I vote we go to the Gulf of Mexico

—Alabama "Gulf of Mexico"

Philosophy & Neuroscience

@The Gulf UI

September 28 – 30, 2023
Sixth Annual Meeting of the
Deep South Philosophy & Neuroscience Workgroup
deepeouthphilneuro.com

Philosophy & Neuroscience @The Gulf VI

September 28 – 30, 2023
Hilton Pensacola Beach, Pensacola Beach, Florida

Program Chairs:
John Bickle, Mississippi State University and
University of Mississippi Medical Center
Nedah Nemati, Columbia University

Keynote Speakers

Neuroscience:
- James Bower, retired, formerly CalTech, and UT Health Sciences Center, San Antonio (Session 11)
- Barbara Finlay, Psychology, Cornell Univ. (Session 7)
- Paul Frankland, Neuroscience & Mental Health, Hospital for Sick Children, Toronto (Session 3)
- Darcy Kelley, Biological Sciences, Neurobiology and Behavior, Columbia Univ. (Session 7)
- A. David Redish, Neuroscience, Univ. of Minnesota Medical School (Session 12)
- Georg Striedter, Neurobiology and Behavior, UC Irvine (Session 7)

Philosophy:
- Kenneth Aizawa, Philosophy, Rutgers Univ., Newark (Session 11)
- Carl Gillett, Philosophy, Northern Illinois Univ. (Session 10)
- Alan Love, Center for Philosophy of Science, and Department of Philosophy, Univ. of Minnesota (Session 8)
- Thomas Polger, Philosophy, Univ. of Cincinnati (Session 1)

Sponsored by

With generous support from
The Deep South Philosophy and Neuroscience Workgroup

is grateful to the

Columbia University’s Presidential Scholars in Society and Neuroscience Program

for its support of our sixth annual meeting.

Thanks to generous funding from Columbia University's Presidential Scholars in Society and Neuroscience Program, 14 graduate students received travel and accommodation support to attend Philosophy & Neuroscience @The Gulf VI.
Philosophy & Neuroscience @The Gulf VI

Due to our beachfront locale and extended lunch, morning and afternoon breaks, the recommended conference attire is causal (American) beachwear.

All sessions will be held in EMERALD COAST ROOM (Tower building, second floor). If your room is on the lobby side of the hotel, take the elevator down to the 2nd floor, and walk across to the Tower Building to avoid lobby traffic.

Schedule of Talks

THURSDAY, SEPTEMBER 28

8:00-8:30am Conference room open, coffee, beverages, light breakfast foods

8:30-8:40am Welcome remarks, thank-yous. John Bickle and Nedah Nemati

Session 1: Does the Brain Compute? Part One 8:40-9:50am

8:40-9:10am Thomas Polger (Philosophy, University of Cincinnati), Philosophy Keynote Lecture, “Color vision and the four-color-map problem, revisited”

9:10-9:30am Alessandra Buccella (Philosophy, SUNY Albany), “Brains, algorithms and the aims of computational cognitive neuroscience”

9:30-9:50am Natalia Castelo Branco Matos (Neuroscience, Yale University), “Visual illusions in fruit flies and humans indicate shared computational goals”

9:50-10:20am Morning Break (coffee, beverages, light snacks)

Session 2: Does the Brain Compute? Part Two 10:20-11:50am

Submitted Symposium: Computational neuroscience and non-computational alternatives

Symposium Overview

Computational neuroscience appeals to heterogeneous accounts of computation. These range from classical cognitivist (e.g., Church-Turing) to far more liberal accounts (e.g., reinforcement). While variety can be the spice of life, the current state of “computation” in neuroscience raises substantial concerns that include lack of consensus within and between disciplines and the exclusion of viable noncomputational approaches. This symposium aims to critically examine the notion of “computationalism” in computational neuroscience and suggest alternatives. The overarching goal of this symposium is to make progress towards unpacking both the descriptive and normative roles of computationalism in neuroscience and to offer alternatives.
Luis Favela (Philosophy, University of Central Florida) and Michael Silberstein (Philosophy, Elizabethtown College, Pennsylvania), “Neural (titular) computation”

Luiz Pessoa (Psychology, University of Maryland, College Park), “The brain as a distributed, entangled system”

Brian Odegaard (Psychology, University of Florida), “Computational modeling of multisensory integration: Pros, cons, and suggestions for future progress”

Randall Beer (Cognitive Science, Neuroscience, Informatics, Computing and Engineering, Indiana University, Bloomington), “Understanding the mechanisms of behavior from the (evolutionary) ground up”

11:50am-1:50pm Lunch Break

Session 3: Neuroscience of Memory 1:50pm-3:00pm

1:50-2:20pm Paul Frankland (Program in Neurosciences and Mental Health, Hospital for Sick Children, Toronto, Canada), Keynote Neuroscientist Lecture, “The neurobiology of engrams

2:20-2:40pm Gregory Johnson (Philosophy, Mississippi State University), “Repetition and memory: A case of confirmation in cognitive psychology and neurobiology”

2:40pm-3:00pm Sarah Robins (Philosophy, and Institute for Integrative Neuroscience, Purdue University), “What neuroscientists think about what engrams must be like”

Session 4: Neuroscience of Consciousness 3:05-3:45pm

3:05-3:25pm: Benjamin Kozuch (Philosophy, University of Alabama), “Visual consciousness is too informationally rich for the PFC to be an NCC”

3:25-3:45pm: Marco Nathan (Philosophy, University of Denver) and Elizabeth Stoll (Western Institute for Advanced Study, Denver, Colorado), “Reframing the problem of consciousness for the age of neuroscience”

3:45-4:15pm Afternoon Break (Beverages and light snacks available)
Session 5: Methodological Issues in Neuroscience, Both Narrow and Broad 4:15pm-5:55pm

4:15-4:35pm Haixin Dang (Philosophy, University of Nebraska, Omaha) and Zina Ward (Philosophy, Florida State University), “Neuroimaging, many-analyst studies, and permissive evidence”


5:15-5:35pm Lua Koenig (Neuroscience Institute, New York University Medical Center) and Laura Gradowski (History and Philosophy of Science, University of Pittsburgh), “Expectation and imagination in scientific inquiry”

5:35-5:55pm Alok Srivastava (Independent Researcher, San Francisco, California), “Neurophysiologists are tinkerer-naturalists in their ways of holding and figuring out phenomena: Two case studies”

FRIDAY, SEPTEMBER 29

8:00-8:30am Conference room open, coffee, beverages, light breakfast foods available

Session 6: Neuroscience and New Mechanism: For and Against 8:30-9:50am

8:30-8:50am Paul Kelly (Philosophy, University of Wisconsin, Madison), “Dynamical models, scientific understanding and explanatory unification”

8:50-9:10am J.P. Gamboa (History and Philosophy of Science, University of Pittsburgh), “Ongoing neural mechanisms of cognition”

9:10-9:30am Dan Burnston (Philosophy and Neuroscience Institute, Tulane University), “Collaborative modeling in neuroscience: Lessons for the philosophy of scientific models”

9:30-9:50am Mark Couch (Philosophy, Seton Hall University), “An argument-based account of mechanistic explanation in neuroscience”

9:50-10:20am Morning Break (coffee beverages, light snacks available)
Session 7: Brain Evolution 10:20am-12:20pm

This session sponsored by a generous gift from the
Presidential Scholars in Neuroscience and Society Program, Columbia University.

10:20-10:50am Barbara Finlay (Psychology, Cornell University), Keynote Neuroscientist Lecture, “The cortex as a Rorschach blot for cognitive scientists, computational theorists and evolutionary biologists alike”

10:50-11:20am Darcy Kelley (Biological Sciences, Neurobiology and Behavior, Columbia University), Keynote Neuroscientist Lecture, “Thinking about neural circuit architectures that support acoustic communication; evolutionary guiderails”

11:20-11:50am Nedah Nemati (Presidential Scholar in Neuroscience and Society, Columbia University) and Maria Tosches (Biological Sciences, Columbia University), “Studying an evolving cortex”

11:50-12:20pm Georg Striedter (Neurobiology and Behavior, University of California Irvine), Keynote Neuroscientist Lecture, “Clever birds and complex brains: Cell types and circuits in evolution”

12:20-2:20pm Lunch Break

Session 8: Evolution, Cognition and Development 2:20-4:30pm

2:20-2:50pm Alan Love (Philosophy and Center for Philosophy of Science, University of Minnesota), Philosophy Keynote Lecture, “Character identity mechanisms versus deep homology in neuroarchitecture”

2:50–3:10pm Carrie Figdor (Philosophy, University of Iowa), “Lessons from neuroscience for the evolution of cognition”

3:10-3:30pm Gregory Kohn (Psychology, University of North Florida), “The contingent animal: Does neuroscience and ethology still need innateness?”

3:30-3:50pm Mateusz Kostecki (Knapska Laboratory, Nencki Institute of Experimental Biology, Polish Academy of Sciences) “Try learning first: On the cost of “instinctive” behaviors”

3:50-4:10pm Elyse Purcell (Philosophy, SUNY Oneonta), “Disorder, antifragility and the evolutionary advantage of social defeat in human and animal minds”

4:10-4:30pm Valerie Hardcastle (Vice President for Health Innovation, Northern Kentucky University), “Entangled Brains and the Experience of Pains”

4:30-5:00pm Afternoon Break (beverages, light snacks available)
Session 9: Neuroscience, Cognitive Ontology and Functions 5:00–6:40

5:00-5:20pm Vincent Bergeron (Philosophy, University of Ottawa, Canada), “Assigning functions to brain structures: How teleology gets in the way”

5:20-5:40pm Trey Boone (Philosophy, Duke University), “Neural degeneracy and multiple realizability”

5:40-6:00pm Caitlin Mace (History and Philosophy of Science, University of Pittsburgh), “Negotiating ascription of content to neural activity”

6:00-6:20pm Joe McCaffrey (Philosophy, University of Nebraska, Omaha), “Does neural contextualism imply holism?”

6:20-6:40pm Michael De Vivo (Philosophy, Florida State University), “Neurocognitive ontology: The case of skilled motor cognition”

SATURDAY, SEPTEMBER 30

8:00-8:30am Conference room open, coffee, beverages, light breakfast foods available

Session 10: Ethical and Social Implications of Recent Neuroscience 8:30-10:30am

8:30-9:00am Carl Gillett (Northern Illinois University), Philosophy Keynote Lecture, “A neuroscientific argument for nihilism and its lessons”

9:00-9:30am Cédric Brun (Philosophy Department, Bordeaux Montaigne University, team leader of NeHuS team (Neuroscience, Humanities and Society), CNRS-University of Bordeaux Research Institute for Neurodegenerative Diseases) and Marie Penavayre (previously Post-doctoral Fellow, Institute for Neurodegenerative Deceases, NeHuS team, now pursuing a career outside Academia), “The explanatory power of neurostimulation studies on criminal behavior”

9:30-9:50am Rayan Magsi (Neurology, University of Toledo) and Nina Atanasova (Philosophy, University of Toledo, and Cleveland State University), “My brainstem is dead. But am I?”

9:50-10:10am Maximiliana Rifkin (Philosophy, CUNY Graduate Center), “Explicating scientific notions of gender identity”

10:10-10:30am Patrick Hopkins (Philosophy, Millsaps College and Psychiatry and Behavioral Science, University of Mississippi Medical Center), “On the evolutionary variety of artificial psychologies”

10:30-11:00am Morning Break (coffee, beverages, light snacks available)
Session 11: Reconsidering the Hodgkin-Huxley Model (Again!) 11:00-12:20pm

11:00-11:30am James Bower (Simulating being a 19th-century landed gentry scientist at: Hill Creek Farms, Ashland, Oregon) **Keynote Neuroscientist Lecture**, “Hodgkin and Huxley: Misunderstood by biologists and misrepresented by physicists”

11:30-12:00am Kenneth Aizawa (Philosophy, Rutgers University, Newark), **Philosophy Keynote Lecture**, “Hodgkin and Huxley and the limits of explanation”

12:00-12:20pm John Bickle (Philosophy and Religion, and Shackouls Honors College, Mississippi State University; Advanced Biomedical Education, University of Mississippi Medical Center), “Hodgkin’s and Huxley’s own assessment of their “quantitative description” of nerve membrane current”

12:20-2:20pm **Lunch Break**

Session 12: Cognitive Neuroscience 2:20-4:10pm

2:20-2:50pm David Redish (Neuroscience, University of Minnesota), **Keynote Neuroscientist Lecture**, “Decision making systems in mammalian brains”

2:50-3:10pm David Barack (Philosophy, University of Pennsylvania), “A neurodynamical alphabet”

3:10-3:30pm Zoe Drayson (Philosophy, University of California, Davis), “Neural mechanisms of linguistic prediction: Some philosophical implications”

3:30-3:50pm Stephan Pohl (Philosophy, New York University), “Empirical desiderata for representation in cognitive neuroscience”

3:50-4:10pm Pietro Pasquinucci (Theoretical Philosophy, FINO-Northwestern Italian Philosophy Consortium), “The constitution of the spatial world: Place cells, cognitive spaces and the phenomenological theory of perception”

4:10-4:40pm **Afternoon Break** (beverages, light snacks available)

Session 13: Idealization in Neuroscience 4:40-5:20pm

4:40-5:00pm Eric Hochstein (Philosophy, University of Victoria, Canada), “Integration without integrated models or theories”

5:00-5:20pm Gabriel Severino (Cognitive Science, Indiana University, Bloomington), “Theory-experiment dialogs: How idealized modeling can inform our experiments”
Session 14: Other Minds (/Brains?) 5:20-6:00pm

5:20-5:40pm Sebastian Purcell (Philosophy, SUNY Cortland), “Did the Aztecs advance a modular mind thesis?”

5:40-6:00pm Nina van Rooy (Philosophy, Duke University), “Does GPT Have Theory of Mind? Attributing Emergent Cognitive Capacities to Large Language Models”

Closing remarks 6:00-6:10pm

John Bickle Thanks, Looking Ahead with DSPNW, and a Request
Discussion of the Hodgkin-Huxley model (Hodgkin & Huxley, 1952) may send mixed signals. On the one hand, the discussion modestly proposes that the model is “an empirical description of the time-course of the changes in permeability to sodium and potassium” (Hodgkin & Huxley, 1952, pp. 540-541). On the other hand, the discussion also boldly proposes “The point that we do consider to be established is that fairly simple permeability changes in response to alterations in membrane potential … are a sufficient explanation of the wide range of phenomena that have been fitted by solutions of the equations.” (Hodgkin & Huxley, 1952, p. 541) In this talk, I will indicate why Hodgkin and Huxley believed that they did not have an explanation of the “mechanism of permeability change,” but did have explanations of a “wide range of phenomena.”

The language of thought (LOT) is still the dominant theoretical option for understanding the mind (Fodor 1975; Quilty-Dunn et al. 2022). In this talk, I will begin to sketch a neuroscientifically motivated alternative. I argue that cognitive function results from the combination of neurodynamical primitives that make up a neurodynamical alphabet. First, I briefly illustrate the view’s conceptual resources to explain cognition with an example from current cognitive neurobiology, the investigation of time perception. Second, I focus on a classic LOT property: discrete constituents that can compose into molecular representations. Neurodynamical systems are discrete but not always decomposable into molecular representations. Neurodynamical systems can subadditively, additively, or superadditively compose, preventing decomposition. But decomposability requires additivity. Hence, a key LOT property is not true of the neurodynamical alphabet, illustrating both the novelty of the approach and how it contravenes the LOT.

So much of the philosophy of neuroscience, and neuroscience itself, begins with assumptions about the essential nature of nervous systems in higher animals, e.g., that they are computational, or informational, or
associational, or predictive. But from an evolutionary perspective, the situation looks rather different. The fundamental problem for any organism is simply to persist long enough to reproduce. Many single-celled and multicellular organisms have solved the problem of coordinating whole-organism behavior in a variety of non-neuronal ways. Thus, nervous systems, like livers and eyes, must be understood as biological specializations in response to particular selection pressures operating along specific lineages. This suggests that a fruitful path for approaching the mechanisms of behavior might be to consider the successive complications that an organism might undergo in order to survive and prosper in an increasingly rich environment. I will sketch such an approach using the relatively theory-neutral language of dynamical systems.

Assigning functions to brain structures: How teleology gets in the way (Session 9)

Vincent Bergeron, Philosophy Department, University of Ottawa (Canada)
vincent.bergeron@uottawa.ca

A primary goal of cognitive neuroscience is to assign functions to brain structures. A serious problem facing this effort is that many different cognitive functions can be assigned to the same brain structure depending on the cognitive context. This failure to observe systematic mappings between cognitive functions and brain structures has led many to conclude that our cognitive ontologies—i.e. our current descriptions of cognitive processes and their components—must either be incorrect or too coarse. In this talk, I argue that teleological thinking is a primary obstacle to the successful mapping of cognitive functions onto the brain. I offer a non-teleological approach to assigning functions to brain structures and discuss the implications of this approach for the development of cognitive ontologies that are better suited to the cognitive neurosciences.

Hodgkin’s and Huxley’s own assessments of their “quantitative description” of nerve membrane current (Session 11)

John Bickle, Department of Philosophy and Shackouls Honors College, Mississippi State University and Department of Advanced Biomedical Education, University of Mississippi Medical Center
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Alan Hodgkin’s and Andrew Huxley’s mid-20th century work on the ionic currents generating neuron action potentials stands among that century’s great scientific achievements. In this talk, I focus on an aspect of this much-discussed case that hasn’t received attention: Hodgkin’s and Huxley’s own assessments about what their famous “quantitative model” accomplished. The “Hodgkin-Huxley model” is now widely recognized as a foundation of contemporary computational neuroscience. Yet Hodgkin and Huxley expressed serious caveats about their model. Including about what it added to their scientific discoveries, as far back as their (1952) paper in which they first presented their model. They were even more critical of its accomplishments in their Nobel Prize addresses a decade later, and these later worries were equally well expressed by the scientific work that both championed and pursued afterwards. Most notably, some worries they raised
about their quantitative model seem still to be relevant to current work in ongoing computational neuroscience.

Neural Degeneracy and Multiple Realization (Session 9)

Trey Boone, Department of Philosophy and Imagination and Model Cognition Laboratory, Duke University  worth.boone@duke.edu

Degeneracy arises across all levels of neuroscientific investigation. It is typically defined as the ability of structurally distinct components to perform the same function. I have two goals in this project. First, I provide a philosophical analysis of degeneracy, offering a precise definition that resolves ambiguities in the common definition. I maintain that degeneracy occurs when distinct instances of a function are relevantly similar despite causally relevant differences in the mechanisms that correspond to those instances. My second goal involves relating this analysis of degeneracy to philosophical discussions of multiple realization. I argue that degeneracy exemplifies a form of “causal” multiple realization, that it resolves some outstanding puzzles in the philosophical literature, and that it does not imply the autonomy of higher levels from lower levels but instead a more nuanced set of challenges to causal investigation in the neurosciences.

Hodgkin and Huxley: Misunderstood by biologists and Misrepresented by physicists (Session 11)

James M. Bower, Simulating being a 19th century landed gentry scientist at: Hill Creek Farms 1275 Old Highway 99 South, Ashland Oregon  bowerj@sou.edu

Using their own words and a computational analysis of their efforts, this talk will demonstrate that both the physiologists’ view that the Hodgkin-Huxley (HH) model is an accurate “description” of how action potentials in neurons are initiated and propagated, and the view of theoretical neurobiologists that HH simply “abstracted away” the biophysics, making the efforts more analogous to Ptolemy’s planetary models than to Newton’s gravitational model of planetary motion, are wrong. Instead, Hodgkin-Huxley shared with Isaac Newton a deep fidelity and concern for the actual physical structure of the systems they were studying, without which neither would have made the discoveries they made. Based on that analysis this talk will make the further claim that understanding and copying the GENESIS of both efforts is the only way to fix the current epistemologically lost state of computational neuroscience, and neuroscience in general.
The explanatory power of neurostimulation studies on criminal behavior (Session 10)

**Cédric Brun**, Philosophy Department, Bordeaux Montaigne University, team leader of NeHuS team (Neuroscience, Humanities and Society), CNRS-University of Bordeaux Research Institute for Neurodegenerative Diseases  cedric.brun@u-bordeaux.fr

**Marie Penavayre**, previously Post-doctoral Fellow, Institute for Neurodegenerative Deceases, NeHuS team (now pursuing a career outside Academia)

This presentation examines the field of neurocriminology and its use of neurostimulation techniques to reduce aggression and violent behavior in individuals with a criminal history. While aiming to understand neurobiological mechanisms of self-control, emotion regulation, and moral judgment, we argue that neurostimulation cannot directly explain criminal behavior. The first section explores empirical and methodological justifications for studying neurostimulation in relation to violent and criminal behavior. The second section discusses the use of the interventionist conception of causal explanation to justify the use of neurostimulation in explaining and preventing such behavior. Ultimately, this paper concludes that neurostimulation studies lack the necessary causal specificity to provide sufficient mechanistic explanations for violent and criminal behavior, questioning their value in correctional or preventive approaches.

Brains, algorithms, and the aims of computational cognitive neuroscience (Session 1)

**Alessandra Buccella**, Department of Philosophy, SUNY Albany  abuccella@albany.edu

Recent cognitive neuroscience studies seem to suggest that scientists are getting close to discovering the computational principles followed by the brain when performing various cognitive tasks (e.g. natural language processing). Generally, studies of this kind are carried out through a combination of neuroimaging, machine learning, and behavioral manipulations. In this paper, I raise two concerns about this popular research methodology and the conclusions scientists tend to draw from studies that follow it. I call them the ‘activity concern’ and the ‘triviality concern’. Despite these concerns, however, I do not aim to conclude that cognitive neuroscience’s methodology is flawed. Relying on Angela Potochnik’s proposal that one of the aims of science is understanding, and that understanding does not require truth, I suggest that the triviality concern can essentially be dismissed and that the activity concern is not as worrisome as it first appeared.
Collaborative modeling in neuroscience: Lessons for the philosophy of scientific models (Session 6)

Dan Burnston, Philosophy Department and Tulane Brain Institute, Tulane University
Dburnsto@tulane.edu

The nature of scientific modeling has become, in recent years, one of the main questions in philosophy of science. This literature, however, often looks at completed, published models, and uses them to make conceptual claims about their semantics and explanatory power. In this talk, I discuss an in-progress modeling collaboration between a physicist, a neurophysiologist and a philosopher, and use this study to bring several themes to the fore. The first is the role of analogy in models; in particular, I argue that analogy has a key role to play in taking a generic model type and applying it to a new system. The second is about the semantics of models; I argue that analogies are employed so that the inferential structure of the model type becomes applicable to the target system. This in turn underlies its semantic and explanatory properties.

An Argument-Based Account of Mechanistic Explanations (Session 6)

Mark Couch, Department of Philosophy, Seton Hall University
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The topic of how to understand mechanistic explanations in neuroscience has been a central concern among philosophers and scientists. In this talk I will offer a way of understanding these explanations that departs from recent accounts. The most popular current account comes from Craver’s “ontic approach to explanation” (2007), in which it is the existing entities in the brain that do the explaining. But this is problematic given that neuroscientists make use of representations of neural entities in their scientific research. I will consider how the action potential can be explained in terms of an earlier type of account that appeals to arguments (Hempel and Oppenheim 1948). Using the example of the action potential, I will explain the features of this approach and address some concerns it raises about neuroscientific practice.

Neuroimaging, many-analyst studies, and permissive evidence (Session 5)

Haixin Dang, Philosophy Department, University of Nebraska Omaha
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Zina Ward, Department of Philosophy, Florida State University
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In 2018, researchers with the Neuroimaging Analysis Replication and Prediction Study (NARPS) launched an ambitious project to assess “the degree and effect of analytic flexibility on fMRI results in practice” (Botvinik-Nezer et al. 2020, 84). The researchers gave seventy teams of
neuroscientists the same task-based fMRI dataset and asked each team to analyze the data in order to render a binary judgment about nine different hypotheses. There was a surprising amount of variability in the teams’ conclusions. In this paper, we ask: what do such “many-analyst studies” tell us about the nature of evidence in neuroscience (and beyond)? While some of the sources of divergent conclusions in many-analyst studies are eliminable, we argue that others are more entrenched. This lends credence to a view of evidence that we call “practical permissivism,” on which some datasets rationally support multiple doxastic attitudes toward a particular hypothesis (Kelly 2014).

Neurocognitive ontology: The case of skilled motor cognition (Session 9)

**Michael De Vivo**, Department of Philosophy, Florida State University
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Amid ongoing debates about taxonomic practices in the mind-brain sciences (e.g., Anderson, 2015; Francken et al., 2022; Khalidi 2023), little attention has been paid to skilled motor cognition (e.g., remembering how to tie a knot or timing a jump to clear a hurdle). While some theorists argue that skilled motor cognition is rooted in procedural memory mechanisms (e.g., Squire 2004; Mason and Just, 2020), I argue that there is no “carve in the joints” of neurocognitive reality that leaves skilled motor cognition intact as a unified, non-gerrymandered natural kind category in mind-brain science. However, contrary to orthodox theorizing about cognitive ontology, I suggest that the natural kind status of skilled motor cognition is a poor indicator of its legitimacy as a neurocognitive taxonomic category.

Neural mechanisms of linguistic prediction: some philosophical implications (Session 12)

**Zoe Drayson**, Department of Philosophy, University of California, Davis
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Predictive approaches to neural processing aim to give a unified account of perception, action, and cognition by appealing to a cortical hierarchy of generative models which work to minimize prediction errors (Friston 2009, Clark 2013, Hohwy 2013). Some proponents of these models have recently emphasized the role of language in providing a source of priors which can manipulate the precision of prediction error estimations. While there is certainly neural evidence of linguistic prediction (the N400 ERP response is modulated by word predictability, for example), there is no consensus on whether the neural mechanisms involved are domain-general or domain-specific. In this paper, I argue that evidence of language-specific neural prediction mechanisms (Ryskin, Levy and Fedorenko 2020, Shain et al. 2020) challenge Lupyan and Clark’s (2015) claim that language is a domain-general prior-setting tool.
Neural (titular) computation (Session 2)

**Luis H. Favela**, Department of Philosophy and 
Cognitive Sciences Program, University of 
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**Michael Silberstein**, Department of Philosophy 
Elizabethtown College  silbermd@etown.edu

Philosophers of neuroscience have claimed that “everyone is (or should be) a computational neuroscientist, at least in the general sense of embracing neural computation.” This claim is uncontroversial if you believe that cognition is explained by neural computation (simpliciter). We take a critical stance towards the claim that neurocognition is best understood as a form of computation. First, there is no “simpliciter” notion of computation in cognitive neuroscience. Second, depending on the concept of computation in play, it is unclear how the claim to explanation is being met. Third, there is a related worry about empirical verifiability. Fourth, cognitive neuroscience itself is only one of various legitimate sciences of cognition, and not a predominant one at that. We conclude that, descriptively, there is no “Computational Theory of Cognition” at work in cognitive neuroscience and, normatively, the scientific investigation of cognition ought not to be guided by a single discipline’s framework.

Lessons From Neuroscience for the Evolution of Cognition (Session 8)

**Carrie Figdor**, Department of Philosophy, University of Iowa  carrie-
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The human brain is homologous to other primate (and mammalian) brains (Dunbar and Shultz 2017), homologous in some structures to avian brains (Jarvis 2005), and analogous in some structures in invertebrate brains (such as cephalopods or insects) (Zullo and Hochner 2011). If we are going to “map” cognitive capacities to the human brain, the capacities we map should be individuated the way the brain is: through the same phylogenetic lens. Whether or not human cognitive abilities line up 1:1 with human brain structures, the methodology of individuation should be the same evolution-based theoretical framework, not the anthropocentric one that has distorted our thinking about cognition for millenia. In this talk I’ll draw on work by two prominent neuroscientists and their colleagues to provide guidance on how cognitive capacities can be individuated in the same phylogenetic manner as the brain already is. I draw lessons from Miguel-Tome and Llinas (2021) and Cisek (2019) for insight into the principles guiding trait individuation in evolutionary sciences that are applicable to individuating cognitive characters and phenotypes.
The cortex as a Rorschach blot for cognitive scientists, computational theorists and evolutionary biologists alike (Session 7)

Barbara L. Finlay, Behavioral and Evolutionary Neuroscience Research Group, Department of Psychology, Cornell University blf2@cornell.edu

My research concerns the evolution and development of the retina and the cortex, and thus, I find myself a participant-observer of the evolution and development of the research community associated with each structure. These two prove to have been strategically positioned to illuminate the unconscious assumptions each discipline brings to guide the observations it makes, and then the hypotheses and experiments generated to find order in their observations. The types, numbers and densities, topology and interconnections of photoreceptors and neurons in the retina are comfortably close to immediate adaptive functions like color perception, acuity, sensitivity and perceptual constancies, making research questions appear direct. On the other hand, the immediate functionality of any neuronal feature in the cortex remains obscure, and “little is known”, as grant proposals typically intone, about the significance of cortical architectural organization overall. Much-discussed issues about cortical organization, such as the functional specificity of cortical areas, modularity, incremental versus qualitative changes in function, and neural re-use and plasticity will be considered in this light.

The neurobiology of engrams (Session 3)

Paul Frankland, Program in Neurosciences and Mental Health, Hospital for Sick Children, Toronto, Canada paul.frankland@sickkids.ca

The strengthening of connections among neurons that are co-active at the time of a particular experience is thought to underlie the formation of memory engrams. While engrams normally exist in inactive (or dormant) states, presentation of a retrieval cue leads to engram reactivation and memory recall. Our work over the last decade has explored the neurobiological bases of engram formation and expression. In my presentation I will highlight recent work that has explored 1) the role of synaptic strengthening in engram formation, 2) contextual modulation of when engrams are expressed, and 3) how the mechanisms of engram formation change over development.
Ongoing Neural Mechanisms of Cognition (Session 6)

J.P. Gamboa, Department of History and Philosophy of Science, University of Pittsburgh jog122@pitt.edu

In the philosophical literature on mechanisms in science, it is common ground that mechanisms are individuated by the phenomena they explain (Illari and Williamson, 2012). Philosophers have argued that phenomena determine the spatiotemporal boundaries of their mechanisms (Craver, Glennan, and Povich, 2021). In this talk, I begin by examining how neuroscientists detect mental phenomena in the lab. I show that operational definitions leave open-ended when exactly mental phenomena occur during an experiment. This raises the potential worry that neural mechanisms of cognition don’t have (experimentally accessible) temporal endpoints. However, I will argue that rather than a worry, this is a more empirically adequate view. Instead of operating with discrete starting and finishing timepoints, neural mechanisms are ongoing. Their components are typically active both before and after the supposed temporal boundaries of the mental phenomena they explain.

The Development of Electrophysiological Tools for the Simultaneous and Separable Recording of Neural Assemblies - An Infra-Experimental Analysis (Session 5)

Juan M. Garrido-Wainer, Centro de Estudios Mediales and Departamento de Filosofía, Universidad Alberto Hurtado, Chile garridowainer@gmail.com

The study of the relationship between tool development and theory testing in neuroscience has sparked great interest in recent years. This presentation studies the development of tools for the electrophysiological recording of neural assemblies. It shows that the concept of neural assemblies allows researchers to identify what experimental variables and range of values for these variables are relevant to measure. However, the technical solutions to the problems of recording neural assemblies depend on the causal properties of the recording systems. Electrophysiological data are a function of the set of states or range of values of electrical activity in cortical tissue. Therefore, assessing tools' productivity is crucial in addition to considering the relevance of data based on concepts and hypothetical claims.
A neuroscientific argument for nihilism and its lessons (Session 10)

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Traditional arguments for “nihilism”, the view that there is no self (or you), are driven by introspection about the structure of our experience. Writers like Thomas Metzinger, and others, have recently pressed nihilism using evidence from the neurosciences, but appear to continue to rely on assumptions derived from introspection. However, I highlight an alternative argument for nihilism built upon neuroscientific evidence and not relying upon introspection. Crucially, I show that if one can establish that higher psychological properties are had by brain areas, then one can provide a plausible argument there is no self (or you) as usually conceived. Strikingly, I show nihilists like Metzinger are completely blind to the key challenge to such an argument, and their nihilism, and hence to the nascent scientific debate about the self/you. I suggest the broader lesson is that nihilists continue to mistakenly endorse introspectively-based assumptions.

Entangled Brains and the Experience of Pains (Session 8)

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As we learn more brain function, it is becoming clearer that many areas process many different types of information at the same time. The fact that there might be dedicated neural correlates of pain is not indicative of anything unusual about how brains function. I shall describe an alternative conceptualization of brain organization and function using a brief history of our understanding how brains navigate in space as an example. Many brain areas that were once thought to do just one thing (e.g., encode place) turn out to support a wide range of functions (place, route, behavioral experiences, and memories of those experiences), and they do so simultaneously. I shall conclude that we do in fact have specific biomarkers for pain, but they are not what one might intuitively imagine them to be.

Integration without integrated models or theories (Session 13)

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It is traditionally thought that integration in neuroscience requires combining different perspectives, elements, and insights into an integrated model or theory of the target system/phenomenon. In this paper I argue that this type of integration is frequently not possible in neuroscience due to our reliance on using different idealizing and simplifying assumptions in our modeling practices. Despite this, I argue that we can still have integration and attain all the benefits that integrated models would provide without the need for their construction. Neuroscientific models which make incompatible assumptions
about the target phenomenon can still be integrated by understanding how to draw coherent and compatible inferences across them. I discuss how this is possible and demonstrate how this supports a different kind of integration.

**On the evolutionary variety of artificial psychologies (Session 10)**

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AI moral debates often focus on cognitive similarity to humans, especially in terms of intelligence and consciousness. How, those are not the only traits we consider morally. We also consider interests. What does a moral agent/patient want, experience, can have go better or worse? All the interests we have previously considered, though, are the result of evolutionary development, which we understand in terms of pain, pleasure, wants, survival, and replication. With AI, however, development can be much more divergent. AIs might result from processes mimicking biological evolution, but also might result from guided evolution, no evolution, or strange-environment evolution. As such, AIs might have bizarrely different interests than we are familiar with or no interests at all. I look at these possibilities, discussing how an evolutionary approach can shed light on AI morality.

**How speculative neuro-psychological theories misrepresent perspective as science: a Wittgensteinian critique (Session 5)**

**Christopher Hoyt**, Department of Philosophy and Religion, Western Carolina University  choyt@wcu.edu

Since the cognitive revolution of the mid twentieth-century, a lot of psychology includes speculative theories about the underlying neurology of mental phenomena. Highly conjectural theories of inference systems, traces and other cerebral phenomena are invoked to explain religious belief, emotion, autism and much else. Wittgenstein offers powerful reasons to believe that such theories not only run too far ahead of the facts to take seriously, but that they are rooted in fundamentally confused ideas about the nature of mind. Seen rightly, such theories merely project their authors’ perspectives in the disguise of science.
Repetition and memory: A case of confirmation in cognitive psychology and neurobiology (Session 3)

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Shapiro (2017) argues that, even if we reject multiple realizability, cognitive psychology and the explanations therein remain independent of neurobiological explanations. One argument that he makes is that confirming psychological explanations indirectly—that is, by using the hypothetico-deductive method or Bayes’ rule—is just as warranted as confirming those explanations by examining the underlying neurobiological processes. Hence, cognitive psychology need not rely on neurobiological investigations. I examine two investigations of the process whereby repetition improves memory performance: one by the psychologists Hintzman and Block (1971) and one by the neurobiologists Xuchen Zhang and his colleagues (2016). I then argue that, because the neurobiological investigation can do all that the psychological investigation can do and it can reveal details about the mechanistic components of the process, the confirmation provided by the neurobiological investigation is superior to the confirmation provided by the psychological one.

Thinking about neural circuit architectures that support acoustic communication; evolutionary guiderails (Session 7)

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The origins of human language present challenges to both Philosophy and Neuroscience. While rare, learned vocal communication and cognitive skills are also found in non-human species. To what extent are these neural skills shaped by a common vertebrate bauplan as opposed to a primate-specific evolutionary history? For example, is “theory of mind” in parrots and crows due to convergent evolution or deep homology? As neither thoughts, words nor their responsible brain circuits are preserved in the fossil record, problem-solving strategies and vocal communication are experimentally investigated in specific “model” systems: vocal vertebrates. Recent findings reveal conserved features across deep time: from ancient paleobatrachians (*Xenopus* frogs) to more recently evolved birds, rodents and primates. Innate calls and songs are strong candidate for evolutionary precursors to language. Song learning in finches and language learning in humans provide evidence for both common and derived descent.
Dynamical models, scientific understanding, and explanatory unification (Session 6)

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It is often claimed that dynamical models are capable of, at least partially, explaining some cognitive phenomena (Haken et al. 1985; Chemero and Silberstein 2008; Stepp et al. 2011). Mechanists disagree, arguing that such models fail to satisfy their proposed model-to-mechanism mapping requirement (hereafter, 3M) (Kaplan 2011; Kaplan and Craver 2020), and are thereby nonexplanatory (Kaplan and Craver 2011). I propose three independent reasons why the mechanist’s judgment that dynamical models are nonexplanatory is mistaken. I then conclude with some thoughts about what theory of explanation best accommodates the possibility of explanatory dynamical models. In contrast to previous proposals (Walmsley 2008; Zednik 2011; Stepp et al. 2011), I suggest that we view dynamical models as explanatory in terms of the unificationist account of explanation (Kitcher 1989).

Expectation and imagination in scientific inquiry (Session 5)

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Theoretical expectations and goal-directed inquiry constrain scientific observation. Research in psychology and neuroscience suggests that goal-directed inquiry leads to failures to attend to phenomena that are not germane to the goal at hand. We apply these findings to science at large, and document several cases in which theory-based expectations and inquiries led scientists to neglect anomalies. We suggest a solution to this worry, arguing that imagination is a tool that frees scientists from theoretical and logical constraints, sometimes leading to scientific breakthroughs. However, imagination does not feature in scientific education, and often the imaginative processes behind a scientific finding are left implicit in reports of scientific discovery. We study a series of cases in which imaginative processes resulted in scientific breakthroughs. These cases suggest that imagination—as freedom from expectations, both logical and theoretical—deserves more space in scientific education.
The contingent animal: Does neuroscience and ethology still need innateness? (Session 8)

**Gregory M Kohn**, Department of Psychology, Animal Social Interaction Lab. University of North Florida  gregory.kohn@unf.edu

While organisms are continually experiencing and interacting with their environments, the role and extent of experiences in behavioral development has been controversial. Some argue that adaptive behaviors are acquired through experiences, while others claim they are the result of innate programs that don’t require environmental input. But does behavioral development in animals reflect the unfolding of innate programs? Here I highlight the widespread role of specifically causal experiences in the ontogeny of species-typical behaviors, with a particular focus on the development of social behavior. I argue that all behaviors are an outcome of a chain of organism-environment transactions – called ontogenetic niches— that begin in the earliest periods of life. This challenges the notion that organisms come prepared with innate programs for behavior. In conclusion I suggest that ethological and neuroscience move away from a retrospective perspective that seeks to control for past factors that obscure the expression of innate programs, to a prospective perspective that seeks to uncover the forward-moving dynamics that characterize an organism’s lifecycle without innateness.

Try learning first: on the cost of “instinctive” behaviors (Session 8)

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Most accounts of the evolution of learning assume that learning is expensive in terms of energy expenditure (development of complex neural structures and the maintenance of neuronal plasticity) and the time investment necessary for the development of the learned behavior. It is being suggested that behaviors of animals with simple nervous systems, behaviors that are necessary for survival, and/or are exhibited by animals living in stable environments should be hardwired to minimize those costs. This assumption leads to the maintenance of hierarchical view of behavioral evolution, according to which “basic” behaviors that appeared early in the evolution are hardwired, and that “simple” animals rely mostly on instincts. I will present multiple experimental and theoretical examples showing that learning and plasticity are in fact cheaper than instinctive behaviors in evolutionary terms and are in multiple cases preferred. I will present important methodological and theoretical implications of this claim and its experimental predictions.
Either visual experience is impoverished, or the PFC is not the NCC (Session 4)

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In recent years, theories saying that the prefrontal cortex (PFC) is a neural correlate of consciousness (NCC) have become increasingly prevalent. Especially popular are versions saying that it is only when stimuli are actually *represented* in the PFC that they are consciously experienced. However, such theories are severely at odds with the character of visual consciousness: On the one hand, visual consciousness appears informationally rich in the extreme, with properties like object shape, color, and location being simultaneously represented in many parts of the visual field; on the other hand, the functions that the PFC carries out, ones such as attention and working memory, are each dedicated to processing only a very small subset of available visual stimuli. In short, if the PFC is to be considered a candidate for producing the content found in visual consciousness, there is a massive gap to be somehow closed, the one between the amount of content there seems to be in visual consciousness and the amount that the PFC represents.

Character Identity Mechanisms versus Deep Homology in Neuroarchitecture (Session 8)

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Over the past two decades, discoveries of unexpected developmental genetic conservation across animal taxa have challenged our understanding of the nature of traits like eyes and legs. “Deep homology” has been used to describe situations where the genetic regulatory apparatus involved in constructing morphologically disparate animal features is shared across phylogenetically distant lineages. However, the concept has been called into question recently for descriptive imprecision and theoretical inadequacy, especially in contrast to the concept of Character Identity Mechanisms (ChIMs). Here I discuss claims of deep homology in elements of the nervous system (“neuroarchitecture”) with special attention to the arthropod central complex and vertebrate basal ganglia, including its components (e.g., mushroom bodies and the hippocampus), and the purported implications for an executive brain in the bilaterian ancestor of protostomes and deuterostomes. The ChIMs framework provides superior conceptual resources for evaluating and testing these claims, as well as helping to set a research agenda for the exploration of additional, distinct patterns of conservation, such as midbrain circuits for balance and motor coordination in insects and mammals that might imply a single origin for eubilaterian brains.
Negotiating Ascription of Content to Neural Activity (Session 9)

**Caitlin Mace**, Department of History and Philosophy of Science, University of Pittsburgh  CBM149@pitt.edu

Whether patterns of neural activity represent or play a mere causal role is a foundational issue in philosophy of neuroscience. According to some representational pragmatists, functions are stipulated to ascribe representational content and are implicit in the experimental paradigms used to isolate patterns of neural activity. I argue that such accounts unduly contextualize functional ascriptions. Identifying and re-identifying patterns requires generalizing across probes and experimental paradigms, so functions are and should be stipulated based on the broader research domain rather than the particular experimental paradigm. Moreover, I argue that neuroscientists carefully negotiate various animal models, probes, modalities, and experimental paradigms to generalize results. Given that there are many ways to parse out and dissect the causal nexus even with the same probe, the broader domain works to take the representations in their particular contexts and make their explanatory purchase generalizable to other contexts.

My brain is dead, But am I? (Session 10)

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Defining brain death is crucial for medical practice and personal end-of-life decisions. It is often assumed that the loss of brainstem function indicates loss of neocortical function as well, but this assumption is problematic. It is clearly false in the case of super locked-in syndrome where neocortical activity is still present despite loss of clinically detectable brainstem function by standard imaging techniques. Functional near-infrared spectroscopy (fNIRS) has been shown as a promising tool in identifying super locked-in syndrome. It is safe, inexpensive, and portable, and has been found superior to other techniques in detecting motor imagery activity. We argue the adoption of fNIRS in brain death protocols ought to be required, else we maybe killing conscious people with super locked-in syndrome.
Visual illusions in fruit flies and humans indicate shared computational goals (Session 1)

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Numerous studies have revealed that visual illusions are often perceived similarly across evolutionary distant groups. This similarity across phyla in fundamental visual percepts highlights the convergence of computational strategies for solving the same problem. Thus, studying the mechanisms of visual processing through shared illusions can reveal conserved computations across species. Here I will explore a few examples in fruit flies where they seem to respond to the same visual illusions that we do. Besides being a curious fact in itself, this similarity also contributes to the mechanistic study of visual perception, since there are many genetic tools available in flies that give us causal access to their brain circuits and function.

Does Neural Contextualism Imply Holism? (Session 9)

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Early debates about functional localization contrasted localizationism (neural structures have specific functions that can be characterized in relative isolation from other parts) and holism (understanding the function of a neural structure requires understanding the functional state of the entire brain, or large swaths of it). While localization has long been a dominant paradigm in cognitive neuroscience, many philosophers and neuroscientists now believe that the functioning of brain structures is *contextual*—i.e. a structure’s function differs based on the neural context in which it is embedded. Some theorists claim that contextualism threatens localizationism as a paradigm for cognitive neuroscience. In this talk, I examine whether contextualism provides a middle ground between localizationism and holism or whether it implies a rejection of localizationism in favor of holism. Using examples from systems and cognitive neuroscience, I argue that contextualism only implies holism where: a) a structure’s intrinsic function changes according to neural context, and b) neural contexts alter the functions of structures in a non-hierarchical fashion.
Reframing the problem of consciousness for the age of neuroscience (Session 4)

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Why is science unable to provide a satisfying theory of consciousness? The core issue is that consciousness is not a concept amenable to explanation, scientific or otherwise. Consciousness is too vague a notion to serve as an explanandum. Rather, it is a black box, a placeholder, an epistemological indicator, whose role is to point to features of the mind in need of explanation in a certain context, without accounting for any of them. What are these features of the mind-brain that fall under the umbrella of consciousness without explaining or being explained by it? We pinpoint three key cognitive features associated with consciousness—perceivable information content, predictive models of the world, and the capacity to initiate volitional action—and analyze them in terms of neural information processing.

Studying an evolving cortex (Session 7)

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Today’s understanding of brain ‘cortex’ as the designated seat of cognition garners attention among neuroscientists and philosophers alike. Nonetheless, while demarcated by its many layers and functional organization in the human brain, what qualifies as cortex in nonhuman animals has been a subject of dispute. Some, recognizing that morphology and function may differ between animals, claim historical similarities by citing the evolved parallels of certain regions as providing meaningful comparison. Others have found homology by thinking through patterned similarities, citing the sophisticated ways that morphology, function, and connectivity interplay. Here, we will explore how the advancement of tools of neuroscience have shaped the designation and boundaries of cortex in non-human animals. We further explore how these tools have enabled fruitful interventions that relate back to the way the term ‘cortex’ has itself evolved over time. Finally, we claim that neuroscience needs a more expansive definition of cortex to not only better accommodate the empirical data, but also the experimental function of the term ‘cortex’ and how it has served to drive brain research.
Computational modeling of multisensory integration: Pros, cons, and suggestions for future progress (Session 2)

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Across the domains of space, time, and speech, many experiments have provided evidence that our senses interact to produce coherent perception of the surrounding sensory world. To better understand how these interactions occur, and the conditions which lead to different types of integration, researchers have employed computational models to account for increasing complexities underlying different sensory experiences. In this talk, I review important behavioral findings about multisensory integration from the last 30 years, the distinct computational approaches that have been used to account for these findings, and recent work which links these computations to different parts of the cortical hierarchy. This talk will provide insights into the pros and cons of these computational modeling approaches and outline open questions that may be addressed more effectively by new empirical paradigms.

The constitution of the spatial world: Place cells, cognitive spaces and the phenomenological theory of perception (Session 12)

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The present paper applies the phenomenological theory of perception and of perceptual space to the neuroscientific evidences regarding some particular kinds of neurons involved in the reproduction of the spatial environment (place cells; grid cells; head-direction cells; border cells; speed cells). In particular, by applying Merleau-Ponty’s conception of the body as an open, operative and transformative system (expressed by the notion of “body schema”) to the firing pattern of place and grid cells, it aims to shows a particular power of analogy and generalization which characterizes the sensible body, and which is involved in the reproduction or constitution of its spatial environment. In the second part, I will apply this interpretation to the problem of “cognitive spaces”, that is, to the question regarding the relationship between the neural mechanism of the place and grid cells and the more elevated cognitive functions, such as linguistic and conceptual cognition.
The brain as a distributed, entangled system (Session 2)

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Brain mechanisms are often described in terms of a relatively modular and hierarchical architecture. I will defend the view that brain mechanisms should be conceptualized in terms of dynamic distributed processes that span the entire neuroaxis. Evolutionary pressures have molded the central nervous system to promote survival. Careful characterization of the vertebrate brain shows that its architecture supports an enormous amount of communication and integration of signals. The general architecture supports a degree of “computational flexibility” that enables animals to cope successfully with complex and ever-changing environments. An implication of the framework I will describe is that brain processes do not respect the boundaries of standard mental terms (perception, cognition, action, emotion, motivation”). Thus, an important goal should be to unravel how dynamic large-scale brain circuits support complex, naturalistic behaviors.

Empirical desiderata for representation in cognitive neuroscience (Session 12)

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We argue that, despite terminological disaccord, there is a methodological consensus on how to study representations in cognitive neuroscience. In order to support the claim that some brain state represents a feature, scientists seek to satisfy four desiderata: The brain state is sensitive to the feature, it is exclusive for it, it is invariant to other features, and the brain state is functional, i.e. plays a causal in the production of behavior. The paper explains how common analyses are used to establish these desiderata. We argue that our framework captures the methodological consensus that guides the field. The case study of the representation of numerosity in the parietal cortex is used to investigate the framework in action.

Color Vision and The Four-Color-Map Problem, Revisited (Session 1)

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Dale Purves and collaborators have proposed that there is an explanatory connection between the four-color theorem in graph theory and the fact that human color vision is structured by four primary hues (Purves, et al., 2000a and 2000b; also 1999, 2002, and 2017). They have argued, variously, that the mathematical theorem provides a rationale, basis, cause, or constraint for color vision. While the general idea is clear enough, the details are elusive. What, exactly, is the explanatory connection that they postulate? And is the proposal a good one? In this talk we explore the Purves, et al. arguments and evaluate their explanatory claims. Then we’ll consider some alternative ways of interpreting the
Disorder, Antifragility and the Evolutionary Advantage of Social Defeat in Human and Animal Minds (Session 8)

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The philosophical debate concerning whether non-human animals have “minds” has remained an intractable problem for philosophical discussion. Often, those within the debate have turned to the evidence (or lack thereof) of rational or orderly thoughts and emotions in non-human animals to investigate the overlap of phenomenal/subjective conscious experience with humans. This paper instead shifts the perspective in this debate by investigating what might be considered “disordered” thoughts and emotions in non-human animals. Exposure to adverse life events and severe social conflicts usually lead to “disordered” thoughts and emotions present in conditions such as depression, neurodegeneration, and cognitive impairment. However, moderate social defeat may provide an evolutionary advantage for the enhancement of learning and memory and be relevant for the problem of phenomenal/subjective experience in human and non-human animal minds.

Did the Aztecs advance a modular mind thesis? (Session 14)

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Is the mind made up of exclusively distinct systems, each with limited communication, or not? Does it, in brief, have modules? If so, how strongly limited are those modules in communication? The purpose of this paper is to situate the Aztec doctrine of ‘no mind’ within the modularity debate. The Aztecs, unlike the Buddhists, do have a sense of self as character. But they do not appear to unify thought, intelligence, consciousness, identity, perception and like features that would be familiar in the ‘West’ after Descartes—what could be taken to constitute a non-modularity view. Tentatively, the talk advances the thesis that the Aztecs held to a strong form of modularity and reviews empirical support for the prima facie adequacy of the position following evidence from evolutionary psychologists.
Behavior arises from neurophysiological computational processes interacting with external conditions. How information is represented changes the computations that can be performed on it and the answers that arise from those computations. Current neuroscience has revealed that different neural circuits implement different computational process on different representations of past (memory), present (perception), and future (goals, motivations) that are optimized for different situations. For example, planning/deliberative processes entail evaluations of imagined outcomes, while procedural/habit processes entail activation of action-chains learned after extensive practice, and Pavlovian/instinctual process entail learning when to release actions drawn from a limited species-important repertoire. I will show direct neurophysiological observations of these systems and their interactions. This new understanding of decision-making systems has enormous implications for fields beyond neuroscience, including questions of what defines the self, of diagnosis and treatment in psychiatry, and of policy questions in economics and sociology, including an understanding how moral codes change behavior.

Explicating scientific notions of gender identity (Session 10)

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Neuroscientists have investigated the developmental role of genes and hormones, neural networks, and socialization on gender identity. However, although they conceptualize it as a self-concept, they remain vague about what that means and why it constitutes an identity. In response, I argue gender identity is a conceptual representation of a gendered self an agent believes or assumes. Among other things, this construal paints a clearer picture of what mental state develops and clarifies the range of ways neural networks may be involved. For example, some neuroscientists argue that the executive, sensorimotor, salience, and default mode networks enable us to toggle between various bodily and social stimuli and our thoughts about ourselves to construe gender identity. Thinking of it as a gendered self-representation one believes or assumes clarifies these networks help us represent ourselves as a certain gender, form beliefs or assumptions about that representation, and evaluate those beliefs or assumptions.
What neuroscientists think about what engrams must be like (Session 3)

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The recent development of tools like opto- and chemo-genetics, miniscope recording, etc. have brought about renewed interest in the concept of—and neural basis for—the engram. In the process, the molecular model of memory – a view espoused by Gallistel for decades but largely ignored in cellular and molecular neuroscience - is getting more attention. A small but no longer insignificant number of cellular and molecular neuroscientists are stepping away from long-dominant synaptic model in favor of the molecular alternative. Colaço and Najenson (forthcoming) have initiated important work on whether we should see the molecular and synaptic models as complementary or contradictory. My interest is in the reasoning neuroscientists use to justify their support of one model or the other. Specifically, I am interested in how their reasoning reveals core assumptions about what engrams must be like. My current research involves cataloging and categorizing these forms of inference and the particular conceptions of the engram that emerge from them.

Theory-experiment dialogues: How idealized modeling can inform our experiments (Session 13)

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This paper investigates the potential for idealized modeling, also commonly referred to as toy or theory-driven modeling, to steer experimental research within the realms of cognitive, brain, and behavioral sciences. Traditionally, the prevalent approach in these disciplines has been data-driven modeling, with techniques such as deep learning or machine learning models taking the lead. However, we put forward the notion that idealized models, far from being obsolete, can contribute unique insights and effectively direct experimental research in cognitive science. To substantiate this, we elucidate two instances of successful research projects where theory-experiment loops have created a symbiotic link between experimental endeavors and idealized modeling.

Neurophysiologists are tinkerer-naturalists in their ways of holding and figuring out phenomena: Two case studies (Session 5)

**Alok Srivastava**, Independent researcher, San Francisco, CA alok.srivastava@gmail.com

I apply the central question of Integrative-HPSSoS research of explaining how Science Research Groups routinely produce new discoveries to the community of Neurophysiologists. They function as tinkerer-naturalists in cultivating their capacity to hold and work phenomena at the intersection of their communication and construction practices. I will be develop two case-studies of seminal advances in neurophysiology with a new theory of semiotic affordances of material and discursive practices in research workshops.
The first case is the 1990 experiments from Richard Aldrich’s lab at Stanford University explaining the voltage gated regulation of membrane potentials through potassium ion channels encoded by gene called shaker in Drosophila studies. The second case is recent work from Daniele Canzio’s lab at UCSF explaining the self-assembly of neuronal circuitry in the olfactory system.

Clever birds and complex brains: Cell types and circuits in evolution

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The capacity for complex cognition evolved independently in birds and mammals. Neurobiologically, increases in cognitive complexity are linked to increases in the size of the brain’s pallium. A closer look reveals significant similarities in the intra-pallial circuits of birds and mammals. According to one theory, many of the neurons in these circuits are not homologous between birds and mammals, because they develop from different embryonic brain regions. Under this view, the similarities are the result of convergent evolution. An alternative view holds that the pallial neurons are homologous as cell types but changed their developmental origin and adult arrangement. Single-cell RNA sequencing may help resolve this debate, but the dispute raises interesting philosophical questions about the mechanisms underlying evolutionary continuity and change. An important long-term goal is to understand the extent to which complex cognition is implemented (and constrained) by different neural mechanisms in birds versus mammals.

Does GPT Have Theory of Mind? Attributing Emergent Cognitive Capacities to Large Language Models

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Recently, various researchers have suggested that the capacity for mindreading or ‘theory of mind’ has emerged in later versions of the Generative Pretrained Transformer (GPT) language model (Kosinski 2023, Bubeck et al. 2023). They argue this on the basis that GPT-3.5 and GPT-4 pass with flying colours one of the most famous and widely used measures of theory of mind ability: the false-belief test. In this talk I critically assess the claims and methodology in Kosinski and Bubeck papers, from a perspective of the evolutionary, developmental and comparative psychology and neuroscience of theory of mind. I argue that GPT passing the false-belief test provides strikingly little evidence for the claim that it has theory of mind, even if it is a reasonably adequate test of theory of mind in children and non-human primates/mammals.
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