BOOKS: PSYCHOLOGY

Et tu *Homo sapiens?*

Marc D. Hauser

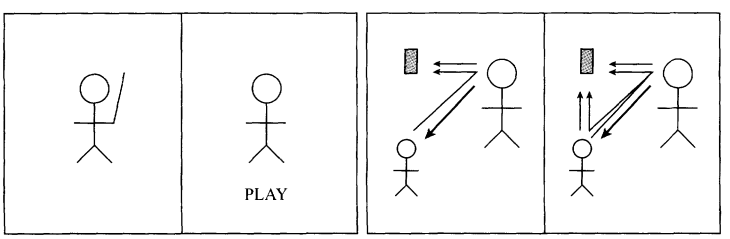
If there has been one question haunting social scientists, it is: What makes humans special as a species? There has been no shortage of potential answers, which include our capacities to generate language, mathematics, tools, art, music, and humor. Typically, these answers are derived from studies that show other animals lack such capacities. Less often do we find an attempt to explain why such capacities are present in one species and absent from others, why such differences matter, or why we need to study both humans and nonhuman animals. Herein lies the beauty of Michael Tomasello's book *The Cultural Origins of Human Cognition*. Tomasello is a leading researcher in fields of primate cognition and language acquisition by children. He has studied chimpanzees in captivity and young humans, and he has written extensively on how both species acquire competence in communication and cognition. He is, thus, ideally placed to shed light on how and why we differ from other species.

The Cultural Origins of Human Cognition
by Michael Tomasello
Harvard University Press, Cambridge, MA, 1999. 254 pp. $29.95. ISBN 0-674-00070-6.

Unlike a Sherlock Holmes mystery, Tomasello's book doesn't require the reader to wait until the book's end to discover "whatdunit"—why humans are different. Tomasello begins by explaining that our phylogeny has handed us a set of basic cognitive capacities, abilities that allow us to exploit (during ontogeny) the knowledge that our species' history has accumulated. However, our species alone evolved the capacity to put our selves into the minds of another; to understand what they believe and desire; and to read their emotions, their intentions, and their goals. In so doing, we alone can learn by imitation and inform by teaching, thereby setting in motion all the attributes that make us uniquely human.

To support his argument, Tomasello works through three relevant data sets to which he has contributed: phylogenetic, ontogenetic, and historic. Concerning phylogeny, he claims nonhuman primates differ fundamentally from all other mammals in possessing a greater understanding of relational categories in both the physical and social domains. After separating primates from other mammals, Tomasello goes on to distinguish the cognitive skills of nonhuman primates. In particular, he reviews observations and experiments that show monkeys and apes are incapable of understanding even the simplest problems of physical causality. They have similar difficulties understanding the intentions and mental states of conspecifics. Tomasello's analysis of primate cognition leads to the striking conclusion that our closest living relatives lack the key mental tool that enables humans to create cultures: putting oneself in someone else's "cognitive shoes" and using this capacity to imitate.

The second piece of the argument is that humans develop within a unique socio-cultural environment. Specifically, human infants are born with a capacity to imitate, an ability that allows them to identify with their kind. Their cognitive revolution begins with the ability to share attention and knowledge with those who look in the same place, and they come to see others as the same, as motivated by goals, intentions, and desires. Enriched by culture and nurtured by social interactions with parents and other sapient colleagues, this capacity develops over the course of several years. With it in place, imitation is not merely a mimetic trick, but rather a form of copying designed to achieve a goal, one constructed by an actor with specific intentions. Because humans imitate by running a mental simulation of the actor's intentions, they often (especially in early infancy) end up replicating some spectacularly silly things such as reaching between one's legs to open a drawer because an actor has demonstrated this perverse action. Importantly, so Tomasello argues, it is the slavishness of imitation that leads to our remarkable culture. Specifically, our capacity to imitate allows us to accumulate what our ancestors invented over centuries. This process, which Tomasello calls the "ratchet effect," is crucial for cultural evolution. Though other species may show cultural traditions—population-specific and socially acquired patterns of behavior such as hand-clasp grooming and termite fishing in chimpanzees—the details of such behavior will often be lost, and new inventions may never be passed on.



Conceptualizing self. Chimps (**left**) can't; they see the gesture and imagine what the partner will do next. Children (**right**) can; they see the linguistic symbol and imagine what sharing attention would be like.

The final piece to Tomasello's argument is history. In particular, he contends that cultural psychologists have failed to consider how our uniquely human capacity for identifying intentions in others forms the foundation, the psychological golden key, for our extraordinary history as a species. It's not that other species are incapable of using tools, computing simple mathematics, or generating signals with language-like properties. But other species cannot build on such foundational capacities to increase the richness of each domain of knowledge. The historical record that humans have laid down brings to life the minds of our ancestors, individuals who could recognize the intentions of others, acquire their tricks, invent new ones, and maintain traditions.

Tomasello builds on foundations laid by Premack and Woodruff's insights concerning mental state attribution (*1*); Donald's ideas on the role of imitation in human evolution (*2*); Dennett's ideas on the design stance for intentional and physical objects (*3*); and the work of Dawkins (*4*), Dennett, Blackmore (*5*), and Boyd and Richerson (*6*) on biological and cultural evolution. What is novel in Tomasello's book are the arguments that recognizing the intentions of others is the only factor that really matters and that much of what we think is interesting about human cognition comes from what we learn from our culture.

I believe this strong form of Tomasello's thesis may face some difficulties (*7*). In his attempt to swing the pendulum away from those who characterize the human mind as modular or domain-specific, I feel Tomasello has caricaturized their position. It is not, as he sometimes implies, that those who hold a domain-specific view of human cognition argue that experience is irrelevant or trivial. Rather, they argue that what is innately specified constrains what experience is relevant, when it is relevant, and how it sculpts

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different possible phenotypic outcomes. No one claims that innate factors fix phenotypic outcomes; instead, these factors limit the range of possible phenotypes. This view of development represents a dialogue between the nativist and the empiricist, and is far more productive than either swing of the pendulum from nature to nurture.

Consider, for instance, the domain of numbers. Although Tomasello states that no one has ever considered number representation to be modular or domain-specific, several theorists have made such claims (Dehaene, Butterworth, Carey, Gallistel, Gelman, Hauser). For example, we have found that birds and mammals (including primates) share a mechanism for exactly computing numbers of objects or events less than five and a second mechanism for approximately computing larger numbers. Support for these mechanisms comes from studies of number representation in trained and untrained animals and human infants, analyses of brain-damaged patients with selective deficits in the number domain, as well as neuroimaging studies that reveal specific areas of activation for precise as opposed to approximate numeric computations. What allows humans to go beyond animals is our language, which provides an exact representational system for large numbers. None of these capacities depend on inferring the mental states or intentions of others, and most researchers invested in this domain of knowledge are keenly interested in both innate constraints and the role of experiential modification, even if they disagree about the specific details of the underlying mechanisms.

A second difficulty for Tomasello's thesis is its reliance on one domain-general capacity—his psychological golden key for our uniquely human nature. But many of the cognitive abilities that separate us from other species are not due to our capacities to attribute mental states to others and to identify others as being similar. For example, although animals share our capacity for dead reckoning, as well as the ability to recruit a geometric module for spatial orientation, only humans appear capable of conjoining geometric and nongeometric features by using a linguistic system as a mediator across different domains. Similarly, the mechanisms that underlie our extraordinary abilities in the domains of number, language, and mental state attribution might all be linked to a more basic capacity: recursion. To date, we have no evidence that animals can think recursively in any domain. If this distinction holds up, it would provide a powerful explanation for the limitations observed in many domains of knowing.

These two criticisms should not detract from the main point: if you are interested in the phylogeny, ontogeny, and history of our species, read Tomasello's wonderful book. *The Cultural Origins of Human Cognition* shows not only how we differ from other primates and why, but also how we should think about the problem and carry out empirical research. It is an elegant treatise on human nature.

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Incredible facts. Chief Justice of Common Pleas Francis North, Lord Guilford (1637–1685), argued that facts "contrary to all manner of experience and observation" could be rejected.

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BOOKS: HISTORY OF SCIENCE

Roots of the Fact

Mary Poovey

Barbara Shapiro's *A Culture of Fact* revisits territory to which historians of science have already laid claim: the provenance of the concept of "fact." Whereas Steven Shapin and Simon Shaffer assume that "the fact" was initially stabilized in the domain of Baconian natural philosophy, Shapiro, a professor of rhetoric at Berkeley, argues that the "matter of fact" originated in the English law court. As a concept that was first applied to human actions, according to Shapiro, "matters of fact" attested to the 16th-century belief that human beings could arrive at "true" and "just" decisions, that people could know about events that happened elsewhere and at another time, and that institutions could provide a place where such judgments were routinely made and rendered consequential.

A Culture of Fact
England, 1550–1720
by Barbara J. Shapiro
Cornell University Press, Ithaca, NY, 2000. 296 pp. $42.50. ISBN 0-8014-3686-9.

In moving the origin of "the fact" backward in time (from the 17th to the mid-16th century) and from studies of the natural world to English courts of law, Shapiro enables us to see how our modern confidence that "facts" exist in the world derives from a confidence about how we know that world. She argues that a "culture of fact" gradually developed in England as the legal concept was generalized to other domains of knowledge. Historical narratives, descriptions of domestic and foreign landscapes, periodical reports of "news," and even theological claims about the basis for religious belief were all informed by the legal assumption that a reliable, unbiased witness could know—even if he or she was not an eyewitness to the events in question. By this account, the Royal Society's experiments, which were designed to produce knowledge about the natural world, gained credibility from the culture of fact that already existed in England. Because English men and women were already convinced that credible witnesses could produce knowledge sufficiently reliable to stand up in court, they were willing to believe that natural philosophers could discover facts about the natural world, even when they did so under conditions so controlled that they seemed far removed from the nature scientists claimed to explore.

The Culture of Fact is based on extensive research in a range of early modern archives, and it will be a valuable resource for historians who want to understand how law, the periodical press, travel writing, and natural philosophy all contributed to early modern empiricism in England. The book is also a valuable corrective to the claim that "facts" and "science" were joined at birth, although Shapiro's respectful treatment of Shapin and Shaffer's work tends to understate the importance of her intervention in this historical account. Indeed, the author provides scant ammunition for readers who might want to celebrate her importance in this or any other respect. Her arid style, indifference to the language or contradictions of her sources, and reluctance to interrogate such categories as "culture" make *A Culture of Fact* resemble a bit too closely the dry-as-dust accounts that apparently earned credibility for witnesses in the early modern courtroom.

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