place. Reproductive success among variant forms of organisms will result primarily from selection and drift. Similarly, replicative success (Leonard & Jones 1987) among variant artifact forms will result from both selection and differences in transmission. Therefore, I cannot agree with Gould's (1996; 1997) plea that the phenomenon of cultural evolution be labeled "cultural development" rather than "evolution" because the latter carries too many biological connotations. It is precisely these connotations that it *should* carry.

Lyman and I have argued (Lyman & O'Brien 1997; O'Brien & Lyman 2000; 2002b) that archaeology today is in a period similar to that of the 1970s, when paleobiologists such as Eldredge and Gould (1972) proposed a new way of looking at the fossil record that involved some retooling of biological evolutionary theory. Despite more than a decade of squabbling, the success of their endeavors is abundantly clear. Evolutionary archaeology, too, is moving past the squabbling period, but challenges remain at both the macro- and the microevolutionary levels. Nonetheless, I suspect that within a decade we will see a modern synthesis in archaeology that will parallel what occurred in biology in the 1940s with the unification of the naturalists and the experimentalists (Huxley 1942). The basic theory requisite to archaeology, conceived of as an unabashedly historical science concerning people and their cultures, has been around since 1859, the year Darwin penned *On the Origin of Species*. The basic problem for archaeology is that Darwin did not write a theory that can be applied directly to the study of the archaeological record (O'Brien & Holland 1990). But we cannot, as Rindos (1989) put it, blame Darwin for not doing our work for us. Rather, we should heed the advice of one of the foremost archaeologists of the early twentieth century, who explained to his colleagues that:

> the sooner we roll up our sleeves and begin comparative studies of axes and arrowheads and bone tools, make classifications, prepare accurate descriptions, draw distribution maps and, in general, persuade ourselves to do a vast deal of painstaking, unspectacular work, the sooner shall we be in position to approach the problems of cultural evolution, the solving of which is, I take it, our ultimate goal. (Kidder 1932, p. 8)

Sober (1992, p. 30) pointed out that "biologists interested in culture are often struck by the absence of viable general theories in the social sciences. All of biology is united by the theory of biological evolution. Perhaps progress in the social sciences is impeded because there is no general theory of cultural evolution." Sober is correct in noting that there is no general theory of cultural evolution, but if the survey by Mesoudi et al. is any indication of the analytical landscape, then it appears that help is indeed on the way.

Darwinian cultural evolution rivals genetic evolution

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Abstract: The study of culture from an evolutionary perspective has been slowed by resistance from some quarters of anthropology, a poor appreciation of the fidelity of cultural transmission, and misunderstandings about human intentionality.

Why is it so easy to accept that Darwinian evolution characterises genetic systems but not elements of culture? Mesoudi et al. begin their welcome and thoughtful article by suggesting that biology's success relative to anthropology as a scientific discipline derives from a willingness to simplify and from the synthetic nature of the theory of evolution. An additional problem that Ruth Mace and I alluded to in 1994 is that large branches of post-war anthropology adopted the view that "facts themselves should be considered as social constructs … and much of anthropology redefined itself as an interpretive humanity rather than a science, concerned with cultural *specificity* rather than comparison across cultures" (Mace & Pagel 1994, p. 549, emphasis added).

This belief in specificity – that particular human cultural elements are each *sui generis* – suggests a reluctance to adopt functional explanations for many aspects of culture: that cultural elements serve purposes, and those purposes may promote well-being, standing, reputation, or other important social attributes that could be related to fitness. Not all elements of culture will be amenable to functional analysis, but it is a useful gambit to assume they are until shown otherwise, and to search for the common link among apparently homologous or analogous traits across cultures. Elsewhere (Pagel 1994), I have called this gambit "the adaptationist wager."

There may also be an under-appreciation and misunderstanding of the fidelity of cultural transmission. Because cultural elements can, in principle, change every generation, they are often not seen as serious candidates for study as replicators. However, language is one part of the dual-inheritance system of culture and genes that is so prominent in humans. Among the Indo-European languages, the words for *two*, *three*, *five*, *I*, and *who* each form a single cognate set across the entire language family: Every Indo-European language speaker has used a related sound for each of these meanings. Given that Indo-European probably arose as a language family about 8,000 years ago (Gray & Atkinson 2003), this translates into rates of evolution (Pagel 2000) as low as that of some genetic elements.

Because cultural elements can be transmitted with high fidelity, then perhaps where they are not, fidelity may be unimportant and not just inherently noisy. For example, we might not expect the fidelity of linguistic transmission to exceed that required for three generations to talk to each other: There is no need to invest in the replication machinery to improve on this. What we observe is that even the most rapidly evolving parts of the fundamental vocabulary of languages change slowly enough to allow communication among generations (Pagel 2000). Biologists have come to treat replication fidelity as a variable of interest in its own right. The human immunodeficiency virus has some of the highest rates of mutation (lowest fidelity) observed in a functioning replicator. Its poor fidelity may allow it to escape detection by the human immune system.

The human capacity for intentionality or goal-directedness is thought by some to undermine the study of culture from within the framework of natural selection. Mesoudi et al. demur (see also Mesoudi et al. 2004), and I would like to add that this criticism may conflate intentionality with omniscience or omnipotence. Late *Homo erectus* may have frequently wished to make fire but could not work out how to produce matches. What matters is that attempts at solving problems, whether or not underpinned by intention or goal-direction, can be placed in a list ordered along a continuum of success. If success matters, those who find their way to the top of this list will outcompete those who do not.

The existence of intentionality makes plausible the argument that horizontally transferred elements of culture can be used to study cultural adaptation. Horizontal transmission or borrowing of cultural elements is often used as a stick with which to beat those who use cultural phylogenies to study the coevolution of cultural elements. But intentionality makes it plausible to apply the research gambit mentioned at the outset: the belief that horizontally transmitted elements of culture are adopted because they serve some function. This gambit will not always pay off, such as when the element of culture has been forced upon a society, but without intentionality the gambit would be fanciful.

Human cultures seem to divide up the world as if they were so many biological species (Pagel & Mace 2004). There is every reason to believe that studying variation among these cultural groups from an adaptationist perspective will yield the same sorts of insights as it has for nonhuman organisms.

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