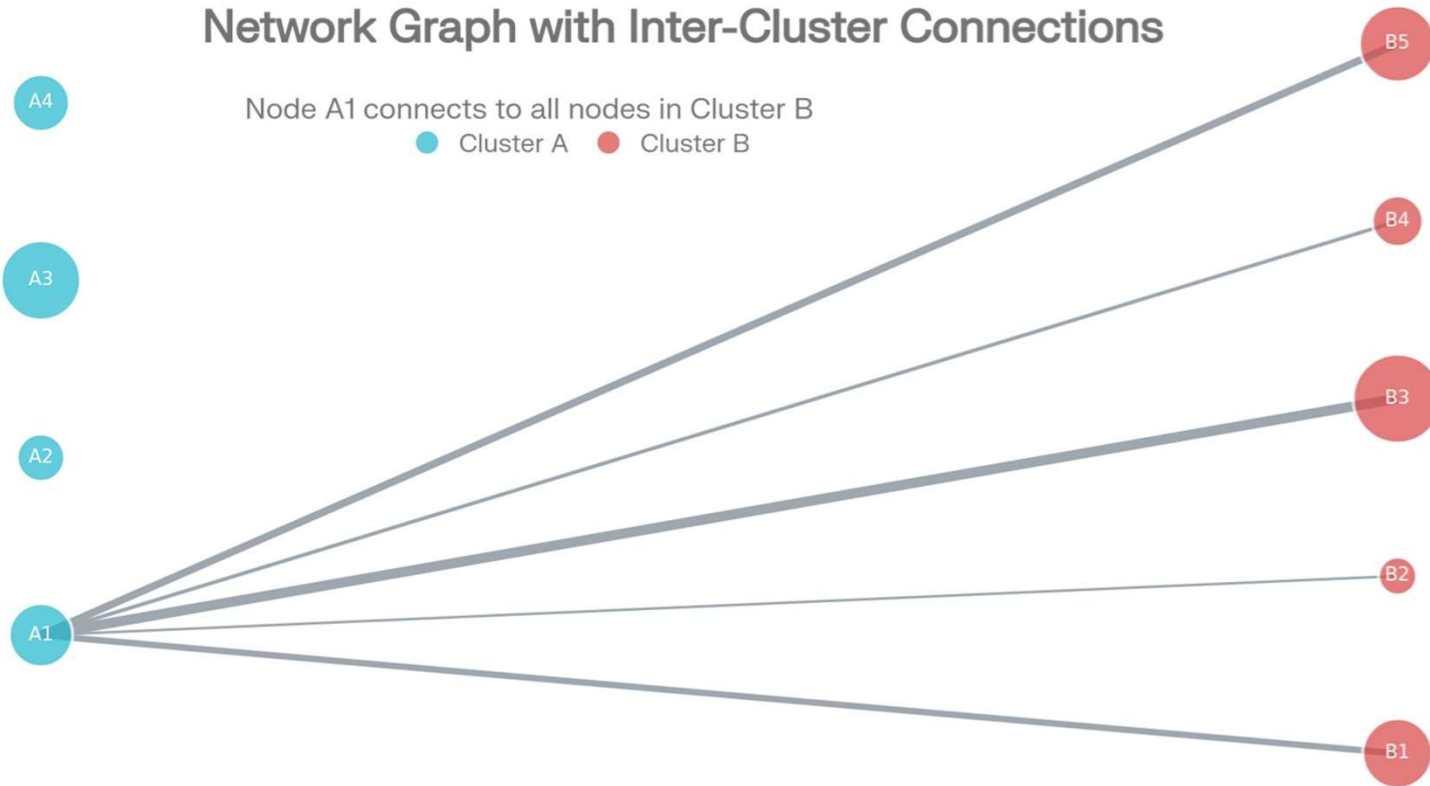


novel causality

The conclusions hold for both resting fMRI & EEG

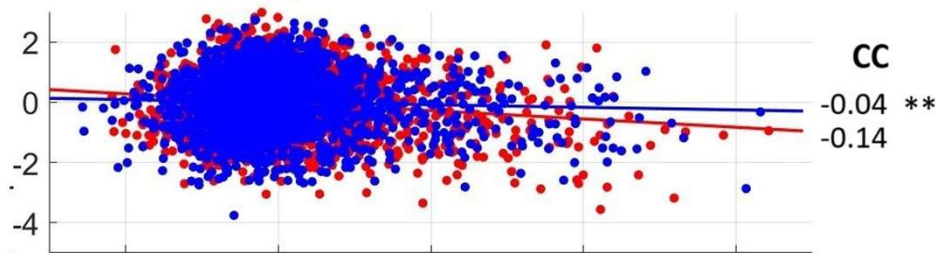
J Neuroscience Methods, 2025

Network Graph with Inter-Cluster Connections

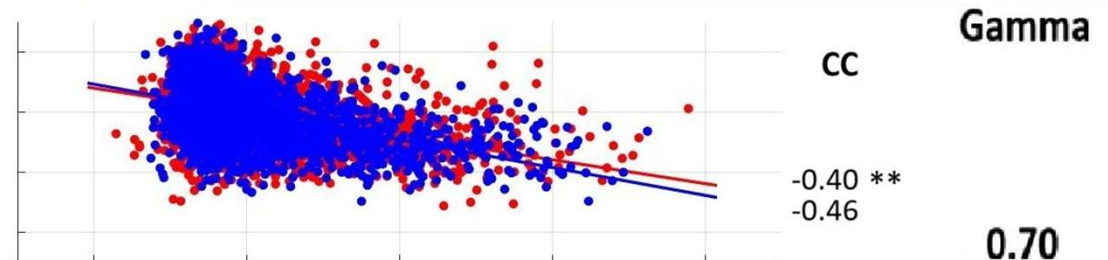


novel causality: between network/compartiment interaction

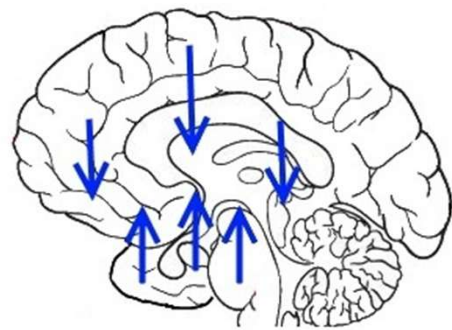
Framing Major Depressive Disorder as a Condition of Network Imbalance at the Compartment Level: A Proof-of-Concept Study



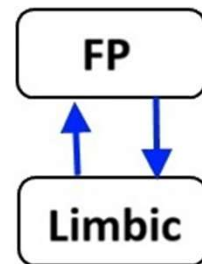
Limbic-to-FP



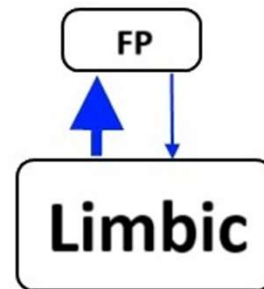
FP-to-Limbic



Homeostasis



Depression

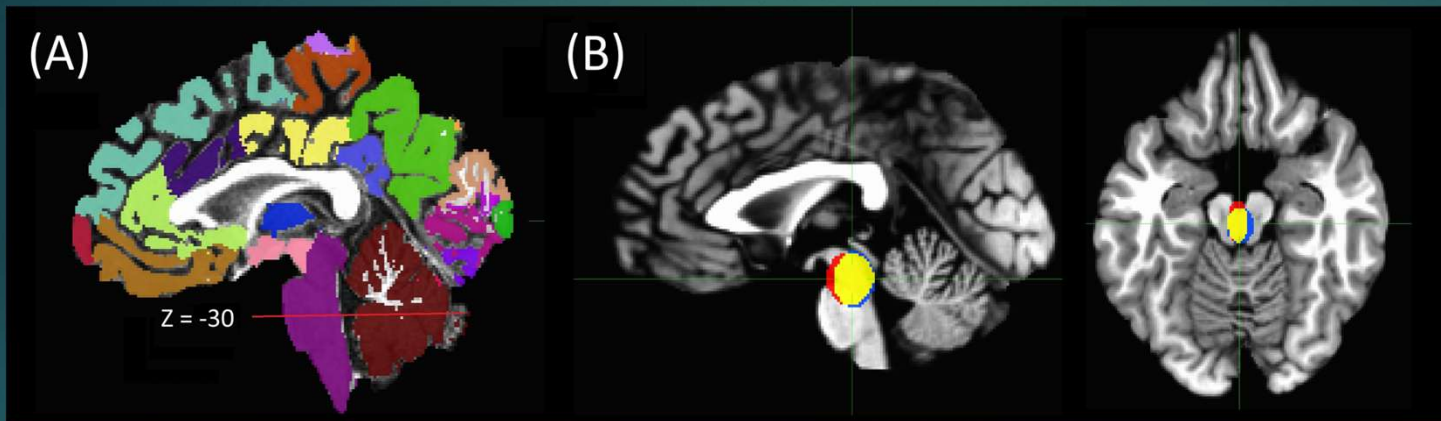


Inter-compartmental interaction
(reciprocal suppressive mechanism)

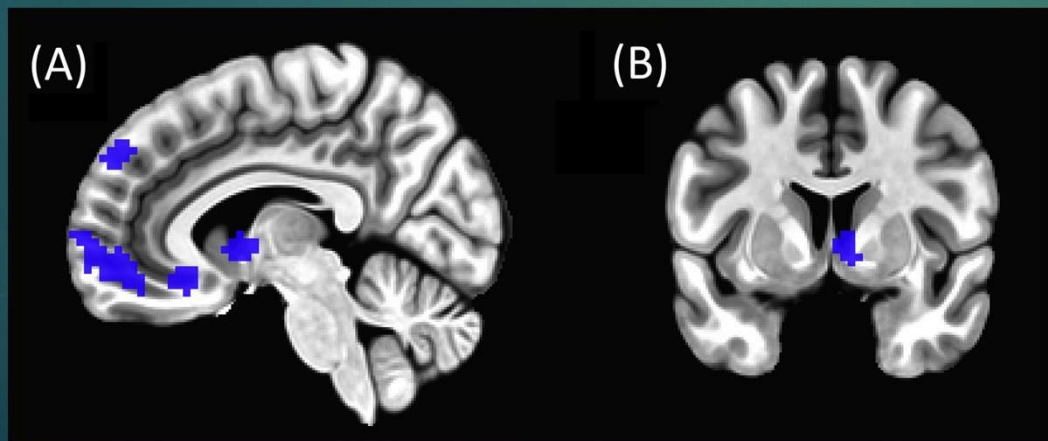
Blue: HC, Red: MDD

Published in Cerebral Cortex, 2025

Ventral Tegmental Area as the Core Pathophysiological Hub of Bipolar Disorder: Evidence from Resting-State fMRI

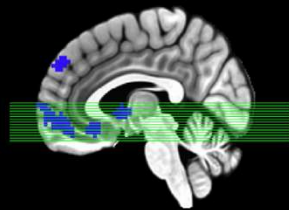


Identification of
VTA via D1
receptor template
(JuSpace)

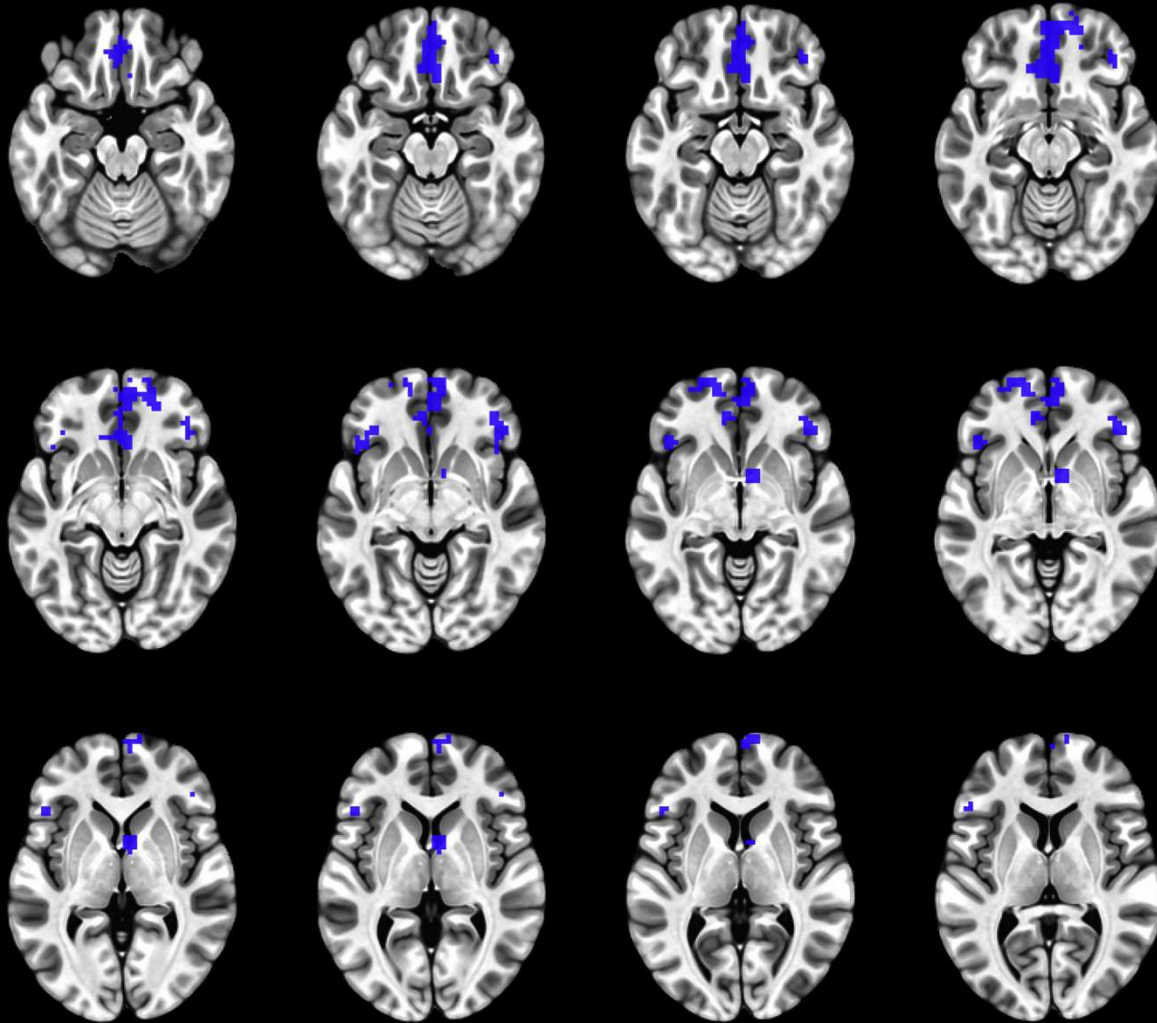


Difference in the functional
connectivity maps seeded by VTA
(BD vs HC)

Full text available from medRxiv



Z from -19 to 7 mm
spaced by 2 mm



RS-fMRI Evidence of Left Frontal Lobe Developmental Deviation as a Candidate Core Pathology of Autism Spectrum Disorder

Table 1 Statistical Comparisons of Functional Volumes in the Left Frontal Lobe

Gamma	ASD		HC		t-scores	p-values
	mean	std	mean	std		
0.30	2923.3	655.4	3291.1	627.2	-3.14	0.002**
0.35	2903.2	664.4	3298.8	647.9	-3.30	0.001**
0.40	2910.8	712.4	3249.7	626.9	-2.77	0.007*
0.45	2878.8	694.1	3284.1	642.3	-3.32	0.001**
0.50	2807.7	735.6	3283.1	662.2	-3.72	0.0003**
0.55	2809.7	768.6	3210.3	681.5	-3.02	0.003**
0.60	2675.5	773.0	3146.9	666.0	-3.58	0.001**
0.65	2628.4	736.1	2995.0	686.8	-2.82	0.006*
0.70	2597.5	762.2	2897.2	789.5	-2.11	0.037
0.75	2477.6	664.4	2782.4	767.1	-2.33	0.022
0.80	2415.8	682.7	2635.0	728.1	-1.70	0.092
0.85	2438.6	617.8	2530.4	677.4	-0.78	0.439

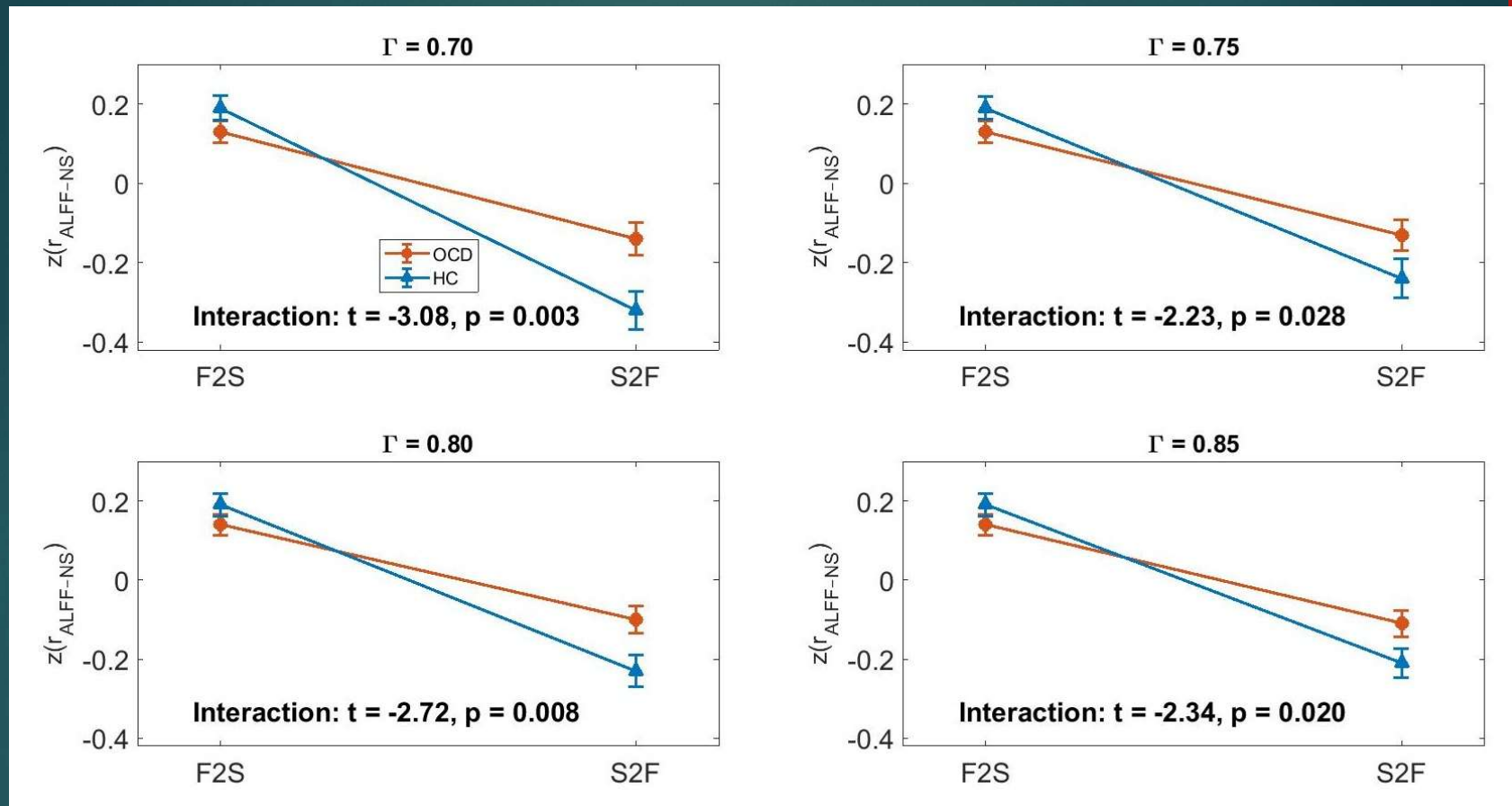
The contents are voxel number. * and ** indicate p-values less than 0.01 and 0.005, respectively.

Focus on left frontal cortex
Lobe-level disorder, like
 compartment-level
 disorder MDD

Functional volume
 defined by MOSI

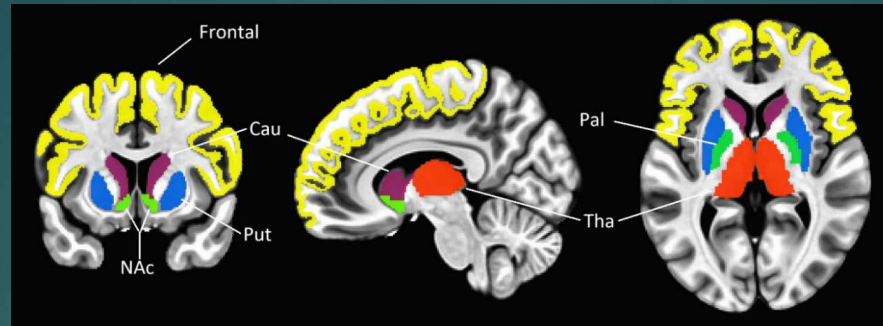
International Journal of
 Developmental Neuroscience,
 2026.

Directional Weakening of Frontal–Caudate Coupling in Obsessive-Compulsive Disorder

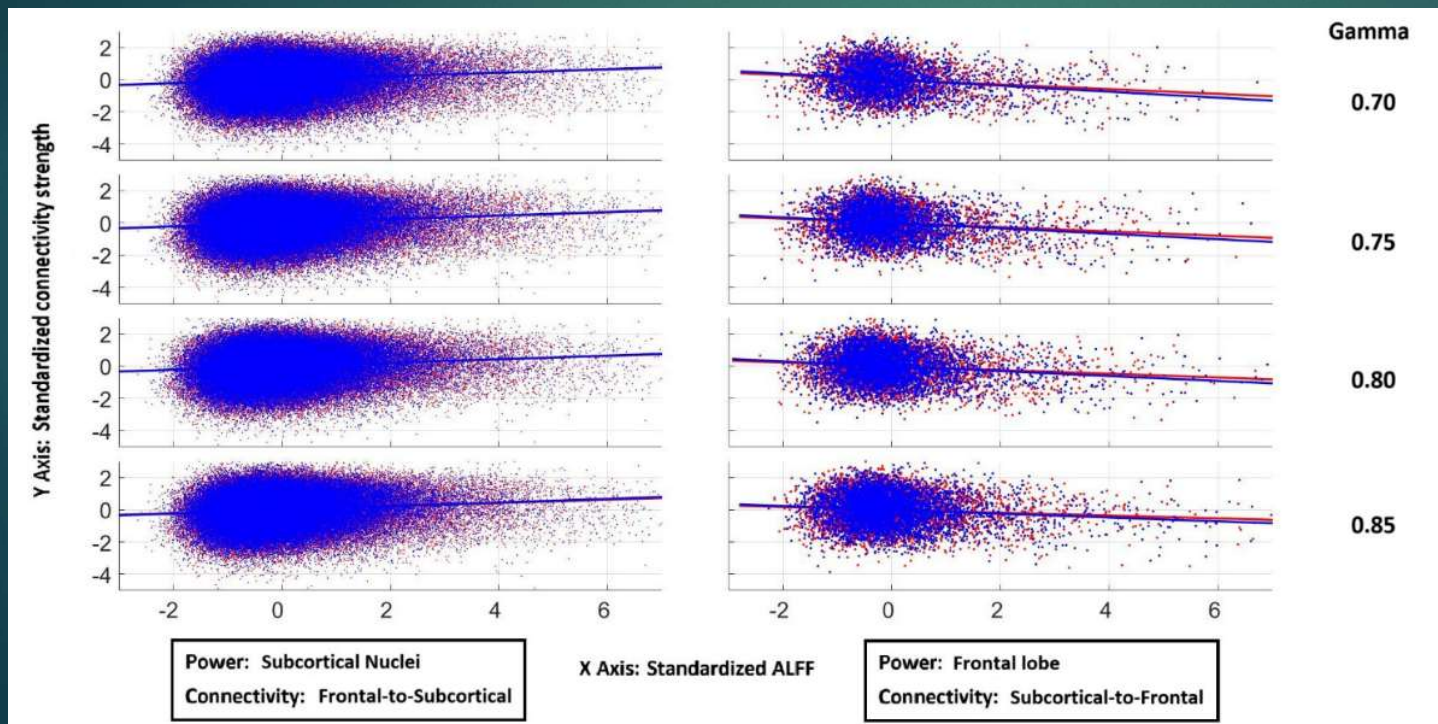


Interaction effects between the caudate and frontal lobe based on the z-transformed correlation between ALFF and nodal strength, $z(r_{\text{ALFF-NS}})$, at four gamma values. Interactions were examined across direction (F2S vs. S2F) and group (OCD vs. HC). Data are shown for OCD (triangles) and HC (circles), with error bars representing standard errors.

Asymmetrical Frontal–Subcortical Aberrance in ADHD: Empirical Support of a Developmental Network Model

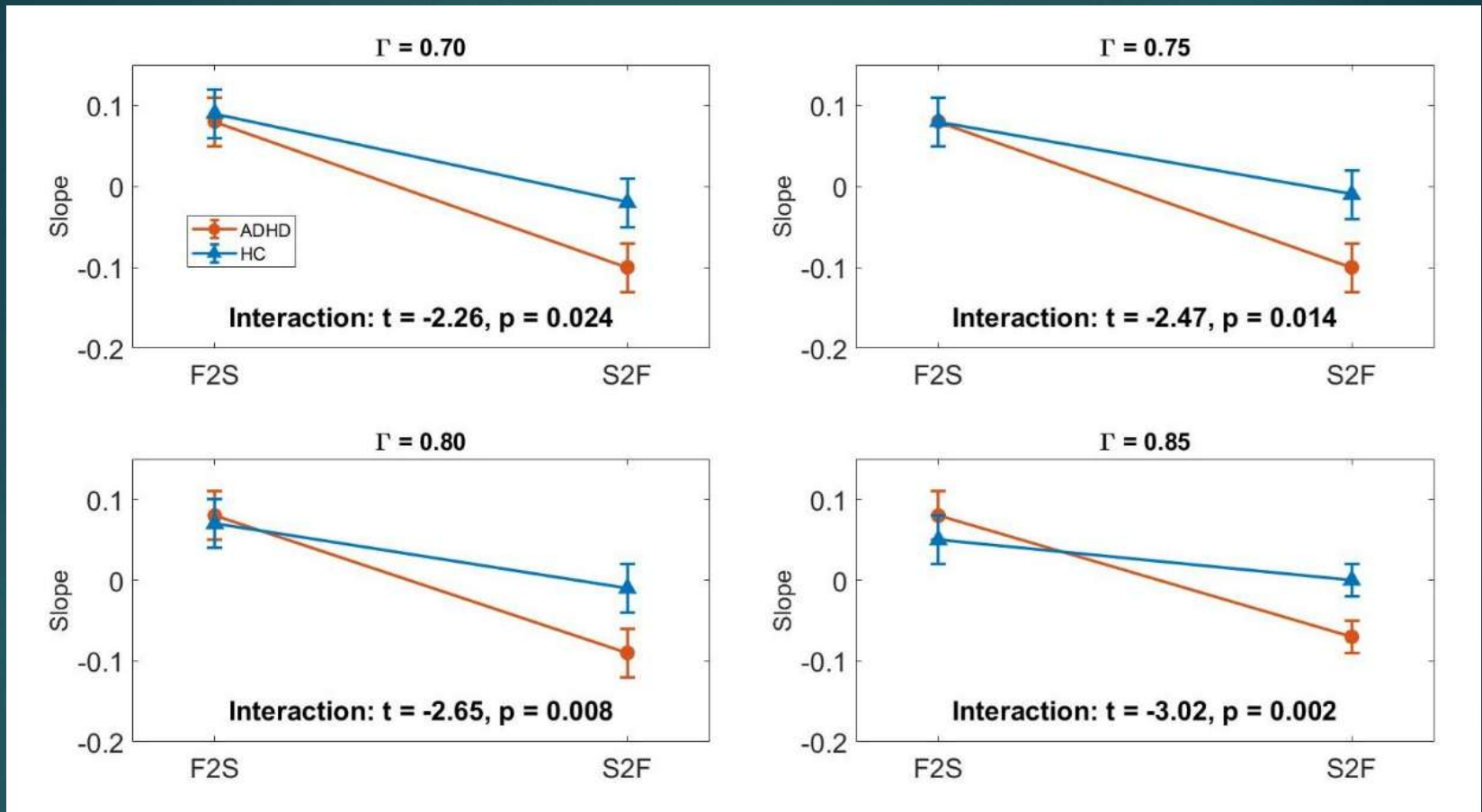


Focus on frontal cortex and five subcortical nuclei



Directional excitation-inhibition balance between frontal-subcortical networks

Full text available from medRxiv



Relationships between ALFF and nodal strength in the NAc and frontal lobe based on slopes derived from Linear Mixed Effects (LME) models at four Gamma values. F2S: slopes of ALFF at NAc against mean functional connectivity between NAc and frontal lobe. S2F: slopes of mean ALFF at frontal lobe against mean functional connectivity between NAc and frontal lobe. Data are shown for two groups, ADHD (circles) and HC (triangles), with error bars representing standard errors.

Once the synthetic approach is complete, we move into the analytical phase, which is something we are already highly skilled at.



Toward **Theory-Driven Brain Science Research in Psychiatry**—where psychological paradigms and engineering methods serve the analytic phase (not abandoning them).



The strength of centralized dialectics: one of the very few options that avoids parochialism and reductionism while enabling **rigorous integrative approach** (hermeneutics) and introducing **creative thinking** into **problem solving**.

Why the name “dialectics”?

- ▶ Complexity vs Simplicity (Hegel’s sense)
- ▶ Analysis vs Integration/Synthesis (Hegel’s sense)
- ▶ Physical brain space vs Virtual brain space (Hegel’s sense)
- ▶ Reasoning of the peripheral pieces (accountability; original sense)
- ▶ Bridging and linking (original sense): between central and peripheral and between peripherals

A variant form of centralized dialectics: **active search mode** for peripheral pieces



Past
Current
Future

Take locus coeruleus in ADHD as an example

Why do human beings have psychiatric disorders?

Major psychiatric disorders appear to arise from two primary sources:

- ▶ (1) The first involves **brain organization bugs**, as exemplified by major depressive disorder (MDD), bipolar disorder (BD), and obsessive-compulsive disorder (OC symptoms in OCD).
- ▶ (2) The second reflects innate **weaknesses in the brain's design** (evolutionary refinement not completed yet?), as seen in autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), and OCD (cognitive and behavioral deficits).
- ▶ Acquired conditions, such as PTSD and brain changes from substance use, are not included in today's framework.



Unleash mental power

<https://dwleeibru.github.io/>

Thank You for Your Attention

	Psychodynamic Therapy	Cognitive Behavioral Therapy (CBT)
Theoretical Basis	Unconscious conflicts, defense mechanisms, early relational experiences	Cognitive model: thought → emotion → behavior chain
Time Orientation	Past experiences (especially childhood), unconscious processes	Present-focused, here-and-now cognition and behavior
Focus of Therapy	Unconscious conflict, personality structure, defenses, emotional processes	Negative automatic thoughts, cognitive distortions, behavioral change

Implicit philosophy in medicine shaped through practice (e.g., Koch's postulates): Modern medicine places strong emphasis on identifying disease etiology and underlying pathogenesis mechanisms. When feasible, targeting or removing the causal factors represents an important therapeutic direction, alongside symptomatic and supportive treatments.

Aspect	Classical Psychoanalysis	Object Relations Theory	Self Psychology
Key Figure	Sigmund Freud	Donald Winnicott	Heinz Kohut
Core Concepts	Conflict theory, drive model, structural model (Id, Ego, Superego)	Internal object representations, early relationship impacts	Self-object needs, mirroring, emotional regulation
Psychopathology	Unconscious conflicts, repression, drive blockage	Internalization failures, splitting, poor internal object relations	Self-object failures, developmental needs frustration
Therapeutic Focus	Conflict interpretation, defense analysis, transference interpretation	Transformational relationship, emotional holding	Corrective self-object experience, empathic attunement

<https://dwleeibru.github.io/>