



Contents lists available at ScienceDirect

Studies in History and Philosophy of Biological and Biomedical Sciences

journal homepage: www.elsevier.com/locate/shpsc

HIT and brain reward function: A case of mistaken identity (theory)

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ARTICLE INFO

Article history:

Received 19 August 2016

Received in revised form

3 April 2017

Available online 28 June 2017

Keywords:

Dopamine

Explanation

Identity

Localization

Mechanism

Reward

ABSTRACT

This paper employs a case study from the history of neuroscience—brain reward function—to scrutinize the inductive argument for the so-called ‘Heuristic Identity Theory’ (HIT). The case fails to support HIT, illustrating why other case studies previously thought to provide empirical support for HIT also fold under scrutiny. After distinguishing two different ways of understanding the types of identity claims presupposed by HIT and considering other conceptual problems, we conclude that HIT is not an alternative to the traditional identity theory so much as a relabeling of previously discussed strategies for mechanistic discovery.

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1. Introduction

The central thesis of the mind/brain identity theory is that every type of mental state or process is identical with some type of brain state or process. Early proponents of the theory intended to rebut two general claims: that mental states and processes are something other than brain states and processes, and that mental states are merely correlated with brain states.¹ Later proponents of the theory intended to enshrine a few further theoretical commitments: that kinds of mental states and processes are reducible without remainder to certain kinds of states and processes in the brain; that the identity relation involved in mind/brain identity statements is necessary; and that mind/brain identity statements are neither analytic nor a priori.

Sadly, the identity theory fell on hard times. From the early 1960s to the late 1980s, it was beleaguered by numerous philosophical challenges, including concerns over multiple realizability,

violations of Leibniz’s law and the modal logic of identity statements, and the apparent incorrigibility of introspective reports.² Since the early 1990s, examinations of case studies and actual scientific practice have become equally important prongs in both challenges to, and defenses of, philosophical theses about mind/brain relationships (Bickle, 2003); but unfortunately, traditional identity theorists have had a paucity of cases of psychoneural identities to celebrate.

These challenges have created the conditions for an alternative to the traditional identity theory, dubbed the ‘Heuristic Identity Theory’ (HIT). The traditional theory supposes that scientists work by generating psychoneural correlations and then accumulating evidence for type-identities to explain them. According to HIT, this supposition puts the cart before the horse. Psychoneural identities are not discovered after a period of protracted scientific research; instead, scientists intrepidly hypothesize them at the outset of inquiry and then use those hypotheses as a discovery heuristic for driving further research.

Interest in HIT has coincided with other favored philosophical trends, including the recrimination of reductionist themes in the

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E-mail addresses: cory.wright@csulb.edu (C. Wright), m.colombo@uvt.nl (M. Colombo), alexander.beard@zoho.com (A. Beard).¹ See Place (1956); Feigl (1958); Smart (1959); Armstrong (1968). Note that identity theorists have often interpreted uses of the term *brain states* as being ‘just a placeholder for whatever the eventual working parts of brains—in fact, of nervous systems, perhaps embodied nervous systems—turn out to be’ (Polger, 2009: 3).² For defenses of the identity theory on conceptual and empirical grounds, see, e.g., Enç (1983); Shapiro (2000); Sufka & Lynch (2000); Polger (2004, 2009); Couch (2004); Shapiro & Polger (2012).

psychological sciences, the rise of explanatory pluralism, and the mechanistic approach to explanation (McCauley, 1996). Embracing pluralism and mechanistic explanation in particular (e.g., Bechtel & Wright, 2009), advocates of HIT have appealed to a few cases from neuroscientific practice to support the claim that ‘hypothetical identities [...] regularly serve as the critical premises in explanatory proposals that inaugurate new lines of scientific investigation’ (McCauley, 2012: 192).

This paper examines this claim, asking two questions. Has HIT received sufficiently convincing empirical support? Is HIT a genuine alternative to the traditional identity theory?

To answer these questions, we shall proceed as follows. In §2, we survey HIT’s basic commitments. In §3, we detail the history of electrophysiological and neuropharmacological research on brain reward function (BRF), which provides an exemplary case study against which to test the predictions and commitments of HIT. Unexpectedly, this case failed to support HIT, motivating closer scrutiny of previously invoked cases. In §4, we argue that, on a standard conception of identity, these previous cases also fail to provide convincing empirical support for HIT; on a broader conception of identity, existing case studies do support HIT, but not as a version of identity theory, as advocates present it.

Philosophical attempts to detail the claims of HIT have only supported a broadly mechanistic approach to mechanistic explanation and mechanism discovery, which often posits hypotheses about the localization of psychological functions in the brain, or hypotheses about the causal production of psychological phenomena by certain neural mechanisms. While scientists often advance such hypotheses as heuristics for discovering mechanisms (Bechtel & Richardson, 1993/2010), it is a mistake to confuse these relations for the identity relation. As it is not a theory about identity, HIT is not any kind of mind/brain identity theory. In particular, HIT is not a new alternative identity theory so much as an epicycle on what has been called the ‘new mechanical philosophy’ in cognitive neuroscience. We consider various additional conceptual problems in §§5–6, and conclude in §7.

2. Heuristic identity theory

2.1. Origination

HIT seems to have originated from remarks by William Wimsatt (1976a: 227–229), who suggested that explanation—*not* reduction—is the proper context in which to understand the role of psychoneural identities in science. For Wimsatt, identities are not the endpoint or goal of an intertheoretic reduction, and they do not serve as a regulative ideal against which intertheoretical relations are formally judged. Rather, they are ‘tools’ used primarily to ferret out errors, and thus play a merely enabling role upstream in the process of refining explanations: ‘[i]dentity claims [...] provide probes of potentially unlimited sensitivity and depth for pinpointing sources of explanatory failures’ (1976a: 227). Wimsatt’s remarks were later reformulated, *en passant*, by Robert McCauley:

Instead of identities being assigned late in the game to those coextensionalities which prove persistently recalcitrant to explanation, they are often proposed relatively early, initiating wholly new lines of research. When in doubt (many scientists) assume the truth of a proposed identity until empirical research clearly indicates otherwise. The postulation of identities is a research tool for extending the explanatory range of theories. They are not proposed as the grounds for justifying eliminative moves in microreductions (even if, after the fact, they may be cited as such). (1981: 225)

Unfortunately, HIT went dark after these two opening salvos, but was resurrected in a series of papers by McCauley & William Bechtel.³

From this body of work emerged the central thesis of HIT: identity statements are discovery heuristics.⁴ Bechtel & McCauley put the thesis this way: ‘claims between psychological processes and neural mechanisms [sic] are advanced as heuristics that serve to guide further research’ (1999: 71). The thought is that identity statements play a heuristic role in the initial development and guidance of research in multiple fields and at multiple levels of analysis: ‘identity claims are made early in a research program and serve as heuristic for further research’ (Bechtel, 2002: 236).

The process of advancing heuristic identities has multiple phases, which McCauley & Bechtel (2001: 751) described as follows. Initially, identity statements involve discrepancies. These discrepancies prompt further research at various levels of analysis to ascertain which proposals should prevail or in which directions to proceed. Next, this further research yields more precise hypotheses about the systems and patterns engaged, provoking new speculations at multiple explanatory levels. Then, speculations imply new ways of orchestrating familiar facts and theories within levels, and suggest new avenues of research. Finally, some of these avenues of research produce new cross-scientific conflicts, which likely begin this cycle anew.

So, in positing identities between mental states or processes and neural states or processes, scientists can apply knowledge of neural mechanisms to guide the development of models of mental states and processes at higher levels of analysis; and then they can justifiably rely on knowledge of mental states and processes to search for lower-level neural mechanisms. As McCauley & Bechtel put it, ‘what we learn about an entity or process under one description should apply to it under its other descriptions’ (2001: 753), which Bechtel repeats elsewhere: ‘[...] unlike [the] traditional identity theory, the focus is on using the differences between what is known about the processes under each description as a discovery heuristic to revise the other’ (2008a: 990). For advocates of HIT, what ultimately matters is the explosive amount of science that can be generated by positing identities. If psychoneural identities play this role—fecundity—in scientific practice, then HIT would rest vindicated in a way that eschews the metaphysical issues raised by traditional versions of identity theory.

2.2. Three overarching commitments

The thesis that identity statements are discovery heuristics is analyzable into at least three successive commitments. Firstly, identity statements are ‘thoroughly hypothetical’ statements about psychoneural relations (Bechtel & McCauley, 1999: 67, 71). Secondly, these hypothetical identity statements are posited at the outset of a period of scientific research. As Bechtel & McCauley wrote, ‘scientists adopt [identity statements] as hypotheses in the course of empirical investigation to guide subsequent inquiry, rather than settling on them merely as the results of such inquiry’ (1999: 67; see also Bechtel, 2002: 236), and again, ‘[i]dentity claims (e.g., that water is H₂O or pain is C-fiber firing) are [...] made at the outset of investigation, often on the basis of a limited number of correlations’ (Bechtel, 2008b: 70). Thirdly, these inaugural statements are then used to facilitate self-correcting research at

³ Bechtel & McCauley (1999); McCauley & Bechtel (2001); Bechtel (2002, 2008a,b); McCauley (2012); see also Schouten & Looren de Jong (2001); Looren de Jong (2006); Bechtel & Hamilton (2007).

⁴ See McCauley & Bechtel (2001: 753) and Bechtel (2008b: 71); see also Bechtel & McCauley (1999: 67, 71); Bechtel & Hamilton (2007: 414).

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