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might be tempting to conclude that those hospital patients are addicted to opioids because their brains mirror the brains of heroin addicts, but most patients live without regular doses of narcotic painkillers once they leave the hospital. Brain activity is misleading, because it obscures the importance of other factors. Postsurgical patients with strong social networks, stable jobs, and financial independence are far less likely to develop addictions than are patients who leave without social and financial support, but those differences do not show up reliably on brain scans. It is useful to know that the nucleus accumbens plays a role in addiction (and in thinking about the self), but it is also important to understand how those two experiences differ phenomenologically, beyond simple brain activity. (And if they do not differ, that is worth discussing explicitly as well.)

Brewer's *The Craving Mind* is an important, groundbreaking book. The notion that mindfulness is tentatively capable of treating a range of addictions is tantalizing, but it also poses further questions. The approach seems to help smokers, but how does it fare for narcotics users? Nicotine addiction may be more stubborn, but it is also less immediately damaging and less likely to impair the cognitive functions that drive meditation. As with so many insightful books, my only "complaint" is that I was left wanting more—more information about Brewer's methods, about how his participants felt as they explored the mindfulness method, and about why mindfulness appears to diminish addiction. But of course that is a good problem to have when reading a book: to be left wanting more rather than wishing it would end.

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## CREATIVE MINDS AND NATURE MYTHS

### The Creative Spark: How Imagination Made Humans Exceptional

By Agustín Fuentes. New York, NY: Dutton, Penguin Random House, 2017. 352 pp. Hardcover, \$28.

In *The Creative Spark*, Agustín Fuentes, a biological anthropologist at the University of Notre Dame, sets out to achieve “a far more nuanced, complete, and judicious account of our evolution than has previously been possible” (p. 5). Given that he has written a popular science book rather than a textbook and that this field has a history of monographs replete with dubious storytelling and sensationalism, Fuentes’s objectives are entirely laudable. *The Creative Spark* synthesizes recent findings from biological anthropology, archaeology, paleontology, and evolutionary biology into a rich and accessible treatise that overturns several long-held myths about the human condition.

There is indeed a judicious balance to Fuentes’s writing. He provides a sketch of the latest thinking in human evolution, and he does so with authority and balance. Too many books in this genre either trumpet human achievements at the unfair expense of other species or otherwise “big up” other animals, such as chimpanzees, to exaggerate the extent of continuity in intellectual abilities with humans. Fuentes falls into neither of these traps, and yet he manages to achieve

a readable text, solidly grounded in scientific data. As well as an excellent introduction for the uninitiated, *The Creative Spark* is likely to prove a useful teaching aid for students of human evolution and specialists in other fields. One of its many admirable qualities is a series of exceptionally clear and useful figures depicting the geographic locations of hominin fossil finds and dispersal events, the sites of animal and plant domestication, and time lines for the major events in human evolution and of key innovations.

However, this is more than a book about human evolution; *The Creative Spark* also presents an explanation for our species' uniqueness. According to Fuentes, the power of imagination, more than any other human attribute, is the secret of our success. Today's arts, science, and religion all derive from the same creative facility that empowered our ancestors' hunting and gathering millions of years ago. They are manifestations of humanity's hypertrophied imagination, as are human language, cooperation, and technological achievements.

In this respect, Fuentes's monograph might appear to the uninitiated to be the latest representative of a now rather crowded genre of popular science books that attribute our species' distinctiveness to a particular "magic bullet," be it our aggression, intelligence, language, or cooperative tendencies. Such books deploy the slightly tired formula of explaining how all that is exceptional about our species follows from a single key evolutionary innovation. I generally do not find such treatments particularly compelling, primarily because they tend to pay too little attention to process and as a result often provide a rather superficial explanation. For me, a satisfactory account of our species must explain *how* any putative unique qualities evolved rather than simply attributing all our achievements to a single character that by chance appeared in our lineage. Rather than a single magic bullet, human uniqueness is the product of complex and mutually reinforcing feedbacks between social, technical, and cultural competences (Laland, 2017).

Here I am conscious that I could appear vulnerable to a charge of hypocrisy, having myself also written a monograph, *Darwin's Unfinished Symphony* (Laland, 2017), that covers much of the same territory and attributes human successes to our culture. However, that book attempts to provide a plausible mechanism for how the unique qualities of human culture evolved out of something like the social learning and tradition observed in other species and to document empirical and theoretical findings consistent with that process. Whether it succeeds is for

others (including Fuentes) to judge, but it at least attempts to provide an explanation outlining the processes that led to the human condition.

Prima facie, the central thesis of *The Creative Spark*—that creativity alone is responsible for human success—is open to question, because it appears to package itself as a magic bullet account. In reality, that packaging is misleading and I think undersells Fuentes's argument. His message is actually richer and more sophisticated than it might appear from the headline claims. Indeed, I suspect that there are few, if any, substantial differences in how Fuentes and I understand the causes of human uniqueness; we have simply chosen to describe them differently.

At the outset, Fuentes asserts that "Countless individuals' ability to think creatively is what led us to succeed as a species" and that "We are, first and foremost, the species singularly distinguished and shaped by creativity" (p. 2). However, he characterizes creativity broadly, such that "a social tradition is a shared bit of creativity" and that "successful collaboration is inseparable from imagination." He goes on to describe a gene-culture coevolutionary feedback process arising from our ancestors' cultural activities, including stone tool manufacture: "The behavior and collaboration involved in making tools actually changed the way our ancestors used their brains and resulted in changes in the way their (and our) brains work" (p. 60). This leaves Fuentes's stance broadly in line with a cluster of "cultural intelligence" accounts of human evolution, including the arguments of Robert Boyd and Peter Richerson (1985; Boyd, 2017; Richerson & Boyd 2006), Joseph Henrich (2016), and me (Laland, 2017). Recognition that a deeper, process-based perspective lies at the heart of Fuentes's argument to my mind greatly strengthens it, even if it might be thought to undermine *The Creative Spark's* originality.

I detect an emerging consensus in the field that our species' remarkable successes derive from a potent mix of innovation and copying. That cocktail is sufficiently generative and accurate to support the cumulative cultural process that underlies human technological advances, feeds back to act as a major source of selection on human bodies and minds, and underpins the large-scale cooperation that characterizes human societies. Boyd, Richerson, Henrich, and I have tended to emphasize the social learning (or "copying") component, whereas Fuentes dwells on the creative ("innovation") element, but really these are two sides of the same coin. There is strong evidence from comparative phylogenetic analyses

that social learning and innovative capabilities have coevolved very tightly among primate species (Navarette, Reader, Street, Whalen, & Laland, 2016; Reader, Hager, & Laland, 2011; Reader & Laland, 2002), which lends theoretical support to the assertion that they go together.

Although the formal theory that supports cultural evolution research (Boyd & Richerson, 1985; Cavalli-Sforza & Feldman, 1981) has probably tended to encourage the treatment of innovation as a process analogous to mutation in which individual organisms generate novel cultural variants, it is widely recognized that this fails to capture the social aspects of innovation. Fuentes is correct to emphasize that much human creativity, including the evolution of complex institutions such as science and religion, and technological progress result from creative refinement or recombination of socially transmitted knowledge. Cumulative culture, comprising repeated bouts of copying and innovation, is what lends humanity its creative spark, and the creativity that fuels that iterative refinement itself evolved through a process imbued with selective feedback.

Fuentes is at his best when using his knowledge of primatology and paleoanthropology to overturn common misconceptions about war and aggression, race, gender differences, and human nature. My favorite chapter in *The Creative Spark* is titled “Creating War (and Peace).” A popular and longstanding evolutionary story is that human violence and war derive from an inherent aggressive tendency adaptive among our primate or hominin ancestors. According to this view, aggressive behavior abounds in human societies today because it increased our forebears’ biological fitness. This argument has been championed by some very prominent biologists and evolutionary psychologists for nearly a century, including Raymond Dart, Konrad Lorenz, Richard Wrangham, and Steven Pinker. Fuentes calmly evaluates the claims and shows that the data do not corroborate them.

There is no clear pattern in primates that supports the hypothesis of a shared evolutionary basis for human violence, as Fuentes details. Severe aggression that results in injury or death is actually quite rare in most primates. Common chimpanzees can certainly be really aggressive, with males using threats to try to coerce females and infanticide sometimes occurring. There can also be violence between chimpanzee groups patrolling their borders. However, there is a lot of variation in aggressiveness and sexual coercion between *Pan troglodytes* populations. Moreover, bonobos (who are as closely related to humans as

common chimpanzees) do not engage in border patrols, lethal intercommunity violence, or infanticide, and females are dominant to males in many circumstances. Fuentes concludes that there would be no less justification for the argument that our primate ancestry predisposes humans to peaceful coexistence than to severe violence.

Considering paleoanthropological and archaeological data, Fuentes describes how “98 percent of all the sites for which we have hard fossil evidence over nearly 2 million years of human life up until 10,000 years ago show no signs of traumatic violence” (p. 149). The clear evidence for hominin hunting during this period undermines any suggestion that “man the hunter” triggered “man the warmonger.” There is no compelling evidence for warfare or even mass killings before 14,000 years ago, with the earliest evidence at Jebel Sahaba in northern Sudan, where 59 bodies were uncovered, 24 of which experienced human-inflicted violence. Rates of violent death increase in the period from 14,000 to 7,500 years ago and again at 7,500 to 5,000 years ago. Even the data from contemporary small-scale societies, such as the Yanomamo of the Venezuela and Waorani of Ecuador, which are famed for their aggression, have now been reanalyzed to show that aggressive males do not acquire more wives and children (i.e., contrary to earlier suggestions, they do not achieve greater biological fitness). Fuentes concludes that any explanation for our current patterns of organized and lethal violence needs to focus not on the deep past but more recent times. The data strongly suggest that the rise of coordinated lethal violence and warfare coincided with the emergence of complex agricultural societies, food storage, ownership, and societal stratification and inequality, as well as the institutionalization of differences within and between communities: “Surpluses of food and other goods, trade relationships, strong community identities, larger and denser communities, and social hierarchies within and between communities all added fuel, and options, to the motives and possibilities for serious conflict” (p. 161).

Fuentes also gently dismantles the story of ancient “he-man hunter-provider” and “dainty female nurturer” sex roles. Following a review of the fossil and archaeological data Fuentes is able to find no evidence of gendered hunting (or toolmaking) differences until recent times. Again, it is with the advent of agriculture, and the associated increase in birth rates and division of labor, that sex roles become much more pronounced. Myth busting is one of *The Creative Spark*’s most admirable qualities. Agustín

Fuentes is the Jamie Hyneman (or Adam Savage) of biological anthropology, and his scientifically grounded deconstruction of suspect evolutionary stories provides an important service to the community.

Part of what makes Fuentes's book successful is the progressive evolutionary framework on which he draws. *The Creative Spark* begins with a "trumpeting" of a new evolutionary synthesis that recognizes important evolutionary roles for extragenetic inheritance (most obviously, the transmission of cultural knowledge) and niche construction, whereby our ancestors themselves created and reshaped their environments, and the natural selection that ensues. It will come as no surprise that I view these refinements as making for a richer and more compelling account of human evolution, as they draw on my work (Laland et al., 2015); however, it is becoming increasingly clear that many social scientists share this perspective. Fuentes describes how our ancestors' toolmaking imposed selection on the human brain, how their culturally learned diets favored gene variants expressed in requisite digestive enzymes, how domestication generated selection for genetic variants of rice with grains that do not readily fall off, and how they created the deeply symbolic and meaning-laden world that spawned both artistic flights and religious foundations.

Fuentes's view of humans as active agents that set their own and other species' evolutionary agendas (albeit often inadvertently), will resonate with those of us tired of evolutionary portrayals of humans as "lumbering robots" pushed around by their naturally selected genes. Humans unquestionably possess an ability to act on their world and to modify their experience of it, including in ways that are neither predetermined nor random. More generally, it is high time to recognize the fact that organisms are self-building, self-regulating, highly integrated, and "purposive" wholes that through entirely natural processes exert a distinctive influence and a degree of control over their own activities, outputs, and local environments, and thereby codirect natural selection. These properties must be possessed by *all* organisms in order for them to be alive (Schrodinger, 1944), but they are perhaps more manifestly self-apparent for humans than other species. We are not merely vessels through which the causal explanatory power of natural selection flows; we are active agents that transduce and filter genetic inputs that derive from prior selection, and we impose direction on subsequent evolutionary events (Lewontin, 2000).

There is so much to admire in Fuentes's monograph that it seems churlish to pick up on its peccadillos, but I take it as my job as reviewer to do so. A couple of issues come to mind. Although in general his claims are well backed up by scientific findings, there were a few places where the text attributed to hominins a creativity that I worried might actually belong to Fuentes. For instance, having described how our ancestors transported honey on large leaves, Fuentes goes on to acknowledge, "We have no direct evidence that they did this." Likewise, the assertions that early *Homo* were "power scavengers" that drove predators away from their kills by shouting, waving sticks, and throwing stones, or that later spear-throwing hominins were intuitive scientists that engaged in experimentation and understood projectile physics, come across as rather speculative. At best, these are plausible hypotheses. I suspect that these suppositions were included in an attempt to make the book fun to read or accessible to a general audience, and fortunately unsupported speculation of this nature is rare.

More of an issue for me was the slightly moralizing, even life-affirming tone of the final chapter, in which Fuentes draws on his knowledge of human evolution to tell us how we should lead our lives and how greater creative expression will enrich us. No doubt Fuentes gives good advice, and I found nothing sinister about any of his pronouncements, but this chapter nonetheless left me feeling ill at ease. There is a difference between scientist and agony aunt. This material felt as if Fuentes might have strayed beyond the scientific evidence to express his own politics and personal opinions. I do not like big-box stores and shopping malls any more than Fuentes, but can we really be sure that their uniformity is "dampening our creative capacities"? Does a knowledge of paleoanthropology really teach us that we should "create equitable access to food and water in our local communities"? Irrespective of what parenting styles were manifest in the stone age, can we legitimately treat the postulate that "parenting is not a solo (or female-only) activity" as "implicit advice from our ancestors"? And whether or not one agrees with Fuentes that "if one is not religious, one shouldn't knock religious individuals because they have a particular faith," I cannot see that this moral stance follows from knowledge of human evolution. In truth, I am skeptical as to whether "our evolutionary story can act as a guide" to maximizing happiness or creativity in the present. The comparison is unfair, but the final chapter stirred up uneasy distant memories of Edward Wilson's hu-

man sociobiological writings (*On Human Nature*, 1978), and the fact that Fuentes's "evolutionarily informed" messages are progressive, politically correct, and broadly in line with my own views did not take away that discomfort. Happily, Fuentes redeems himself in the final pages by encouraging his readers not to passively accept what they are told, including by him, but rather to "do some science" and check out the evidence for themselves (referring readers to some helpful endnotes).

Quibbles aside, *The Creative Spark* is a compelling book, providing an up-to-date overview of the latest thinking on human evolution and a valuable corrective to age-old myths about "human nature." I wholeheartedly recommend it.

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## EVOLUTION, ANIMAL BEHAVIOR, CULTURE, AND THE HUMAN MIND

### Darwin's Unfinished Symphony: How Culture Made the Human Mind

By Kevin Laland. Princeton, NJ: Princeton University Press, 2017. 464 pp. Hardcover, \$35.

There many facile attempts to explain human evolution, and the human mind, in popular and academic literatures. Most such accounts opine about how humans might connect to patterns of cognition and evolution in other animals, focus on specific traits, and are couched in reductionist narratives. Such attempts seek to force the multifaceted and extensive patterns of complexity in human systems into models with few variables via arguments based in the standard evolutionary approach (SEA). The SEA emphasizes changes in the frequency of DNA sequences across generations, with a focus on four specific processes: natural selection, genetic drift, mutation, and gene flow. It emphasizes the actions of natural selection and their resultant functional impacts as the key to the origins and selective mechanisms or histories of evolutionarily relevant human traits. Often such efforts emphasize the commonality of patterns and processes between humans and other organisms, as opposed to the specific evolutionary discontinuities that emerged along the hominin and human lineages. Although some insight has been developed in these attempts, they are largely unhelpful for two key reasons.

First, evolutionary processes are about both continuities and discontinuities. It is absolutely clear that humans share much in common with primates, other mammals, and all of life. However, critical and distinctive evolutionary patterns and processes emerge along the trajectories of the hominins, and especially in the genus *Homo*, after splits with related lineages. Our genus has a highly distinctive evolutionary history (Coward & Grove, 2011; Foley, 2016; Fuentes, 2017b), one that must be recognized and effectively integrated into models if attempts to characterize the