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COGS 184

Discussion Week 2

Past evolutionary approaches have seen a great opposition to the inclusion of culture and its influence on evolution. Previously, it was claimed that the only routes were (1) culture directly changing genes due to mutations or (2) indirectly changing the probability of survival and reproduction. Laland et al. (2000) claims that biological evolution depends on natural selection, genetic inheritance and niche construction. Niche construction is the path by which culture plays a role. Specifically, it describes how we modify, change, or select the environments we live in. By our changing of the environment, both negative and positive, this generates feedback that modifies the selection pressures and fitness of our own species. Culture affects how we construct niches and the information that is shared which results in a fitness cost that affects genetic evolution.

In the beginning of this paper, when discussing the two routes of how culture can impact evolution, I have a criticism of how the first method is dismissed. They claim that the idea of culture directly changing genes isn't possible as seen by Lamarckism. I'd claim that if culture *does* impact the niches we live in or activities we participate in, this *can* affect us. For example, through epigenetic we know that the food we eat, stress we incur, or pollution we're exposed to all can cause mutations or move methyl groups on our genes that change the expression. So while the majority of epigenetic is not about changing genes specifically, the expression of the phenotype is modified. Similarly, I would argue that some cultural practices might sponsor activities that cause mutations (e.g. not using sun protection).

Moreover, the authors describe how organisms modify their own selection pressures so it's expected that environment-altering traits would co-evolve with those that survive based on natural selection in environments. While not exactly the same, it reminded me of bat adaptations we learned of in COGS 144. Bats rely on echolocation to hunt, this means that they need an environment in which they can produce their clicks, the clicks bounce off of something, and the return sound dictates where a prey might be or the surrounding environment. If the environment of the bat was changed, say the bat was put in a grassland without cave walls, all of these adaptions of using clicks and expecting tight walls, is no longer as applicable. There may be ways in which bats modify their environment to make echolocation work more efficiently causing this co-evolving set.

Moreover, one of the initial theories was that culture could only affect genetic evolution by influencing adaptations. But, I'd argue that culture can modify the selection process itself. Many cultures *choose* who to sacrifice or who goes to war which directly affects the likelihood of which types of individuals are more or less likely to die. Additionally, as we learned in COGS 100, thanks to technology and medicine, those who would die without the advent of those are less likely to. Kirsh, who teaches 100, even claimed that

the impact of technology has far outpaced natural selection and that selection has a long road to catch up. The only times we natural selection seems to catch up and override cultural innovations is during times like our current pandemic.

The most fascinating part of this article was in analyzing the growth of the *Homo sapien* brain. The idea is that the human brain has a much higher metabolic rate than the body (it requires many resources). If we only looked at steady, gradually natural selection, the metabolic rates of the body and brain would remain consistent. We wouldn't see the enormous jump that we do. This suggests that cultural processes can accelerate evolution; the cultural practice of cooking food and eating a diet of meat gave more nutrients to the brain for a lower digestive cost which allowed our brains to expand.

Additionally, this made me think of yesterday's lecture in COGS 184. With the advent of the social hierarchy, we now have home bases and groups working together. One man against an elephant is unlikely to be successful, but a team? Far more. Therefore, groups and culture can shield low fitness. By also having individuals working together, splitting up tasks for food or clothing, they may be more able to construct niches and be less impacted by changing environments (like the glaciation we spoke of). I think it was very smart and I must praise the authors for their defense of the fact that culture isn't some process independent of evolution, fitness, or the environment. Even team work, which is only possible by shared values or trust (culture), makes it possible for species to survive in vastly changing environments without the morphological adaptions, conflict with other groups, and general predation.

I have to agree with the authors in the commentaries in criticizing the lack of clarity and evidence. The authors should have been more specific in how culture impacts niche construction and therefore, its impact on evolution but also when culture does not impact. We need more granularity with this. I also with that they dove into the hominid example more. Evolution most often looks at most relative fitnesses of individuals but also between groups. Culture is mainly a human aspect and it seems difficult to measure the evolutionary impact of it when we are the only species to have it and we have only been around for a blip of time. Because of this, I would ask: how is culture truly separate than niche construction?

These ideas can be wrapped into the theory of "gene-culture convolution" that claims that evolution utilizes genetic evolution, ontogenetic processes (how information we acquire impacts our fitness), and social learning to transmit that knowledge. Niche constructing may allow species to be less affected by fluctuations in the environment or pressures faced alone which allows them to be more resistant to genetic evolution.

Both authors of "The challenge of understanding complexity" (David Sloan Wilson) and "Niche construction: A pervasive force in evolution?" (Wim J. van Der Steen) both agree with the idea that there is a feedback process between the environment and

organisms. Both criticize the paper for dismissing previous frameworks without an attempt to specify their own model.

Wilson claims that rather than develop a new model of culturally inherited niche construction, Laland et al. (2000) adapt Boyd and Richerson's theory as evidence of an alternative to MLS theories when it is an MLS theory. This theory is split into a within-group component to identify relative fitness between individuals and the overall fitness of a group in relative between-group comparisons. In the paper by Laland et al. (2000), they fail to discuss the *relative* fitness within a group as the Boyd and Richerson theory requires. Additionally, Wilson suggests that the authors need more empirical evidence or to rely on the adaptionist perspective they have dismissed. However, empirical evidence is challenging given this cultural lens as *Homo sapiens* are the only with a fossil record of culture; therefore, it would be hard to have a relative comparison across species. Finally, if culture could be seen as a "super-organism" they may be able to use an adaptionist program to develop a series of predictions given a set of cultural values.

Van der Steen also takes issue in the imprecise definitions of niche construction. While the paper defines niche construction as referring to activities, choices, and metabolic processes, van der Steen mentions that the footnote definitions counter this by defining it as a *physical process*. By emitting perceptual processes, it seems counter-intuitive to mention "choices" or ideas. Additionally, the Laland et al. (2000) paper argues that niche construction uses social learning and cultural inheritance but not how specifically those factors influence niche construction. Potentially, all examples of natural selection could count as examples of niche construction because the niche is constantly evolving because of—and changing—natural selection. Therefore, more clarity is needed. As a final note, van der Steen uses an example of dark morphs replacing light when exposed to more pollution. He suggests that this adaption decreases the threat of predation because of camouflage. However, I personally take issue with the idea that this *isn't* about a change in niche like the author suggests because a change in pollution *is* a change of the environment and modifies the fitness of species.