INTERNATIONAL NEURAL NETWORK SOCIETY

May 2021

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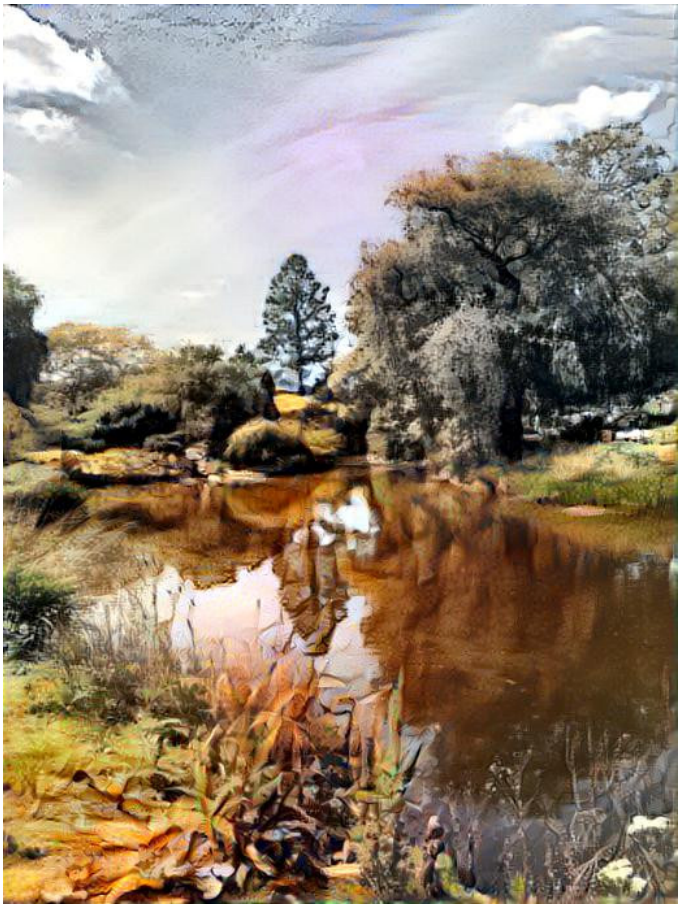

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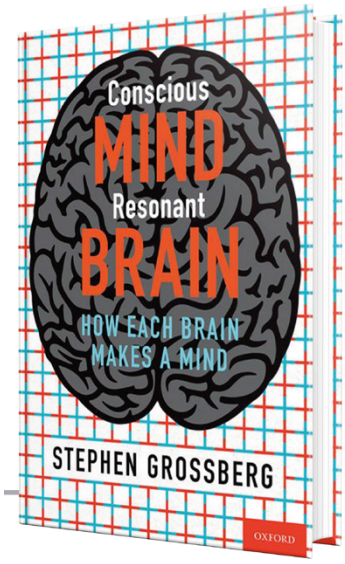

New Book by INNS Founder and First President Stephen Grossberg on How Each Brain Makes a Mind

Oxford University Press will publish in May, 2021 my Magnum Opus, which is called Conscious MIND, Resonant BRAIN: How Each Brain Makes a Mind

https://global.oup.com/academic/product/conscious-mind-resonant-brain-9780190070557?cc=us&lang=en&

Summary:

• Explores how your mind works, notably how you learn to consciously see, hear, feel, and know things
• Explains how mental disorders can be understood on a continuum with normal behaviors
• Creates a computational foundation for applications of autonomous adaptive intelligence and AI

Description:

How does your mind work? How does your brain give rise to your mind? These are questions that all of us have wondered about at some point in our lives, if only because everything that we know is experienced in our minds. They are also very hard questions to answer. After all, how can a mind understand itself? How can you understand something as complex as the tool that is being used to understand it?

This book provides an introductory and self-contained description of some of the exciting answers to these questions that modern theories of mind and brain have recently proposed. Stephen Grossberg is broadly acknowledged to be the most important pioneer and current research leader who has, for the past 50 years, modelled how brains give rise to minds, notably how neural circuits in multiple brain regions interact together to generate psychological functions. This research has led to a unified understanding of how, where, and why our brains can consciously see, hear, feel, and know about the world, and effectively plan and act within it.

The work embodies revolutionary Principia of Mind that clarify how autonomous adaptive intelligence is achieved. It provides mechanistic explanations of multiple mental disorders, including symptoms of Alzheimer's disease, autism, amnesia, and sleep disorders; biological bases of morality and religion, including why our brains are biased towards the good so that values are not purely relative; perplexing aspects of the human condition, including why many decisions are irrational and self-defeating despite evolution's selection of adaptive behaviors; and solutions to large-scale problems in machine learning, technology, and Artificial Intelligence that provide a blueprint for autonomously intelligent algorithms and robots.

Because brains embody a universal developmental code, unifying insights also emerge about

shared laws that are found in all living cellular tissues, from the most primitive to the most advanced, notably how the laws governing networks of interacting cells support developmental and learning processes in all species.

The fundamental brain design principles of complementarity, uncertainty, and resonance that Grossberg has discovered also reflect laws of the physical world with which our brains ceaselessly interact, and which enable our brains to incrementally learn to understand those laws, thereby enabling humans to understand the world scientifically.

Accessibly written, and lavishly illustrated, Conscious Mind/Resonant Brain is the magnum opus of one of the most influential scientists of the past 50 years, and will appeal to a broad readership across the sciences and humanities.

Advance Reviews

"Conscious MIND and Resonant BRAIN is a tour de force on How the Brain Works. It's a masterpiece on brain science and neuro-computing that could only be created by Grossberg."

-- Leon Chua, University of California at Berkeley

"Whenever you claim to be "the first to do" this or that in artificial intelligence, it is customary – and correct – to add "with the exception of Stephen Grossberg". Quite simply, Stephen is a living giant and foundational architect of the field."

-- Karl J. Friston, University College London

"This is a breath-taking book authored by a giant pioneer of the brain and mind."

-- Shun-Ichi Amari, RIKEN Brain Science Institute

"Professor Grossberg is a rara avis. In an age of increasing specialization, he has a remarkable, unparalleled, gift of seeing connections between seemingly unrelated ideas. And he writes about these with passion, but without compromising accuracy."

-- V. S. Ramachandran, University of California San Diego

"Stephen Grossberg is a true genius, who has discovered and developed many of the most important concepts and theories about how our brains make our minds. His fundamental contributions to science for over 50 years are richly worthy of a Nobel Prize."

-- Leonid Perlovsky, Harvard University

"Stephen Grossberg is a "big picture" thinker who has had a remarkably deep influence on many aspects of several fields. It's difficult to overstate the range of his vision and the depth of his thinking, and I expect this book to be required reading in many courses for years to come."

-- Stephen Kosslyn, Foundry College

"After reading many papers by the author, I always wished that he would present them in a coherent whole. And here it is. A magnificent volume of great science from mind to brain and back, a condensed arts poetica of a great scientist."

-- György Buzsáki, New York University

"The current volume charts the remarkable developments that have led Dr. Grossberg to a principled, unified theory of the link between brain and mind. Dr. Grossberg's insights are unparalleled in their breadth and detail, leading us to a scientific understanding of the most remarkable aspect of the mind, consciousness."

-- Michael Mozer, Google Brain, Mountain View, CA

"Stephen Grossberg is one of the most original and influential theorists in contemporary cognitive science and computational neuroscience. In Conscious MIND Resonant BRAIN, he takes the reader on an eye-opening tour in which he addresses fundamental problems of mind and brain from his unique theoretical perspective. This is an important book that should be of interest to anyone who wonders how a brain can give rise to a mind.

-- Daniel L. Schacter, Harvard University

"In this book Stephen Grossberg shares the wisdom and encyclopedic knowledge that he acquired over 50 years of research devoted to unravel the mysteries of the human brain. Stephen pioneered the field of theoretical neuroscience and this approach allowed him to discover general principles that govern functions as diverse as visual perception, learning and memory, attention, emotion, decision making and consciousness. It is the essence

of overarching principles to be abstract and to sometimes defy intuition, but Stephen succeeds to convey the essential in a language that is readily accessible to the non- expert. He embeds the discussion of neuronal mechanisms in the rich framework of cognitive psychology and elegantly bridges the gap between scientific evidence and subjective experience. He takes the readers by the hand and lets them discover the often surprising philosophical, ethical and societal implications of neurobiological discoveries. For those who enjoy intellectual adventures and wish to explore the boundaries of the known this scholarly written book is a real treasure."

-- Wolf Singer, Max Plank Institute for Brain Research, Frankfurt

"Although a behavioral modeler and not a neuroscientist, I have followed Stephen Grossberg's research closely for many years, because I regard him as one of the very most creative and insightful neuroscience theorists that the field has seen. His book should be a must read for those wanting to understand how the brain produces mind."

-- Richard Shiffrin, Indiana University

"How often do we have the chance to hold a true masterpiece? Grossberg's monumental accomplishments developed over multiple decades now written at an accessible level to a broader audience. What a true privilege!"

-- Luis Pessoa, University of Maryland

"Steve Grossberg is one of the most insightful and prolific writers on biological intelligence. This book is a masterful presentation of fundamental methods of 4modeling minds, brains and their interactions with the world, many of which are due to the author and his collaborators. The models are presented as mathematical systems, including computing and neural networks. The variables, parameters and functions represent biological and environmental concepts; mathematical conclusions are interpreted as predictions of biological behavior. In many cases these have been verified experimentally. There are illuminating and surprising connections to other disciplines, including art, music and economics. Highly recommended to a general audience."

-- Morris W. Hirsch, University of California at Berkeley

"This comprehensive overview of Grossberg's contributions to our understanding of the mind and brain shows exactly how prescient he, and his colleagues, have been. Whatever one's specific interest, from visual illusions to mental illness, this book provides a principled treatment of it. The principles flow from Grossberg's early framing of many of the questions that have come to define computational neuroscience – including his early understanding of the centrality of expectations. Kudos to him for pulling it all together here."

-- Lynn Nadel, University of Arizona

"This book is not for the faint of heart. Stephen Grossberg has been a giant in the field of computational neuroscience for 60 years. In this book he presents his carefully developed, integrative neurobiological theory on how the nervous system generates our conscious lives. It is bold yet self-reflective and therein challenging to all students trying to figure out how the brain does its tricks. A must read."

-- Michael Gazzaniga, University of California at Santa Barbara

"Conscious Mind, Resonant Brain is the magnum opus of one of the giants of neural networks. The soaring ambition of this book reflects the career achievements of Grossberg's insatiable appetite for understanding how brains work. It is a must-read for those interested in all aspects of how the mind and brain function in health and disease."

-- Donald C. Wunsch II, Missouri University of Science and Technology

"Grossberg has single-handedly elevated the psychophysics and psychology pioneered by Herman von Helmholtz and William James into a comprehensive mathematical theory of brain and behavior with profound implications and strong empirical support."

-- David Hestenes, Arizona State University

"An excellent and wide-ranging view of how the brain perceives the world for us by a pioneering brain theoretician."

-- Wolfram Schultz, University of Cambridge

Bringing Research AI to Industry

-By Kumar Shridhar, NeuralSpace

I am happy to announce that we have started NeuralSpace that brings the research AI to the industry. We work in the NLP domain where our solutions are designed for low resource languages where data is scarce. It can be languages spoken in India, the middle east, Africa or south east Asia. With the new digital economy penetrating these markets, it is essential that the people in these nations enjoy the AI enabled services in their local language. We launched a product in India where a person can play any music/TV show in the local Indian language. We are working hard to bring all the NLP research to low resource languages and it is a story I wanted to share with the INNS members.

Going Beyond AI toward Natural Intelligence (NI)

- By Harold H. Szu (Interveiw)

Cutting Edge AI: (i): applying 5G smart sensors (deep learning integration, a done deal); (ii) chemical signals effects (simulations level by Jeffery Jenkins of CUA);(iii) design hardware robots(with both small electronic and big chemical signals: nanotechnology, perhaps!)

https://www.youtube.com/watch?v=8Th2yqWt5mM

Dr. Okyay Kaynak becomes the EiC of a new journal

Dr. Okyay Kaynak has been assigned the Editor in Chief responsibility of a new journal; Discover Artificial Intelligence. You are invited to submit your work for possible publication in this journal.

https://www.springer.com/journal/44163

First Neuroaesthetics Lab in Romania

– By Oana Geman

The main aim of the project is the development of a neuroaesthetics study programme at the University of Suceava, Romania, benefitting from the expertise available at NTNU and University of Bergen, Norway. Reaching this aim requires 2 complementary activities:

1. The development of a Neuroaesthetics Curriculum based on the existing neuroaesthetics courses taught at University of Bergen, to be supported by a published course manual which will be made available for free to all interested. Two academic staff from the University of Suceava have travelled to the University of Bergen in November-December 2020 where they worked together with academic staff from NTNU and University of Bergen on the development of the curriculum.

2. The organization of a thirty-days international teaching programme at University of Suceava in the first semester of the 2021-22 academic year during which four Norwegian academics, one from NTNU and three from the University of Bergen will come to Romania to teach courses in neuroaesthetics. This will be complemented by student learning mobilities for thirty Romanian students who will spend one month at the University of Bergen participating in courses in neuroaesthetics and neuroscience research methods.

The outcome will be an integrated curriculum for a pilot neuroaesthetics study programme offered jointly by the University of Suceava, NTNU, and University of Bergen. The programme will be the first of its kind ever offered in Romania, enhancing the quality of education and training by diversifying the existing study programmes on offer and aligning the University of Suceava to the newest trends in interdisciplinary research across the humanities and the sciences.

https://neuroaestheticslab.usv.ro/

Research within biomedical and bioinformatic areas, machine learning and ANN

-By Terje Solsvik Kristensen

Western Norway University of Applied Sciences

https://wo.cristin.no/as/WebObjects/cristin.woa/6/wa/personVis?type=PERSON&pnr=330152&la=en&instnr=203

Fulbright Scholar Program Awards

- By Pavlo V. Tymoshchuk

Dr. Tymoshchuk was awarded by the grant of Fulbright Scholar Program and obtained a certificate of Fulbright Scholar Award in 2015. The Fulbright Program is an oldest and most prestigious internationally recognized program of competitive, merit-based grants for international educational exchange of scholars and students funded by the United States government. The grant was awarded in the area of Computer Science, in particular, in Artificial Neural Networks, Artificial Intelligence and Robotics, and Parallel Computing. In the scope of this grant, Prof. Tymoshchuk worked in the Electrical and Computer Engineering Department of Missouri University of Science and Technology in collaboration with his Associate Faculty Prof. of Missouri University of Science and Technology Donald C. Wunsch during nine months. The research was performed in the area of designing continuous-time spiking K-Winners-Take-All neural circuit and its applications for parallel sorting and parallel rank-order filtering.

During the work, Dr. Tymoshchuk made presentations of his Fulbright research project "Spiking K-Winners-Take-All Neural Circuit and Its Application for Parallel Sorting and Parallel Rank-Order Filtering" on the seminar of Applied Computational Intelligence Laboratory and on the seminar of Intelligent Systems Center at Missouri University of Science and Technology.

In the scope of Fulbright Scholar Program, Prof. Tymoshchuk gave outreach lecture "Spiking K-Winners-Take-All Neural Network and Some Its Applications" at University of Texas at Arlington on kind invitation of Prof. of University of Texas at Arlington Daniel S. Levine and Prof. of University of Texas at Arlington Frank L. Lewis.

Dr. Tymoshchuk successfully completed his Fulbright Scholar Program and received corresponding certificate in 2016. Results of this work were published in the paper [1] and inspired on the number of further publications, in particular, the papers [2] and [3] and the book [4].

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In June, 2018, on the occasion of the 25th anniversary of the Fulbright Program activity in Ukraine, Prof. Tymoshchuk was awarded by the acknowledgment from Fulbright Program in Ukraine for contribution in development of international cooperation in scientific, educational, and culture area and for creation an intellectual face of L'viv city.

References

[1] P. Tymoshchuk and D. Wunsch, "Design of a K-winners-take-all model with a binary spike train," IEEE Trans. Syst. Man. Cybern. B, Cybern., vol. 49, no. 8, pp. 3131-3140, Aug. 2019.
[2] P. Tymoshchuk, "A neural circuit model of adaptive robust tracking control for continuous-time nonlinear systems", in Proc. 28th Int. Conf. ICANN, LNCS 11727, 2019, pp. 819–835.
[3] P. Tymoshchuk, "Optimal control for continuous-time scalar nonlinear systems with known dynamics", in Proc. 16th Int. Conf. Control, Automation, Robotics and Vision, Shenzhen, China, 2020, pp. 695–700.
[4] P. Tymoshchuk and M. Lobur, Principles of Artificial Neural Networks and Their Applications: Tutorial. L'viv, Ukraine: L'viv Polytechnic Publishing House, 2020.

XPRIZE Pandemic Response competition concluded

-By Risto Miikkulainen, The University of Texas at Austin

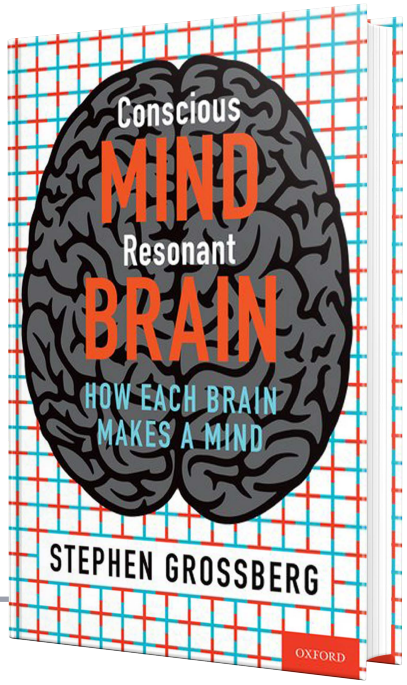
The XPRIZE Pandemic Response Challenge concluded with the announcement of two winners: a first-place team led by Nuria Oliver from Valencia, Spain and a second-place team led by Mitja Lustrek from Slovenia, splitting the prize purse of $500K. Eight other teams received an honorable mention. The teams employed a variety of techniques from standard epidemiological modeling to evolutionary optimization. New technology was also developed by Cognizant AI Labs to evaluate the predictors and prescriptions in the competition, as well as methods that allow combining individual solutions into superpredictors and superprescriptors. Such collaborative opportunities as well as deployments informing real-world policies will be pursued in the follow-up to the competition.

https://evolution.ml/xprize/

NEW FROM OXFORD PSYCHOLOGY

Conscious MIND, Resonant BRAIN

How Each Brain Makes a Mind



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"Conscious MIND Resonant BRAIN i*s a tour de force on how the brain works. It's a masterpiece on brain science and neuro-computing that could only be created by Grossberg."*

Leon Chua, University of California at Berkeley

"After reading many papers by the author, I always wished that he would present them in a coherent whole. And here it is. A magnificent volume of great science from mind to brain and back, a condensed ars poetica of a great scientist."

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"Conscious MIND, Resonant BRAIN *is the magnum opus of one of the giants of neural networks. The soaring ambition of this book reflects the career achievements of Grossberg's insatiable appetite for understanding how brains work. It is a must-read for those interested in all aspects of how the mind and brain function in health and disease."*

Donald C. Wunsch II, Missouri University of Science and Technology

- Explores how your mind works the way it does, notably how you learn to consciously see, hear, feel, and know things
- Explains how mental disorders can be mechanistically understood on a continuum with normal behaviors
- Creates a computational foundation for the next generation of autonomous, adaptive, and intelligent algorithms, devices, and mobile agents in engineering, technology, and AI

Since his first revolutionary discoveries in 1957 of how brains make minds, **Stephen Grossberg** has been internationally recognized as the field's most important pioneer and current research leader. Even in 1989, before he gave the annual University Lecture at Boston University, where he holds an endowed chair, the BU President, John Silber, introduced him as the Newton and the Einstein of this field. His incomparable work has continued to illuminate everything from perception, through cognition and emotion, to action, in health, disease, technology, and AI.

978-0-19-007055-7 | 800 pgs | Hardback | May 2021

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