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

Gruesome Grey Pulp
A scientific screwball musical comedy

What is it to be “human”? Is it merely the ability to think? Or is it also how we feel?

If you’re George, a neuroscientist, it all boils down to our brain and how its different circuits control our actions and thoughts.
If you’re Liz, a psychoanalyst, being human is more than just what lies between our ears — it’s about emotions and living.

Featuring DR. GEORG NORTHOFT, playwright and world-renowned neuroscientist and Canada Research Chair, University of Ottawa, internationally recognized actress ELIZABETH EnCHE and highly acclaimed composer JOHN KERKISCHAN

Monday, April 25, 2011 at 7 pm
Great Canadian Theatre Company
1222 Wellington Street West

TICKETS:
$45 per person, includes a dessert reception
Call 613.230.5196 to purchase your tickets today

In support of
The Royal’s Depression Research Centre

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)
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

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

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 “constructs” 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”

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

RESTING STATE

World/Environment

SELF
The spontaneous activity’s neural and biochemical features are experience-dependent.
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?

How Is Our Self Altered in Psychiatric Disorders? A Neurophenomenonal 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

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

<table>
<thead>
<tr>
<th>Test of cognitive performance (LPS-3)</th>
<th>Low NI (n=11) Mean (s.d.)</th>
<th>High NI (n=11) Mean (s.d.)</th>
<th>low NI v. high NI T(df)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test of cognitive performance (LPS-3)</td>
<td>134.82 (9.74)</td>
<td>136.73 (12.61)</td>
<td>T(20) = 0.397</td>
<td>0.70</td>
</tr>
<tr>
<td>Multiple Choice Vocabulary Intelligence Test (MWT-B)</td>
<td>142.27 (2.97)</td>
<td>138.73 (6.25)</td>
<td>T(20) = -1.700</td>
<td>0.11</td>
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<tr>
<td>Narcissism Inventory (NI)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Threatened self</td>
<td>16.42 (1.30)</td>
<td>23.69 (8.05)</td>
<td>T(20) = 2.952</td>
<td>0.014</td>
</tr>
<tr>
<td>‘Classical’ narcissistic self</td>
<td>20.98 (4.08)</td>
<td>28.20 (5.34)</td>
<td>T(20) = 3.566</td>
<td>0.002</td>
</tr>
<tr>
<td>Idealist self</td>
<td>26.36 (2.93)</td>
<td>32.19 (4.36)</td>
<td>T(20) = 3.679</td>
<td>0.002</td>
</tr>
<tr>
<td>Hypochondriac self</td>
<td>13.82 (3.49)</td>
<td>20.00 (6.66)</td>
<td>T(20) = 2.726</td>
<td>0.016</td>
</tr>
<tr>
<td>Total score</td>
<td>19.96 (1.61)</td>
<td>26.17 (5.09)</td>
<td>T(20) = 4.237</td>
<td>0.001</td>
</tr>
<tr>
<td>Toronto Alexithymia Scale (TAS-20)</td>
<td>33.36 (6.28)</td>
<td>43.40 (9.54)</td>
<td>T(19) = 2.875</td>
<td>0.010</td>
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<tr>
<td>Interpersonal Reactivity Index (IRI)</td>
<td></td>
<td></td>
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<tr>
<td>Fantasy scale</td>
<td>20.73 (2.83)</td>
<td>22.20 (4.64)</td>
<td>T(19) = 0.888</td>
<td>0.39</td>
</tr>
<tr>
<td>Empathic scale</td>
<td>25.82 (3.71)</td>
<td>25.10 (4.48)</td>
<td>T(19) = -0.401</td>
<td>0.69</td>
</tr>
<tr>
<td>Perspective-taking</td>
<td>23.73 (3.55)</td>
<td>22.40 (2.99)</td>
<td>T(19) = -0.921</td>
<td>0.37</td>
</tr>
<tr>
<td>Personal distress</td>
<td>16.00 (3.44)</td>
<td>18.80 (3.12)</td>
<td>T(19) = 1.948</td>
<td>0.07</td>
</tr>
<tr>
<td>Post-hoc rating indices for state emotional reaction towards the stimuli</td>
<td></td>
<td></td>
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<tr>
<td>Empathy</td>
<td>59.33 (15.24)</td>
<td>60.00 (14.65)</td>
<td>T(20) = -0.104</td>
<td>0.92</td>
</tr>
<tr>
<td>Perspective-taking</td>
<td>56.36 (14.71)</td>
<td>58.64 (14.60)</td>
<td>T(20) = -0.366</td>
<td>0.72</td>
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<tr>
<td>Emotional intensity</td>
<td>59.42 (6.22)</td>
<td>56.57 (9.39)</td>
<td>T(20) = 0.839</td>
<td>0.41</td>
</tr>
<tr>
<td>Emotional valence</td>
<td>41.00 (4.34)</td>
<td>38.44 (5.59)</td>
<td>T(20) = 1.199</td>
<td>0.25</td>
</tr>
<tr>
<td>Personal relevance</td>
<td>35.41 (10.86)</td>
<td>43.99 (13.53)</td>
<td>T(20) = -1.641</td>
<td>0.12</td>
</tr>
<tr>
<td>Sympathy</td>
<td>48.11 (4.81)</td>
<td>47.99 (10.59)</td>
<td>T(20) = 0.035</td>
<td>0.97</td>
</tr>
<tr>
<td>SCL-90-R GSI</td>
<td>41.73 (5.52)</td>
<td>53.50 (6.77)</td>
<td>T(19) = 4.387</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BDI global score</td>
<td>1.91 (2.26)</td>
<td>5.20 (4.39)</td>
<td>T(19) = 2.191</td>
<td>0.041</td>
</tr>
</tbody>
</table>
High narcissism: 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.

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

How spontaneous brain activity and narcissistic features shape social interaction

Andrea Scalabrini¹,², Zirui Huang³, Clara Mucci², Mauro Gianni Perrucci¹,⁴, Antonio Ferretti¹, Andrea Fossati⁵, Gian Luca Romani¹,⁴, Georg Northoff⁶ & Sjoerd J. H. Ebisch¹,⁴

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

[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]
Proceedings of the National Academy of Science, April 2016

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

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

Martino et al. (2016) PNAS,
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Mind, Brain Imaging and Neuroethics Research Unit, Institute of Mental Health Research, Royal Ottawa Mental Health Centre, Ottawa, Ont., Canada

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*, Paola Magioncalda, Matteo Martino, Hsin-Chien Lee, Ying-Chi Tseng, and Timothy Lane

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

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
Self and Symptoms – Spatiotemporal – Do we need “Spatiotemporal Psychopathology”?

Spatiotemporal psychopathology I: No rest for the brain’s resting state activity in depression? Spatiotemporal psychopathology of depressive symptoms

Georg Northoff a,b,c,d,e,*

How do resting state changes translate into psychopathological symptoms? From ‘Spatiotemporal correspondence’ to ‘Spatiotemporal Psychopathology’

Georg Northoff a,b,c,d,e

How do abnormalities in the brain’s spontaneous activity translate into symptoms in schizophrenia? From an overview of resting state activity findings to a proposed spatiotemporal psychopathology

Georg Northoff a,b,c,d,e, Niall W. Duncan c,d,e

Review
Spatiotemporal Psychopathology II: How does a psychopathology of the brain’s resting state look like? Spatiotemporal approach and the history of psychopathology

Georg Northoff a,b,c,d,e

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

neuropsychoanalysis in practice

brain, self, and objects

Oxford University Press 2011

Neuropsychodynamische Psychiatrie; Springer 2018

Neuropsychodynamic Psychiatry

Website: www.georgnorthoff.com