

## Recent Critiques of Dual Inheritance Theory

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### Books under Review

Morin, Olivier. 2016. *How traditions live and die*. New York: Oxford University Press. Hardcover \$99.00, paperback \$39.95, Kindle \$15.65

Lewens, Tim. 2015. *Cultural evolution: Conceptual challenges*. New York: Oxford University Press. Hardcover \$45.00, Kindle \$17.04.

### Abstract

The dual inheritance or gene-culture coevolution theory of human evolution was developed in the 1970s and 80s. Early work built mathematical theories derived from then-current work in human development, sociolinguistics, and the diffusion of innovations. More recently it has included a considerable amount of new empirical work. The theory has always had critics in evolutionary biology and the social and behavioral sciences. Morin's book critiques the theory from an alternate epidemiological or attraction theory of cultural evolution that doubts that imitation and adaptation play significant roles in cultural evolution. Lewens book is a wide-ranging analysis of critiques of gene-culture coevolution theory which finds most of them in error or at least not fatal to the project. His book includes a chapter on critiques based on considerations of human nature, of which Morin's book is one variant, and which he argues are faulty. That is my conclusion as well.

Keywords: Cultural evolution, dual inheritance theory, attraction theory, human nature

### *How traditions live and die*

Morin's big questions (4) for his book (hereafter *HTLD*) are "Why is there culture instead of nothing?" And "Why among humans rather than elsewhere?" Some cultural traditions are quite long-lived, although many are not. His basic argument is that for cultural traditions to persist a tradition must solve what he calls the Flop Problem and the Wear and Tear Problem. The Wear and Tear Problem is manifest in the game of Chinese Whispers in which a simple story is told by one person to another and by the second person to a third and so on down the line. Such a micro-tradition is rapidly corrupted, worn and torn by the inaccuracy of the transmission process. The Flop Problem is that no matter how faithfully we perform some micro-tradition, most such performances will be unobserved or ignored by others, ending its propagation. Morin argues that solving the Flop Problem solves the Wear and Tear Problem whereas he claims that many authors seem to think that the reverse is true. He disparages the idea that speedy, accurate imitation and teaching, which might reduce the Wear and Tear Problem, play any significant role in cultural transmission. He argues that the real work is done by ostensive communication by which he means communication which points to something, say to convey the meaning of a word by pointing to an example. He asserts that this is a soft form of inheritance in which the recipient

of the communication must do substantial reconstructive work to acquire the cultural item in question. The only way that a cultural tradition can persist for very long is for two conditions to obtain. First learners must exist in a thick network of communication such that they are exposed repeatedly to the same idea. Narrow communication chains are bound to flop. Second, a successful tradition must somehow be *attractive* to persist. *HTLD* pictures human history as a slow accumulation of traditions that are sufficiently attractive to persist for a long period of time. At the same time he disparages the idea that human history often involves the relatively gradual increase in the sophistication of technology and social organization, what many of us refer to as cumulative cultural evolution. He instead sees the accumulation of traditions as just more relatively simple traditions.

*HTLD* ends with a “strange vision: There could have been human populations just like we know them, with humans communicating and cooperating just like we do, but whose cultural traditions resemble those of modern chimpanzees” (11, 213-252). Intrinsic attractors shape cultural traditions but the essential adaptations for communicating and cooperating derive from human nature. Traditions are just an accidental byproduct of our communicating.

I had a strange vision once myself when I was eleven or twelve. I imagined the wind blew because trees waved their branches; even the grass blades did their brave little best to help. Since wind blowing and branch waving are highly correlated, I didn't see any way of disproving this hypothesis with the information I had at hand, though all the adults I mentioned it to found it strange. Subsequently, I learned in high school biology that plants don't have the analog of muscles. In university biology I learned that this is because photosynthesis generates too little energy to make such activities possible. Not until after graduate school did I understand enough atmospheric science to understand what really drives the wind. Is Morin's notion of non-adaptive culture and the importance of human nature as dubious as my waving branches theory of the wind? I think so!

The chief reason that Morin thinks that culture is an accidental byproduct is that he subscribes to the attractor or epidemiological theory of cultural change proposed by Dan Sperber (1996). In this theory, one of the main causes of attraction is universal, evolved cognitive biases. Indeed in *HTLD* this seems to be the most consequential type of attractor. Of course proponents of this theory readily admit that all sorts of local considerations shape culture as well, the idiosyncratic evolution of the vocabulary and grammar of particular languages is an example given in *HTLD*. Sound symbolism, the tendency of words in many languages to use similar sounding words to express similar ideas, is given as an example of a universal cognitive attractor.

I think that the importance of universal cognitive attractors of the kind Morin refers to is greatly exaggerated. In dual inheritance theory, the local *differences* in cultures are largely what are *adaptive* (Boyd and Richerson 1985). In theory, culture is a very good system for adapting to environmental variation in time and space. In particular, it is good for adapting to environments that vary on shorter time or space scales that natural selection on genes can easily track. Because, on the human scale, it apparently requires a very large and costly brain, culture has to more than pay this high overhead cost.

How do cultural traditions lead to local adaptations? Take diet as an example. Our closest living relatives rely disproportionately on fruit and have a limited repertoire of cultural tricks like termite fishing to extract protected resources. Humans are heavily reliant on tool-based extraction, hunting and farming for their subsistence. This leads to traditional knowledge of the natural history of local areas and specialized toolkits adapted to hunt and extract the resources of

these places. Compare two marine focused traditions, that of the Inuit and that of the Polynesians. The watercraft they deploy are very different but elegantly adapted to their environments. The Polynesian outrigger canoe is fast and allows foraging over a wide area. But it capsizes rather easily; a modest handicap because being dunked in a tropical sea is not particularly dangerous. The skin covered kayak makes use of only a small amount of scavenged driftwood and, if capsized, can be quickly flipped upright before its operator gets wet in fatally cold water. The Polynesian diet is mostly cultivated crops for calories supplemented by fish for protein. The Inuit traditionally had almost no access to plant foods and relied on eating raw meat to obtain vitamin C. The Polynesians could afford to be rather casual about shelters and clothing, whereas clever clothing and well-constructed shelters were life and death matters for the Inuit. Typhoons and droughts were serious natural hazards in much of Polynesian, against which supplies of long-lasting fermented breadfruit are stored under the supervision of chiefs. Archaeologists tell us that the Polynesian and Inuit adaptations evolved over considerable spans of time, some within the last few hundred years. We know that we cannot depend on human nature to supply us with some species wide ur-knowledge because stranded explorers and unsupported colonists often perish in environments where the well-adapted natives make a good living. If they are lucky, the natives pass along enough of their traditional knowledge to carry them over until resupply or rescue. Human “nature” contains neither detailed plans for constructing outrigger canoes and kayaks nor a sufficiently powerful general intelligence to invent them on the spot as needed (Henrich 2016).

Adaptation to local environments in time and space is thus what cultural evolution is all about (Boyd, Richerson, and Henrich 2011). During the last ice age the climate was highly variable in time, apparently more variable than in past ice ages. Anatomically Modern Humans took advantage of this variability to leave Africa and colonize Eurasia, perhaps because our superior capacity to track millennial and submillennial scale climate variation gave us a competitive advantage (Richerson and Boyd 2013). In the climatically rather stable Holocene, we have undergone two sorts of adaptive radiations. First, humans evolved a very diverse array of subsistence systems, glimpsed in the examples of the Polynesians and the Inuit. Farming systems were developed to adapt to semi-deserts and oases, poor tropical soils, the extreme elevations of the Andes and the Himalaya. Reindeer herders practice a form of pastoralism north of the Arctic Circle. 20<sup>th</sup> Century ecological anthropologists gave us excellent accounts of many of these adaptations (e.g. Steward et al. 1959). Second, beginning around 5,000 years ago, some human societies became dense enough to urbanize and urban communities began to elaborate a series of full-time specialized roles—political elites, priests, potters, carpenters, brick-makers, jewelers, merchants and the like. In the last few centuries the size and internal complexity of many societies has exploded. Not all of these changes may be sustainable in the long run, but they have all seemed desirable to their innovators and adopters at the time.

By what evolutionary mechanisms do such cultural adaptations arise? First, by accident or design people innovate. New forms of familiar tools and techniques appear. Then we seem to use a hierarchy of decision rules to acquire or discard innovations we are exposed to. If information is available on the relative performance of an innovation, that is often decisive both in laboratory experiments and in the observations of students of the diffusion of innovations. Sometimes causal opacity makes it difficult to evaluate an innovation (Harris 2012). An innovative piece of fishing gear cannot be closely observed in action and variation in fish catch is high. Here an adoption decision can be based on rules of thumb that have a better than random chance of acquiring useful innovations and avoiding useless ones. If successful or respected

fishers are using the innovation, that is a useful clue. If the majority of them are using it, that is another useful clue. These decision rules do not have to be very strong to be effective at the population level. A classic result in population genetics is that even rather weak selection is quite effective in the long run. Choice-based forces in cultural evolution have the same property. In a large population many people make adoption decisions over an extended period of time so even rather weakly adaptive learning rules act as potent evolutionary forces on the time scale of a few generations.

Morin protests against the idea that cultural epidemiologists depend entirely on cognitive factors to explain cultural evolution, arguing that they have lately branched out far beyond such factors in their search for attractors. I grant that, but they have so far failed to correct one of the greatest blunders of the cognitive “revolution,” ignoring reinforcement. The terms “learning” and “reinforcement” are absent from *HTLD*’s index. Many reinforcers are well nigh universal and partly cognitive components of human “nature.” People are positively reinforced by tools and traditions that accomplish their functions with minimum cost and effort—roofs that shed rain, pots that are not too fragile, darts that fly straight, diets that are nutritious, social systems that provide companionship and security, and art works that delight. Practices that fail to meet such standards induce innovation and a search for better options to acquire culturally. These are rather general criteria, and the means to satisfy them was, until recently, highly dependent on the local availability of resources and on historical contingency. Rice is a highly productive crop in warm wet climates, but wheat is better adapted to climates that are seasonally dry or cold. Barley is even more tolerant of drought and cold than wheat. Adaptations to locally available food resources helped shape the diverse cuisines of the world. Our gut flora and even our genes participate in the evolution of cuisines. Local adaptations are thus anything but idiosyncratic. Until attraction theorists come to terms with reinforcement they are operating without one of the most important sources of adaptation in cultural evolution.

*HTLD* has a number of other critiques about other approaches to the study of culture. For example, Morin does not think that cultures are homogeneous. He does not think that cultures are imitated faithfully and compulsively. I think he is correct on these issues. Cultures plainly vary at the individual and community level. Imitation is as strategic as possible, given an oft high level of causal opacity.

On several issues *HTLD*’s critiques are quite flawed. In Chapter 3, “The Myth of Compulsive Imitation” contrasts an alleged heavy dependence of dual inheritance theorists on compulsive imitation and strong forms of social influence on cultural transmission. Morin argues instead that humans are populations of flexible imitators. He constructs a straw man. As I sketched above, the idea that humans are as flexible and strategic imitators as possible is fundamental to the dual inheritance view. Yet, comparative experiments with chimpanzees and other apes and monkeys show that children are much more accurate social learners than our close relatives (Whiten et al. 2009, Dean et al. 2012). Experiments with preverbal infants have shown that in the first twelve months of life a rather powerful imitative capacity develops in most children (Carey 2009). Phylogenetic studies show that at least some items of culture retain signals of history for thousands of years (e.g. Walker et al. 2012). Chapter 4 of *HTLD* argues that repetition, redundancy and proliferation, based on thick diffusion chains are all that is needed to solve the flop problem, thus obviating the need for accurate imitation. Dual inheritance theorists agree that diffusion chains are important. Small populations or narrow diffusion chains will tend to lead to flops for the same statistical reason that small genetic populations lose genetic diversity (Kline and Boyd 2010). Likewise, repeated exposure to ideas or practices is important.

If positive reinforcement or other cognitive biases favor a cultural trait it is certainly more likely to persist than if they disfavor it.

If imitation is not necessary to solve the Flop Problem, why is there such convincing evidence that humans are especially good at it? If culture is not adaptive in the first place, it is a considerable embarrassment that we are such skilled imitators. If culture is generally adaptive, then the contradiction disappears. In addition to the Flop and Wear and Tear problems, human social learners have to master a large repertoire of culturally transmitted skills on the adaptive account. In addition to skills related to acquiring food, shelter, clothing, humans have to master language, social institutions, esoteric and ritual knowledge. The ability to imitate is *part* of solving the Large Repertoire Problem. The faster you can learn the meaning of a new word, the more new words per day you can learn. A lot of cultural variants require adopting them temporarily to try them out. Only if you can quickly learn how to use a new tool or recipe well enough to see if it works for you can you properly evaluate it. Certainly, experienced individuals use ostensive communication to help guide the learning of less experienced ones, and culture learners make extensive use of following eye gaze and pointing on the part of experienced individuals. Large populations and repetitive exposure to the same cultural variant are important too. *HTLD* frequently implies that dual inheritance theorists rely exclusively on accurate imitation and introduces ostensive communication, wide transmission chains, repetitive transmission as if these are novel correctives to the error of relying on accurate imitation. Dual inheritance theorists actually think that all of these factors are important to solve the Flop, Wear and Tear, and Large Repertoire Problems.

*HTLD* also takes a shot at the idea that the relatively gradual cumulative evolution of complex artifacts and social institutions is at the heart of human's success as a species. Again, if culture is not an adaptive system, then this argument must be wrong. Morin does make two points in this context that I agree with. First, throughout most of *Homo*'s evolutionary history the rate of the cumulative cultural evolution was very slow to judge from the stone tool record. This remained true even after our brains evolved to approximate modern size about 200,000 years ago. The archaeological evidence from Africa suggests that many advanced techniques did evolve between 200,000 and 50,000 years ago, but they may often have been subsequently lost and reinvented (Jacobs et al. 2008). Some evidence suggests that human populations throughout most of the history of our genus have been small (Li and Durbin 2011). If so, the Flop Problem would indeed have been severe, limiting the complexity that could accumulate in artifact traditions and social institutions. Around 50,000 years ago modern humans spread from Africa to Eurasia, human numbers began to steadily increase, and a more sustained increase in toolkit complexity began (Atkinson, Gray, and Drummond 2008). One function of the division of labor is to solve the Large Repertoire Problem—not everyone has to know everything—and large populations favor a greater division of labor. Second, Morin argues that humans gained more cultural items, not necessarily more complex ones. Fair enough, a visit to a modern kitchen appliance store will convince you of that. On offer are hundreds of simple tools, many of obscure and highly specialized function. Of course, you can also purchase in such stores quite complex ranges, refrigerators, bread making machines and the like.

*HTLD* rather briefly disputes the evidence for the gradual improvement of traditions without coming to terms with the evidence. The gradual improvement in traditional adaptations is a major tenet of dual inheritance theory, since if complex behaviors can be invented by individuals when wished or needed, then culture as a scientific concept is essentially superfluous (Tooby 2015). This evidence for gradual cumulative improvement is hardest to refute when the

improvements are dramatic and recent enough to be well documented by archaeologists and historians. Take Western European maritime technology. The expansion of the Roman Empire to France and England brought Mediterranean shipbuilding techniques to the Atlantic. As the economy of Northwestern Europe improved in the Tenth Century, shipwrights building for the Baltic and North Atlantic coastal trade began to introduce innovations to the Roman ship. These included sturdier hulls and sternpost rudders. The Baltic cog and the Scandinavian Knarr could sail in the stormy North Atlantic with reasonable safety, carrying a cargo of 20 or so tons. The Scandinavians used Knarrs to bring cattle to Greenland and to settle as far west as what is today Nova Scotia. By 1500 Atlantic shipwrights were building ships of 1000 tons. They introduced a divided sail plan with multiple sails on multiple masts and fore-and-aft as well as square sails. These ships could be equipped with cannon for defensive or offensive purposes. The sciences of cartography, piloting, and celestial navigation began a series of advances at this time. Mariners in Columbus' time could determine latitude at sea. The chronometer for determining longitude was invented in the mid 18<sup>th</sup> Century. By the middle of the 19<sup>th</sup> century, sailing ships of up to 10,000 tons were built and iron hulls and steam power were introduced. In the 20<sup>th</sup> Century, steel hulls and oil fired engines became standard and by the end of the century ships exceeding 100,000 tons were in service. The cumulative evolution of ship complexity is on display in many maritime museums around the world (Lavery 2004). Indeed, many other technology museums trace the progressive evolution of farm buildings and machinery, industrial production systems, canals and inland waterways to name a few.

Morin is quite skeptical of the idea that cultural group selection and culture-driven gene-culture coevolution can play any role in the evolution of human cooperative propensities. If humans are not compulsive imitators, how can cultural differences between societies arise and be stable enough to influence genetic evolution? Will not flexible, strategic social learners favor cultural variants that are in the interests of their genes, obviating the possibility that altruistic traits that compromise genetic fitness can ever become more than rare accidents? Since the dual inheritance theorists do indeed argue that social learners are strategic and flexible, are they not on the horns of a dilemma? The short answer is that *HTLD* does not engage with the concept of institutions. Human societies are governed by socially transmitted rules that define a set of roles and prescribe the rights and duties of people occupying those roles. Marriage is an example. All human societies have rules that prescribe roles in a kinship system and what rights and duties apply to the occupants of these roles. Marriage is a subset of the kinship system that defines the roles of husbands, wives, and their children. In most societies in the Christian tradition marriage is monogamous and is the major institution regulating the economics of reproduction and the raising of children. In matrilineal traditions, a mother's brother takes on some of the functions of husbands in the Christian tradition. In strongly patrilineal systems, women in effect marry a lineage, not just a husband. Kinship institutions are highly variable between societies and often heavily contested.

Much of what we call politics is a struggle to preserve or change institutions. Still, they often have great historical continuity; Christian monogamy has its roots in the pagan monogamy of Greece and Rome (Henrich, Boyd, and Richerson 2012). Institutions tend to be hard to change because: (1) individuals cannot unilaterally opt in or out of an institution, it takes a critical mass of people to collectively organize a new one. (2) Institutions are complex and interlocking so that changing one institution often strains others. (3) Institutional rewards and punishments tend to deter deviance. Individuals who privately detest an institution may conform to it because of these incentives. (4) Institutions are hard to acquire by diffusion. Even if another society clearly works

better than yours, it is hard to know why exactly why. Even if you have a good idea why, it is cumbersome to try out an institution to find out for sure. (5) Children seem adapted to learn social rules laid down by adults (Chudek and Henrich 2011). Although institutions vary greatly in detail, their existence is very widespread in human societies. Not learning the locally appropriate ones will impact your fitness! For these reasons cultural group selection typically falls on institutional differences between societies or other organizations like competing businesses. Institutional variation is often large, consequential in competition, and stable enough for selection to act on them. The empirical evidence that cultural group selection is important is abundant (Richerson et al. 2016).

*HTLD*'s argument is very similar to that of other human nature theorists going back to Edward Wilson's writings in the late 1970s and early 1980s (Richerson Submitted). They all hew to a conservative position regarding the tenets of the Modern Synthesis, particularly the insistence that only genes evolve in a Darwinian way, that the inheritance of acquired variation does not exist, and that phenomena like culture, to the extent that it exists at all, are proximate factors that cannot fundamentally affect ultimate evolutionary factors operating on genes. This position is muddled. Morin's argument is that evolution would never favor a cultural system that is faithfully gene-like. But in the case of the Modern Synthesis, the genetic system is portrayed as extremely faithful. Don't the arguments deployed against culture not being too gene-like also apply to genes themselves? What the dual inheritance theorists fundamentally discovered is that selection can favor a whole range of inheritance systems from very "Lamarckian" to very Mendelian in their faithfulness. Depending upon the costs of decision-making and the structure of spatial and temporal variation a population is exposed to, the impact of acquired variation on what a subsequent generation inherits should vary. In some circumstances you should do almost exactly what mom does, and in other circumstances it will be advantageous to treat what mom says as a low information prior giving the barest starting point for exploring further information via social and/or individual learning (Boyd and Richerson 1985).

I do not think that *HTLD* grapples effectively with either this theory or the empirical evidence that so strongly supports it.

### ***Cultural evolution: Conceptual challenges***

I have reviewed Tim Lewens' *Cultural evolution: Conceptual challenges* elsewhere (2016). I give a brief summary of that review here by way of contrast to Morin's book. The broad outlines of dual inheritance approach to human evolution were formulated in the 1960s and 70s and it has attracted a fair amount of critical commentary over the years. Lewens' objective is to cast a philosopher's critical eye on these critiques to see if any of them are sound. He divides approaches to understanding how culture changes as a function of time into three types: *historical*, *selectionist*, and *kinetic*. The historical approach is descriptive but largely a-theoretical and the selectionist imagines that natural selection-like processes operate on culture much as they do on genes. The kinetic theorists imagine a broader set of processes affect cultural evolution than just natural selection. The dual inheritance theory, of which I gave a sketch above, is a kinetic theory and the approach to which Lewens devotes most of his attention.

Lewens finds it easy to dismiss many complaints about kinetic theories as based on errors of understanding of evolutionary theory in general. For example, kinetic theories are not inherently progressive as some critics have argued. Nevertheless, the tendency for technical and social complexity to increase, especially over the past 50,000 years, is a phenomenon to explain. Other critics complain that attributing change to selection or fitness is vacuous since the only

way to know whether a trait is favored or disfavored by selection is to observe if it increases or decreases over time. This old complaint against Darwinian theory is wrong because both biological and cultural evolutionists are keen to understand exactly why traits increase or decrease in particular concrete cases. Evolutionary theory is not an explanation of the form of a universal natural law but rather is a framework guiding the search for explanations of concrete cases.

*Cultural Evolution* spends two chapters assessing whether dual inheritance theory is committed to a strong distinction between human nature and culture, as many critics suspect. Lewens himself is a strong critic of any strong form of human nature (Lewens 2012). The kinetic theorists in fact think that culture and genes co-evolve and co-develop in such an intimate fashion that dissecting out a gene-based human nature is impossible. Even if human nature existed, you couldn't find it!

Dual inheritance theory relies heavily on mathematical models to understand cultural evolution. Critics worry that such models are too closely tied to analogies with genes and cannot do justice to the complexity of human socio-cultural systems. As Lewens relates, the models are often deployed exactly to understand how the evolutionary properties of genes and culture differ. Evolutionists generally are keenly aware of the complexity and diversity of natural and socio-cultural phenomena. It is a very naïve modeler who confuses their necessarily simple model with the much more complex real world.

Some critics of dual inheritance theory argue that it cannot explain the role of power in human socio-cultural systems. Power and status differentials arguably influence cultural evolution and dual inheritance theorist do speak of prestige bias. A fuller account of power will depend on introducing demographic and economic considerations together cultural evolutionary ones, a project admittedly in its infancy (Turchin 2016).

Lewens argues that the differences between the kinetic theorists and the kind of Evolutionary Psychology pioneered by John Tooby and Leda Cosmides (1992) are exaggerated. This is an interesting claim in the context of this review as Morin's arguments in *HTLD* have a family resemblance to those of Tooby and Cosmides. Both are based on a strong version of the human nature concept in which genes are what really evolve and cultural evolution plays little fundamental role. I think that Lewens is wrong on this point. Tooby and Cosmides can be read as offering a quite radical critique of culture as an explanatory tool (Tooby 2015; Brown and Richerson 2014), rather similar to Morin's "strange vision."

Lewens ends with an argument favoring drawing upon all of the social and biological sciences and history to understand human evolution. Kinetic theory is a general sound enterprise but only a part of a larger enterprise. I couldn't agree more. Morin's view that cultural traditions are accidental byproducts of communication seems to lead to a much more exclusive vision of the task before cultural evolutionists. What is needed is largely an account of the mind's attractors and how they evolved to construct our behavioral repertoires. The cognitive neuroscientists that I read have a much more expansive vision (e.g. Panksepp and Biven 2012).

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