Andy Clark & Michael Wheeler: Embodied cognition and cultural evolution

neuroanthropology.net (https://neuroanthropology.net/2008/11/23/andy-clark-michael-wheeler-embodied-cognition-and-cultural-evolution/) · by View all posts by gregdowney

The **Cognition and Culture** website has posted a link to the new edition of the *Philosophical Transactions of the Royal Society B* on 'cultural transmission and evolution of human behaviour.' I wanted to comment on just one piece on embodied cognition and cultural evolution, by philosophers Michael Wheeler and Andy Clark (unfortunately, Philosophical Transactions B is behind a subscription wall, although there's a one-page 'free preview' [ouch] here (http://journals.royalsociety.org/content/94g6448k4j0w7288/fulltext.pdf?page=1)). The Cognition and Culture website has the table of contents posted here (http://www.cognitionandculture.net/index.php?option=com_content&view=article&id=247:phil-trans-b-issue-on-cultural-transmission-and-the-evolution-of-human-behaviour&catid=3:publications&Itemid=5). I was vaguely familiar with Michael Wheeler's work (http://www.philosophy.stir.ac.uk/staff/m-wheeler/wheeler-page.php) before this piece, but Andy Clark (http://www.philosophy.ed.ac.uk/staff/clark.html) (it's not much of a profile) has written some of the work that's most influenced my thinking about the effects of varied skill acquisition on cognition, especially his remarkable book, *Being There: Putting Brain, Body and World Together Again* (Amazon listing

(http://www.amazon.com/exec/obidos/tg/detail/-/0262531569/qid=1076522863/sr=1-3/ref=sr_1_3/002-5600206-2570462?v=glance&s=books)).

A ream of Clark's papers can be found here (http://www.philosophy.ed.ac.uk/staff/clark/publications.html). A review of Michael Wheeler's book, *Reconstructing the cognitive world: The next step*, written by Leslie Marsh can be downloaded here (http://cogprints.org/5893/1/wheelerFINAL.pdf). We'll come back to Andy Clark's work again in later posts.

I must admit a **certain morbid fascination with how one of my favorite streams of thought — embodied cognition — would fare combined with cultural evolution — an area of scholarship that, well, to put it nicely, is uneven** (before you get all defensive, let me just stop you with one word: mimetics (https://neuroanthropology.net/2008/06/12/we-hate-memes-pass-it-on/)). It's sort of like watching one of your good friends get hit on by a sleazy guy at a bar. She looks happy, but you're sort of cringing at the chance that she might actually take him home. In spite of this instinctual cringe, this special edition of *Philosophical Transactions* has some really interesting work on cultural evolution, especially because many of the pieces focus tightly on the enormously problematic issue of cultural transmission.

Michael Wheeler and Andy Clark: emergent modularity v. strong instructionism

Wheeler and Clark (p. 3565) highlight at the onset that there is an inherent tension between the understandings of cognition in embodied cognition and in evolutionary psychology. From embodied cognition, we get a model of human

cognitive development as 'a kaleidoscope of complex ratchet effects [that] fuel the flexible and, to a significant degree, open-ended character of thought and action.' In contrast, the vision of the brain from evolutionary psychology 'has stressed the selective fit of the biological brain to some ancestral environment of evolutionary adaptedness, with an attendant focus on upon the limitations and cognitive biases that result.' **Whereas embodied cognition models the brain as a product of dynamic interplay among processes at different time-scales — evolutionary, developmental, and immediate –, evolutionary psychologists tend to assume the existence of underlying, enduring structures in the brain, shaped by natural selection and encoded (even where we cannot find evidence) in genetic structures.**

If I had to pin down my biggest problem with evolutionary psychology, I think Wheeler and Clark hit it square on the head here, far more eloquently and rationally than I have been able to manage. To say it bluntly, on the subject of brain, the views from embodied cognition and evolutionary psychology, at least in their simplest forms (we'll complicate these in a minute) couldn't be more opposed: emergent v. innate, learned v. programmed, contingent v. inevitable, consistency as a product of systems v. assumption of universal 'nature'.

Wheeler and Clark's critique of much of evolutionary psychology and the 'massive modularity' hypothesis is far reaching and substantial, but **the authors do a great job granting space to these positions and integrating the strongest insights from evolutionary psychology**. They're surprisingly even handed and balanced, which really changes the tone of much of the discussion (Jerry Fodor, in contrast, is positively molten in his scathing critiques of those who take modularity theory into evolutionary psychology, perhaps because they've claimed him as one of their inspirations). There's a lesson in this for this author as well...

For example, Wheeler and Clark discuss how massive modularity proponents are not strictly or necessarily wedded to any simple argument for universal human psychology because environmental mechanisms may be necessary to trigger the emergence of functional modules or may be, in contrast, 'disabled' by developmental dynamics. What then are evolutionary psychologists arguing for if not 'universal human nature'?

> The answer, nicely isolated by Buller (2005), is an evolved species-wide set of genetically specified developmental programs that (i) determine how the emerging human phenotype responds to critical environmental triggers and (ii) control processes such as genetic switching. It is at that level that strict universality (allegedly) holds, and at which our evolved human nature is (allegedly) to be found. (Wheeler and Clark, p. 3567)

For these theorists, innate developmental programs interact with variable environmental input to produce the manifest cultural, cognitive, and behavioural variation observed in humanity.
[By the way, Buller's work is an excellent discussion and critique of evolutionary psychology, deftly but perhaps confusingly referencing in the title, *Adapting Minds*, the seminal work of evolutionary psychology, *Adapted Minds*.]

Rather than simply advocating that 'modularity' be tossed on the scrap-heap because of the dispiriting results of collaboration with evolutionary theory up until now, Wheeler and Clark advocate 'remoulding modularity' to coincide with a more sophisticated, empirically plausible vision of both brain dynamics and human evolution. Drawing on work on 'modularization' (such as Kamiloff-Smith 1992) **they argue for 'emergent modularity,' a model that accounts for brain tissue specialization and functional isolation in the brain without excessive pre-determination or design.** Instead, relatively simple proclivities

— things like attention to salient information — help the brain 'bootstrap' itself up into some very specialized structures by focusing developmental dynamics on specific environmental input.

In addition, Wheeler and Clark pry apart the assumption that any evolutionary treatment of the brain must necessarily focus on domain specific (narrow purpose) brain functions (like the proverbial 'snake detector,' 'face recognizer,' or 'language module'). They profile a number of researchers who suggest that *general* cognitive mechanisms might prove to be an evolutionary advantage. The reason that this is crucial is that it demonstrates that there's simply no reason to yield to simplistic evolutionary psychology arguments that assume strict modularity *must* flow from any evolutionary treatment of the human brain. The connection has to be demonstrated as it is simply not logically necessary. Conceding the evolution-must-lead-to-modularity argument, in my opinion, has led to many anthropologists pulling away from evolutionary insights on the human brain, a position that is simply untenable, but is understandable given the way massive modularity theorists have used evolutionary explanation.

Wheeler and Clark are not denying the importance of genes; far from it, they are simply trying to remove the assumption of strict 'instructionism,' the idea that a phenotypic trait is wholly encoded in genes, from discussions of genetic 'coding.' Wheeler and Clark don't just want to swing the pendulum back too far in the direction of considering traits to be dynamic, developmental, and emergent, a position they find excessively 'liberal' on the question of genetic contributions to phenotype. The goal: **'if we can successfully navigate between the Scylla of strong instructionism and the Charybdis of excessive liberality, we would potentially have access to such an account** [taking both genetic and cultural inheritance into account, that is]. Allied with the concept of emergent modularity, that result would do much to effect a rapprochement between our alternative visions of evolved human cognition' (p. 3571).

An alternative: neuroconstructivsm

Wheeler and Clark discuss niche creation, a concept we've been over before at Neuroanthropology (see, for example, Daniel's recent post on the work of Agustín Fuentes (https://neuroanthropology.net/2008/11/14/agustin-fuentes-and-niche-construction/)). For those of you who've just arrived at the party, an example of niche creation that Wheeler and Clark reference is 'when beaver offspring inherit both the dam that was communally constructed by the previous generation and the altered river flow that that physical structure has produced' (p. 3571). One generation shapes the environmental niche in which they live, affecting the survival and selection of subsequent generations.

Wheeler and Clark argue that researchers pursuing embodied cognition will find strong allies among those theorists who are taking Kevin Laland, John Odling-Smee, and their colleagues' discussion of 'niche creation' into the realm of cognitive ecological niches, because **the cultivated niche becomes both a source of developmental input for the emergent modules in the brain and a vehicle of cultural transmission.** And humans are extraordinary manipulators of their own ecological niche. As Wheeler and Clark write:

> For rampant niche construction yields a rapid succession of selective environments, and hence favours the (biological) evolution of phenotypic plasticity. Hominid minds, Sterelny suggests, are adapted to the spread of variation itself. To cope with such variability, we are said to have evolved powerful forms of developmental plasticity. These allow early learning to induce persisting and stable forms of neural reorganization, impacting our range of automatic skills, affective responses and generally reorganizing human cognition in deep and profound ways. The upshot is that 'the same initial set of developmental resources can differentiate into quite different final cognitive products' (Sterelny 2003, p. 166). (Wheeler and Clark 2008:3565)

Wheeler and Clark describe the extended space we use when thinking as an example, such as how we may manipulate physical objects to help us to classify and order them, or how we parse complex cognitive problems into shorter ones and using some material means to note intermediate results. 'Non-organic props or aids' to our memory and cognitive abilities can then become a channel of cultural inheritance that not only supplements our mental faculties, but also shapes the next generation's (and our own) cognitive development. To continue our example, the techniques that I learn to conduct calculations not only affect my own brain, they become the lessons that I visit upon my children's brains when they are in crucial formative stages of development; **my technique for expanding mental abilities becomes my children's environmental niche for honing intellectual skills**.

We could add myriad examples of other forms of cognitive crutches that become part of our brains' development niche, including such brain-shaping cultural artifacts as language, literacy, visual art and decoration, electronic media, music, games, rich and varied material culture (and even insulation from some parts of material reality), and on and on and on... A tool in the hand of their creator, most

of these have long-ago become relatively predictable and permanent parts of our developmental environment, shaping 'human nature' in profound ways, a fact only driven home in the horrifying cases where children are deprived of these channels for cognitive inheritance and formation.

What Wheeler and Clark do that I have never been able to accomplish (well, one of the many things) is that they highlight so clearly the crucial role of cognitive niche creation and, after outlining how this concept might play a role in evolution, chart a way to a reconciliation between embodied cognition and evolutionary theory. Their perspective, they call **'neuroconstuctivist'** (after the work of Mareschal and colleagues 2007a, 2007b).

Following conversations with Daniel this weekend, I might prefer 'neuro-cultivation' when talking to my anthropology colleagues, but only because 'constructivist' has more baggage than a Hilton heiress in our field that I'd prefer to avoid (such as 'social constructionism' in its more radical forms). But I can live with 'neuroconstructivist'...

This doesn't mean that Wheeler and Clark are too conciliatory toward those who want to see the human brain as a Swiss Army Knife of predetermined tools. They argue that niche creation combined with an evolutionary perspective yields a very different neuroconstructivist account of human distinctiveness:

> For what is special about human brains, and what best explains the distinctive features of human intelligence, may be precisely their ability (courtesy of extended development and extensive neural plasticity) to enter into deep, complex and ultimately architecture-determining relationships with an open-ended variety of culturally transmitted practices, endowments and non-biological constructs, props and aids. Perhaps it is because our brains,more than those of any other animal on the planet, are primed to seek and consummate such intimate relations with non-biological resources that we end up as bright and as capable of abstract thought as we are. If so, our distinctive universal human nature, insofar as it exists at all, would rather be a nature of biologically determined openness to deep, learning- and development-mediated, change. (p. 3572)

This neuroconstructivist account of 'human nature' places no limit on its variation, unlike the innatist assumptions in modularity theory. The genetic changes that gave us the modern human brain generated 'a cognitive machine intrinsically geared to self-transformation, artefact-based expansion and a snowballing/bootstrapping process of computational and representational growth' (p. 3572).

In other words, Wheeler and Clark map out a path toward reconciliation between evolutionary theory and interest in the brain that isn't the same one — massive modularity, instinct, universal grammar, etc. — that seems now to be so out of step with both contemporary evolutionary theory and brain sciences. The result is really outstanding and thought provoking, and I can't recommend the article highly enough if you can get your hands on it.

The abstract of the piece is:

Much recent work stresses the role of embodiment and action in thought and reason, and celebrates the power of transmitted cultural and environmental structures to transform the problem-solving activity required of individual brains. By apparent contrast, much work in evolutionary psychology has stressed the selective fit of the biological brain to an ancestral environment of evolutionary adaptedness, with an attendant stress upon the limitations and cognitive biases that result. On the face of it, this suggests either a tension or, at least, a mismatch, with the symbiotic dyad of cultural evolution and embodied cognition. In what follows, we explore this mismatch by focusing on three key ideas: cognitive niche construction; cognitive modularity; and the existence (or otherwise) of an evolved universal human nature. An appreciation of the power and scope of the first, combined with consequently more nuanced visions of the latter two, allow us to begin to glimpse a much richer vision of the combined interactive potency of biological and cultural evolution for active, embodied agents. [abstract here (http://journals.royalsociety.org/content/94g6448k4j0w7288/)]

References

Buller, David J. 2005. *Adapting Minds: Evolutionary Psychology and the Persistent Quest for Human Nature*. Cambridge, MA: MIT Press. (Amazon listing (http://www.amazon.com/Adapting-Minds-Evolutionary-Psychology-Persistent/dp/0262524600/ref=sr_1_1?ie=UTF8&s=books&qid=1227475186&sr=8-1))

Clark, Andy. 1997. *Being There: Putting Brain, Body and World Together Again*. Cambridge MA: MIT Press. (Amazon listing (http://www.amazon.com/Being-There-Putting-Brain-Together/dp/0262531569/ref=sr_1_1?ie=UTF8&s=books&qid=1227475405&sr=1-1))

Karmiloff-Smith, Annette. 1992. *Beyond Modularity: A Developmental Perspective on Cognitive Science*. Cambridge, MA:MIT Press. (Amazon listing (http://www.amazon.com/Beyond-Modularity-Developmental-Perspective-Cognitive/dp/0262611147/ref=sr_1_1?ie=UTF8&s=books&qid=1227480930&sr=1-1), Google books preview (http://books.google.com/books?id=xhUll82paFYC&dq=Karmiloff-Smith+beyond+modularity&pg=PP1&ots=IAWel8u1im&source=bn&sig=s8DWlySFhEX2BelACU2zOjtBVrw&hl=en&sa=X&oi=book_result&resnum=4&ct=result#PPR7,M1))

Mareschal, Denis, Mark Johnson, Sylvain Sirois, Michael Spratling, Michael Thomas and Gert Westermann. 2007a. *Neuroconstructivism – I: How the Brain Constructs Cognition*. New York,
NY: Oxford University Press.

Mareschal, Denis, Sylvain Sirois, Gert Westermann, and Mark Johnson. 2007b. *Neuroconstructivism – 2: Perspectives and Prospects*. New York, NY: Oxford University Press.

Sterelny, Kim. 2003. *Thought in a hostile world: The evolution of human cognition*. Oxford, UK: Blackwell. (Amazon listing (http://www.amazon.com/Thought-Hostile-World-Evolution-Cognition/dp/0631188878))

Wheeler, Michael, and Andy Clark. 2008. Culture, embodiment and genes: unravelling the triple helix. *Philosophical Transactions of the Royal Society B* 363(1509): 3563-3575. doi 10.1098/rstb.2008.0135 [

(https://europepmc.org/articles/pmc2607343?pdf=render)abstract here (http://journals.royalsociety.org/content/94g6448k4j0w7288/)]

neuroanthropology.net (https://neuroanthropology.net/2008/11/23/andy-clark-michael-wheeler-embodied-cognition-and-cultural-evolution/) · by View all posts by gregdowney