Relating Explanatory Paradigms in Cognitive Neuroscience – Pluralism, Integration and Elimination

(Abstracts, alphabetical by author)

Chemero, Tony (Cincinnati)
Observables and unobservables in the cognitive and neural sciences
Thu, 26th February
15:45 – 17:00

Colaço, David (Munich)
Two impediments to relating explanatory paradigms in cognitive neuroscience
Wed, 25th February
14:30 – 15:45

We are awash in debates over which explanatory paradigms are promising in cognitive neuroscience, including debates over whether there is a single appropriate paradigm. Because these debates reflect broader concerns about the nature of explanation, I use this talk to take a step back and address two characteristics about paradigms that are impediments to relating them unless tackled head on. These impediments relate to the two parts of an explanation: the explanandum, and the explanans.

First, we must tackle whether applications of paradigms address the same explananda. If they are oriented to different explananda, including both different ostensive phenomena and different characterizations of phenomena, this difference will affect our ability to relate paradigms. I explore this issue for memory, where subtly different articulations of an explanandum affect how they are explained and what paradigm seems most appropriate.

Second, we must tackle what componentry should be implicated in the explanantia of these paradigms. While we typically associate certain componentry with paradigms, such as entities and activities with mechanistic explanation, some components can be freely incorporated into multiple paradigms. This freedom entails that the explanatory relevance of this componentry does not single out a particular paradigm as the most promising. I explore this issue for metabolic considerations, which are posited to be explanatorily relevant but can be integrated into either mechanistic or constraint-based paradigms.

Egan, Frances (Rutgers)
Integrating causal/mechanical and rational perspectives on thought
Wed, 25th February
11:45 – 13:00

Mechanistic and computational models of cognitive processes both aim to provide causal explanations of cognition. Neither is eliminable in favor of the other; they answer different kinds of questions. We also expect cognitive processes to be recognizable as *thought*, in other words, we expect that they can be seen as *rational*. Mechanistic accounts can't provide this perspective. Computational accounts can, I argue, because they model the causal processes responsible for cognition as *mathematical* processes. This is the key idea of the *mapping account* of computation. According to the version of the mapping account that I favor, a physical system S has the capacity to compute a function F just in case:

I. There is a mapping from (equivalence classes of) physical states of S to the arguments and values of F, such that:

II. Causal state-transitions between the physical states mirror the formal dependency relations between the arguments and values of F.

Appealing to the teleological function of a computing mechanism – as some recent accounts of physical computation have done – adds a normative dimension, but not the right sort. We can see some activities of the mechanism as *malfunctions*, but not as *miscomputations* or *mistakes*. I conclude by arguing, briefly, that the dual perspective afforded by the right sort of mapping also accounts for the idea that attributions of propositional attitudes in folk psychology are simultaneously causal and rationalizing explanations of behavior.

Einav, Asaf (BGU)
Mechanistic explanations and representations
Wed, 25th February
16:00 – 17:15

Fresco, Nir (BGU) & Schulte, Peter (Umeå)
Computation-based accounts of representation & the liberality problem
Wed, 25th February
10:15 – 11:30

Heemskerk, Johan (Warwick)
Dissolving a teleosemantic schism
Thu, 26th February
11:30 – 12:45

Teleosemantics is a branch of philosophy in which theorists attempt to provide a naturalistic theory of representational content. It is marked out by a framework in which content is determined by (i) the function of a representation and (ii) a mapping relation between the representation and something in the world. However, there is a schism within teleosemantics between those who take the appropriate account of functions to be etiological (typically, the evolutionary function of a component) and those who advocate for non-etiological functions (typically, systemic functions). In this talk, I will argue for teleosemantic pluralism – etiological and non-etiological teleosemantics are not in conflict and can co-exist. I begin by spelling out the 'explanatory turn' in teleosemantics; in short, a theory of content should deliver content ascriptions which are consistent with the use of content in scientific explanation. Using a distinction due to Mayr, I will argue that there are (at least) two distinct types of scientific explanation, ultimate and proximate. Very broadly, an ultimate explanation explains why a trait is present, while a proximate explanation explains how a trait is present. I argue that etiological teleosemantics aims for consistency with ultimate explanation, while non-etiological teleosemantics aims for consistency with proximate explanation. The upshot is that, given two independent adequacy conditions, the two types of teleosemantics can co-exist. Indeed, both types of theory are required for a full understanding of both how and why the mind works as it does.

Kohar, Matej (TU Berlin)
Explaining at the interface: How models combine to explain together
Thu, 26th February
14:15 – 15:30

Often, several models jointly explain a single phenomenon of interest. In philosophy of neuroscience and cognitive science, there are well known accounts of how explanatory models can be related (e.g. Craver's account of mechanistic integration, or Marr's account of explanatory levels). This paper argues that relations between model elements in different models cannot be neatly fitted into a single schema (mechanistic integration, Marrian levels, etc.). Rather there are tentative, often ad hoc links between model elements. resulting in complex, shifting and fractured stores of explanatory knowledge.

The argument is illustrated by a case study concerning an explanation of congenital prosopagnosia (Avidan & Behrman, 2021). Here, at least three separate models converge to deliver the explanation – the general model of visual feature extraction in the ventral stream, a model of vector subtraction in grid-cell assemblies (Bicanski & Burgess, 2018) and a model of neural tuning (Tan & Poggio, 2016).

Piccinini, Gualtiero (Missouri)
Basic intentionality as mechanistic teleosimulation: How brains can represent the nonexistent
Fri, 27th February
10:45 – 12:00

What I call basic intentionality is the capacity to think about nonexistent entities and nonoccurring states of affairs. I argue that basic intentionality can be explained mechanistically in terms of teleosimulation: the offline deployment of neural representational resources in function-guided simulations. Teleosimulations need not involve the nonexistent; they are neural representations that can dynamically integrate indicative (how things are), imperative (what to do), and evaluative (what difference something makes for the organism) elements. To prepare the ground, I characterize teleosimulations as components of neurocomputational mechanisms and defend a neurocognitive informational teleosemantics that fixes content via teleofunction and (often conditional, population-level) informational constraints while accommodating mixed selectivity and representational drift. I then argue that teleosimulative mechanisms can recombine representational resources offline and keep track of systematic departures from online tracking conditions. When this monitoring capacity is in place, the system can represent absent or nonactual targets by inheriting content from the roles those representational states would play under successful online tracking. This yields a mechanistic explanation of basic intentionality—and a stepping stone toward a mechanistic explanation of full-blown intentionality, including propositional attitudes and their expression in language.

Ross, Lauren (UC Irvine)
Explanation in cognitive neuroscience: Pluralism, principles and precision
Thu, 26th February
10:00 – 11:15

The topic of scientific explanation continues to receive significant attention in the philosophical literature. Indeed, philosophical work since the mid-20th century has made significant progress in advancing our understanding of types of scientific explanation and the standards they should meet. This talk explores three main questions in this space: (1) what we ultimately want from accounts of scientific explanation, (2) the extent to which mechanistic frameworks can provide this, and (3) how to make progress in moving forward. This talk will outline two hard problems of scientific explanation and suggest strategies in moving forward that involve the importance of specifying clear principles, precise explanatory targets, and focusing on causation before mechanism.

Williams, Danielle (Purdue)
A contextual account of explanatory relations in cognitive neuroscience
Fri, 27th February
12:15 – 13:30

Questions about how different explanatory practices in cognitive neuroscience relate often presupposes that there are stable, context-independent explanatory strategies or paradigms that can be straightforwardly compared or integrated. In this talk, I challenge that presupposition and I argue that before we can assess whether explanatory approaches in cognitive neuroscience conflict, complement, or admit of pluralistic integration, we must first examine how those explanations are actually used, taking into consideration the contexts in which they operate and the questions they are intended to answer. On this view, explanatory types cannot be related in the abstract. Instead, their relations emerge only once their contextual deployment within specific explanatory practices is made explicit. To motivate this approach, I examine computational, mechanistic, and dynamical explanations, to show that how those explanatory types relate depends on the explanatory context.