in view of linguistic evidence for 12 Tasmanian languages (Bowern 2012).

Moreover, dramatic innovations in Tasmania during the Pleistocene challenge the treadmill model. Even if the Tasmanians were not completely isolated, these technological and other developments began earlier and were more comprehensive than those witnessed elsewhere on the continent. This pattern, together with the Holocene disappearance of bone tools, is explicable without invoking demographic factors (Gilligan 2014).

Henrich's ethnographic contrasts with Fuegians and Andaman Islanders are revealing. He attributes the Fuegians' more substantial clothes to their alleged wider social connections (Henrich 2004). Yet the simple difference in climate due to higher latitude is sufficient to explain the difference with Tasmania (Gilligan 2007*b*). Paralleling the Tasmanians, the Fuegians nonetheless wore less clothing than their Patagonian neighbors to the north, probably for similar reasons; their cold tolerance astonished Darwin (1839). We can excuse Darwin's ignorance of thermal physiology in 1832 but not Henrich's in 2004. Similarly, he suggests that the Andaman Islanders benefited from hypothetical connections to Asia (Henrich 2006), but little evidence is discernible in historical or genetic records (Cooper 1989; Wang et al. 2011). And despite highlighting the Tasmanian paucity of clothes, he omits to mention that the technological complexity of the Andaman Islanders did not extend to clothing, which was less than that of their Asian neighbors—less even than that of Tasmanians (Cipriani 1966; Colebrook 1807; Mouat 1863; Temple 1901).

I have deeper misgivings. One is value judgement: aside from using the awkward term "maladaptive," Henrich (2004) actually states that "valuable" technologies were abandoned. The Tasmanians might have disagreed. This raises concerns about veiled ethnocentrism and the nature of the discourse concealed within evolutionary approaches to the Other (Descola 2005; Derrida 2002; Sahlins 2008), not to mention the explanatory weakness of the adaptation concept with culture (Ingold 1980) and even biology (Popper 1972). There is irony, too, in privileging social evolution while discounting biological evolution. I am bothered also by the appearance of elegant mathematics alongside inelegant ethnography. Mathematics lends a scientific "garb" (Husserl 1954), as does evolution. I note that, in their abstract, the authors refer more cautiously to the "elaboration" of cultural complexity.

Andersson and Read are generous in wanting to salvage the treadmill model, albeit in a weaker variant. If the strong version is invalid, it is not clear to me why a weaker version would be less so. Neither should it be shielded within multifactorial approaches, which can similarly have the untoward effect of covering the weaknesses of individual factors. More worrying is how the traction it has gained in the wider world may distract from more nuanced approaches that can better accommodate the interactions between biology and culture.

Michael J. O'Brien and R. Alexander Bentley
Department of Anthropology, University of Missouri, 317 Lowry Hall, Columbia, Missouri 65211, USA (obrienm@missouri.edu)/ Department of Comparative Cultural Studies, University of Houston, 3623 Cullen Boulevard, Houston, Texas 77204, USA (rabentley@uh.edu). 31 VIII 15

With their summary of debates over the role population size plays (or does not play) in the evolution of cultural complexity, Andersson and Read provide a detailed road map through the pluses and minuses of competing models that date back at least to the Enlightenment. Hume (1985 [1777]:382), for example, in response to the view of Montesquieu and others that the population of the ancient world was larger than that of the modern world (Engerman 1997), wrote, "wherever there are most happiness and virtue, and wisest institutions, there will be the most people."

In anthropology, modern debates stem from Shennan's (2001) article "Demography and Cultural Innovation," which was followed by three studies that addressed trait loss in Tasmanian toolkits over an 8,000-year period (Henrich 2004, 2006; Read 2006). Henrich (2004) argued that behavioral information—in the Tasmanian case, information on how to produce certain tools (spear throwers, boomerangs, hafted fishing spears, and so on)—can be lost through processes such as imperfect imitation of a skill (Eerkens and Lipo 2005). A population must continually compensate for this "treadmill of cultural loss" (Kline and Boyd 2010)—a Red Queen effect whereby a population runs faster and faster just to remain in the same place. Henrich's premise was that, on average, a larger population means less cultural loss. Conversely, having fewer people leads to higher rates of loss, especially of "tools that are hard to learn to make, and easy to screw up" (Henrich 2006:776).

Powell, Shennan, and Thomas (2009) used Henrich's model to propose that the explosion of cultural evolution in Europe ca. 40,000 BC, traditionally considered the signature origin of biologically modern humans, could reflect a population increase with no necessary changes in human cognition, counter to a popular view (Klein 2002; Mithen 1996). Powell and colleagues added stochastic and geographic elements to Henrich's model to show how chance clusters of local migrating groups could, by exceeding the crucial population threshold, begin to undergo cumulative cultural evolution over generations.

As Andersson and Read point out, the treadmill hypothesis is now treated as established fact in some circles. Within the last several years, however, a number of studies focused on identifying the drivers of the complexity of tool kits of farmers, pastoralists, and hunter-gatherers from various environmental and ecological zones (e.g., Collard, Buchanan, and O'Brien 2013; Collard et al. 2013*a*) have shown that risk and mobility, rather than population size, are the major factors in terms of increasing or decreasing complexity.

Clearly, as Andersson and Read argue, we cannot assume that any demonstrated correlation between population size and complexity automatically favors the treadmill model. Demography represents one among several causal factors in how population density and structure affect social learning, as recent discussions of innovation in the developing world have shown (Banerjee et al. 2013; Malakoff 2013). Social-network structure is also a crucial factor (Centola and Baronchelli 2015). The fact that innovation increases superlinearly with urban population size (Bettencourt and West 2010), for example, is partly a result of the face-to-face interaction facilitated by urban life (Pan et al. 2013) but also of how those interactions are structured through assortative mixing, organizations, and communication. In this view, one fascinating research question is how modern media and organizations, as they replaced kinship as the prime organizers of cultural transmission, affected the pace and direction of cumulative cultural evolution (Bentley and O'Brien 2015).

Andersson and Read echo two issues we have raised (Bentley and O'Brien 2011; O'Brien and Bentley 2011; see also Read 2006; Vaesen 2012*a*). One is the effect of assuming a Gumbel (as opposed to a Gaussian, say) distribution as a model for both the maximum skillfulness in a population and the skillfulness of learners who learn from that maximum. Another is exactly how role models are selected from within a population. It may seldom be the case that potential imitators can find the "best" model (Atkisson, O'Brien, and Mesoudi 2012). Alternatively, instead of imitators copying the best model with some error, each individual is copying the average skill level—averaged across individuals in the group—plus some minor learning error that is normally distributed around zero, either positively or negatively. This standard model yields a random walk in terms of the mean skill level for the group, with stochastic change that can go up or down over time (Bentley and O'Brien 2011). In addition, such a model is unpredictable, in that each random walk is unique. Thus copying the majority, where behavior is continually drawn to the status quo, could make cumulative adaptive evolution merely a matter of drift (Hamilton and Buchanan 2009). Vaesen (2012*a*) provided a more formal mathematical proof that the cultural-loss hypothesis (Henrich 2004) still holds when assumptions about the selectivity of social learning are relaxed but that cultural gain disappears when social learning is less selective, such as through conformist bias.

The bottom line is that demography is never the universal primary driver of cultural complexity. Hence the selectivity of social learning, or the "transparency" of expertise (Bentley et al. 2014), is among the crucial variables to be measured. Population size is part of this variable, but so too are social-network structures, homophily, and the media of communication. Besides, the social network is also the network of ideas themselves—the path-specific potential for complementary technologies or ideas to be recombined into novel ones (Hildalgo and Hausmann 2009).

When Samuel Johnson stated, "by seeing London, I have seen as much of life as the world can show" (Boswell 1848 [1791]:35), he was referring to both people and ideas. To turn that into an anthropological example, we could ask, "Were Paleolithic cave art traditions maintained through thousands of years through a continuous transmission chain of generations of expert artists and their apprentices, or through the cave art itself, which could have been imitated at intervals of many generations?" This is a challenging research question that invites a detailed analysis of the pathways of cultural transmission beyond the simple correlation between population size and cultural complexity.

Tim Taylor
Department of Prehistoric and Historical Archaeology, University of Vienna, 1190 Wien, Franz-Klein-Gasse 1, Austria (timothy.taylor@univie.ac.at). 19 X 15

Richerson's *Nature*-validated claim that "group size determines cultural complexity" (2013:351) puts one in mind of E. B. Tylor, writing in the preface to the second edition of *The Aborigines of Tasmania*: "That these rude savages remained within the present century representatives of the immensely ancient palæolithic period, has become an admitted fact" (Tylor in Ling Roth et al.1899:vii).

The comparison underscores the fact that Andersson and Read's article should not have been as necessary as it clearly is. While welcoming it warmly, one has also to be concerned by the growing popularity of simplistic and reductivist views of human culture—views whose genealogy goes back to the reaction against Enlightenment values that increasingly characterized ethnology during the second half of the nineteenth century. This was the same period when the fiction emerged that transmissible "units of culture" were the predominant, if not sole, form of cultural reproduction (e.g., Ratzel 1882–1891). Although Andersson and Read do not address this explicitly, it is clear that their (broadly successful) attempt to downgrade Henrich's "treadmill model" from law to a not-uninteresting speculation with possible utility in modeling some instances of cultural change is an effort also directed against a baleful reemergence of a tacit essentialism.

Tasmania is key here, as its ostensible archaeology and ethnography were referred to by Henrich in developing his original thesis (2004). He described a Tasmanian aboriginal culture, after the postglacial separation of the territory from mainland Australia, characterized by "severe" and "maladaptive losses of particular kinds of skills and related technologies" (Henrich 2004:197). For example, "despite their cool maritime climate, the Tasmanians . . . appear to have lost the ability to make cold-weather clothing—a skill that likely allowed them to weather the last glacial maximum" (Henrich 2004:198). But if this ever bothered the Tasmanians, they did not let on. Henry Ling Roth, who, with additional contributors, produced the most comprehensive ethnographic synthesis (1899), notes that the population were a source of wonder to Europeans in terms of the good health