Q&A *with* STEPHEN GROSSBERG

Founding Chairman of Department of Cognitive and Neural Systems

Founding President of International Neural Network Society

Founding Editor-In-Chief of Neural Networks

Wang Professor of Cognitive and Neural Systems, Boston University

Professor Emeritus of Mathematics & Statistics, Psychological & Brain Sciences, and Biomedical Engineering

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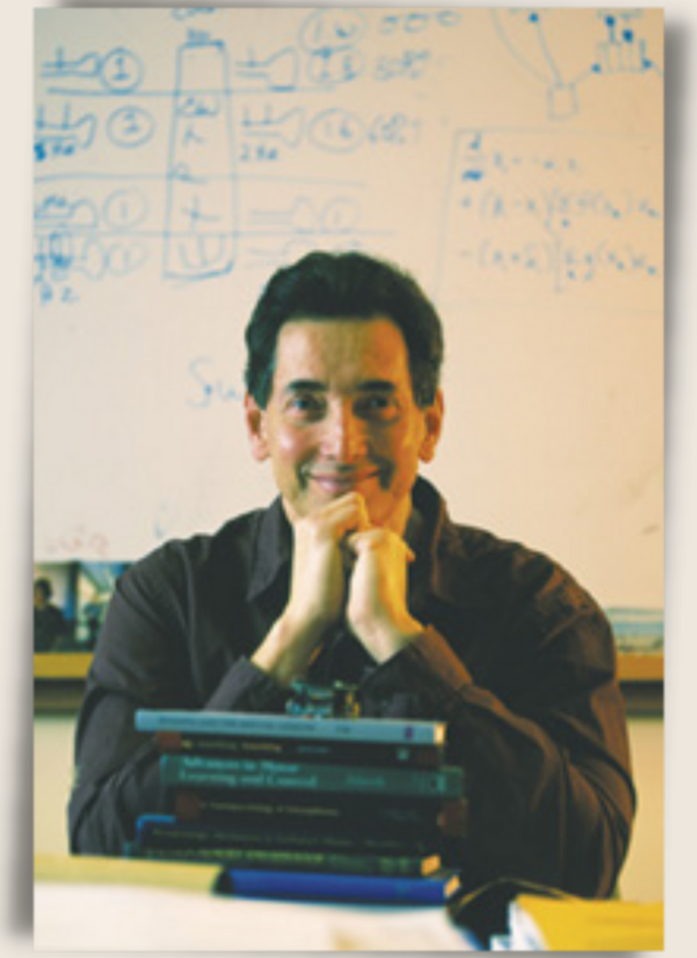
Recently published: CONSCIOUS MIND, RESONANT BRAIN: HOW EACH BRAIN MAKES A MIND

An Interview

by Interactive Intelligence

Founder of the fields of theoretical psychology and cognitive science, computational neuroscience, and biologically-inspired technology



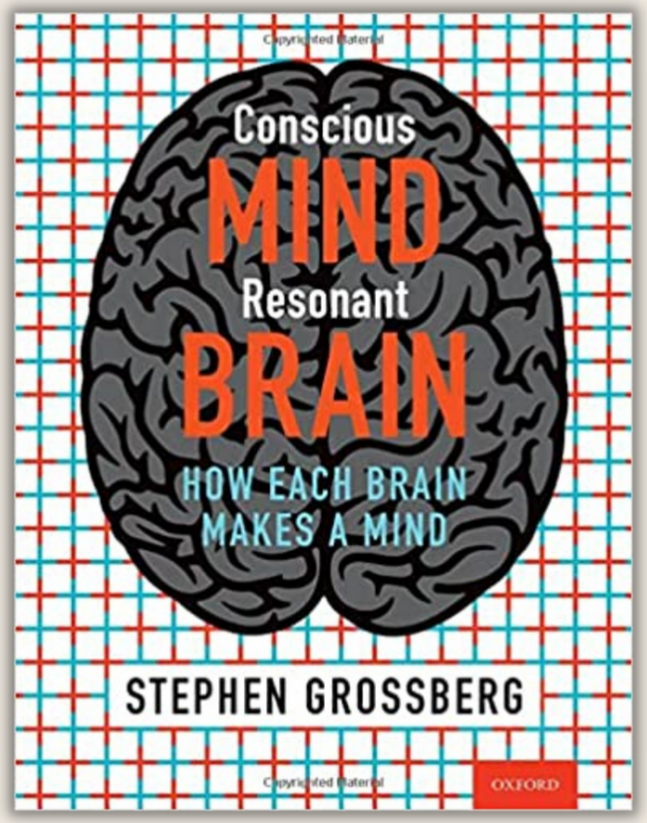
50 YEARS AGO, MOST DID NOT BELIEVE IN "COMPUTATIONAL NEUROSCIENCE"...

...but Grossberg did.

- At 17 years old, attended Dartmouth University as the first joint undergraduate major in Mathematics and Psychology
- Mathematics PhD student at Stanford and Rockefeller University
- Assistant Professor of Applied Mathematics at MIT
  - Discovered neural models of how brains make minds
- President and Provost of Boston University awarded Grossberg an endowed Chair in Department of Cognitive and Neural Systems
  - *Developed world's leading graduate department that theoretically explains how brains make minds*

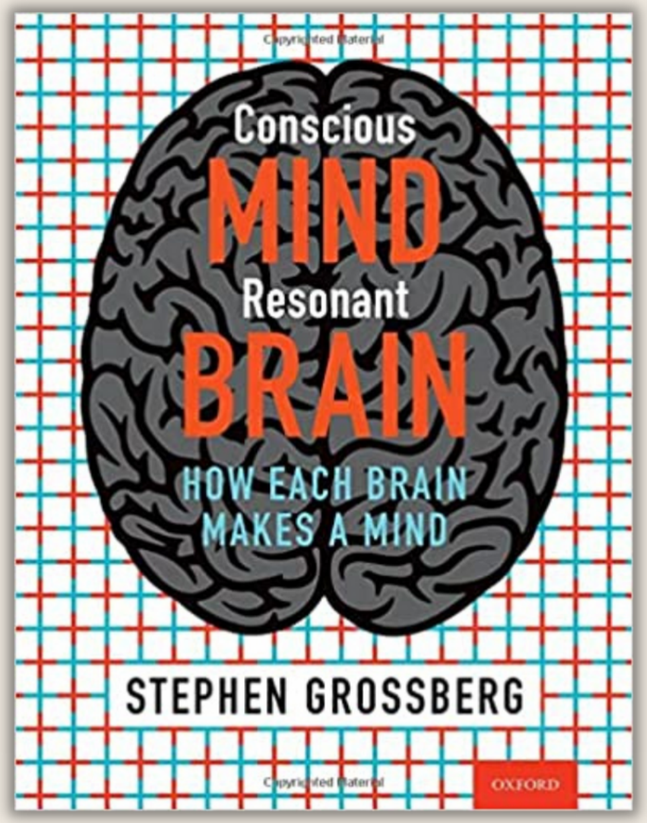
Closest Collaborator: Gail Carpenter

Stephen Grossberg and his mathematician wife, Gail Carpenter, together developed the wide-ranging Adaptive Resonance Theory and founded BU's department of cognitive and neural systems (CNS)



INTRODUCTION

“BRAIN EVOLUTION NEEDS TO ACHIEVE BEHAVIORAL SUCCESS”



Brief Overview

Questions to Grossberg

Interactive Intelligence

Q1

How would you explain your work to someone that doesn’t have any prior knowledge?

Introduction

Q2

Could you say a little more about your new book and its contents?

Introduction

Q3

Do you think that there is a biological mechanism of backpropagation or Deep Learning?

Topic: AI / Neuro

Q4

How does Deep Learning differ from Adaptive Resonance Theory, or ART?

Topic: ART

Q5

What happens with a cold start—when we are born, do we have no top down expectations? Or are they just very frequently wrong?

Topic: ART

Q6

There are 150,000 cortical columns in the neocortex that all look very similar across it. Does ART have an explanation for what each does as a module?

Topic: ART

Q7

What haven't you explained to your satifaction about how the brain works? Any paradoxes left to solve in your mind?

Topic: Neuroscience

Q8

Can we reach general AI by simulating the brain, or by simulating the evolution of the brain?

Topic: AI

Q9

First it was calculators, then chess, then computer vision, then natural language. What is the next big milestone task for AI to accomplish?

Topic: AI

Q10

How exactly does ART / a resonant state evade catastrophic forgetting? If the resonant state's neural activity causes rewiring of neurons, wouldn't that mean that the synapses that changed are forgetting something in order to reflect the nearly learned connections?

Topic: ART

Q11

Do you think that some form of ART is necessary and sufficient for intelligent behavior or that there are other ways of achieving that general goal, perhaps that were never exploited by evolution or biology but that may work just as well?

Topic: ART

Q12

Do you think it is possible for machines to exhibit intelligence without using algorithms exactly like ART?

Topic: ART

Q13

My understanding is that a common critique of backpropagation in the brain is that it would require each feedforward neuron to pair with one that feeds back and this is not biologically observed. It seems like ART has a similar problem where each bottom up signaling neuron needs a complementary top down neuron. Is this biologically plausible / seen?

Topic: ART

ADVICE TO STUDENTS

1

What is your advice for those that are “lost”? How would you encourage us (neuroscience and computer science majors) to view this field? How should we approach the *world?*

2

If you could become an undergraduate student, what would you do differently? Do you have specific hopes about how you want humanity to develop?

University of Washington

We are truly honored to host this event with Stephen Grossberg.

THANK YOU FOR VISITING