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Complexity, Natural Selection, and Cultural Evolution

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Peter Taylor begins his reply to me by objecting to Steve Fuller's intelligent design-based critique of the intelligibility of science—which is the object of my criticism.[1] He argues that Fuller's own point of view does not make sense and that intelligent design should lead one to *lack* motivation to study nature since God can just change the rules at any point. That, of course, depends upon what God is taken to choose to do. In any event, I certainly cannot be expected to make a case for Fuller's argument that is stronger than the one he presents.

Fuller is certainly right that belief in the book of nature as authored by God motivated early scientists to engage in scientific inquiry to fulfill their religious aims. That is a truism in the history of science. My argument against Fuller's view is that the pursuit of science is no more stymied by a transition away from theological motivations for conducting science than ethics or purpose in life are blocked by a move away from religious belief.

Despite registering a lack of sympathy and understanding of Fuller's project, Taylor shares with him the belief that the scientific consensus behind evolution by natural selection is flawed and that it would be better to abandon Darwin's account and begin anew. It was precisely this kind of extreme *anomaly mongering* that I criticized in Fuller. It is evident in Taylor's stated desire to push the Lewontin-Gould critique of adaptationism beyond a rejection of just-so stories to denial of natural selection as a mechanism at all.[2] Despite telling us "Intelligent design exponents be warned—not all science studies critics of Darwinism play into your hands," that's exactly what Taylor's critique does.[3]

The Political Consequences of Natural Selection

He abandons Darwinian explanations for more contextual ones by claiming that complexity cannot be tamed by Darwin's simple metaphor. In doing so, he goes further than a call to incorporate developmental or sociological complexity within evolutionary accounts—as endorsed by defenders of an extended evolutionary synthesis and as I have done in my article.[4] I take on board much of the critique of adaptationism that has been driven by the criticism of human sociobiology. I accept that simple, biological explanations of complex human behaviors are unlikely to be effective.

Indeed, the key error of sociobiological accounts of human behavior and culture that I identify is that they miss that our biological adaptations have made possible another level of Darwinian selection entirely, which means groups will differ from each other as the result of cultural, not genetic, evolution. Moreover, reading to the end of Taylor's

[1] Peter J. Taylor 2016, 85.
[2] Taylor 2001.
[3] Taylor 2016, 86.
[4] Massimo Pigliucci and Gerd B. Müller 2010; Eva Jablonka and Marion J. Lamb 2006.

challenge to the metaphor of selection, it is clear that he has also reified the *political* critique of sociobiology into a requirement that scientific findings never threaten to bring about negative social stereotyping.[5]

Thus, while Taylor notes that E.O. Wilson does, in fact, present a positive valuation of homosexuals, suggesting that they evolved as they are in order to assist their kin in raising children, such a positive valuation would collapse if they stopped assisting their kin in the modern world. It is, however, not clear, why an explanation of how our genes evolved by natural selection requires us to only value that mechanism itself and conform our behavior to its desiderata.

In fact, it is urgent that the political case for basic human rights for gays and lesbians, as well as women and minorities denigrated by questionable sociobiological accounts, be made separately from any empirical account of their traits or provenance. The political critique of sociobiology's methods has been a useful exercise in that it revealed the bad assumptions and methods behind a reductive approach towards explaining human complexity. That critique should never be turned into a fetish and it is by no means clear that rejecting speculative scientific hypotheses for their perceived social consequences is either justified or, ultimately, consistent.[6]

Artificial and Natural Selection

Taylor's main objection to my own account of Darwinism is that my treatment of artificial and natural selection distorts Darwin's views and ignores the fact that natural selection is a metaphor. Here, he seriously misunderstands my discussion of natural and artificial selection. No one doubts that artificial selection was used to motivate an understanding of natural selection by analogy. Indeed, I explicitly argue that the growing prevalence of selective breeding provided the analogical basis for Darwin's theory.[7] I take it that all scientific explanations depend upon a metaphorical structure that is then exploited by the modeler. So to say that natural selection is a metaphor is not to say much.

More to the point, it is simply not the case that artificial selection is utterly different from natural selection just because there is an explicit selector in artificial selection (a selector created by evolution by natural selection!). That is why I discussed Darwin's argument that pigeons don't revert to wild types, as well as modern niche construction theory, according to which animals help select the traits of other organisms by shaping the environment in similar ways to what humans do in shaping the selection environment of domestic animals.[8]

Darwin recognized the conscious and unconscious effect of human behavior on selection as a continuum, with explicit, conscious human selection one extreme of a range of

[5] Taylor 1998.
[6] Alice Dregger 2015; William T. Lynch 1994.
[7] Lynch 2016, 33.
[8] Lynch 2016, 32.

situations where human behavior shapes the environment driving plant and animal evolution.[9] The context of this whole discussion is Fuller's claim that Darwin did not believe that humans could significantly modify nature, a kind of failure of nerve on his part. I think I showed that this was not the case. Darwin believed that artificial selection imposed fewer constraints on the human capacity to mold nature than his contemporaries believed.

Moreover, domestication itself has now been demonstrated to have started with self-selection for tameness by the future animal domesticates, as they adapted to proximity to human habitations. Darwin had identified commonalities in the domesticated phenotype and these have now been shown to be the byproduct of selected changes in aggression and fear, as demonstrated in the famous Belyaev fox experiments.[10] Such changes exploit cryptic genetic variation without phenotypical effects, changes that accumulated during evolution prior to human intervention, which are then exposed to selection by the human role in the animal's environment.[11] Humans driving away or killing aggressive animals while tolerating tame ones in their vicinity acts just like any other animal behavior in the environment that can shape natural selection, favoring the emergence of new ecological niches.[12]

Moreover, scientists are now coming to realize that selection for domesticated varieties of grains occurred through a process that is closer to natural selection than conscious breeding. Domestication as a model for natural selection has received a new lease on life by research that suggests that domestication is not as directed by human choice or as rapid as originally believed. In looking at the domestication of grains, Purugganan and Fuller argue that "[t]he domestication process appears driven largely by unconscious selection pressures and is in principle simply natural selection in the novel environments established by human agriculture."[13] Even where researchers like Hillman and Davies posit a rapid transition to domesticated varieties of grains, based in part on the experimental study of the cultivation of surviving wild varieties, they conclude that this rapid evolution could occur "without any conscious selection."[14]

So in that sense, the first stage of domestication just is natural selection rather than something humans have imposed on nature by directly controlling breeding. When humans do take greater charge in directing animal or plant breeding, the resulting "artificial" selection does not somehow escape the mechanism of natural selection, as directed breeding must abide by the constraints of survival and reproduction, even given human management of the environment, as worries about inbreeding among domesticated animals bred to type demonstrate.[15]

[9] Lynch 2016, 32.
[10] L.N. Trut et al. 2007.
[11] Richard C. Francis 2015, 16.
[12] Stephen Budiansky 1999; Darcy F. Morey 2010.
[13] Michael D. Purugganan and Dorian Q. Fuller 2010, 181.
[14] Gordon C. Hillman and M. Stuart Davies 1990, 157.
[15] Donna J. Haraway 2007, ch. 4.

Evaluating Theories of Evolutionary Change

Besides objecting to the metaphorical basis of natural selection, Taylor also argues that the mere existence of transitional forms does not mean that natural selection obtains, as evolution could have proceeded by other means that would also predict transitional forms. I would argue that we ought to approach this point historically, as it is not terribly meaningful to object to a successful scientific theory on the purely hypothetical grounds that some alternative theory with Duhem-Quine equivalence could be constructed.

Indeed, that, again, is the key point that Taylor shares with Fuller—if alternative hypotheses cannot be ruled out as potential explanations of the available facts, they both presume that these alternatives should be treated as equally credible. However, as Lakatos pointed out, we typically judge which programs are worth pursuing by their fruitfulness at generating predictions that are corroborated over time. While no crucial experiments can be expected to decide the issue, it does not follow that explanations that simply exploit the predictions made by another theory, adjusting its theoretical structure accordingly, should carry the same weight as a theory that is actually guiding new, productive work. Scientific theories are judged by their fruitfulness in guiding inquiry.

The evolutionary view available to Darwin as a competitor theory and most familiar to his contemporaries was Robert Chambers' anonymously published *Vestiges of the Natural History of Creation*.[16] Chambers' theory did not predict properly transitional forms, according to Darwin, let alone forms that are responsive to changes in environment. Instead, living forms advance along a predetermined path of change rather than adapt their characteristics to local environments. At the time, Asa Gray drew the inference from Darwin's theory that human transitional forms should be found, which was later corroborated, as I discuss.[17] Consequently, the basic Lakatosian track record (which Fuller himself uses as a criterion) is progressive, notwithstanding hypothetical Duhem-Quine equivalences. Nor would I think that Taylor's own alternative account of evolution would be able to predict the Tiktaalik fish I mention in the paper.[18]

Indeed, I'm not sure that isn't the point of Taylor's account of "unruly" complexity—all determinate models ought to be rejected because there are always interactions with the environment and other processes.[19] In open systems, this is always the case in science, which is why experimental isolation of causes is sought, where possible, to supplement field observations that are subject to complex interactions with other causes.[20]

Understood in terms of my article's appeal to recent work on cultural evolution, Darwin's significance is to uncover the basic mechanisms that lead to an evolutionary process: variation, inheritance, and differential survival. The theory predicts that whenever you can uncover such mechanisms, one should find selection-driven evolution. The modern

[16] Robert Chambers 1844.
[17] Gray 1860; Lynch 2016, 29 n. 4.
[18] Lynch 2016, 29.
[19] Taylor 2005.
[20] Roy Bhaskar 1975.

evolutionary synthesis worked out one particular evolutionary system, but there are others that show that Darwin's project continues to be fruitful. It also shows that an understanding of complexity ought to begin by identifying evolutionary systems that can then be studied for their interaction with the environment and other processes.

Contextual Explanations in Science Studies

Taylor takes a similar skeptical approach towards understanding the complexity of the institution of science itself. He is "skeptical that there is a singular institution called science."[21] Science, like evolution, certainly produces results that are radically dependent upon circumstance and no single set of traits characterizes life, or science, in general. However, it is just an unquestioned dogma of science studies today that science should be understood as any representation of nature by any society whatever and not an institution whose emergence was historically contingent.

In opposing the political errors of Eurocentrism, we have adopted the dogmatic view that there are just different "episode(s) of systematic knowledge-making" that should all be explained piecemeal by contextual factors.[22] Just as tearing down Darwinian natural selection so sociobiologists can't make an uncongenial home there is counterproductive, so, too, is adopting contextualism as a global strategy for avoiding any hint of Eurocentrism in accounting for the emergence of modern science. In fact, one of the problems with Fuller's view is that he presumes that Abrahamic religions have an intimate and permanent connection to the heart of science as an institution—it is aggressively Eurocentric in that sense (allowing for a somewhat broader view by including Islam).

The best response, however, is not to argue that each and every picture of nature held by any human group is the same kind of thing as modern science (or all are completely different from each other, which amounts to the same thing), but to see that historical contingency of the Gould type exists in the history of modern science. Modern science did emerge, fitfully, in particular times and places. Path dependency means that we can as easily be misled by the Islamo-Christian metaphysical assumptions connected to this emergence, as Fuller is in writing them into the essence of science.

My view is that science is historically contingent, in Gould's terms. It is an exaptation of our evolved biological characteristics, subject to further evolution at the cultural level. The paper's long discussion about the origins of agriculture and the development of religion and science are included to make this point. Just as with the critique of adaptationism in biology, a critique of essentialism in science is necessary. However, just as we shouldn't throw out selection with the adaptationist water, so too, should we not reject Fuller's views only by endorsing an unfocused contextualism that fails to explain anything general at all.

[21] Taylor 2016, 85.
[22] Taylor 2016, 85.

Models and Complexity

Models by their very nature fail to capture the complexity of the world. Their value comes from their ability to guide inquiry in a way that can allow us to slowly build up a better, general account of a complex reality, even though there will always be elements exogenous to the modeled system. Generally speaking, scientists are aware that they are simplifying things, though sometimes they are unaware of exactly how they are doing so or where they go awry in adopting particular kinds of simplifying assumptions rather than others.

Consider, for example, the new mathematical game theoretical accounts of evolution. Obviously these are models—extended metaphors—that treat natural selection as if it was a game with strategies. Early findings showed that "tit for tat" was an especially successful strategy that led to differential success in modeled environments. Is this a finding or a mistake?

It is an *early* finding, since science works by dialectically engaging its past findings to generate new findings. The institutional generation of repeated novelty distinguishes modern science from other social representations of nature.[23] As such, the simplified assumptions underlying early game theoretic accounts can be challenged by incorporating more complex, but still mathematically tractable, assumptions into new models with the hope that the results will shed light on more complex evolutionary strategies. Just this kind of effort has illuminated new aspects of evolution, from a better understanding of specific ecological interactions to an understanding of how cooperation emerges, making possible new levels of evolutionary selection.[24]

Is an emphasis on "unruly"—untamable—complexity "better?" Only in a very ad hoc sense, in that one can *always* appeal to aspects of the modeled reality that are not captured by the model. In this limited view, a non-model model always wins but only once all the facts are in and the components of construction are given one by one without any further discussion of how they interact and what this says about other cases (beyond that "they are complex, too").

One can, in short, be a critic, after-the-fact, of any model that cannot be definitively matched to the facts. But it does not help you guide the further investigation of new cases—it is not progressive in Lakatos' sense. When this kind of extreme skepticism is wedded to ideological correctness, the critique can go awry in the long run, even if its methodological use in the short run is salutary.

Why do Darwinian explanations need impossible standards of proof but any story of complexity in science or science studies is considered superior—especially when they provide no guidance in actually carrying out any further investigations? Taylor routinely conflates the issue of whether a proposed explanation can explain a particular phenomenon and whether we can know it to be true given the limited tools at our disposal

[23] Randall Collins 1998.
[24] Martin A. Nowak 2011.

that can trace the timing and function of proposed adaptations.[25] An emphasis on complexity that just eliminates theoretical perspectives judged either too simple to match reality or too difficult to prove is not helpful.

Conclusion

Taylor's own contribution to the anti-adaptationist critique of human behavioral explanations initiated by Lewontin and Gould is important, epistemologically and politically. But the solution to the spread of reductionism is not to blow up all explanations, something that seems to be a permanent temptation in STS.[26] If you explain everything by a process of construction that proceeds by innumerable, one-off components of context, then you will explain nothing at all (and, in fact, smuggle in all kinds of unrecognized explanatory assumptions).

Taken to its extreme, this represents not a critique of science, but a rejection of it. Science, on this view, is a conceit where you assume falsely that you can eliminate complexity. Only explaining every possible concrete event or outcome by contextual and contingent factors would be allowed—no generalizing across contexts and certainly no comparisons with nonhuman animals, which might allow ideologues to justify contemporary inequalities.[27]

Instead, I believe Lakatos (and Feyerabend) had it right in thinking about the theoretical context of science as dialectical, related, on the one hand, to overcoming the theoretical inadequacies of prior perspectives by pushing the programs until they break down, and, on the other hand, looking to see how new perspectives make possible more fruitful programs of research.[28] This is why the paper looks at how the limitations of certain versions of Darwinism were overcome in a way that put in place new models for dealing with complexity. It neither throws its hand up in defeat nor does it just reduce everything to contextual complexity without remainder.

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[25] Taylor 1998, 22-23.
[26] e.g. Bruno Latour 1988, 1996; Michael Lynch 1993.
[27] Taylor 1998, 28-29.
[28] Imre Lakatos and Paul Feverabend 1999; John Kadvany 2001.

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