

NANYANG TECHNOLOGICAL UNIVERSITY



Human Cognition Initiative at NTU

Balázs Gulyás

Professor of Translational Neuroscience, Lee Kong Chian School of Medicine, Imperial College London – Nanyang Technological University Singapore balazs.gulyas@ntu.edu.sg

An Overview of NTU

DETERTORN

TITTT

NTU - A Brief History

- 1955: Founded as Nanyang University (Nantah; 1955 1979)
- 1981: Establishment of Nanyang Technological Institute (NTI)
- 1991: Establishment of Nanyang Technological University (NTU)
- 1991 2001: Focused on education of engineers & business graduates for Singapore market
- 2001 2006: Establishment of several new disciplines
 - School of Biological Sciences (2001)
 - School of Humanities & Social Sciences (2004)
 - School of Physical & Mathematical Sciences (2005)
 - School of Art, Design & Media (2005)
- 2006 2011: Heavy investments in research & recruitments
- 2010: Establishment of Lee Kong Chian School of Medicine in collaboration with Imperial College London (first intake in AY2013)
- 2014: Establishment of Asian School of The Environment

About NTU

The NTU Academic Structure



NTU Leadership



President Bertil Andersson



Provost Freddy Boey



Lam Khin Yong Chief of Staff & Vice President (Research)



Er IVIeng Hwa Vice President (International Affairs)



Lee Sing Kong Vice President (Education Strategies)

NTU Yunnan Garden Residential Campus

50% of Students and 30% of Full Time Faculty living on campus





The new medical school: LKCMedicine



NTU's Figures at a Glance

At a Glance



OF THE CLASS OF 2012 RECEIVED A JOB OFFER WITHIN FOUR MONTHS OF GRADUATION

NTU's International Profile

- 70% of international faculty & research staff (from >75 nationalities)
- Extensive international graduate student recruitment (≈ 52% Masters & ≈ 79% PhD international students)
- International academic partnerships with top universities based on mutual academic esteem
- Working with global industry partners
- International leadership



NTU Seeks to cover both worlds (Academic Excellence and Societal Relevance)

Nature Publishing Index



Times Higher Education global ranking



Global Top 100 & 12th in Asia Pacific

No. 1 in the World for Industrial Collaboration

Asian Research Impact Trends – Singapore's Universities Top in Asia

Source: Thomson Reuters 2014



NTU 1st in Asia



NTU Strategic Plan 2011-2015



Research on human cognition – human cognition initiative

Why should a technological university have human cognition research?

Technological universities have an increasingly strong interest in cognitive neuroscience



Only in the US more than 200 PhD programmes!

Medical schools have an increasingly strong interest in cognitive neuroscience



Columbia University Medical Center

Columbia Psychiatry



DEPARTMENT OF



Cognitive Science

Yale school of medicine



Center for Cognitive Neuroscience Duke University







SCHOOL OF



Satellite Research Centre (SaRC)





NTU already has a strong - but dispersed - initial background in cognitive neuroscience



National Institute of Education CRADLE







School of Humanities and Social Sciences, Division of Psychology



NTU Business School,

Division of Strategy,

Management and Organisation



The new medical school and its partners are strongly motivated



Some further platforms, supporting cognitive neuroscience research

Medical Imaging and Signal Analysis, NITHM & School of Electrical Engineering



NTU Complexity Programme and ParaLimes

tyBioInformatics Research,idSchool of ComputeresEngineering



Nanyang Institute of Technology in Health and Medicine (NITHM) NTU – Parmenides Center on Cognostics (*future plan*) www.parmenides-foundation.org





Overview of the Clinical Brain Lab

S.H. Annabel Chen, PhD annabelchen@ntu.edu.sg





- Cerebellum involvement in Higher Cognition
 - Applications to Alcoholism,
 Schizophrenia, OCD, Dyslexia and
 Autism
 - Aging in Asia Pacific Countries
 - Aging networks and cognitive training
- Developing Research in
 Learning and Emotion



Alphabetic and Character Languages





- Both Convergent and Divergent regions were identified
- A sub-network consisting of the left Middle Frontal Gyrus and the right Fusiform Gyrus was proposed to be specific to Chinese character processing



Using fMRI to examine curricular issues

- Two algebraic problem solving methods are taught in Singapore schools
 - Symbolic algebra is taught in secondary school
 - The *model method* is taught in primary school
- Considerable time and effort are expanded on teaching the model method in the primary years
 - Is it worthwhile?



Results and conclusions



Similar brain areas were activated by the two approaches, but the symbolic method activated areas associated with the use of attentional resources, suggesting that it is better suited for older children with greater access to such resources. Cosequently, to facilitate students' transition from primary to secondary algebra (i.e., the teaching of symbolic algebra) the linkages between the various problem solving methods need to be made explicit. This will better allow students to leverage on their prior knowledge regarding the model method.

Future Directions

Optimising Learning

- Understanding optimization
- Social and emotional skills
- Executive functions
- Understanding and usage of knowledge
- Psychological wellbeing
- Cultural nature of learning
- Creativity and student dispositions



Ying-yi Hong YYHong@ntu.edu.sg



Georgios Christopoulos CGeorgios@ntu.edu.sg

1. The mechanisms of cultural mixing







Cultural Mixing

Genetics of Culture

Neuroscience of Cultural Interactions



3. Future Cities: Human Cognition *and* Built Environment



Overview of the LKCMedicine Translational Neuroscience Programme







Pathological ageing – neurodegenerative diseases:

NANYANG Imperial Colleg

- Neuropsychology – cognitive tests

SCHOOL OF MEDICINE

- Neuroimaging (morphological, functional, molecular)

National Neuroscience Institute

- Blood born and peripheral biomarkers

Neurological disorders (with strong emphasis on TBI)

- Neuropsychology cognitive / behavioural analysis
- Neuroimaging (morphological, functional, molecular)
- Blood born and peripheral biomarkers

Mental disorders

- Neuropsychology behavioural / cognitive markers
- Neuroimaging (morphological, functional, molecular)
- Proxy / blood born biomarkers

Neuroimaging at NTU: the future

The human neuroimaging triad:

MRI: morphology + function (fMRI, DTI, ...) PET: molecular - biochemical MEG: electrophysiology

Human neuroimaging in Singapore: MRI: CIRC + Duke-NUS + <u>NTU</u> PET: CIRC MEG: <u>NTU</u>





A joint venture between the Agency for Science, Technology And Research (A*STAR) and the National University of Singapore (NUS)







A vision on cognitive neuroscience at NTU





