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The Extended Mind Thesis

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The Extended Mind Thesis

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Introduction

The extended mind thesis claims that the cognitive processes that make up our minds can reach beyond the boundaries of individual organisms to include as proper parts aspects of the organism’s physical and socio-cultural environment. Proponents of the extended mind story thus hold that even quite familiar human mental states (such as states of believing that so-and-so) can be realized, in part, by structures and processes located outside the human head. Such claims go far beyond the important but less challenging assertion that human cognizing leans heavily on various forms of external scaffolding and support. Instead, they paint mind itself (or better, the physical machinery that realizes some of our cognitive processes and mental states) as, under humanly attainable conditions, extending beyond the bounds of skin and skull. Extended cognition in its most general form occurs when internal and external resources become fluently tuned and deeply integrated in such a way as to enable a cognitive agent to accomplish her projects, goals and interests. Consider for instance how technological resources like pens, paper, and PCs are now so deeply integrated into our everyday lives that we couldn’t accomplish many of our cognitive goals and purposes without them. Technological resources have become so thoroughly enmeshed with our internal cognitive machinery as to count, so the extended mind thesis claims, as a part of the machinery of thought itself. Underlying (but distinct from) the extended mind thesis is a commonplace observation. It is that intelligent problem solving of the kind we find in adult humans isn’t something the naked brain can achieve all on its own but is the outcome of the brain and body operating together in an environmental and often technologically-loaded setting. Humans possess the kinds of high-level cognitive skills and abilities we do in no small part because of the many tools we use for thinking. The extended mind thesis goes further, however, by claiming that it is mere prejudice to suppose that all cognition must take place within the confines of the organism’s skin and skull. Cognitive Science, it is then claimed, shouldn’t just concern itself with the more or less enduring processes taking place inside the heads of cognitive agents. Cognitive scientists should also investigate, on a kind of equal footing, temporary, soft-assembled wholes that mesh the problem-solving contributions of the brain and nervous system with the body and physical and socio-cultural environment. The section on “Extended Mind and Epistemology” was kindly prepared with the assistance of Spyridon Orestis Palermos. Many thanks to Orestis, and to Duncan Pritchard and John Sutton, for their help and advice.
General Overviews
There are a number of monographs and essays that provide useful introductions to the extended mind thesis, and to the work in cognitive science that (partially) motivates it. Clark and Chalmers 2002 provide the seminal statement of the extended mind thesis, and much of the current debate is in part based on the arguments of this paper. Clark 1997 draws on a wide body of empirical research in robotics, artificial life, connectionism, developmental psychology and economics to make a case for extended cognition. Haugeland 1998 contains an early statement of the view that minds can profitably be thought of as complex systems that emerge from the dynamic couplings of brain, body and world. It also described (contested) criteria for determining whether the mechanisms that support cognition can be “partitioned-off” from body and world. Rowlands 1999 (cited under “Memory”) develops an argument that evolution favoured essentially hybrid cognitive processes. Drawing on research from (more or less) mainstream psychology he constructs accounts of visual perception, memory, thought and language as extended cognitive processes. Wheeler 2005 shows how the extended mind thesis has its philosophical foundations in Heidegger’s phenomenology and explains how Heidegger’s philosophy when combined with the extended mind thesis contains the seeds of a solution to the frame problem, which has so far proved an inuperable problem for orthodox cognitive science. Wilson and Clark 2009 offer a useful taxonomy of extended cognition along the two dimensions of the nature of the external resources recruited by cognisers, and the durability of extended cognitive systems. Adams and Aizawa 2009 assembles and further develops a number of important challenges to the extended mind thesis, and advances an alternative “intracranialist” view of cognitive systems. The introduction to the Menary 2010 anthology contains a state of the art survey of the debate surrounding the extended mind.

A comprehensive critique of the arguments for the extended mind.

The original statement of the extended mind thesis (including the ‘parity arguments’ described later in this entry).

A book-length exploration of cognition as embodied and as environmentally scaffolded. This wide body of empirical research helps to motivate and support the extended mind thesis. For a similar survey of recent research (mostly in robotics) see the opening chapter of Clark 2008 (cited under “Textbooks”).

An influential early statement of the view that minds should be thought of as product of the dynamic coupling of brain, body and world. Contains a useful (but also controversial) criterion for fixing the boundaries of cognitive systems.

A useful survey of the current debate surrounding the extended mind. Forms the introduction to an important collection of essays.

Suggests that the extended mind thesis is part of a new movement in cognitive science that has its philosophical foundations in Martin Heidegger’s existential phenomenology.
Uses the extended mind thesis to propose a solution to the frame problem, a notoriously stubborn problem for orthodox cognitive science.


Provides a useful taxonomy of extended cognition and argues that the resulting account of cognitive extension can be used to respond to a number of prominent objections to extended cognition.

Textbooks

There are currently a number of book length treatments of the extended mind thesis which would work well as textbooks for advanced undergraduate or postgraduate courses on the extended mind. Clark 2008 offers a careful and nuanced defence of the extended mind using up to date examples from cognitive science. Rupert 2009 would work well as a detailed statement of the challenges to the extended mind. It also contains a well worked-out alternative conception of cognitive systems. Clark 2001 provides a friendly overview of the philosophy of cognitive science that is explicitly set out in such a way as to make room for a science of the extended mind usefully described in the book’s final chapter. Rowlands 2003 provides a clear and readable survey of externalist approaches to the mind including the extended mind situating externalist ideas in an historical context with useful discussions of Descartes, Kant, Husserl, Sartre, Wittgenstein and Putnam.


This work isn’t intended as a general introduction to the extended mind thesis but it would work well as an advanced introduction. It contains a detailed presentation of the extended mind thesis including many new examples of relevant empirical work, and engages many of the major challenges to the extended mind that have been mounted over the last decade.


This introductory textbook charts the changes in cognitive science’s understanding of cognition from classical cognitive science to connectionism to dynamical, embodied cognitive science. Chapter 8 (pp.140-159) provides useful background to the extended mind thesis. The Second Edition (In Press-2013) includes a new chapter on the arguments for, and against, the extended mind.


Covers externalist ideas more generally, though there are two chapters dealing specifically with the extended mind and extended consciousness. The chapters on the history of philosophy are helpful for setting the intellectual background to externalism. The book also contains useful discussions of the extended mind in relation to consciousness (see “Consciousness, Self and Agency”) and the philosophy of action.


This critical monograph was not written to work as a textbook, but it would work well as an advanced introduction. The book is organised around Rupert’s contrast between (merely) ‘embedded’ cognitive systems and genuinely extended cognitive systems. Rupert deploys this distinction to mount criticisms of many of the main arguments for extended cognition.

Anthologies
The extended mind thesis is a relatively new topic in the philosophy of mind and so anthologies have only recently begun to appear. The collection by Menary 2010 covers all of the main debate surrounding the extended mind. There are also a number of papers that deal with disagreements within the extended mind camp about how extended cognition is best conceptualised. The extended mind thesis grew out of work in cognitive science on situated cognition. Robbins and Aydede 2009 is a collection of papers by leading cognitive scientists, psychologists and philosophers on the related (but more general) topic of situated cognition.

This is a collection of essays that deal directly with the extended mind thesis. Contains a useful introduction, essays by leading opponents and supporters of the extended mind, and essays suggesting different directions in which the extended mind thesis might be taken in the future.

This substantial anthology brings together cutting edge research from cognitive science, anthropology, robotics, philosophy, psychology and neuroscience concerned with the nature of situated cognition. The Extended Mind thesis offers a controversial theoretical framework for conceptualizing this empirical work. It should be stressed that many researchers concerned with situated cognition would stop short of embracing the Extended Mind, arguing instead for a view of minds as embedded in their environments.

Intellectual Precursors and Inspiration
The intellectual roots of the extended mind lie partly in work in cybernetics and systems theory that stresses the importance of feedback loops that run through the body into the world in explaining cognition. Gibson 1979 shows how visual perception is the result of a dynamic coupling of perceiver and environment in which the perceiver manipulates information-bearing structures found in its environment. The extended mind thesis stresses the role of the socio-cultural, material setting in linking neurobiology to higher-level cognitive processes. Vygotsky 1978 describes how higher-level psychological processes take form through the child’s participation in social, material and institutional culture. Hutchins 1995 offers a rich and detailed account of how external props and aids, and sociocultural practices contribute to the process of ship navigation. Dennett 1996 shows how well-designed tools (including the ‘tool’ of public language) can mesh with our native abilities to extend them in far-reaching ways. Donald 1991 is also concerned with the role of public language in the evolution of culture and cognition. He develops an evolutionary hypothesis and a well worked-out cognitive architecture that accounts for transition from non-symbolic intelligence to symbolic thought. Kirsh and Maglio 1994 shows the importance of offloading actions in the environment and argue that, under certain circumstances, this might serve the purpose of priming memory by reducing the need of internal, costly and potentially error-prone computations. Merleau-Ponty 2005 distinguishes between perception and action and proposes an embodied account of perception that is informed by the psychology of his time. Through a phenomenological analysis of the concept of perception, he also challenges the schism between mind and body formulated and endorsed by Cartesianism. In a similar vein, Heidegger 1962 claims that humans are essentially beings in the world and systems of related practices; practices that occur and constitute the instrumental network of relations that characterises each one of us and our situated existences in the world.

Dennett distinguishes between different levels of intentionality each of which yields a different kind of mind. Particularly important for the Extended Mind is the account he gives of Gregorian creatures that can supplement their biological problem-solving abilities with tricks, shortcuts, strategies and tools acquired through culture from their peers. Dennett argues that the most powerful of these tools is public language.
Takes up the question of how humans managed to bridge the gap between symbolic thought and nonsymbolic forms of intelligence. Donald argues the modern human mind must be seen as a hybrid structure composed of capacities that are the product of biological evolution and neurophysiological structures that result from the imposition of technological and cultural constraints.

Gibson was openly hostile to information processing models of psychological processes in a way that many proponents of the extended mind thesis would resist. However his idea of an optic array structured in ways the perceiving animal can discover through movement remains a key influence on extended and situated approaches to perception.

Heidegger’s magnum opus is many things but in part it is an attack on Cartesian philosophy for its failure to recognise the situatedness that is a part of our way of being as human beings. The extended mind ideas of cognitive technology and the vision of the cognitive agent as immanent within a web of active causal factors meshes well with Heidegger’s notion of equipment and his description of human existence as being-in-the-world.

Hutchins provides a detailed analysis of a navigation team working on the bridge of a navy ship as a socially distributed cognitive system. Hutchins shows how the practices of the navigation team can be described in computational terms, and argues for an understanding of human cognition as both a computational and a cultural and social process.

Epistemic actions are actions performed on the world with the goal of extracting or uncovering information. Kirsh and Maglio show how expert players of the video game Tetris perform epistemic actions to generate information about the shape of a zoid (game piece) that will enable the player to correctly determine where to place it.

Merleau-Ponty offers detailed phenomenological description, deeply informed by the psychology of his day, of the many ways in which perception is embodied and situated. His rejection of the distinction between perception and action has been proven a significant influence on the extended mind. His discussion of the body schema has also influenced extended mind thinking about the relation between the human body and tools.

The idea that humans exploit structures in the environment to “scaffold” our problem solving plays a central role in arguments for the extended mind. This idea of scaffolding originates in the writings of the Soviet psychologist Lev Vygotsky, and in this work he shows how human higher cognitive processes develop in the social sphere with the adult providing a ‘zone of proximal development’ that scaffolds infant learning and behavior.

**Extended Functionalism**
The extended mind thesis is sometimes depicted as flowing naturally from functionalist views concerning the ‘multiple realizability’ of cognitive processes. Just as it doesn’t matter what physical materials accomplish the functions constitutive of a cognitive process, nor does it matter,
or so it is argued, just where those physical materials are located. If this is correct, then the material components upon which a cognitive process ‘runs’ may sometimes be spread across brain, body and world. What matters is that the components play the right sort of roles and are integrated with other cognitive processes in the right sort of way. Wilson 1994 demonstrates how the boundary of skin and skull needn’t form the boundaries of computational systems. Computation processes, he suggests, can extend beyond the skin into the world to include operations of resources located outside of the individual cogniser. Adams and Aizawa 2009 and Rupert 2004 argue (in slightly different ways) that most external processes lack key functional properties characteristic of cognitive ones, and do so in such a way as to preclude external processes from counting as cognitive. Clark 2008 (part 2) and Wheeler 2010 respond to this objection by defending a version of functionalism that avoids tying the functional properties definitive of cognition to the functional properties characteristic of internal biological processes. Rowlands 2009 argues that such a response may fall foul of the liberalism-chauvinism problem that has traditionally plagued functionalism. Taking up a similar worry, Sprevak 2009 argues that an extended functionalism may be overly liberal in what it allows to count as cognition in a way that runs the risk of undermining functionalism altogether. Menary 2007 attempts to avoid these worries by emphasizing the ‘complementarity’ of internal biological resources and external tools and representations.

A comprehensive and up to date statement of many of the most perplexing and difficult problems facing proponents of the extended mind thesis.

Part 2 of this monograph includes a defence of extended functionalism and responses to most of the main arguments against the extended mind, including those by Adams and Aizawa 2009 and by Rupert 2009.

A defence of the extended mind thesis that avoids the appeal to functional considerations and emphasizes the integration and ‘complementarity’ between biological and non-biological components and processes.

A review essay aiming to clarify the extended mind thesis and its relationship with classical functionalism. Rowlands challenges proponents of the extended mind to provide a defence of the extended mind that is neither chauvinist nor overly liberal.

Rupert argues for an embedded approach to cognition according to which cognitive processes can causally depend on environmentally located resources without those resources being constituents of cognitive processes. He offers a number of arguments meant to favour an embedded description of cognition over an extended account.

Sprevak attempts to disarm worries concerning the functionalist argument for extended cognition, but ends by raising some new difficulties that cast doubt upon both functionalism and the claims concerning the extended mind.

As advertised in the title, Wheeler responds to a number of central objections to extended functionalism. The paper includes extensive discussion of the parity principle, and seeks to demonstrate that it should be understood in a way that doesn’t beg the question either against or in favour of the thesis of the extended mind.

Challenges those who have argued from computationalism to individualism defending instead the possibility of computational processes that operate on information located in the individual’s environment. Wilson shows how this understanding of computation is consistent with computational explanations found in cognitive psychology.

“Second Wave” Approaches
The literature on extended cognition includes two distinct styles of argument supposed to favor the extended mind thesis (EMT). One strand invokes the so-called “parity principle” while the other emphasizes considerations of ‘complementarity’. Complementarity approaches investigate the many different ways in which diverse components of a cognitive system intermingle and function together in triggering, driving and forging complex cognitive behaviour, and seek to avoid some of the difficulties to which first-wave parity-style defences seemed prone. Sutton 2010 distinguishes such first and second-wave of arguments for EMT. He defends the latter approach over the former by analysing the different but complementary contributions that exograms (external memories) and engrams (internal memories) make to cognitive behaviour. Sutton et al. 2010 offer a detailed, multidimensional account of collaborative recall. Such a multidimensional account is then offered to show that research on memory can support an extended and socially distributed view of cognition. Menary 2010 discusses and extends Sutton’s framework, suggesting two dimensions (the manipulation and transformation of information) as a means of cashing out the details of the particular way in which individuals and environments intermingle to achieve sophisticated cognitive tasks. These two dimensions characterize the notion of integrationism (Menary 2007). Integrationism, on Menary’s account, concerns the way in which ‘internal’ and ‘external’ aspects of cognition are merged and combined into a larger hybrid cognitive whole. A similar perspective is embraced by Kiverstein and Farina 2011. Rowlands 2010 argues for what he calls an ‘amalgamated’ conception of mental processes. Weiskopf 2010 argues against Menary’s case for integrationism,

A “complimentarity” argument for extended cognition. A secondary goal of the paper is to show that complementarity and functionalist defences of EMT aren’t necessarily opposed.

Menary offers a multidimensional framework for the study of extended cognition and argues for cognitive integration involving the key dimensions of manipulation and transformation.

Defends an account of cognition in which thinking is bounded neither by the brain nor by the skin of an organism. It describes processes of progressive integration in which neural and bodily features entwine with the functions of representational vehicles.

Rowlands defends the idea that mental states frequently depend, for their realization, on the amalgamation between neural, bodily and extra-neural processes. He then develops an account of ‘ownership’, which aims to deliver an account of cognition that is embodied and extended.

Presents the authors’ empirical work on collaborative recall, which is offered as experimental evidence for an extended and socially distributed account of memory. This paper explicitly bypasses any consideration of metaphysical claims about constitution by describing, in rich detail, the whole range of differently-influential causal processes that contribute to remembering.


Distinguishes between first and second waves approaches, and highlights some of the major problems with standard defences of EMT and stresses the complementarity principle - the idea that outer states or processes (such as exograms) should synergize with, rather than replicate, the functions and the roles of internal biological resources.


A critique of Menary’s integrationism that questions the appeal to normativity that distinguishes the integrationist view from its competitors.

Perception and Action

Extended mind approaches to perception and action reject what Hurley 1998 (cited under “Consciousness, Self and Agency”) called the “classical sandwich” view of cognition, according to which perception and action are peripheral processes and cognition is the central process that provides the filling for the sandwich. Externalist approaches to cognition also typically embrace this idea and stress the active nature of perception, in which a perceiver uses her body and various other structures in the environment to offload perceptual processing onto the world. Ballard et al. 1997 argues that in order to avoid maintaining and updating costly, enduring and detailed internal models of our visual surroundings we sample the environment in ways suited to the particular needs of the moment. In a similar vein, Churchland et al. 1994 suggests that everyday visually guided problem solving may exploit a multitude of tricks and special-purpose routines to offload perceptual processing onto the external world. Analogously, Brooks 1991 notices that in order to adequately describe certain perceptual processing tasks we ought to “use the world as our own best model” and visit, revisit and sample it in detail at specific locations and timings as required. In accordance with this line of argument, Gray et al. 2006 argues the short time scales over which sensorimotor behaviour occurs are crucial for much of our problem-solving activity and suggest that it is a mistake to privilege any location or any type of operation in the online assembly of a cognitive routine. Kirsh 1995 further investigates the extent to which we rely on external structures in the environment to perform actions and achieve tasks and demonstrates that most of these actions and tasks couldn’t be accomplished in absence of these continuous temporal cost-benefit tradeoffs. Hurley 2001 argues for an extended account of perception and describes it as a kind of active achievement in which real-time, action-oriented physical interactions with the milieu are necessary for furnishing the content of experience. In a similar vein, Auvray and Myin 2009 offers an account of perception via sensory substitution in extended mind terms. Van Leeuwen et al. 1999 describes in detail how the creation of certain forms of abstract art relies on interactive processes that criss-cross the traditional boundaries of mind and world. Aizawa 2007 deftly deploys a distinction between causal coupling and constitution against these type of arguments for a constitutive role of sensorimotor behaviour in perception.

Uses the distinction between causal-coupling and constitution to argue against the 
constitutive involvement of sensorimotor interaction with the environment in perception.


When a blind person learns to perceive the world using a sensory substitution device do they regain visual function? This paper argues that SSDs are mind-transforming tools providing blind users with modes of access to the environment they would otherwise lack.


Describe a series of experiments which demonstrate how saccades (eye movements) can be used to access task relevant information in the world, thereby lightening the computational load on working memory. This study has been taken as an example of how the brain can exploit the body (eye movements) and world (as an external store of information) to lighten cognitive load.


Ground-breaking paper which describes Brooks’ revolutionary approach towards situated robotics. Brooks’ robot models are built out of special-purpose, quasi-independent problem-solving mechanisms that demonstrate how situated action in the environment constitutes a fundamental level of cognitive behaviour.


Argues against a view of vision as the computational transformation of incoming light signals into standard, detailed models of a three-dimensional external world. The visual brain is instead described as employing fast, frugal and adaptive strategies that interweave sensing with moving and acting in the world.


Following up on the Ballard studies described above, this paper reports experiments that show how cognitive agents often make on the fly decisions about whether to offload storage of information onto the world retrieving this information on a need to know basis, or whether to store information on-board in working memory.


Rejects a view of perception and action as standing in a linear relation where action is a means to changing perception, and perception causes changes in action. Hurley defends a view of perception and action as ‘non-instrumentally and constitutively interdependent’ developing an extended theory of perception.


Reports a series of studies that show how we organize the space around us to simplify problem solving – for example, by grouping our shopping into types of products. This organisation of space is said to reduce descriptive complexity, allowing processes of selective attention, and action control to operate on elements of the scene in ways that simplify the amount of information that has to be stored on board to solve problems. This illustrates a recurring theme in writings on the extended mind: we actively structure our environments in complex ways thereby simplifying the kinds of computation our brains are required to perform.

Case study of the use of sketchpads by abstract artists that puts forward the idea that the distinctive way in which abstract art is realized, and more generally forms of higher cognition are accomplished, depend on the deployment of non-biological wide-ware that complement the structures of our onboard neural machineries.

Language and Thought

Work on the extended mind often (e.g. Clark and Thornton 1997) invokes language as a kind of meta-tool enabling a variety of cognitive extensions involving symbol-based externalizations of memory and reasoning. This is presented as part of the answer to a large and unresolved puzzle: how do we humans manage to negotiate so many apparently hugely complex cognitive domains? The answer may lie, it is often suggested, in the canny re-use of the fruits of basic sensorimotor learning amplified and transformed by the iterated interactions of language and culture. Human brains, such views suggest, are marinated in a canny re-use of the fruits of basic sensorimotor learning amplified and transformed by the iterated interactions of language and culture. Human brains, such views suggest, are marinated in a succession of artificially structured environments that constrain the models that the brain must learn, building gradually but incrementally upon our basic sensorimotor grip on reality. Language itself, existing as structure in the world, then provides new targets for basic forms of learning, attention, and response. Boysen et al 1996 describes studies in which chimpanzees were trained to use symbol tokens, thereby enabling them to carry out complex reasoning tasks by means of the symbolic tokens they would otherwise be unable to perform. Clark 2006 describes how public language doesn’t only provide us with vehicles for communicating our thoughts but can also be used by us to augment and transform our cognitive capacities. Clark and Thornton 1997 identifies a type of statistical learning that depends upon the recoding of data (“representational redescription”) accomplished through the external scaffolding of language and culture. Deacon 1997 develops a complex theory of language evolution according to which humans didn’t start out equipped with a capacity for symbolic thought (as is argued by proponents of the language of thought hypothesis). Instead the emergence of symbolic forms of communication was a key factor in the evolution of the human brain and opened the doors to complex forms of human cognition that we do not find elsewhere in the animal kingdom, such as capacities for abstract thought and counterfactual thinking. Goldin-Meadow and Wagner 2005 reviews research on gesture and the role gestural bodily movements play in supporting the fluidity of our thinking and in learning and problem-solving. Goody 1977 describes how writing functions as a technology of communication functions as an instrument of psychological and social change tracing the beginnings of philosophy and science in ancient Greece to the emergence of a writing system. Jackendoff 1996 is the source of a central idea developed further in Clark 2006 that public language symbols support metacognitive capacities or the ability to think about thinking. Wheeler 2004 provides a critical exploration of a claim made in Clark and Thornton 1997 (ch, 10) that language is the ultimate artifact when it comes to transforming our cognitive powers as humans. Wheeler takes up the claim that Clark defends that language augments our biological capacities without fundamentally affecting any change in those biological capacities.


The authors trained chimps to perform higher-order sameness/difference judgments by using external plastic tokens. The symbol tokens function as material symbols allowing the chimps to transform a problem that would call for complex abstract reasoning into a simple pattern matching task, well-suited to brains that function as pattern recognition and completion devices.

Develops the idea (based on a number of empirical studies) that external symbol structures of a public language can work together with basic modes of operation and representation endemic to the biological brain to transform and enhance an agent’s cognitive capacities.


Clark and Thornton describe a type of statistical learning that requires the recoding of data by means of public language symbols if the system is to succeed in discovering the statistical regularities required for learning the task. Provides an empirical argument that it is only by combining the biological processing power of our brains with external systems of representation that our brains can solve this type of statistical learning problem.


Argues for a co-evolutionary view of language and the brain in keeping with an idea explored in the literature on the extended mind that our brains are fundamentally pattern recognition devices, and our capacity for compositionally structured thinking and logical reasoning is dependent on public language.


A review paper that details a series of experiments the authors have run demonstrating how gestural movements don’t only help us to express our thoughts, but also play an essential role in learning. The latter claim has been taken up by Clark as an illustration of how bodily action can “turbo-charge” thinking enabling us to solve problems we wouldn’t be able to solve otherwise.


Investigates the effects on cognition of writing developing the idea through a number of social anthropological case studies that literacy played a major role in human cognitive evolution.


Takes up an idea that originates with the Soviet psychologist Lev Vygotsky that internalization of language provides us with a way of making our thoughts into objects of thought and reflection thereby enabling a capacity for thinking about thinking. This is among the core examples of how language doesn’t only perform a communicative function, but can also extend our cognitive capacities.


Clark has argued that language enhances and augments human cognitive capacities without transforming our human biological architectures. Wheeler casts a critical eye on this claim focusing on the changes that he thinks must take place in our cognitive architecture when public language is internalized.

**Memory**

Extended approaches to memory take memory to be an inferential process that is constructive and creative rather than reproductive. Information is stored over time not in the form of independent representations that exist independently from other representations at separate locations in a memory system. Extended theories of memory claim that stable storage of information over time is achieved through the integration of biological and external material, symbolic, technological and cultural artifacts. Rowlands 1999 argues that that there is no reasonable reason for regarding working memory as purely intracranial and rather describes it as hybrid in character, consisting of both internal and external processes. Sutton 2009 provides an
excellent synoptic overview of extended approaches to memory with a focus on personal or autobiographical memory. Donald 1991 describes in detail the changes that took place in human memory from the spread of exograms (external forms of representation). Tribble 2005 explains how actors in early modern theatre were able to learn many different parts through the interplay of biological recall, specially engineered spaces and clever social practices. Wegner 1987 focuses on transactive memory, the idea that people can use other people to encode, store, and retrieve knowledge. By placing direct emphasis on the social organization of diversity he then attempts to explain and understand how people think together. Wilson 2005 shows how an extended approach to memory can account for much of what social sciences like anthropology and sociology mean when they appeal to the notion of “collective memory”. Tollefsen 2006 radicalizes Wilson’s social manifestation thesis –the claim that certain dispositional mental states (like memory) depend on a social context for their realization - and uses the work on socially, distributed and transactive memory to defend the possibility and plausibility of collective minds. In essence, she claims that groups possess some of the intentional and epistemic properties that characterize individuals and on this basis argues for the emergence of proper, collective group cognition. Finally, Campbell 2004 shows how people can accomplish good remembering by becoming essential parts of narrative and emotional environments.


Campbell rejects the proposed shift from an archival model of autobiographical memory to a reconstructive one. Episodic and autobiographical memory, she argues, shouldn’t be described only as a cognitive process but should be understood through the things we make and do when we “remember”. Campbell invites us to keep memory in the world and to characterize it in the interplay between different narrative and emotional contexts.


Makes the argument that the structure of the primate mind was radically altered by external representational systems including memory technologies. Chapter 8 (pp.269-360) is the key chapter for memory, but is best approached after reading chapters 1-5 (pp.5-161)


Chapter 6 (pp. 119-147) of this book points to the work of George Miller to show the many limitations that internal working memory has to face when we remember things. Argues that at least some memory processes must be understood as the result of a series of interactions between a remembering organism and its milieu and on these basis claims that working memory is essentially “hybrid” in character.


Useful historical overview of extended approaches to memory reviewing a broad body of work dealing mainly with autobiographical memory from social science and cognitive science.


Explores the space of interaction between social ontology, extended cognition and the interdisciplinary study of remembering. Tollefsen specifically focuses on socially distributed transactive memory and uses the experimental work on collective recall to explain the formation of group minds; memory systems that are more articulated and effective than those realized by the individuals that comprise them.

Wegner, D. (1987). “Transactive memory: a contemporary analysis of group mind”. In B. Mullen & G. R.Goethals (Eds.), *Theories of group behavior* (pp. 185–208). New York: Springer-Verlag. Makes an empirical case for transactive memory - a type of remembering in which individuals can serve as external memory aids to each other. Shows how transactive memory plays a crucial role in group learning, problem solving and knowledge production.


**Consciousness, Self, and Agency**

The extended mind thesis was originally formulated by Clark and Chalmers 2002 (cited under “General Overviews”) as a thesis about unconscious cognition, and there is currently disagreement among its proponents as to whether related arguments might apply to consciousness. Aizawa 2010 critically discusses the appeal that has been made to neural plasticity in arguing for extended consciousness and offers a different interpretation of this work and other empirical studies that supports an internalist, brain-bound theory of consciousness. Hurley 1998 is a detailed defence of the existence of extended conscious experiences. Noë 2009 is written for a popular audience but provides a useful and accessible way into arguments for extended consciousness. Noë 2006 provide more careful defenses of his account of extended consciousness. Clark 2009 surveys a number of arguments for the extended conscious mind and finds each of them either inconclusive or wanting. Block 2005 argues that arguments for extended consciousness rest on mistaking a causal contribution of the environment to conscious experience for a constitutive contribution. Prinz 2009 examines many of the arguments that have been given for extended consciousness. Ross et al 2007 investigates how the causal factors operating at both micro and macro time scales that generate our decisions are distributed across mind, body and world. The will is typically taken to be the home of the Cartesian homunculus, but this anthology presents a very different and decidedly anti-Cartesian picture of decision-making and agency that shows how the locus of agency is both temporally and spatially distributed.


Block was the first to employ the causal/constitution distinction in arguing against extended mind theories of consciousness. He also appeals to empirical evidence from work on the two visual pathways in the brain which he claims cannot be explained in extended mind terms.

Clark explores a number of arguments for the extended conscious mind and finds all of them have shortcomings. He concludes that while the vehicles of cognition sometimes extend, the vehicles of conscious experience do not.

Classic treatment of issues concerning consciousness, extended physical bases for conscious experience, and the nature and location of the self.

Popular treatment (book-length) attacking the view that conscious experience can be explained by appeal to neural states alone. Consciousness, it argues, is not an internal process that occurs at the neural level or within the brain but is rather a holistic activity that essentially involves both the organism and the environment.

Paper attacking the view that conscious experience can be explained by appeal to neural states alone. Makes the connection between arguments for the extended mind and arguments for extended consciousness.

Critically explores many of the central arguments for situated, embodied, and extended approaches to consciousness and finds problems with all of them.

Collection of essays that deals with the concept of individual conscious will showing how the will is not contained within the boundaries of the individual body but slips out into world through scaffolding provided by the environment and through interpersonal dynamics which typically accompany decision-making.

Emerging Topics
Emerging topics include the relation of the extended mind story to work on virtue ethics and the nature and possibility of knowledge, new technological horizons, anthropology, group cognition, and the possibility of collective minds.

Extended Mind and Epistemology
Important new insights and issues are now emerging at the intersection between work on the Extended Mind and work in virtue ethics and epistemology. The questions here concern the relation between our best accounts of knowledge (which are increasingly externalist in flavour) and our best accounts of mind. Do these accounts of knowledge either require, or in some way support, the vision of cognitive processes extending out into the world? Adams 2012 argues that they do not and the extended mind thesis has no bearing on debates in epistemology. Carter 2013 argues that the extended cognitive processes are consistent with cases of environmental epistemic luck and so cannot serve as the basis for a theory of knowledge. Giere 2012 shows how the production of scientific knowledge often relies on distributed cognitive processes. Goldberg 2010 argues that often we depend on others in forming beliefs. His book thus raises issues about whether belief formation should be understood as a group-level, distributed process. Hetherington 2012 is an investigation of the nature of epistemic agents which shows how once we operate with an externalist account of knowledge it is possible to think of the epistemic agent as an extended knower. Menary 2012 argues that some of the cognitive abilities that generate knowledge involve practices of creating and manipulating information stored in the environment. He defends an integrationist account of the extended nature of cognitive abilities in keeping with his earlier work on extended cognition. Palermos 2011 argues that the cognitive abilities that
produce knowledge can include external artefacts (e.g. scientific instruments). He shows how virtue reliabilism and the extended mind thesis are mutually supporting theories. Pritchard 2010 launched the field of extended epistemology by arguing for the consistency of the concept of cognitive ability deployed in epistemology and the extended mind thesis. Roberts 2012 argues that the extended mind thesis can be strengthened by using resources from virtue epistemology. In particular he addresses the notorious problem of cognitive bloat that threatens the extended mind thesis – the worry that once we allow the existence of extended cognitive systems it is difficult to demarcate what does and what does not count as a part of such systems.

Adams argues that the Extended Mind hypothesis is orthogonal to mainstream epistemology.

By focusing on knowledge-undermining environmental luck, Carter argues that well established intuitions of mainstream epistemology appear to be in tension with central aspects of the Extended Mind story.

Giere argues that even though scientific cognition can often qualify as a distributed cognitive process, considerations about spatial and temporal dimensions, epistemic norms, and the need for agency in science demonstrate that the mental state of knowing cannot be so distributed.

The book argues that some belief-forming processes involving "reliance on others" paradigmatically the process of testimonial belief-formation, should be conceived as interpersonal (and so "extended") processes.

Hetherington argues that instead of endorsing skepticism about knowledge that cannot be wholly or significantly credited to a biological person, epistemologists would be better off embracing the idea of extended knowers.


Palermos argues that not only is the Extended Mind hypothesis necessary for virtue epistemology (in order for the latter to account for knowledge produced by artefacts), but that the two views also share core similarities that render them mutually supportive.

Pritchard suggests that contemporary epistemology can accommodate the extended mind hypothesis. The reason is that the ability intuition on knowledge—an arguably necessary condition in any adequate account of knowledge—is well suited for a treatment along the lines suggested by ‘active externalism’.

Roberts argues that Extended Mind theorists can exploit a virtue epistemological understanding of epistemic responsibility in order to resolve problems involving the limits of cognitive extension.

**Technology**

Clark 2003 made a case for the extended mind thesis based on the multifarious ways in which we incorporate technological devices into our cognitive lives. Chalmers 2008 returns to this argument examining to what extent ubiquitous items of technology such as iPhones extend our minds. Lanier 2010 by contrast worries that we should take care not lose sight of ourselves among the mass of machineries and tools we incorporate into our everyday lives. Halpin et al. 2010 explore the same issue through a philosophical reflection on the nature of the internet. Norman 2010 acknowledges the importance of technological developments for bypassing the congenital limitations that affect our biological bodies while sounding important notes of caution.


Chalmers suggests that technologies such as iPhones are ceasing to be mere tools and are increasingly taken up as active parts of our minds.


Clark argues that the augmentation of our cognitive capacities is not a recent part of our evolutionary history but is fundamental characteristic of the kinds of minds humans have evolved.


Explores the character and status of web objects such as websites and mash-ups, relating them to issues concerning cognitive extension and collective intelligence.


A critique of the open source movement that highlights the downsides of “the wisdom of the crowd”. In contrast to work that stresses technology-based cognitive expansions, Lanier celebrates the “physical sufficiency” of the organism in the emergence of cognitive processes.


Explores the nature of the tools we use in our daily lives. Norman endorses the thesis that the devices we couple with are (sometimes cluttered) extensions of our minds and but warns of the dangers of injudicious couplings.

**Material Culture and Cognitive Archaeology**

In recent years, some anthropological studies have attempted to sketch a framework for understanding the cognitive basis of the engagement of the mind with the material (and especially the artefactual) world. Are material engagements key to the process by which minds like ours emerge? Would such engagements provide another kind of evidence for the extended mind thesis? Donald 2000 synthesizes contributions from various disciplines (ranging from neurobiology, psychology, to archeology and anthropology) in the attempt to show that our minds have co-evolved in symbiotic partnership both with brain and culture. Drawing upon evolutionary biology, Griffiths and Stotz 2000 resist the very notion of human nature and challenge the idea that the human mind is constrained to develop along fixed pathways. What is special about human development, they argue, is its distinctive degree of reliance on external scaffolding.
Within a similar framework but drawing very different conclusions, Sterelny 2010 argues for what he calls the “scaffolded mind”; an understanding of human cognitive capacities that describes cognition not just as embodied and embedded but as intimately sculpted and deeply transformed by the activities conducted in the cognitive niche. Ingold 1998 endorses an “anti-mentalist, anti-cognitivist constructionism” and argues against the idea that humans participate concomitantly in two distinct worlds, nature and society. He rather claims that they are inseparably bio-cultural individuals enmeshed in a complex set of environmental relations that characterize their world. Renfrew and Malafouris 2009 claim that culture is a constitutive factor of the human mind and explore the multiple spatio-temporal interconnections between cognitive archaeology and materiality while developing an interdisciplinary account of human cognition. Turkle 2007 contains essays that describe how everyday objects can function as companions providing us with an emotional connection to the past. De Cruz 2008 defends the extended mind perspective on the grounds of work conducted on neuroscience and anthropology. She argues that the distinctively human capacity to manipulate external representations (such as numbers) complements internal operations processed internally and enables deep functional and structural changes in the architecture of our brains. Hutchins 2011 defends the relevance of socio-cultural processes to cognitive science and emphasizes the role of transmitted cultural practices.

Develops a model of multiple cognitive pathways to examine how natural numbers are represented. Argues that natural language is neither necessary nor sufficient for their development and claims that culture, along with the enduring interactions between internal cognitive resources and external ones, becomes instrumental in the shaping of human cognitive behavior.

Argues that human minds have emerged from non-symbolic forms of intelligence through progressive absorption of novel representational systems, advances a theory of the evolution of cognition that unfolds in four different stages (from episodic, mimetic, to myths and theoletic) and emphasizes the role of socio-cultural adaptations in shaping our evolutionary trajectory.

Challenges ‘genecentrism’ from a developmental systems perspective and argues that this perspective converges with recent work in psychology and embodied cognition. What individuals inherit from their ancestors is not a set of unchangeable developmental outcomes, but rather the ability to develop a mind through a series of interactions with a wide (and evolving) range of developmental resources.

In stressing the pivotal role of the brain in the recruitment of external resources, standard defences of EMT still concede too much ground, Hutchins argues, to internalist and individualist accounts of cognitive behavior.

Argues for an account of human nature that is biological and cultural in equal measure.

Anthology exploring the interrelations between the extended mind and what Renfrew and Malafouris call the “Material Engagement Theory”, the hypothesis that says that there is a synergy between cognition and material culture; a constitutive intertwining of brains, bodies and things.

Distinguishes the extended mind model of cognition from the view that through niche construction minds are scaffolded. Sterelny argues that the extended mind is a limiting case of his scaffolded theory of mind.

Curates a series of essays that explore how everyday objects can function as intellectual and emotional catalysts. The essays provide a powerful illustration of how artifacts are more than just tools, but can function as things with which we think and feel.

**Group and Social Cognition**
Groups sometimes function as collective agents that can display intentions, make decisions and achieve specific goals. But can groups as a whole be subjects of mental states and display collective cognitive processes and mental skills that are normally assigned to single individuals? Wilson 2004 discusses the group mind hypothesis in the biological and social sciences through the analysis of David Sloan Wilson’s understanding of group selection and then argues that much of the group-mind hypothesis can be expressed and defended in extended mind terms. In a similar vein, Theiner et al. 2010 claim that groups of people can possess mental properties and cognitive capacities. In particular, they argue that such skills and capacities can go well beyond the simple aggregation of the cognitive properties displayed by isolated individuals. On these grounds they offer a defence of EMT based on a social and collective dimension. Gallagher & Crisafi 2009 defend a full-blown, socially extended and distributed account of the mind but make their claim even more radical by suggesting that specific social, cultural and economic structures – what they call “Mental Institutions” – can themselves represent genuine cases of cognitive extension. Rupert 2011 argues that the general inference from an argument that envisage individual cognitive extension to an argument that postulates extended group cognition can be undermined by a parsimony principle. In order to explain group cognition, he argues, we do not require extended architectures because we can explain the phenomenon of group cognition on the basis of the cognitive capacities that are displayed within the boundaries of each individual cogniser. Finally, Krueger 2011 draws upon developmental psychology and research on gesture to argue that some of the processes that are at the root of social cognition have an extended structure and that social interaction itself is a kind of extended social cognition, driven and partly constituted by the amalgamation of internal states with bodily features via environmental scaffolding.

Introduces the role of social structures (such as legal and educational systems) and cultural and economic organizations (such as museums or banks) in extending the mind.

Argues that a “we-space” gets established in social interaction that forms the basis for interpersonal understanding and gestures and other forms of bodily expression can play a constitutive role in the creation of this we-space, and thus make a constitutive contribution to social cognition.

Critically discusses a series of empirical arguments that have been offered to support group cognition and group cognitive states.
Defends the idea that groups form emergent and organizational cognitive ensembles, and on this basis attempts to undermine the “causal-constitution conflation” charge that has been often deployed against EMT.

Provides an analysis of group minds in terms of the Social Manifestation Thesis, according to which certain group conditions and social contexts need to be in place in order for a person to exercise certain of her cognitive skills.