



The Extended Scientific Mind

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Received 14 September 2015; received in revised form 17 February 2016; accepted 10 March 2016

Available online 1 April 2016

Abstract

According to externalist theories of scientific cognition, scientific theory formation and revision are sometimes achieved by cognitive systems that range beyond the biological boundaries of individual scientists. Two kinds of externalist theories deserve to be sharply distinguished. The first is *The Extended Scientific Mind*, which is an application of The Extended Mind to scientific contexts. According to this externalist theory, the cognitive systems responsible for a scientist's inferences can extend into her extra-cranial environment and incorporate elements with which she is intimately coupled. The second kind of externalist theory is a *population-level theory* of scientific cognition, which characterizes the dynamics of populations and communities of scientific researchers. Externalist theories of this type posit cognitive properties of these population-level dynamics that are not necessarily instantiated by any individual scientist who is a member of such populations. I argue that population-level theories of scientific cognition are more plausible than The Extended Scientific Mind because the latter posits cognitive systems that are explanatorily unwarranted. On the assumption that non-scientific cognition and scientific cognition are fundamentally alike, a similar moral holds for externalist accounts of ordinary cognition.

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Keywords: Extended mind; Extended cognition; Scientific cognition

0. Introduction

This article addresses a foundational issue in the cognitive science of scientific cognition. The issue is the extent to which internalist or externalist theories of cognition are appropriate for characterizing scientific theory formation and revision. “Internalism” and “externalism” in the present context do not concern the *content* of cognitive states but rather the location and boundaries of cognitive systems. Internalism in this sense is the view that cognitive mechanisms, representational vehicles or other cognitive structures are located solely within the head or skin of individual cognitive agents. An internalist framework for characterizing scientific cognition is captured by:

Scientific Internalism: The cognitive systems responsible for scientific theory formation and revision are invariably circumscribed within the head or skin of individual scientists.

According to *externalist* approaches to cognition, some cognitive mechanisms, representational vehicles or other cognitive structures have components located beyond the biological boundaries of an individual. An externalist framework for characterizing scientific cognition is captured by:

Scientific Externalism: Scientific theory formation and revision are sometimes achieved by cognitive systems whose boundaries are located beyond the head or skin of an individual scientist.

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Though I assess a cluster of externalist proposals simultaneously,¹ two types of externalist frameworks for characterizing scientific cognition ought to be sharply distinguished despite often being run together. The first is *The Extended Scientific Mind* (TESM) which is an application of The Extended Mind (TEM) to contexts of scientific reasoning. According to a theory of this type, the cognitive systems subserving a scientist's inferences can extend into her extra-cranial environment and incorporate elements with which she is intimately coupled (Giere, 1996, 2002, 2007; Giere & Moffatt, 2003). The second is *population-level* theories of scientific cognition, a distinct kind of externalist theory that characterizes the dynamics of groups of scientists and communities of researchers. Such theories posit cognitive properties of these dynamics that are instantiated by populations but not necessarily by any individual scientist who is a member of such populations (Kitcher, 1990, 2003; Sarkar, 2007; Strevens, 2003; Hull, 1988).

I will argue that there is reason to sharply distinguish TESM from population-level theories of scientific cognition because the latter are more plausible than the former. Here is the plan for presenting this argument. After introducing TEM and then TESM in Section 1, I pursue an objection to TESM throughout Sections 2 and 3. In Section 4, I argue that population-level theories are not harmed by this objection and explore the previous discussion's implications for externalist approaches to non-scientific cognition.

1. The Extended Mind (TEM)

TEM characterizes a cognitive agent's systematic interactions with her environment in terms of cognitive systems that contain both the agent and any environmental elements with which she is intimately coupled. According to TEM, an agent's cognitive vehicles, mechanisms, or other cognitive structures can "extend" beyond their biological boundaries and integrate with such elements. The borders of the extended cognitive systems that form, according to TEM, do not invariably coincide with the individual's original biological boundaries. Instead, many proponents of TEM treat a cognitive agent's cranial boundaries as more or less arbitrary in terms of tracing the perimeters of cognitive systems. The tendency to adopt internalist frameworks is often regarded as a kind of prejudice, perhaps inherited from Descartes.

I will focus on a version of TEM defended by Andy Clark and Rob Wilson though my discussion has implica-

tions for a broader set of TEM's proponents. My interest is in evaluating a class of views on which extended cognitive systems may subserve "higher" cognition—paradigmatically including conscious planning, decision-making and (scientific) reasoning. I will not comment on proposals of extended "lower" cognition, for example concerning aspects of early perceptual processing or sensorimotor control (Chemero, 2009; O'Regan & Noe, 2001). If one rejects such a distinction, the conclusions I draw regarding "higher" cognition apply to extended cognition more broadly.

Wilson and Clark draw inspiration for their version of TEM from a variety of fields that describe organism–environment relations, especially including niche construction in biology and ecology:

Thinking is a kind of building, a kind of intellectual niche construction that appropriates and integrates material resources around one into pre-existing cognitive structures. In cognition, agents modify or augment the capacities that those pre-existing structures enable (Wilson & Clark, 2009, p. 58).

According to this version of TEM, systematic relations to the environment that augment or modify extant cognitive structures can lead to "functional integration" so as to form extended *information processors* whose decomposable parts include both intra and extra-cranial components. One result, on Wilson and Clark's view, is that extended cognitive systems can include "wideware" (Wilson, 2004) that allows for cognitive demands to be "offloaded" from internal onto external resources (Wilson & Clark, 2009, p. 59). Overall, TEM promises to illuminate how systematic interactions with the environment facilitate complex cognitive achievements.

1.1. Distinguishing TEM from population-level theories

Population-level theories of cognition, I maintain, are an importantly different kind of externalist theory. They posit an array of complex interactions among a population's members such that cognitive properties become distributed over the dynamics of the population. Externalists often simultaneously endorse both TEM and population-level theories. For example, Wilson (2010) describes his externalism as "... identif[y] cognitive systems themselves as reaching beyond individuals into their physical and social environments" (p. 171). A taxonomical approach suggested by Wilson's remark is to treat population-level theories of cognition as a special case of TEM—as characterizing the particular case where an individual mind extends onto a social community in which it is embedded.

An objection to such a taxonomy is that it fails to sufficiently demarcate theories of individual-level phenomena from theories of population-level phenomena, despite such theories often being distinguished in other scientific domains. A separation of this kind avoids two

¹ *Externalism* has been characterized by a collection of concepts and terms, including "distributed," "situated," "extended," "embedded," "collective," "vehicle externalism" and "locational externalism," to name many of the most prominent. The present article collapses distinctions made elsewhere, for example, between the extended *mind* and extended *cognition* and between *embodied* and *extended* cognition. I am less concerned with an exhaustive taxonomy of varieties of externalism than with evaluating two broad classes of view that deny Scientific Internalism.

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