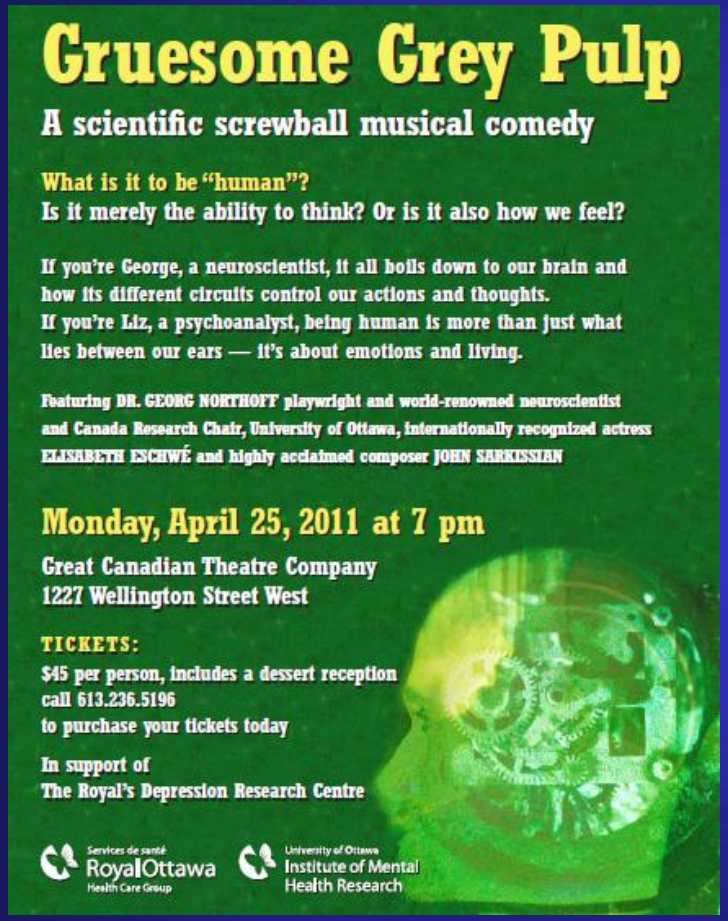
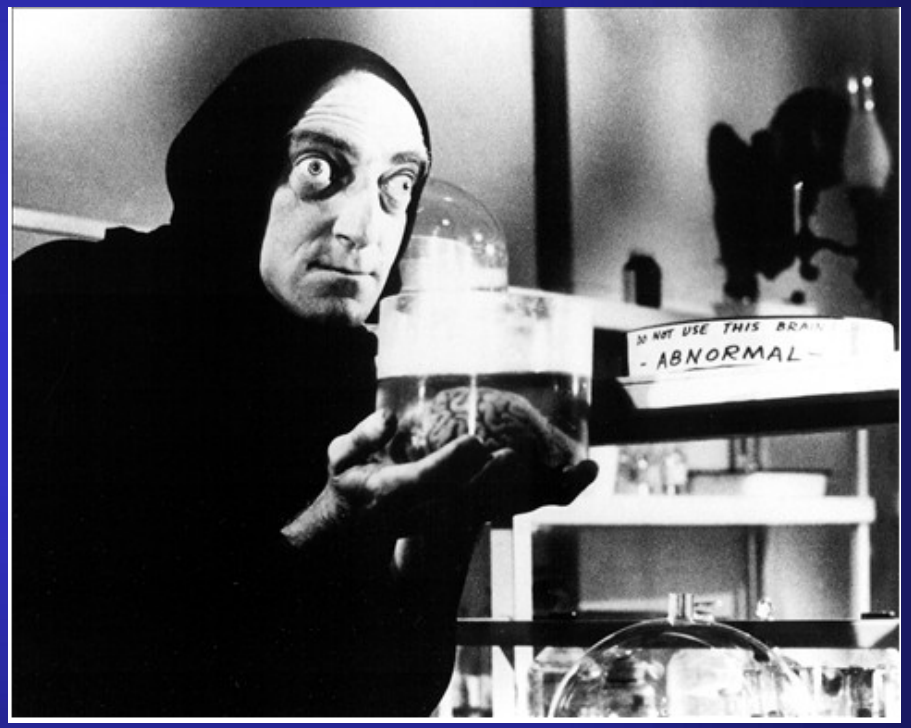
Brain and Self – Why are they relevant for diagnosis and therapy of psychiatric disorders?





A Grey Pulpy Gruesome Device?

“Those who are in love with practice without theoretical knowledge are like the sailor who goes onto a ship without rudder or compass and who never can be certain whether he is going. ….. Practice must always be founded on sound theory” (Leonardo da Vinci 1510, p.175/Chapter 10 and footnote 11 on p.546 in his biography)

Brain is like a Car

Speed of car depends on the strength of your Gas pedal push - The more you push, the faster the car

Brain as Behavioral-Cognitive Reflex Apparatus (Sherrington, Cognitive Neuroscience)

Trends in Cognitive Sciences July 2012, Vol. 16, No. 7

(a)

Extrinsic view of the brain
Self and consciousness are determined by the stimulus alone

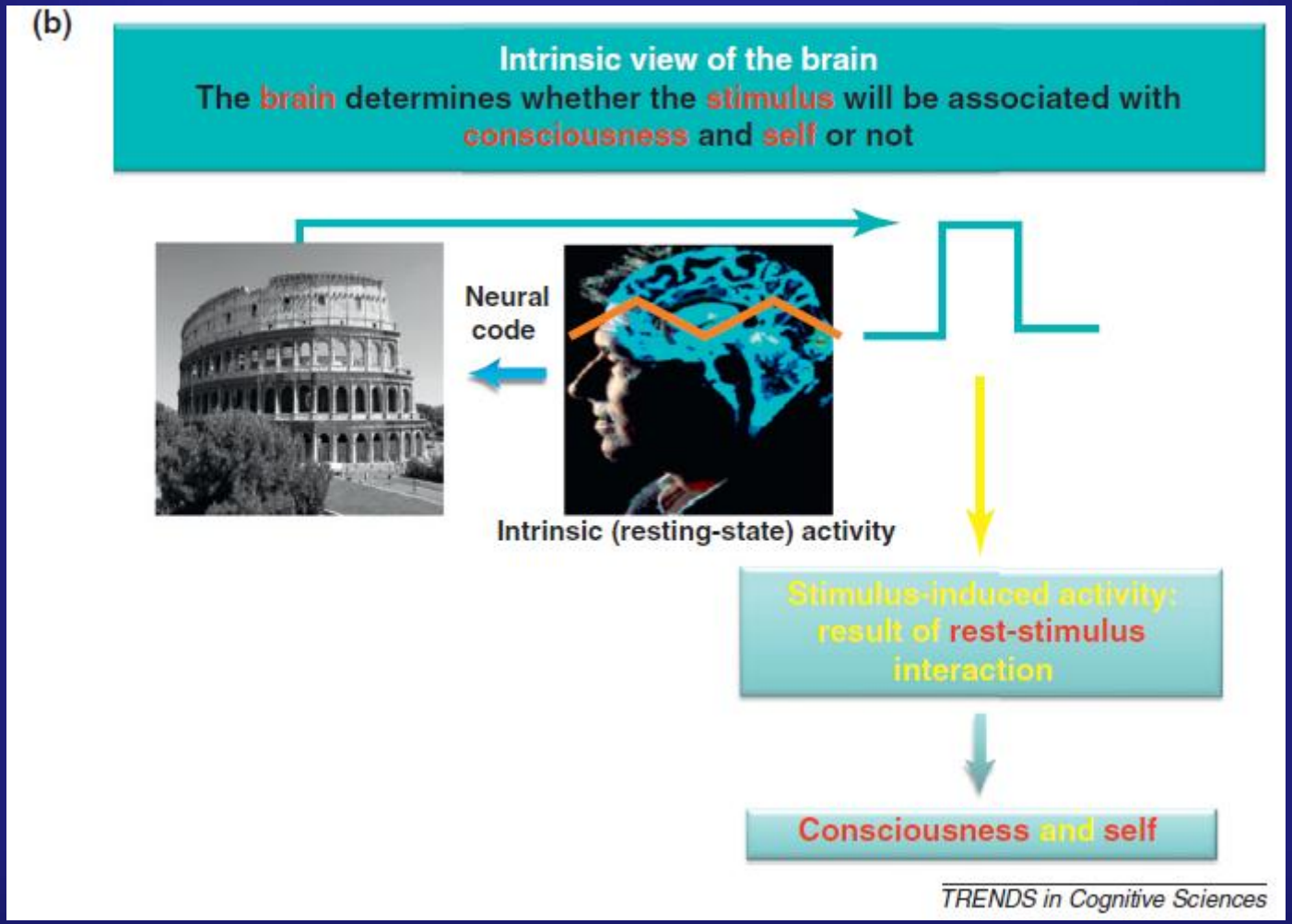
Stimulus-induced activity: result of stimulus-stimulus interaction

Consciousness and self

Brain is not like a Car

Imagine: You step out of this building and You see your car spontaneously driving back and forth in spatiotemporal trajectories - This is what your brain does

Brain as Active Player in its Neuronal Activity (Brown, Lashley, Llinas, Shulman, Panksepp)



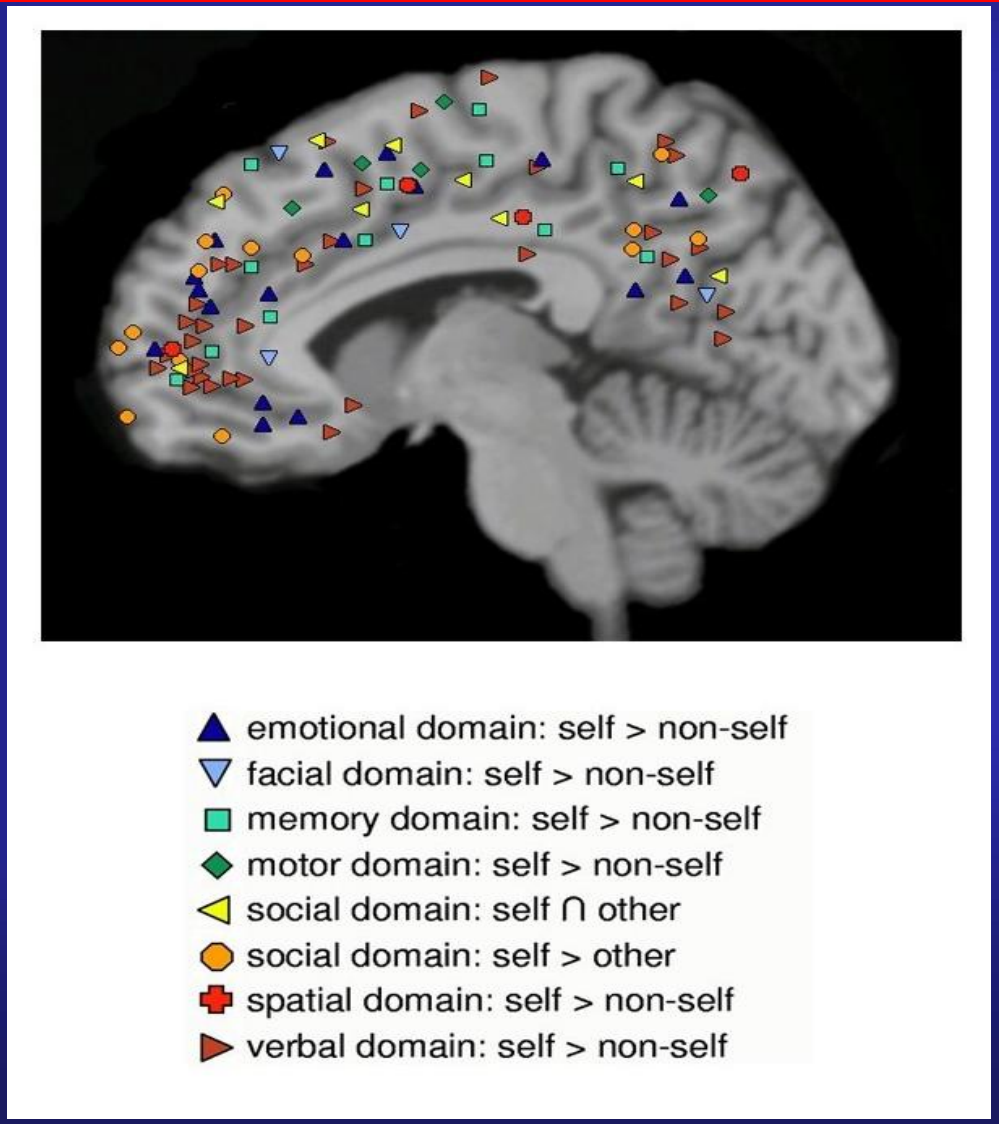
What is the self?

However: there are conditions where the person you see and experience is no longer me but a different self: Jesus, Buddha, Nophretete, Mao, and other famous people

How can we test for the Self and its neuronal basis in the brain?

See pictures of your Self, present your own name, show autobiographical events, etc. while your brain is scanned in fMRI or EEG

Distinction between Self and Non-Self: Cortical midline structures and domain independence

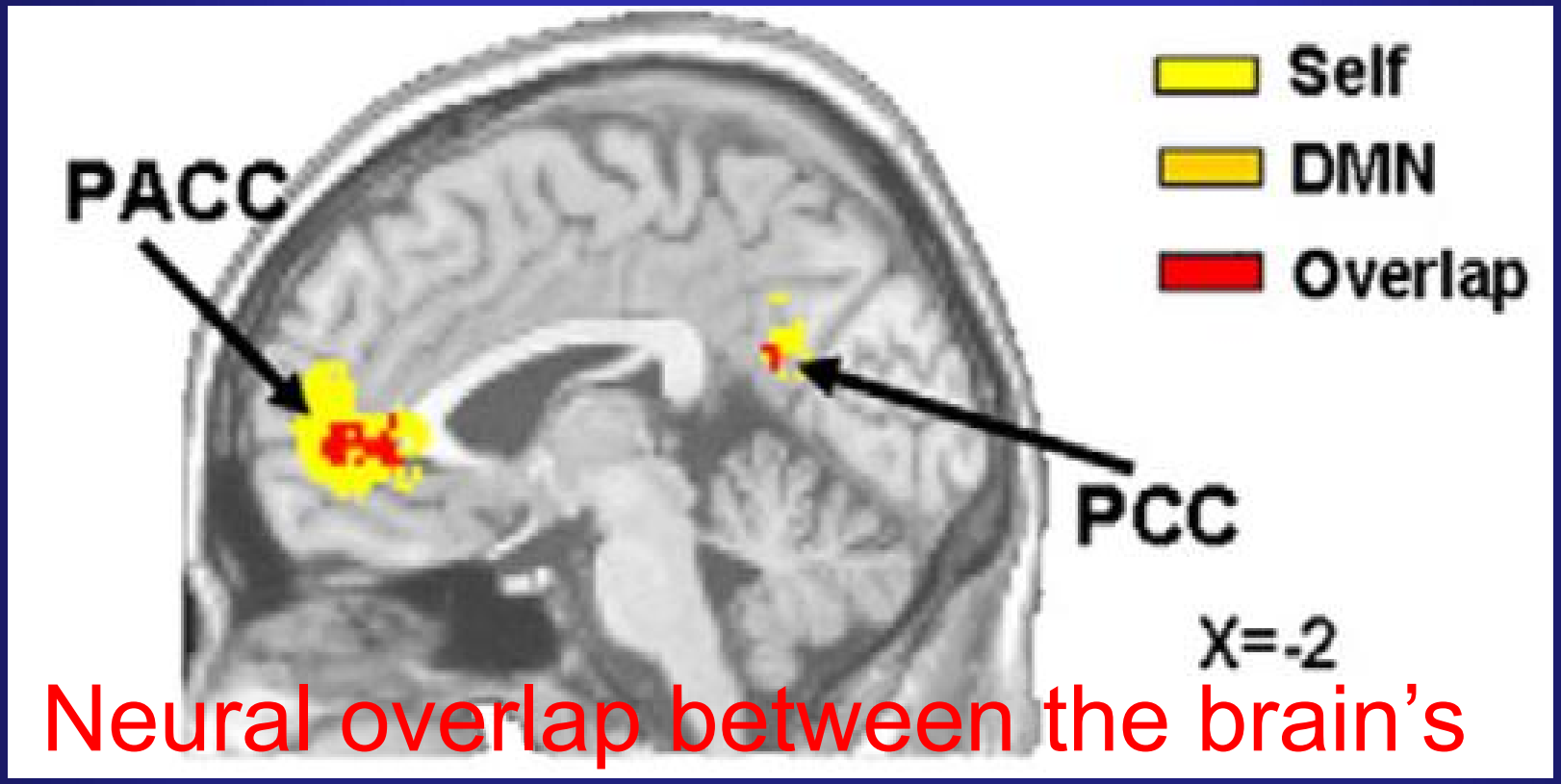


Your Self stands out – it is different from everything else in the world

As your self is different from both world and brain, it should show the strongest activity and distinguish itself from the brain's spontaneous activity

[Trends in Cognitive Sciences, 2004, 2008, 2011]

You remember the brain's spontaneous activity? You better do, as it is highly relevant for your Self!!!!!

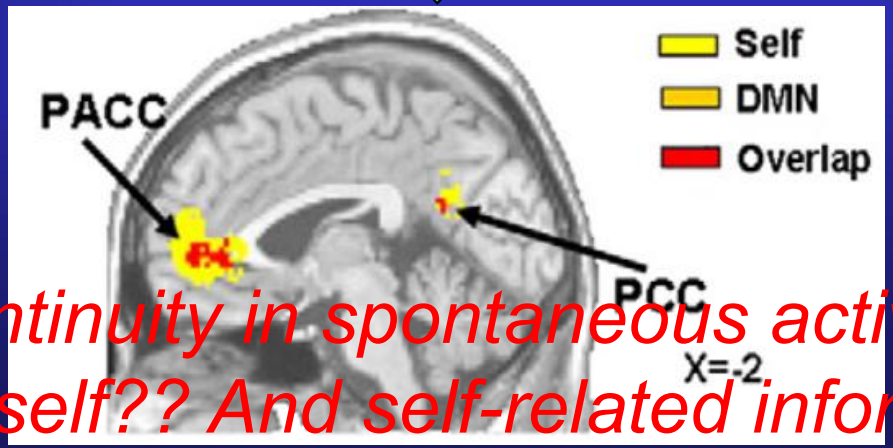


Neural overlap between the brain's spontaneous activity and your Self

[Consciousness&Cognition, 2010, Neuroimage, 2011]

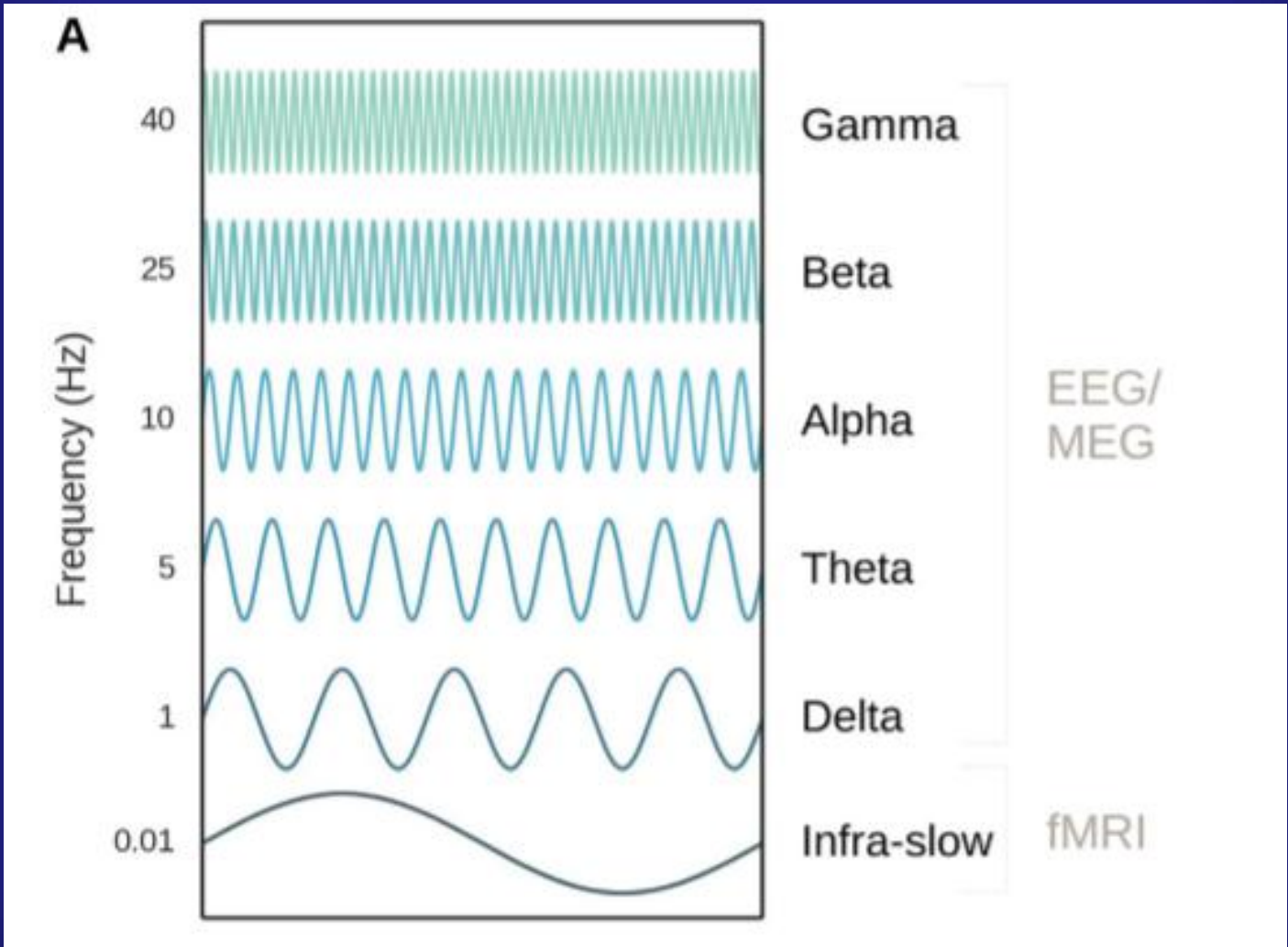
What is the "Common currency" between Brain and Self?

Temporal continuity of Self: Your self is always there despite continuous change in brain, body, and world



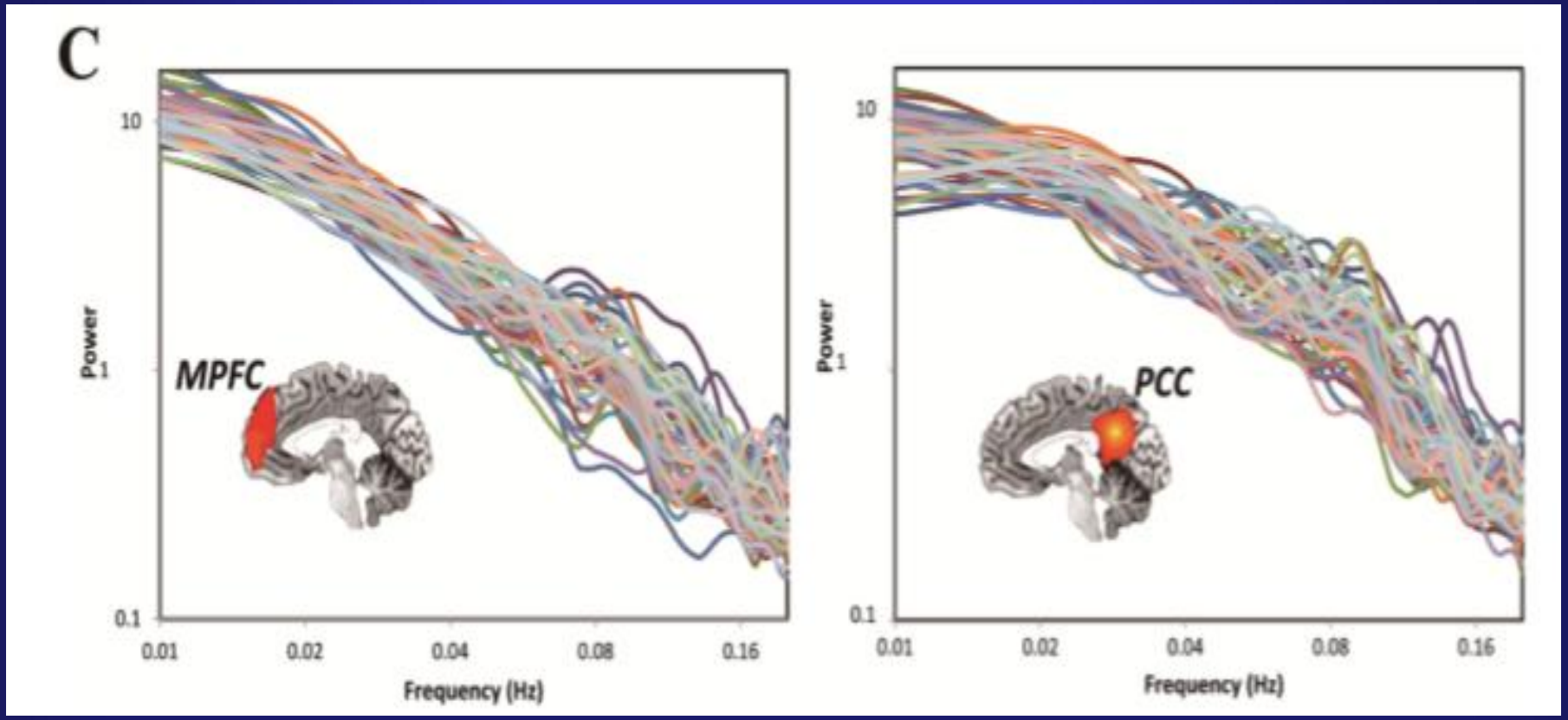
Temporal continuity in spontaneous activity of CMS: Encoding of self?? And self-related information?

The Brain's spontaneous activity "construct its own Time: "Inner time"



Northoff and Duncan (2016) Progress in Neurobiology

Temporal continuity in the brain's spontaneous activity: Long-range temporal correlation – Similarity in temporal frequency pattern across time = Scale-free activity/Power law exponent



Huang et al. 2016, Neuropsychologia

From the Time of the brain's spontaneous activity to the Time of the Self - Neuronal continuity and "Self-continuity"

Neuropsychologia 82 (2016) 161–170

Contents lists available at ScienceDirect

Neuropsychologia

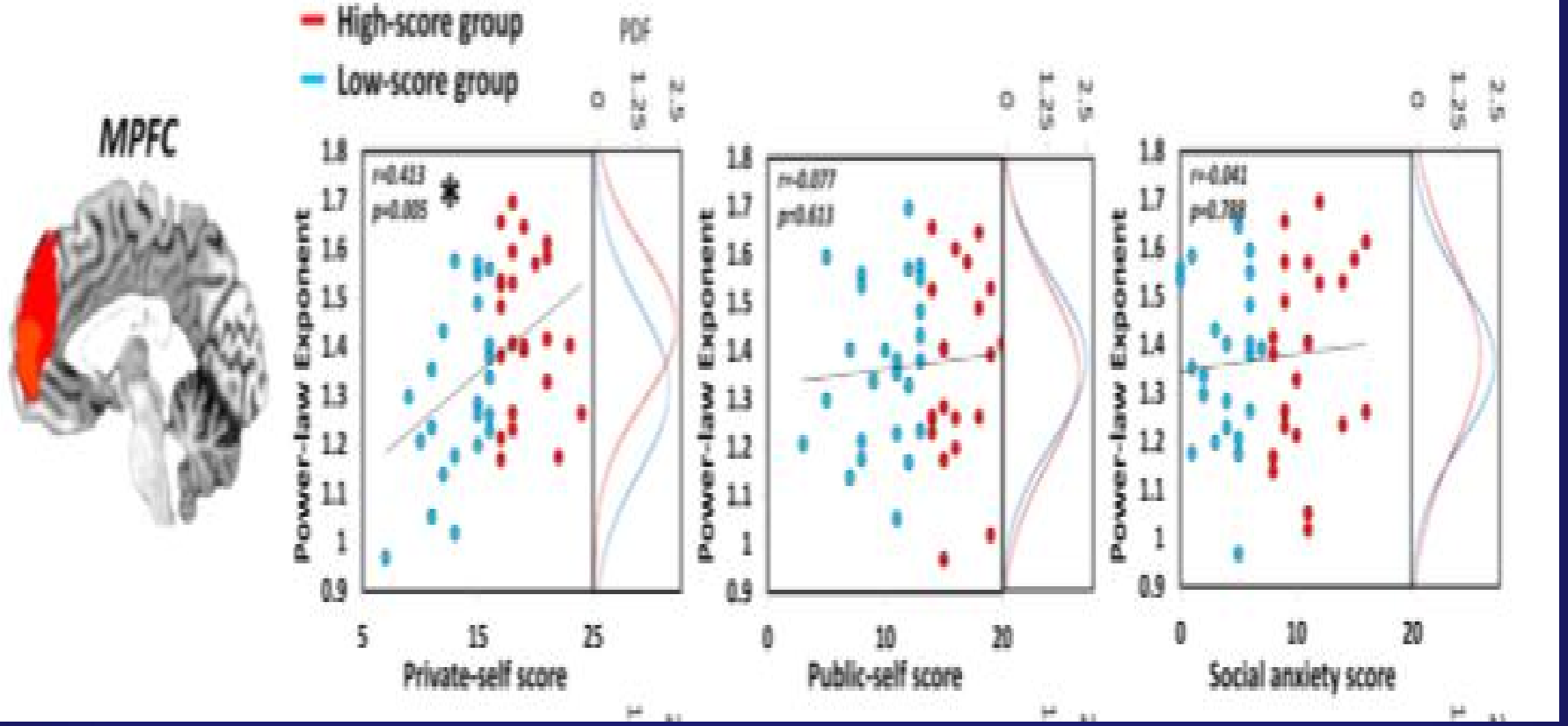
journal homepage: www.elsevier.com/locate/neuropsychologia

The temporal structure of resting-state brain activity in the medial prefrontal cortex predicts self-consciousness

Zirui Huang[a,*,1], Natsuho Obara[a,b,1], Henry (Hap) DavisIV[c], Johanna Pokorny[d], Georg Northoff[a,e,f,g,h]

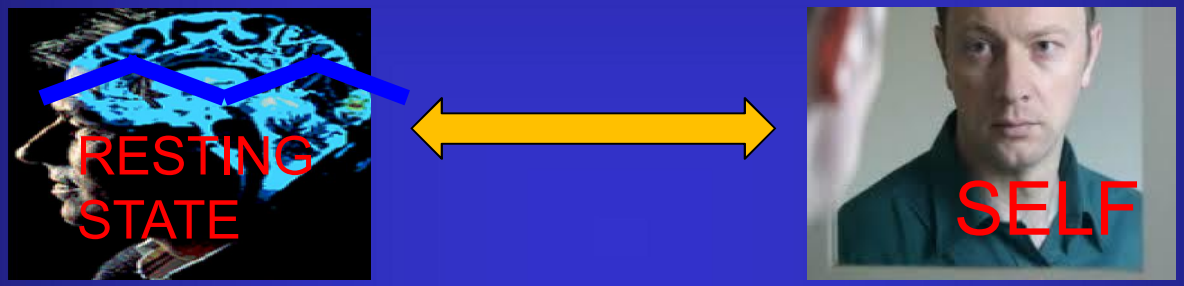
Huang et al. 2016, Neuropsychologia

From Neuronal continuity to Mental continuity of the Self: Power law in Medial prefrontal cortex predicts the degree of Private self-consciousness



Huang et al. 2016, Neuropsychologia

Plan and Outline of talk



World/Environment

The spontaneous activity's neural and biochemical features are experience-dependent

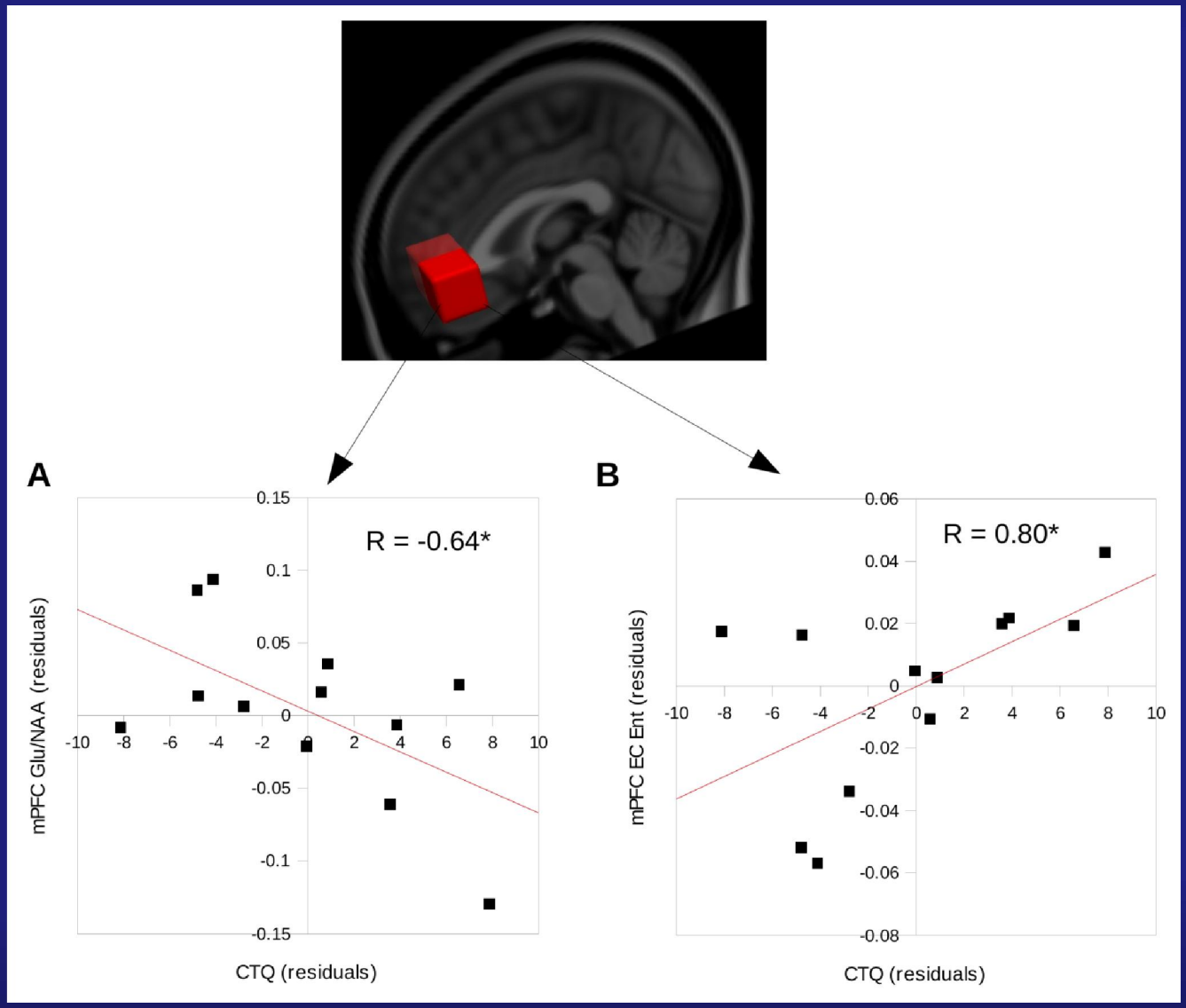
◆ Human Brain Mapping 00:00–00 (2015) ◆

Negative Childhood Experiences Alter a Prefrontal-Insular-Motor Cortical Network in Healthy Adults: A Preliminary Multimodal rsfMRI-fMRI-MRS-dMRI Study

Niall W. Duncan,[1,2,3,4]* Dave J. Hayes,[5] Christine Wiebking,[1,6] Brice Tiret,[7] Karin Pietruska,[8] David Q. Chen,[5] Pierre Rainville,[8] Malgorzata Marjańska,[9] Omar Mohammid,[1] Julien Doyon,[7] Mojgan Hodaie,[5] and Georg Northoff[1,2,3,4]

Nakao et al. 2013, Duncan et al. 2015, Human Brain Mapping

Early Childhood trauma modulates adult resting state activity as in Entropy = disorder or chaos



Nakao et al. 2013, Duncan et al. 2015, Human Brain Mapping

Psychiatric disorders – Are they basic disturbances of the resting state and hence of the sense of self?

Psychopathology

Psychopathology
DOI: 10.1159/000363351

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Accepted after revision: May 2, 2014
Published online: October 3, 2014

How Is Our Self Altered in Psychiatric Disorders? A Neurophenomenal Approach to Psychopathological Symptoms

Georg Northoff

Mind, Brain Imaging and Neuroethics Research Unit, Institute of Mental Health Research, Royal Ottawa Mental Health Centre, Ottawa, Ont., Canada

Northoff, G (2015) J Affective Disorders; Schizophrenia Bulletin, World Psychiatry

Self and Narcissism: Empty or lacking affect

Difficult concept: Freud, Kohut; here operationalized as dimensional personality trait with a continuum between 'normal' and 'pathological'

Investigation of a healthy sample: Subdivision into high and low narcissism according to the scores (> 66%, < 33% of total score) in the Narcissism Inventory (Denecke/Hilgenstock 1989)

Psychological: TAS (Alexithymia), Empathy, BDI, SCL-90; Neural: fMRI during empathy (face (Ekman) perception with subsequent rating of empathy (high, low)

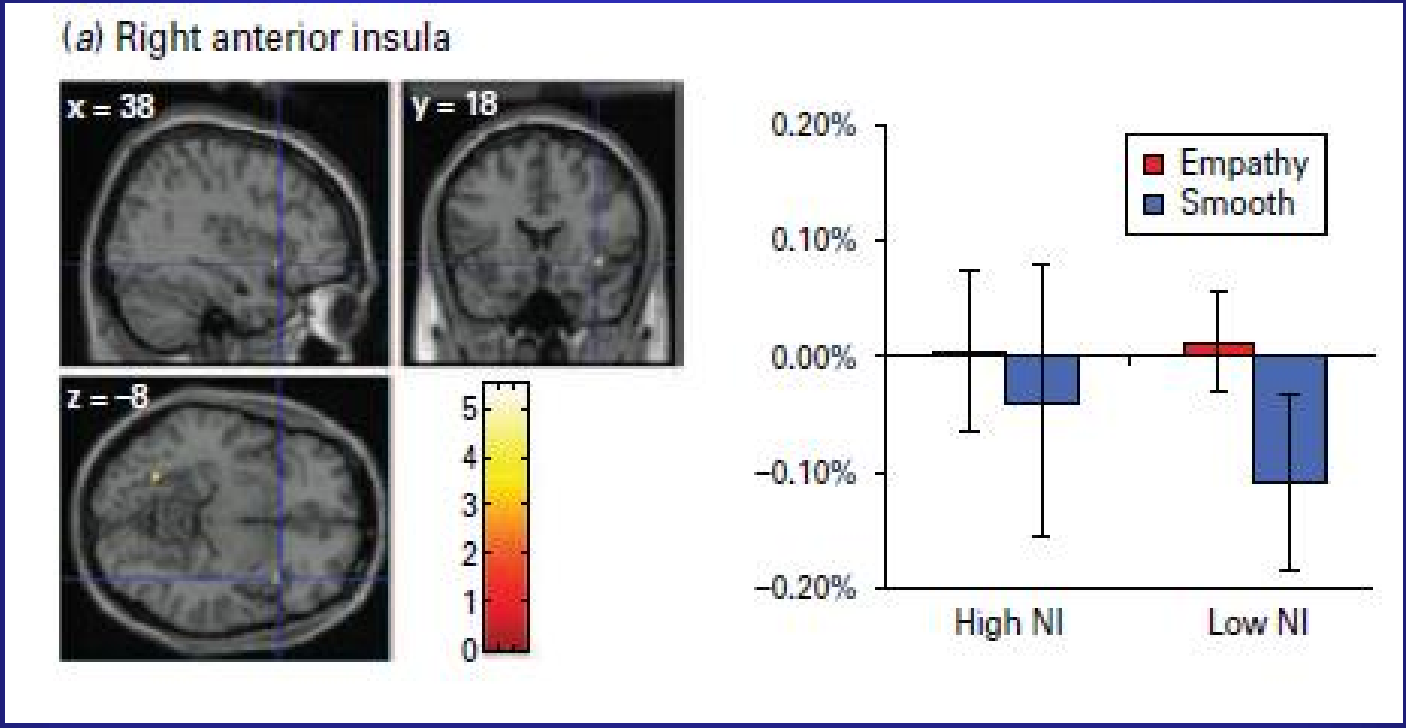
[Psychological Medicine, 2011, Scientific Report 2017)

Psychological Results: Reduced empathy for others

	Low NI ($n=11$) Mean (S.D.)	High NI ($n=11$) Mean (S.D.)	low NI *v.* high NI	
			T(df)	p value
Test of cognitive performance (LPS-3)	134.82 (9.74)	136.73 (12.61)	$T(20)=0.397$	0.70
Multiple Choice Vocabulary Intelligence Test (MWT-B)	142.27 (2.97)	138.73 (6.25)	$T(20)=-1.700$	0.11
Narcissism Inventory (NI)				
Threatened self	16.42 (1.30)	23.69 (8.05)	$T(20)=2.952$	0.014
'Classical' narcissistic self	20.98 (4.08)	28.20 (5.34)	$T(20)=3.566$	0.002
Idealist self	26.36 (2.93)	32.19 (4.36)	$T(20)=3.679$	0.002
Hypochondriac self	13.82 (3.49)	20.00 (6.66)	$T(20)=2.726$	0.016
Total score	19.36 (1.61)	26.17 (5.09)	$T(20)=4.237$	0.001
Toronto Alexithymia Scale (TAS-20)	33.36 (6.28)	43.40 (9.54)	$T(19)=2.875$	0.010
Interpersonal Reactivity Index (IRI)				
Fantasy scale	20.73 (2.83)	22.20 (4.64)	$T(19)=0.888$	0.39
Empathic concern	25.82 (3.71)	25.10 (4.48)	$T(19)=-0.401$	0.69
Perspective-taking	23.73 (3.55)	22.40 (2.99)	$T(19)=-0.921$	0.37
Personal distress	16.00 (3.44)	18.80 (3.12)	$T(19)=1.948$	0.07
Post-hoc rating indices for state emotional reaction towards the stimuli				
Empathy	59.33 (15.24)	60.00 (14.65)	$T(20)=-0.104$	0.92
Perspective-taking	56.36 (14.71)	58.64 (14.60)	$T(20)=-0.366$	0.72
Emotional intensity	59.42 (6.22)	56.57 (9.39)	$T(20)=0.839$	0.41
Emotional valence	41.00 (4.34)	38.44 (5.59)	$T(20)=1.199$	0.25
Personal relevance	35.41 (10.86)	43.99 (13.53)	$T(20)=-1.641$	0.12
Sympathy	48.11 (4.81)	47.99 (10.59)	$T(20)=0.035$	0.97
SCL-90-R GSI	41.73 (5.52)	53.50 (6.77)	$T(19)=4.387$	<0.001
BDI global score	1.91 (2.26)	5.20 (4.39)	$T(19)=2.191$	0.041

[Psychological Medicine, 2011, Scientific Report 2017)

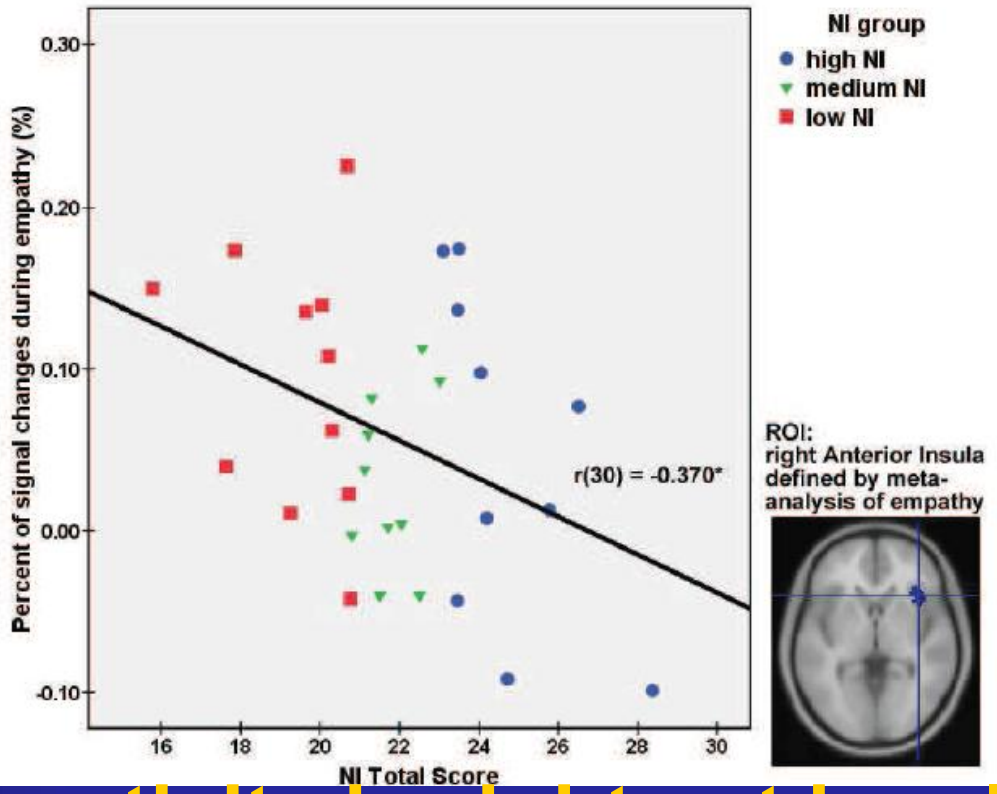
High narcisissm: reduced activity in Right anterior insula as typical “feeling region”: “feel yourself”



[Psychological Medicine, 2011, Scientific Report 2017)

Empathy-related signal changes in right ant insula correlate with the degree of narcissism

Supplementary FIGURE 3: Percent of signal changes from right anterior insula correlated with NI score for all three groups of subjects.



The less activity in right ant insula, the less empathy, and the less the person feels itself and others, and the more Narcissism

[Psychological Medicine, 2011, Scientific Report 2017)

Narcissism and social interaction

SCIENTIFIC REPORT

OPEN

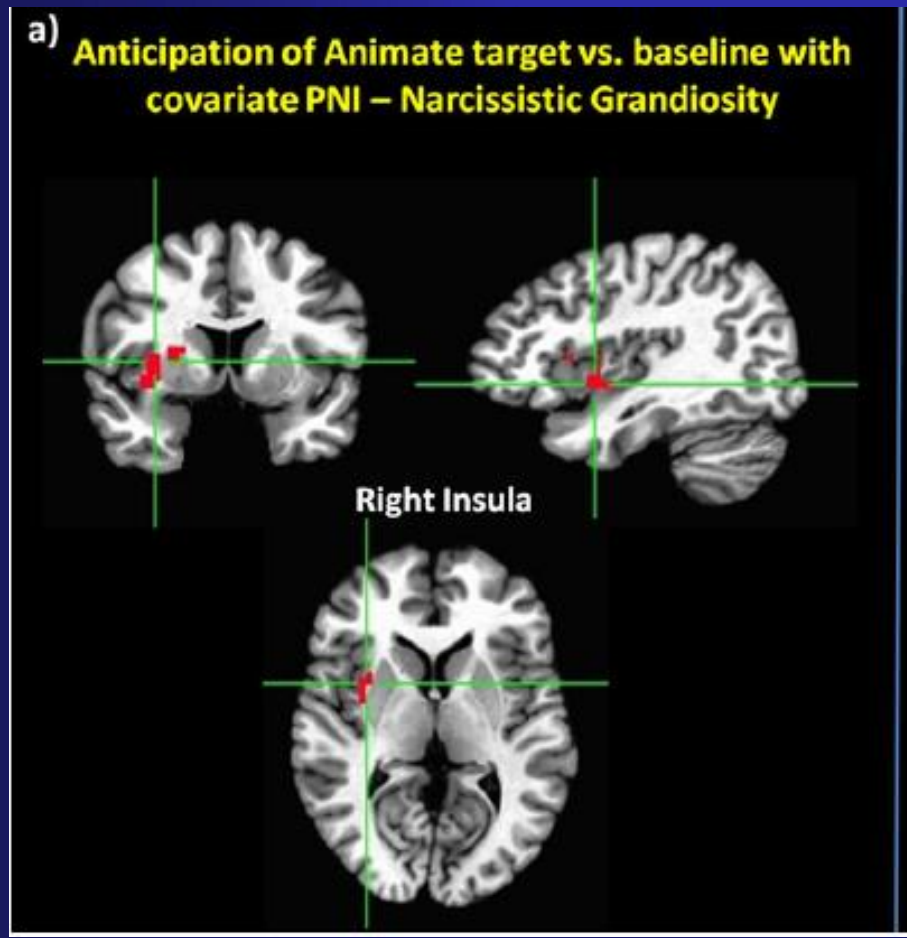
How spontaneous brain activity and narcissistic features shape social interaction

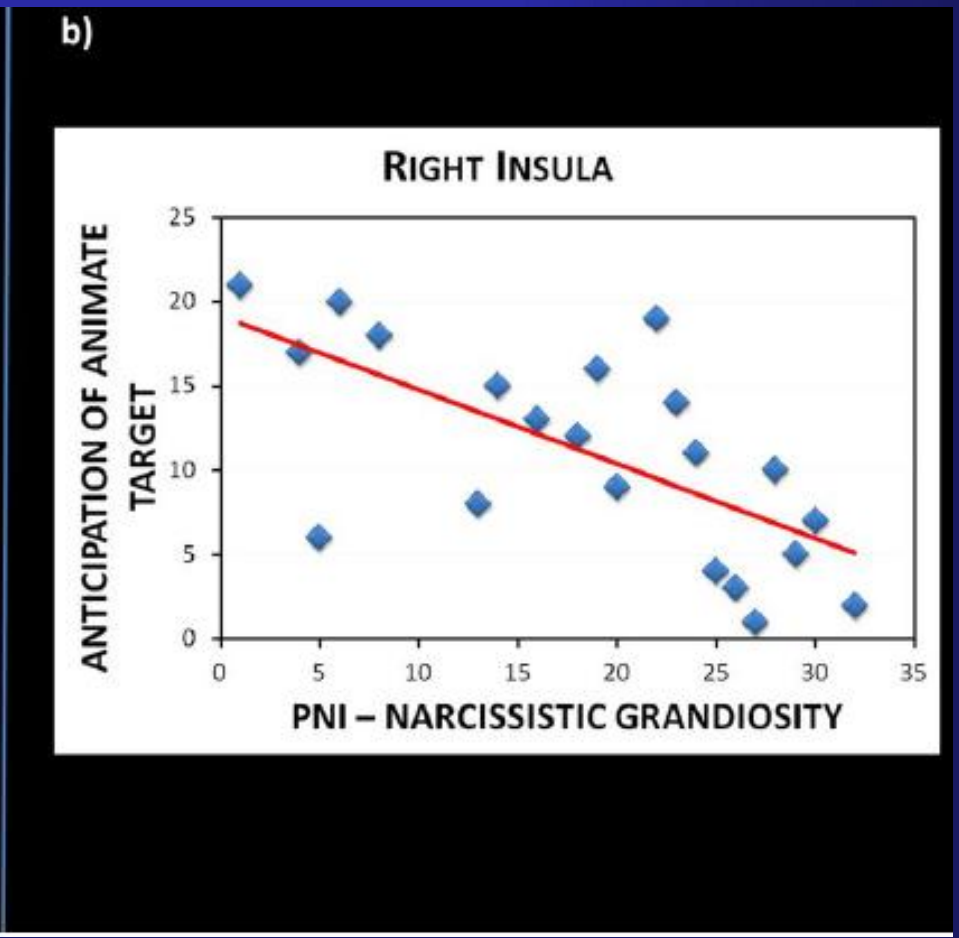
Received: 15 March 2017
Accepted: 9 August 2017
Published online: 30 August 2017

Andrea Scalabrini[1,2], Zirui Huang[3], Clara Mucci[2], Mauro Gianni Perrucci[1,4], Antonio Ferret
Andrea Fossati[5], Gian Luca Romani[1,4], Georg Northoff[6] & Sjoerd J. H. Ebisch[1,4]

[Psychological Medicine, 2011, Scientific Report 2017)

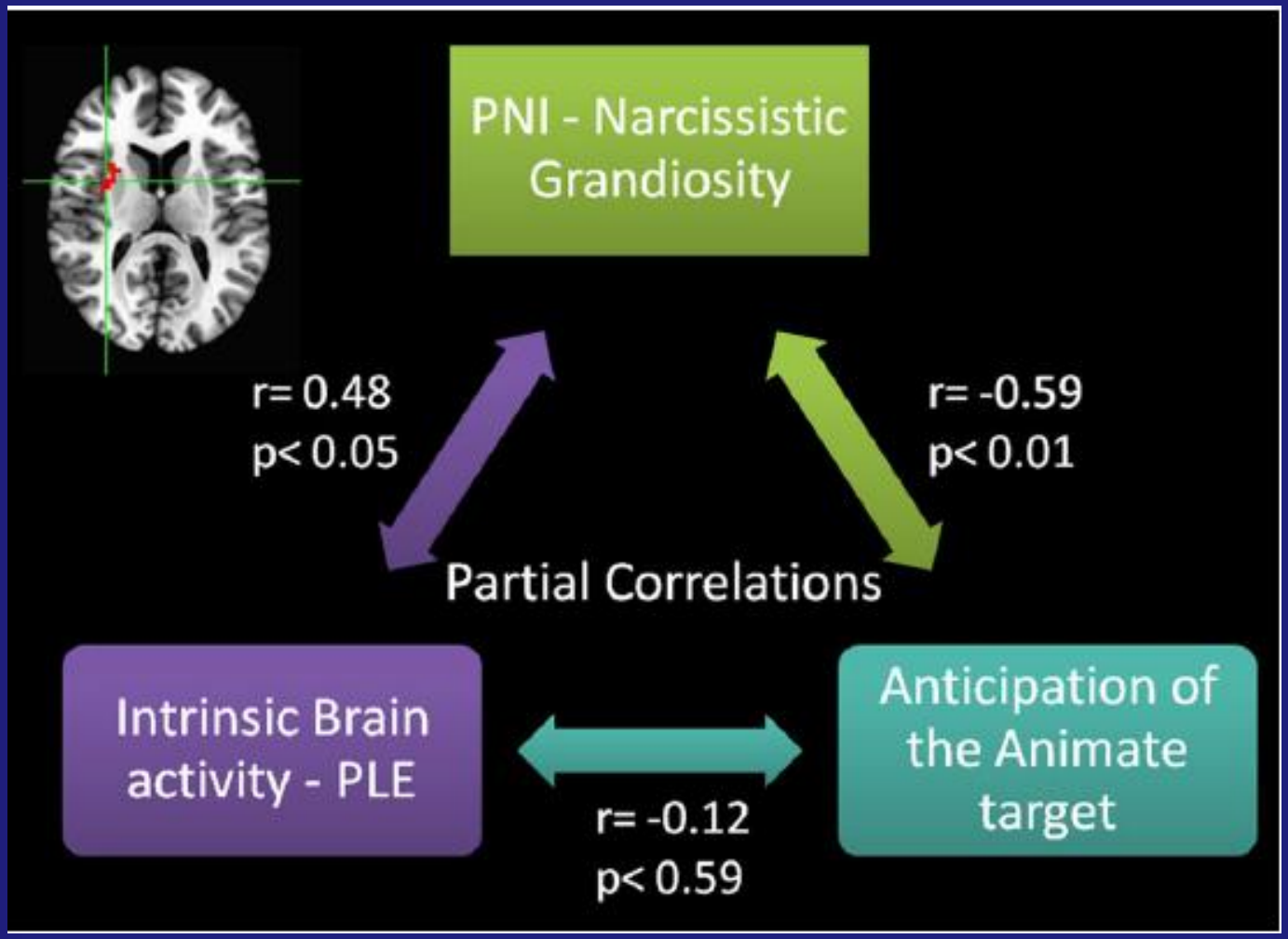
Narcissism – Less response to external social stimuli in the right insula: External stimuli are not perceived – Only the self is perceived





[Psychological Medicine, 2011, Scientific Report 2017)

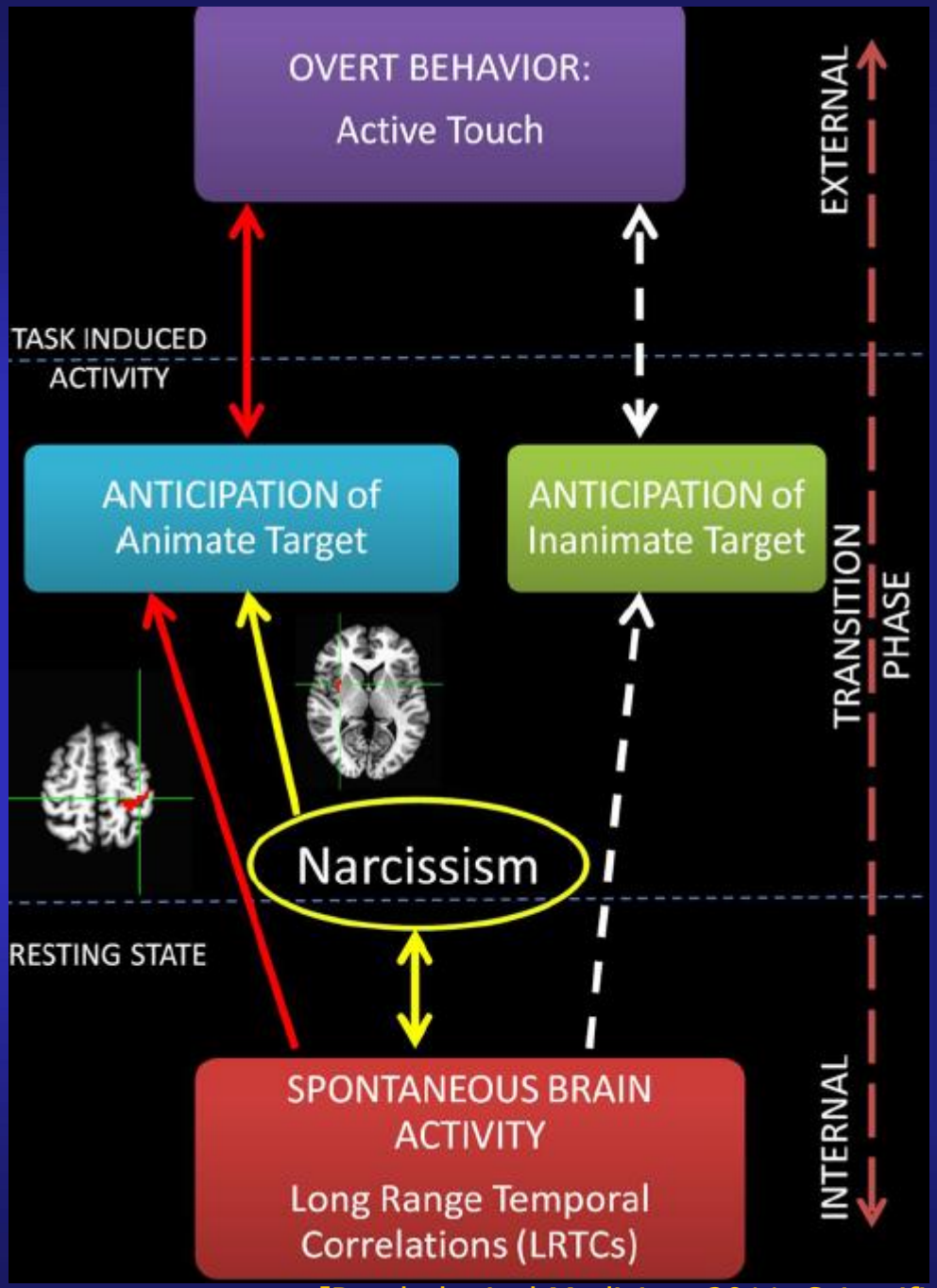
The brain's spontaneous activity and its speed are too slow in narcissism



The slower the intrinsic brain activity, the less activation /response to stimuli, and the more narcissistic grandiosity

[Psychological Medicine, 2011, Scientific Report 2017)

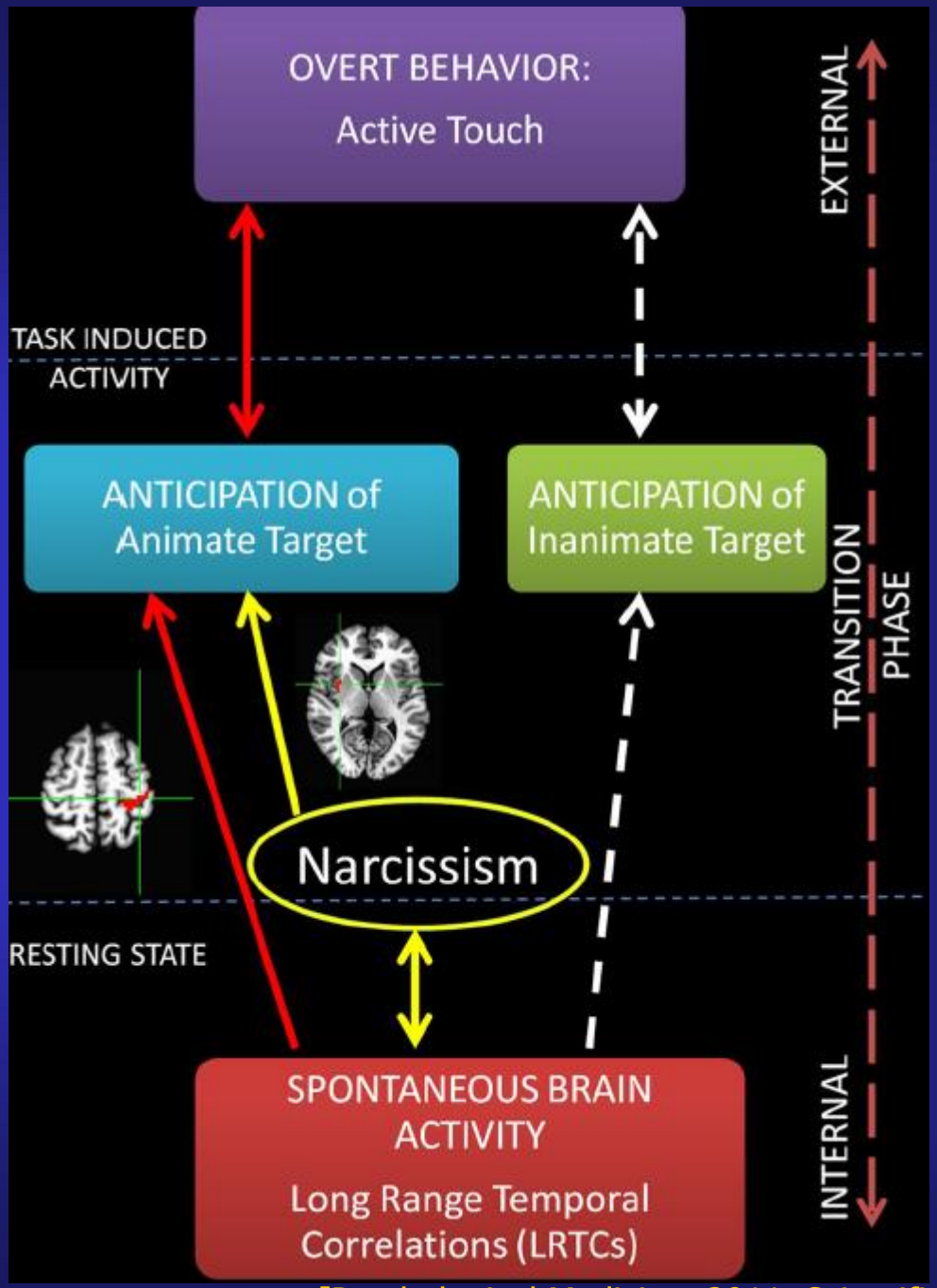
Narcissism: Temporal *Dysbalance in speed between internal mental world (brain's spontaneous activity) = slow brain activity, and the brain's response to external stimuli = fast brain activity*



[Psychological Medicine, 2011, Scientific Report 2017)

Therapy:

Make their spontaneous activity faster (through for instance, music therapy) and stimulate their right anterior insula (through psychotherapy)



[Psychological Medicine, 2011, Scientific Report 2017)

Spatiotemporal Psychopathology: So far only spatial component – how about "Temporal Psychopathology"?

Classic: EEG/MEG; but: fMRI – Infraslow Frequencies ?

PNAS

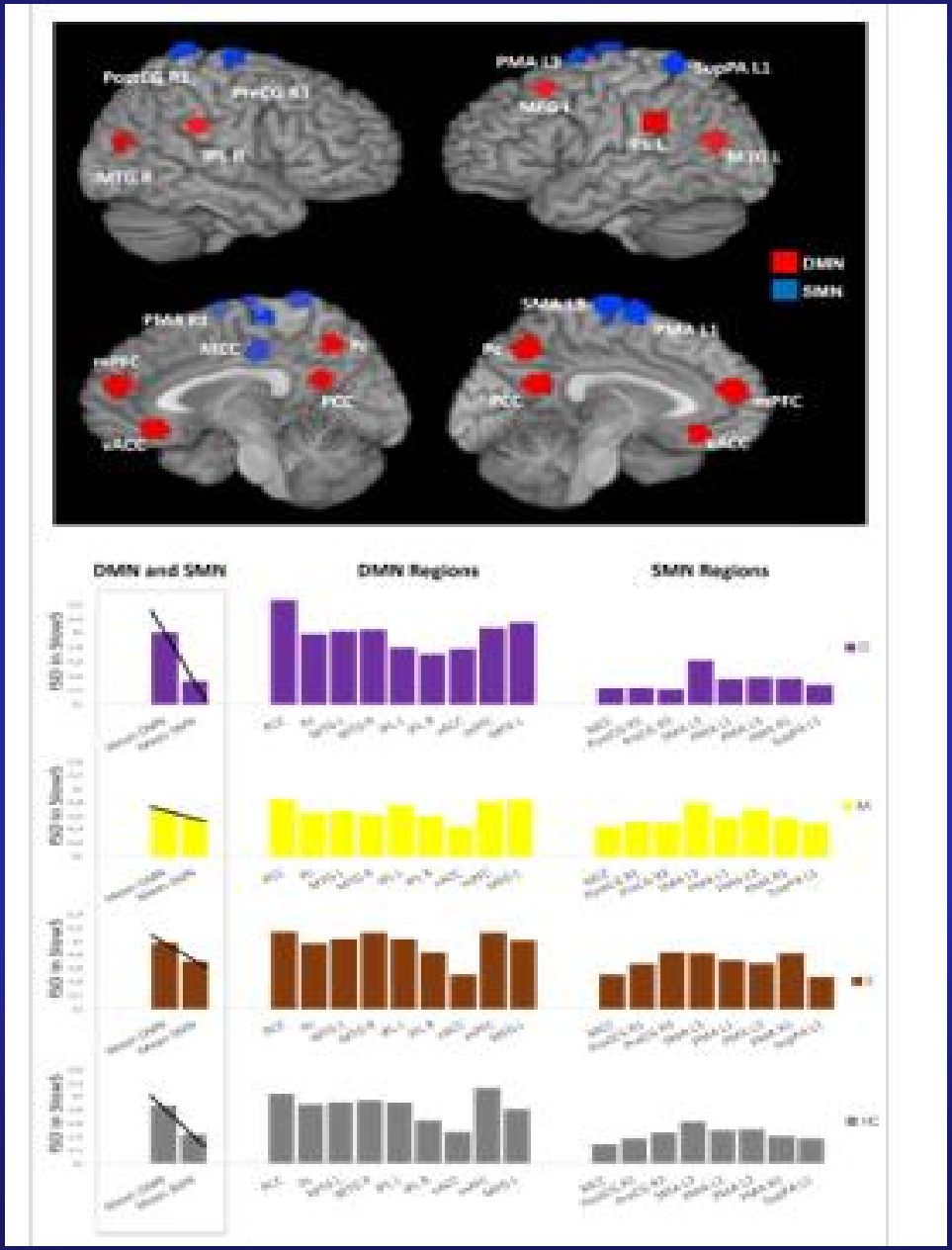
Contrasting variability patterns in the default mode and sensorimotor networks balance in bipolar depression and mania

Matteo Martino[a,1], Paola Magioncalda[a,1,2], Zirui Huang[b], Benedetta Conio[a], Niccolò Piaggio[c], Niall W. Duncan[d,e,f], Giulio Rocchi[a], Andrea Escelsior[a], Valentina Marozzi[a], Annemarie Wolff[b], Matilde Inglese[g,h], Mario Amore[a], and Georg Northoff[b,d,e,f,i,j,k,2]

[a]Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics, and Maternal and Child Health, Section of Psychiatry, University of Genoa, Genoa 16100, Italy; [b]Mind, Brain Imaging, and Neuroethics, Royal's Institute of Mental Health Research, University of Ottawa, Ottawa, ON, Canada K1Z 7K4; [c]Department of Radiology, Section of Neuroradiology, University of Genoa, Genoa 16100, Italy; [d]Graduate Institute of Humanities in Medicine, Taipei Medical University, Taipei City 110, Taiwan; [e]Departments of Psychiatry and Radiology, Brain and Consciousness Research Center, Taipei Medical University–Shuang Ho Hospital, New Taipei City 23561, Taiwan; [f]Centre for Cognition and Brain Disorders, Normal University Hangzhou, Hangzhou 31121, China; [g]Department of Neurology, Radiology, and Neuroscience, Mount Sinai School of Medicine, New York, NY 10029; [h]Magnetic Resonance Research Center on Nervous System Diseases, University of Genoa, Genoa 16100, Italy; [i]Research Center for Mind, Brain, and Learning, National Chengchi University, Taipei City 11605, Taiwan; [j]Department of Philosophy and Cognition, Zhejang University, Hangzhou 310015, China; and [k]University of Ottawa Brain and Mind Research Institute, University of Ottawa, Ottawa, ON, Canada K1Z 7K4

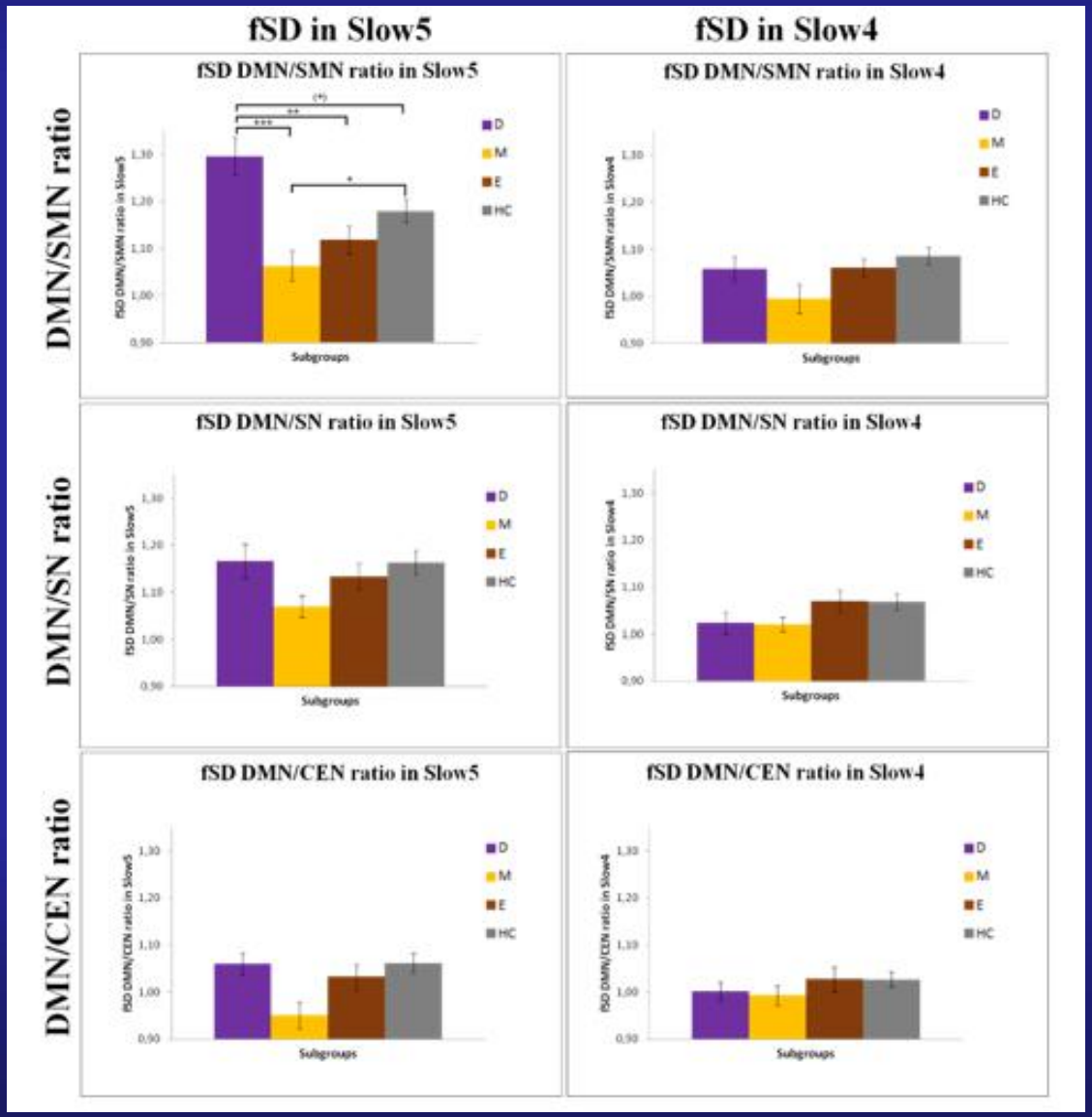
Proceedings of the National Academy of Science, April 2016

Bipolar disorder – Variability within DMN and SMN



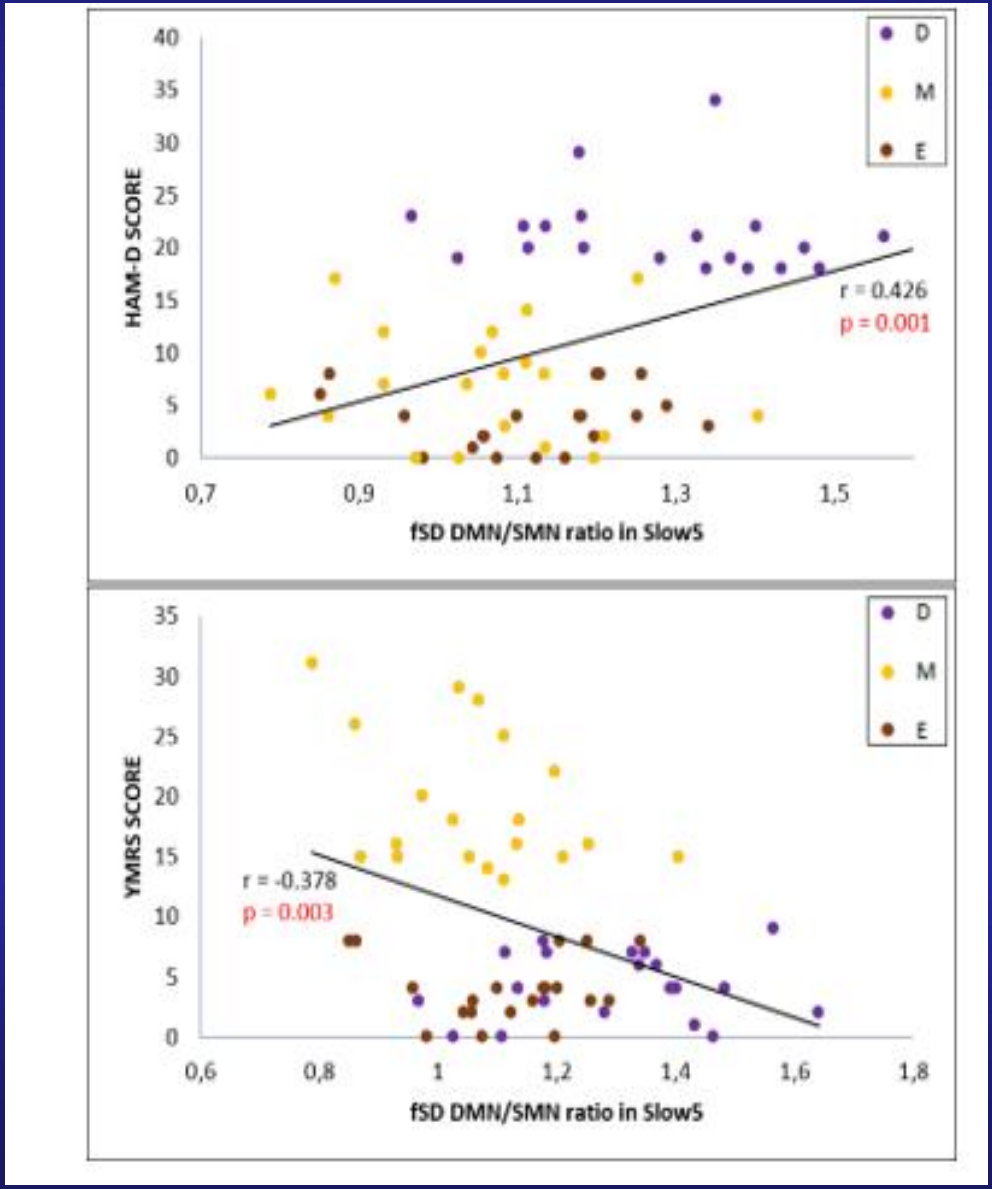
Martino et al. (2016) PNAS,

Bipolar disorder – Opposite variability pattern in resting state DMN-SMN ratio in depression and mania



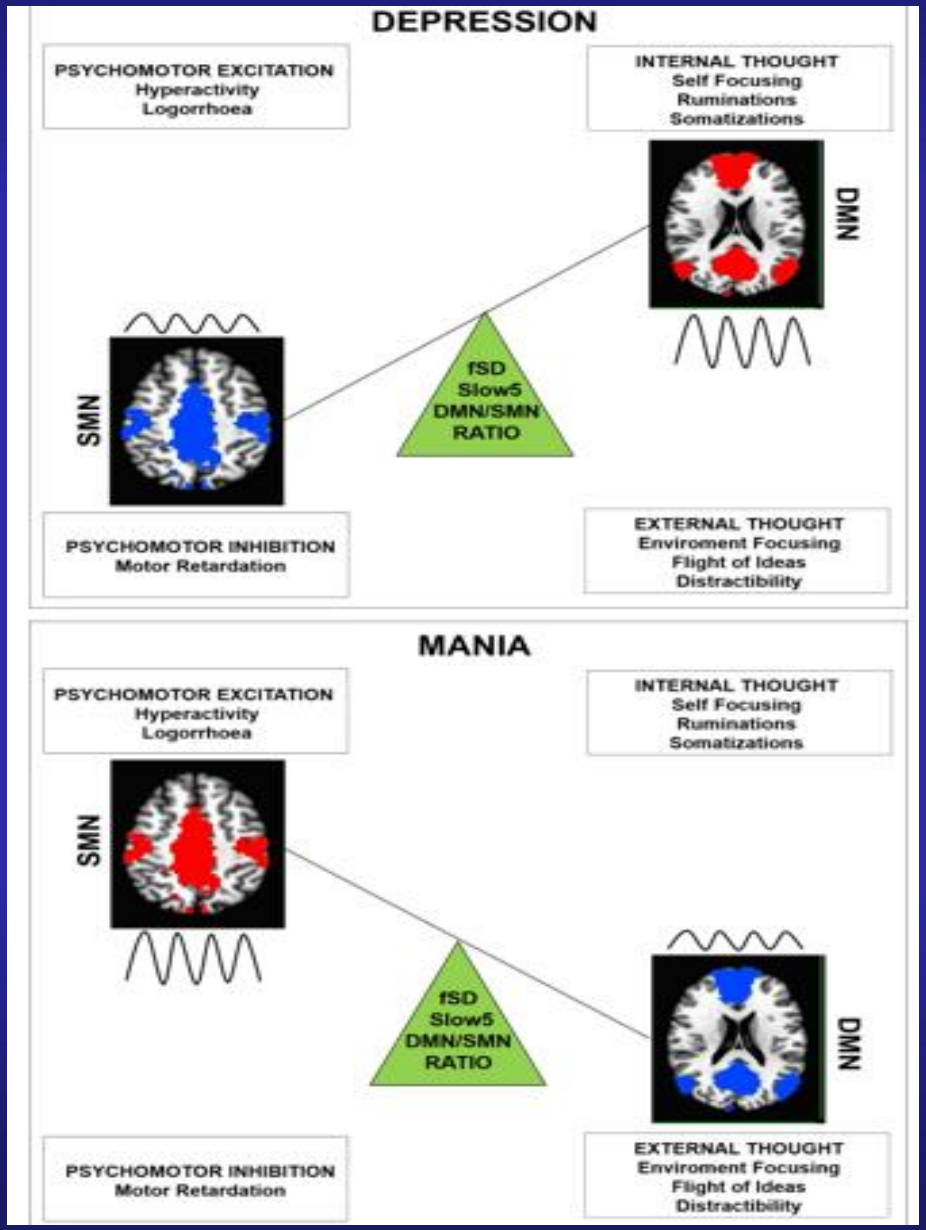
Martino et al. (2016) PNAS,

Opposite correlation of DMN-SMN SD ratio with manic and depressive symptoms



Martino et al. (2016) PNAS,

Opposite SD balance between DMN-SMN – Self and its Psychopathological symptoms



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Georg Northoff

Mind, Brain Imaging and Neuroethics Research Unit, Institute of Mental Health Research, Royal Ottawa Mental Health Centre, Ottawa, Ont., Canada

Northoff, G (2015) J Affective Disorders; Schizophrenia Bulletin, World Psychiatry

How does the brain's construction of Time stand in relation to the Time of the world?

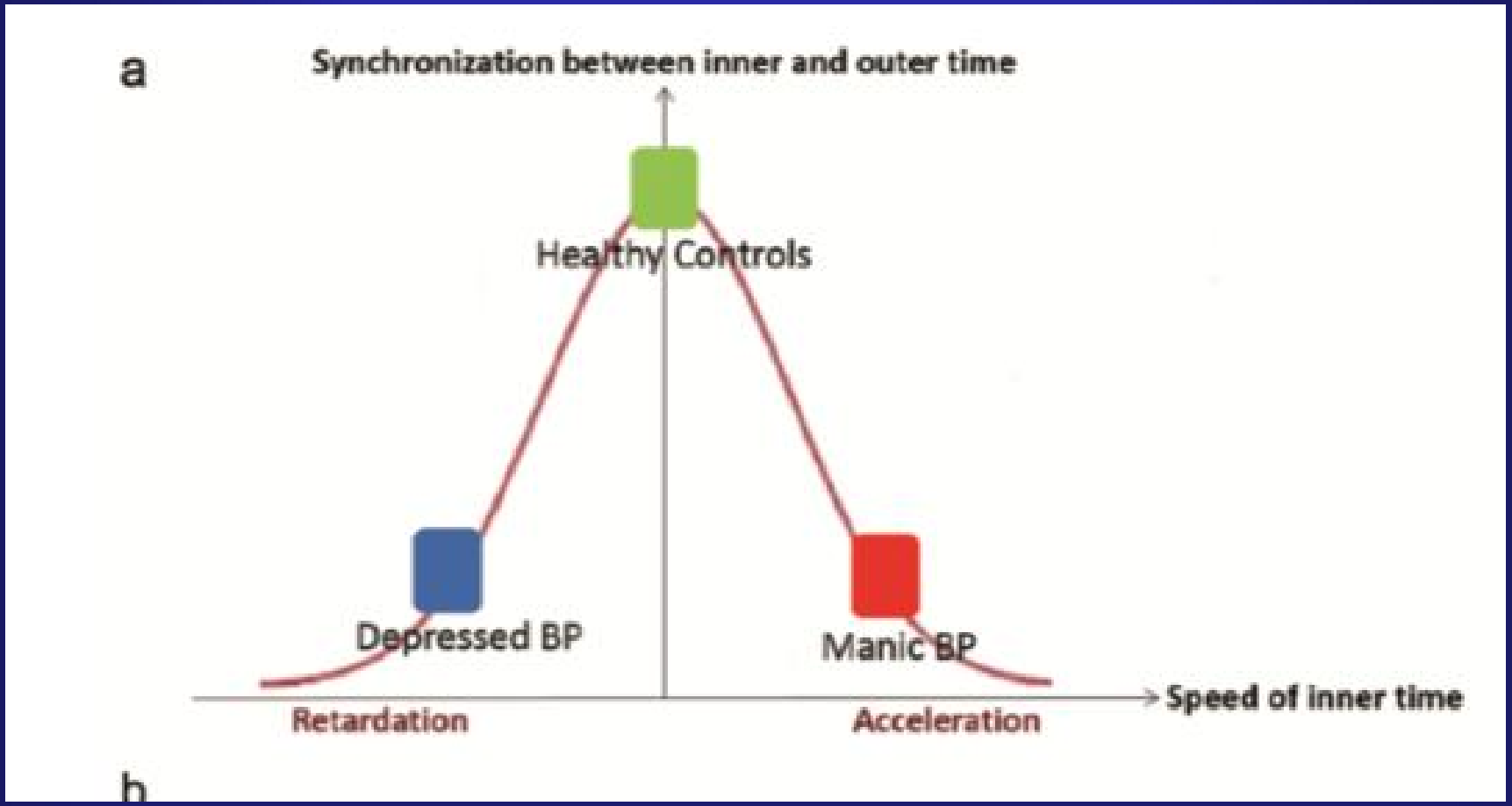
Schizophrenia Bulletin
doi:10.1093/schbul/sbx050

Too Fast or Too Slow? Time and Neuronal Variability in Bipolar Disorder—A Combined Theoretical and Empirical Investigation

Georg Northoff*[,1–5], Paola Magioncalda[2,6,9], Matteo Martino[2,6,9], Hsin-Chien Lee[7], Ying-Chi Tseng[8], and Timothy Lane[4,5]

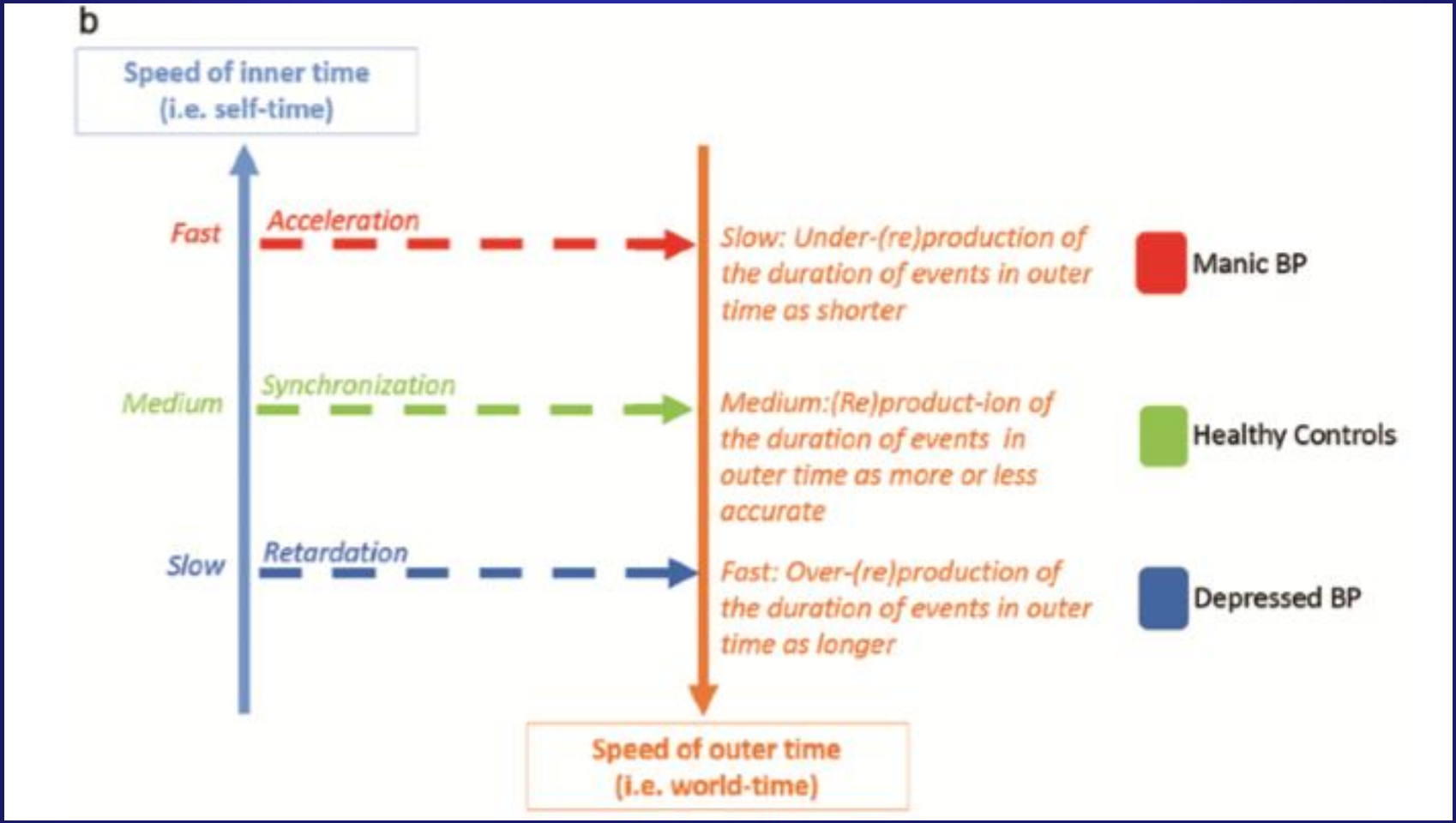
Northoff et al. (2017) Schizophrenia Bulletin

The *Brain's* construction of its "Inner Time" may be either *in* or *out* of tune with the "Outer Time" of the *World* – Bipolar disorder



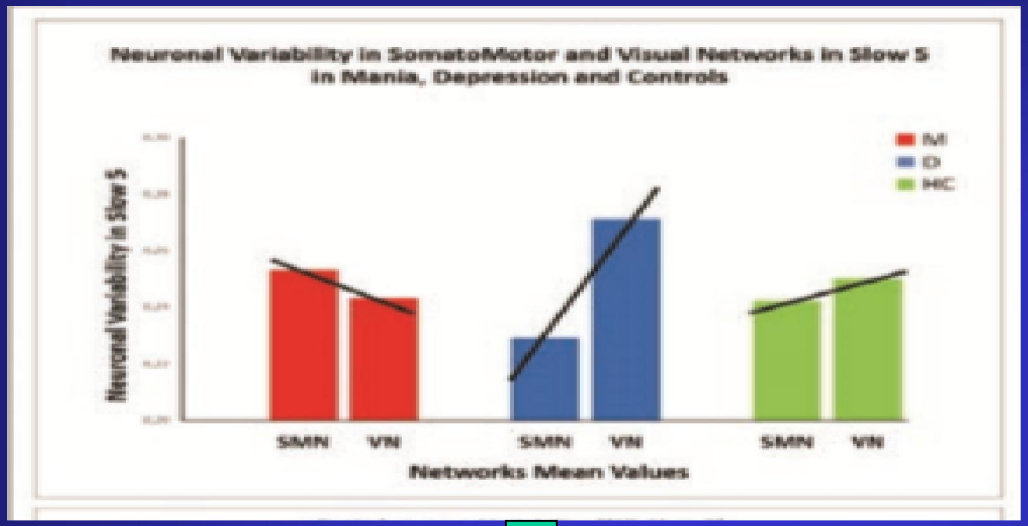
Northoff et al. (2017) Schizophrenia Bulletin

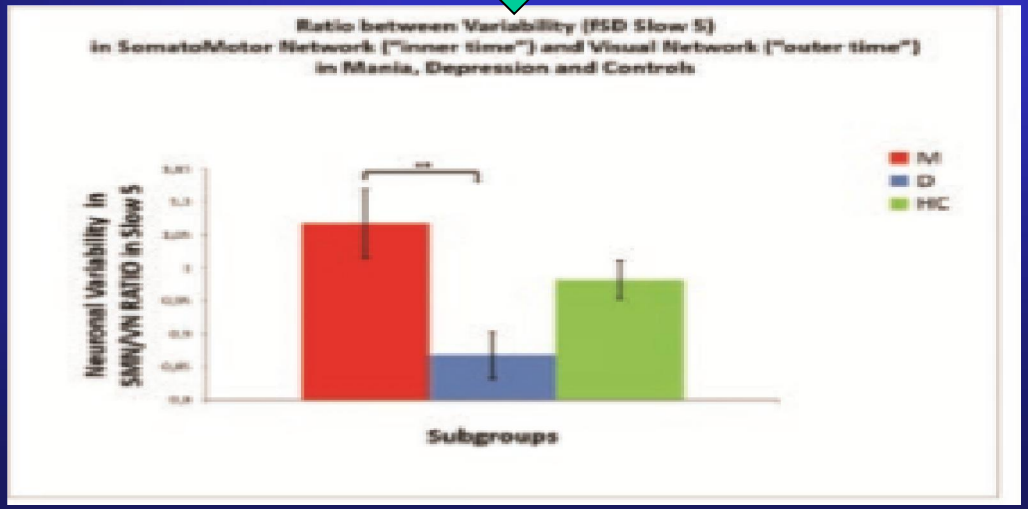
“Everything is relative”: “Inner time speed” as measure or reference for Consciousness or Perception of “Outer time speed”



Northoff et al. (2017) Schizophrenia Bulletin

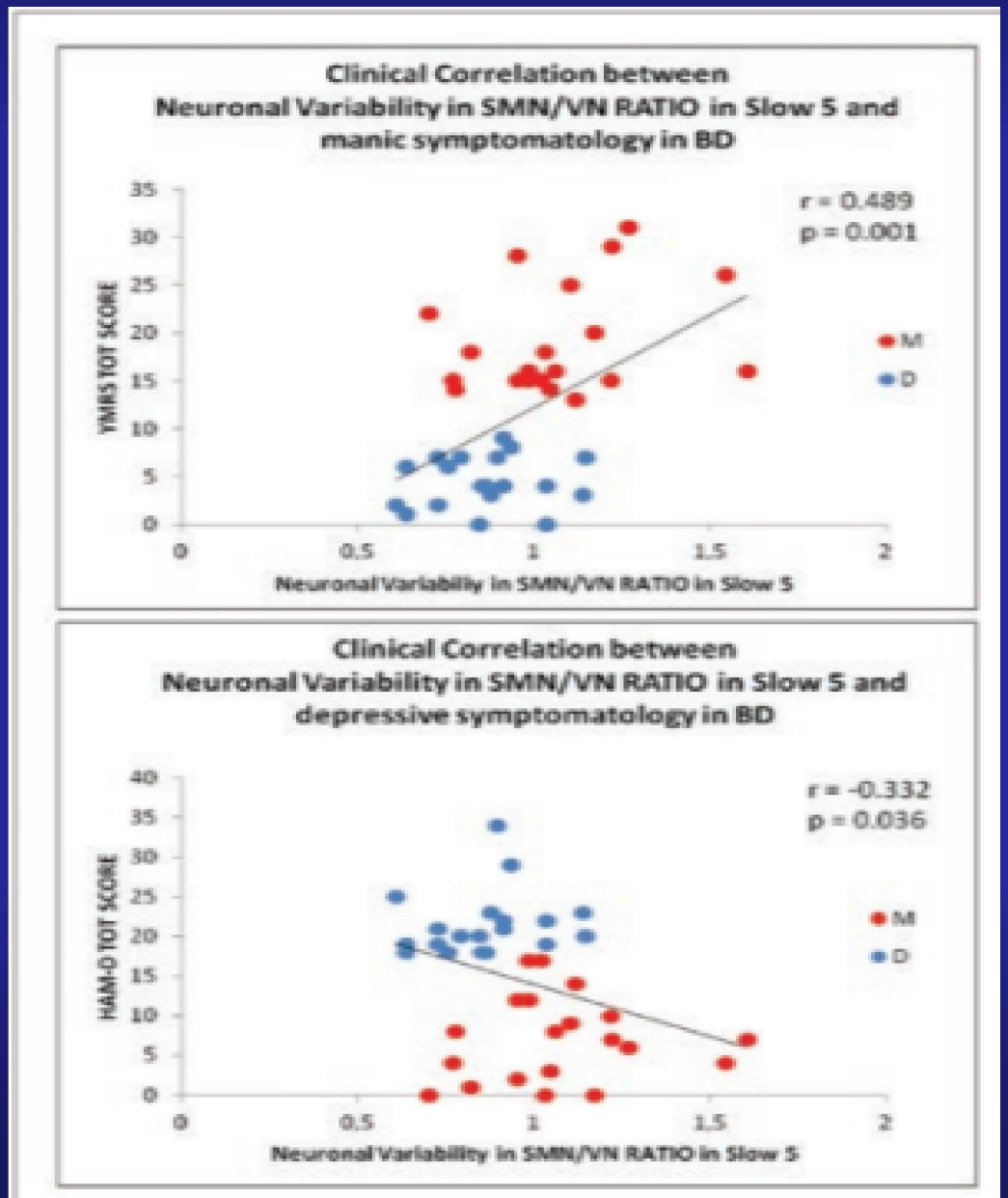
“Speed of Time” = Neuronal speed = Neuronal variability: “Inner time” = Somatomotor network – “Outer time” Visual network





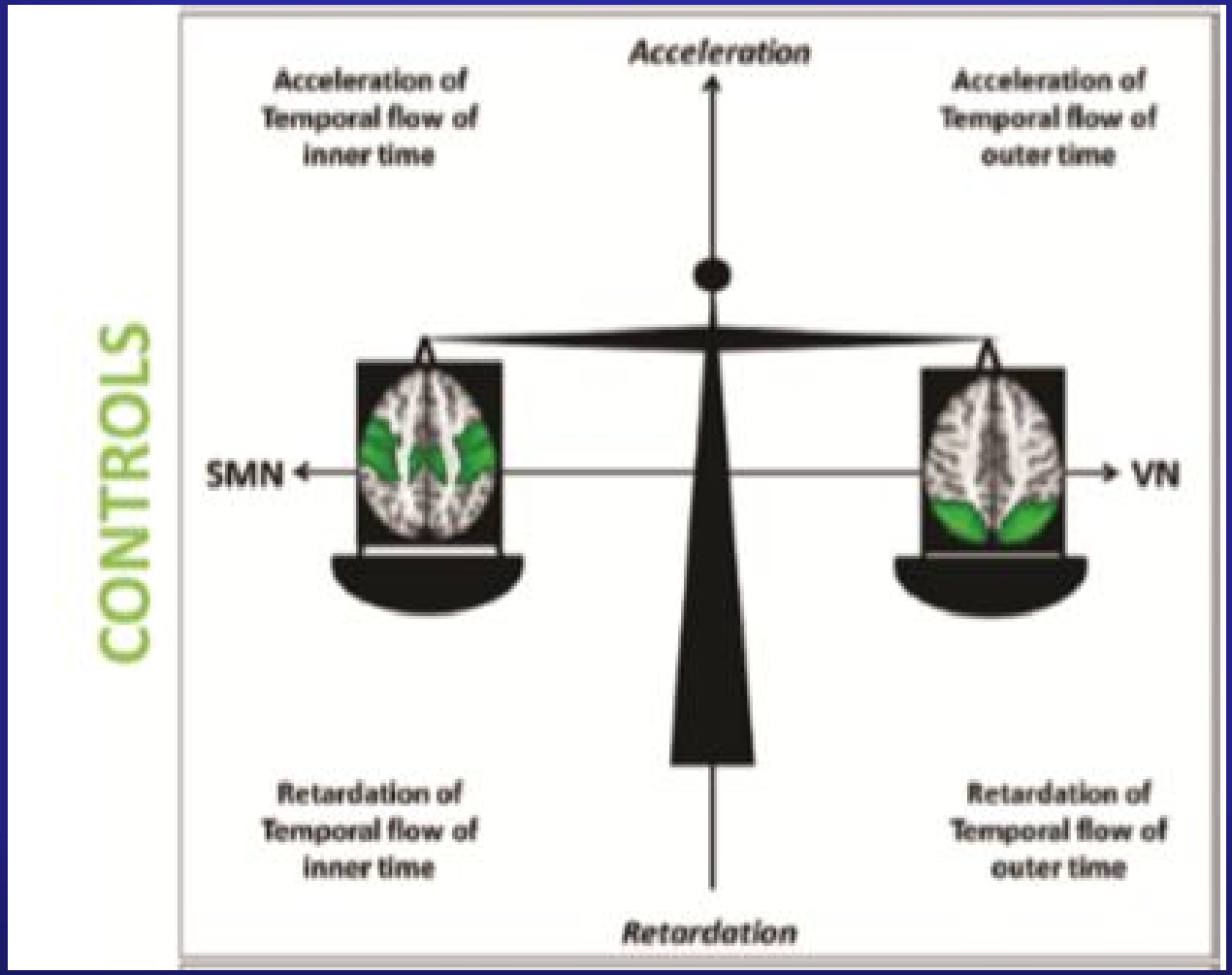
Northoff et al. (2017) Schizophrenia Bulletin

Neuronal balance/ratio between “inner” and “outer” time predicts clinical symptoms



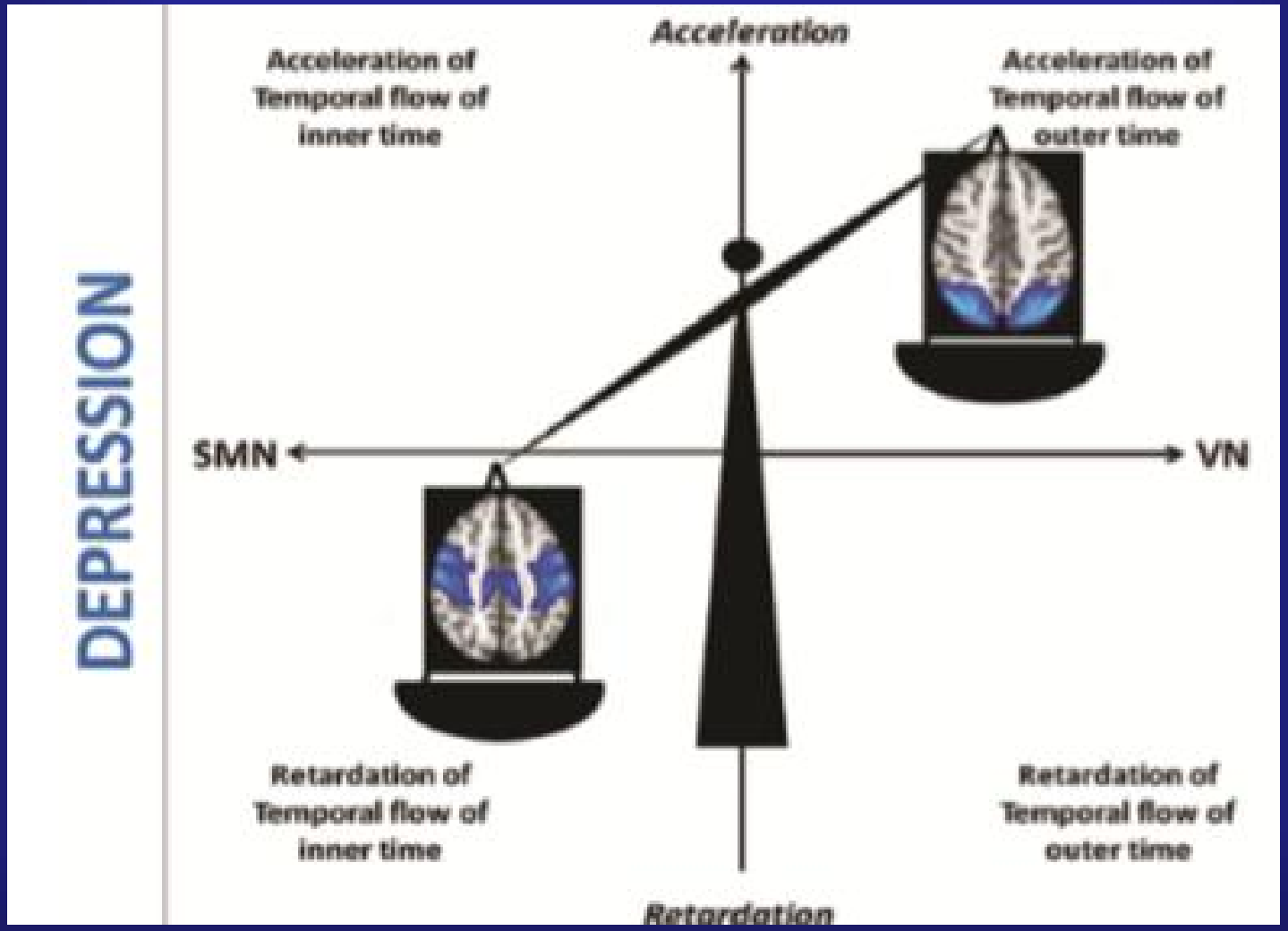
Northoff et al. (2017) Schizophrenia Bulletin

Healthy subjects: Balance between “Inner Time” and “Outer time” – We are “in tune” with the Time speed of the world



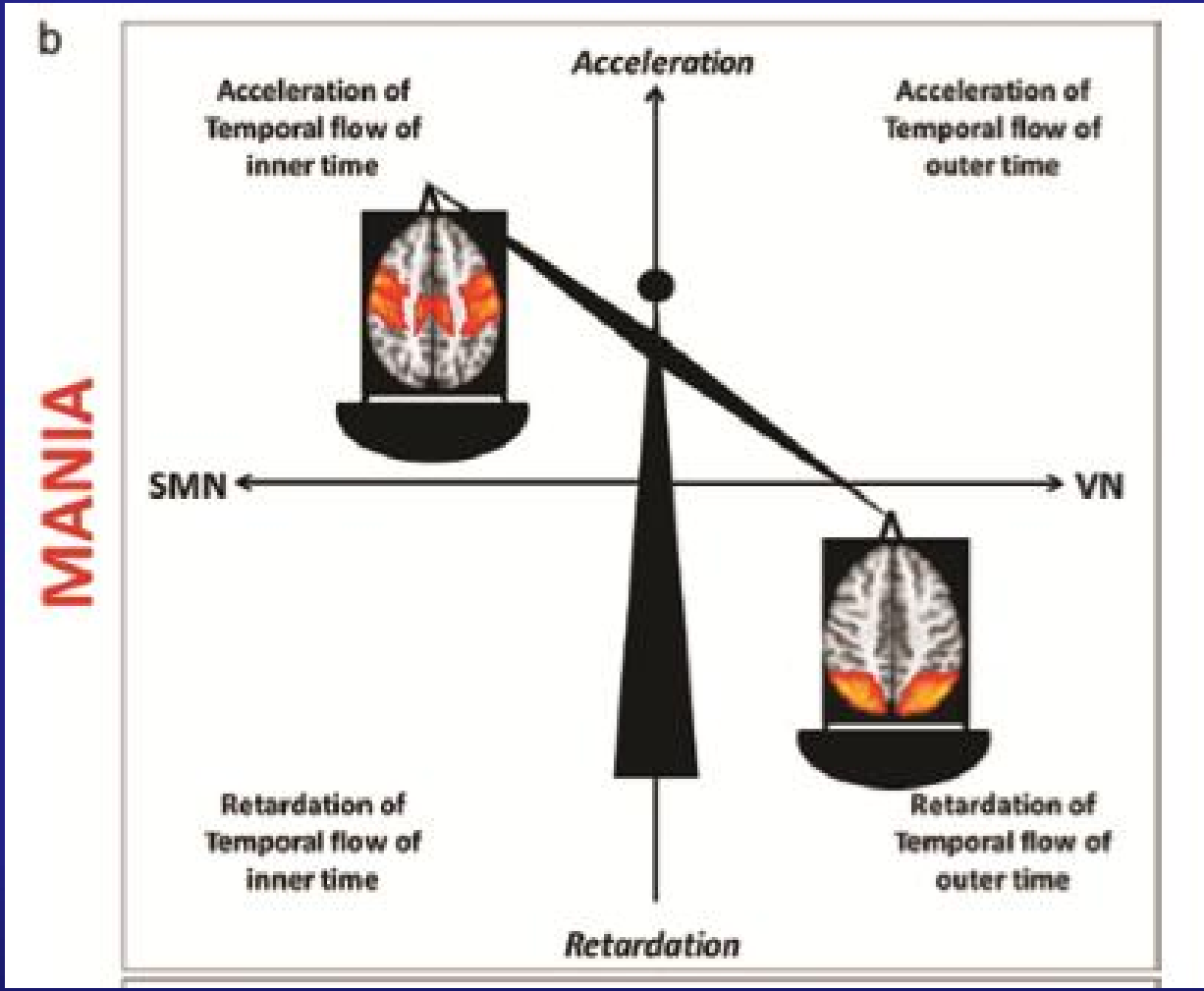
Northoff et al. (2017) Schizophrenia Bulletin

Depression: Decreased Neuronal variability leads to decreased "Inner time speed" – "Too slow" for the world



Northoff et al. (2017) Schizophrenia Bulletin

Mania: Increased Neuronal variability leads to increased “Inner time speed” - “Too fast” for the world

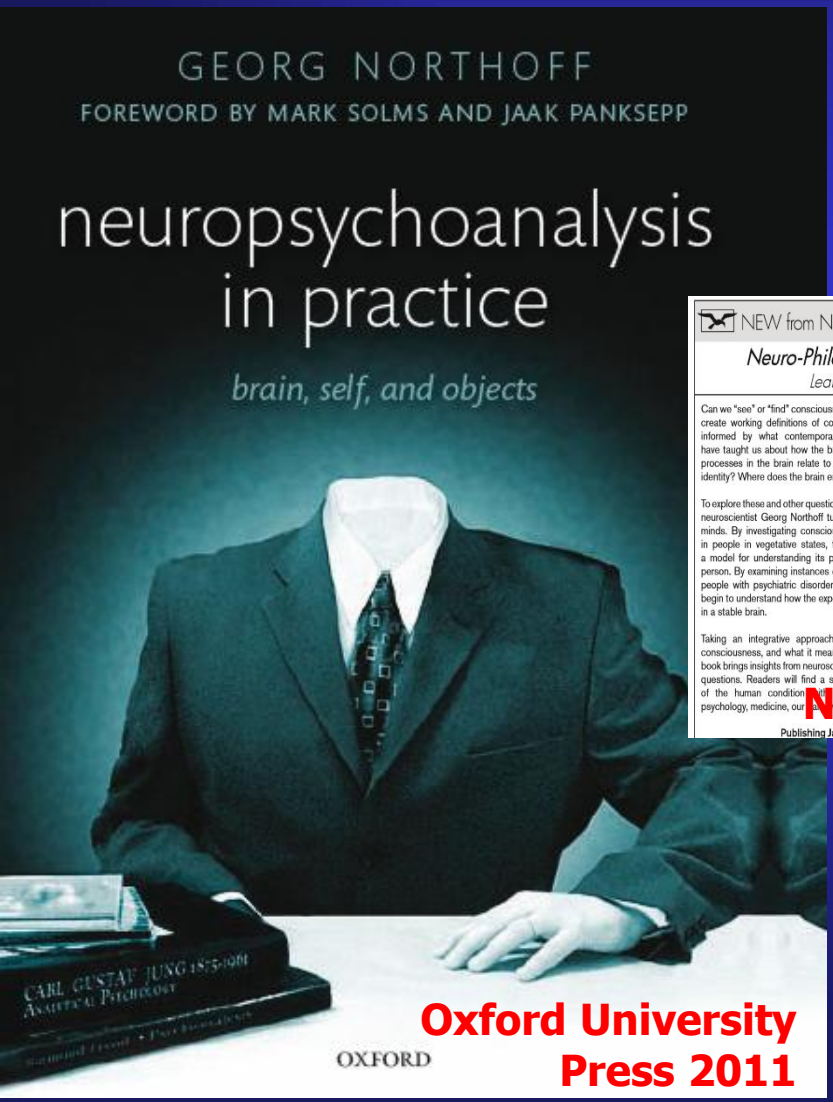


Northoff et al. (2017) Schizophrenia Bulletin

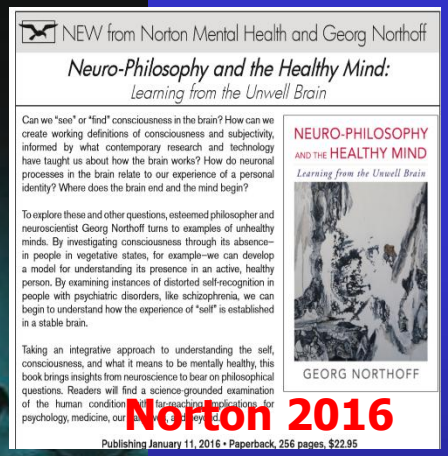
Self and Symptoms – Spatiotemporal – Do we need *"Spatiotemporal Psychopathology"?*

Northoff 2015, 2016, J Affective Disorder, Current Opinion in Psychiatry, Progress in Neurobiology 2016, World Psychiatry 2015

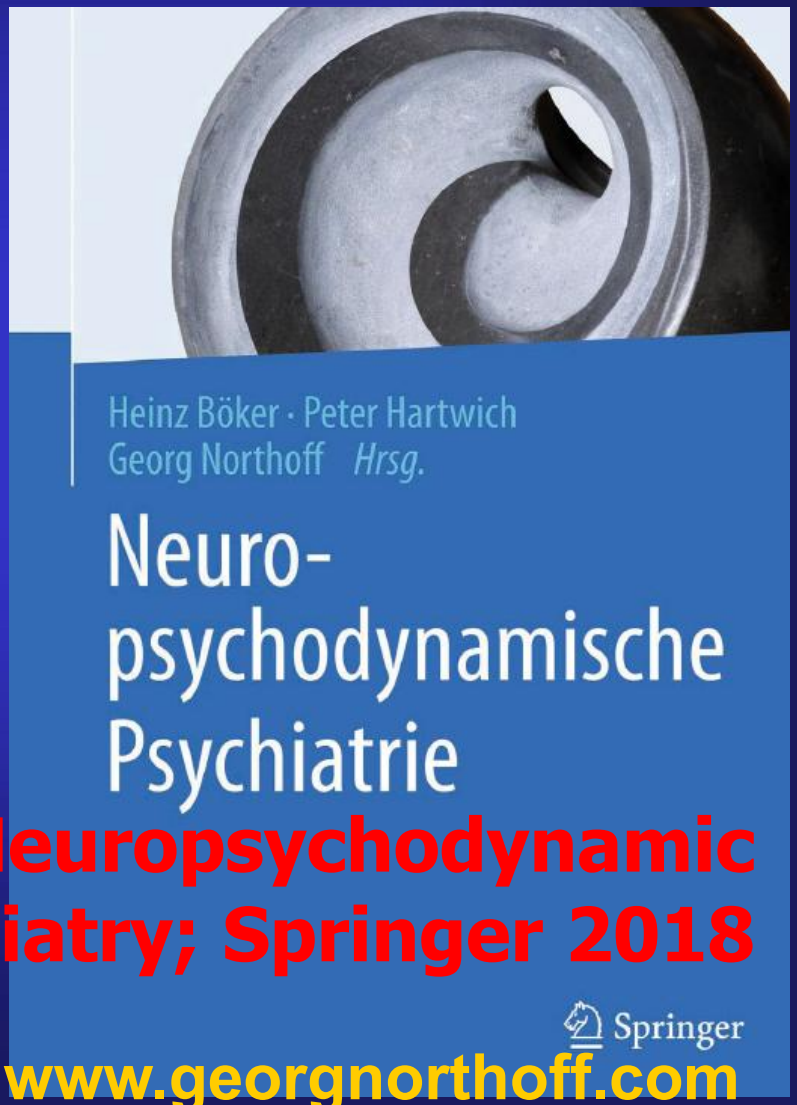
Diagnostic and therapeutic markers: Spatiotemporal therapy – Psychotherapy, Musictherapy, and Stimulation therapy



Oxford University Press 2011



Norton 2016



Neuropsychodynamic Psychiatry; Springer 2018

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