pared to the (low-fidelity?) constructed-learning niches of nonhuman primates (Fragaszy et al. 2013). Whether such structured environments and social tolerance constitute "teaching" depends on the definition employed (Kline 2015) and contributes to the ambiguity of taxonomic distinctions between high- and low-fidelity transmission. Both Whiten (2015) and Stout (2013) stress the importance of individual learning (practice), and Bril and colleagues (Parry, Dietrich, and Bril 2014; Rein, Nonaka, and Bril 2014) have shown that even modern human knappers do not "imitate" in the strictest sense of copying particular movements. In fact, "imitation" (loosely defined as copying the means rather than the ends of an observed action) is another slippery concept (Stout 2011) that depends on the level of analysis (e.g., is a particular flake removal a means or an end?) and lends further ambiguity to the category "high fidelity." Finally, a number of recent publications have specifically attempted to diagnose the presence or absence of mechanisms like imitation and teaching from archaeological evidence (Högberg, Gärdenfors, and Larsson 2015; Shipton and Nielsen 2015; Stout et al. 2010). None of this work is decisive, but it clearly goes beyond unquestioned assumptions about social transmission. What is needed is more research effort, not a "reset" of assumptions.

Tennie et al.'s argument for individual/low-fidelity learning as a null hypothesis is motivated by the contention that high-fidelity transmission is absent from modern ape "cultures" and presumably from the chimpanzee-human common ancestor. This is a controversial position. Captive chimpanzees are known to imitate specific actions (Horner and Whiten 2005; Whiten et al. 2004) and to display conservatism (Price et al. 2009) and conformity bias (Whiten, Horner, and de Waal 2005) in socially learned tool use, leading to the establishment of stable traditions. Tragic "natural experiments" involving snare injuries to wild gorillas and chimpanzees (Hobaiter and Byrne 2010) demonstrate imitation of motor procedures despite differences in bodily capacities, and different groups of lowland gorillas maintain distinct technical traditions for eating nettle leaves, distinguished by specific actions such as folding the leaf bundle (Byrne, Hobaiter, and Klailova 2011). One of these traditions persists despite being less efficient than the alternative, and it is not a likely convergence point for individual learning. Given these known capacities of other apes, it is difficult to see why an absence of imitation should be the null hypothesis for the Early Stone Age. Such a null unduly privileges transmission mechanisms as the explanation for differences in cultural accumulation, distracting from other factors such as individual cognitive limitations (Stout 2011; Whiten, Horner, and Marshall-Pescini 2003), levels of sociability (Pradhan, Tennie, and van Schaik 2012), the internal dynamics of cultural evolution (Enquist, Ghirlanda, and Eriksson 2011; Stout 2011), or gene-culture coevolution (Morgan 2016).

More generally, I would suggest that a formal null/alternative hypothesis testing framework is the wrong heuristic for our current state of understanding. As Tennie et al. point out, we are not yet able to directly diagnose transmission mechanisms from archaeological evidence. As ethologists have discovered (Byrne 2007; Laland and Janik 2006), this leaves us with a problematic process-of-elimination approach to culture as that which is left over when all other possible explanations have been eliminated. It is logically impossible to falsify a null in this way, and the approach can be expected to reject most actual cases of culture. The island test illustrates this, because many things that are indeed learned by high-fidelity transmission would not be impossible for an individual to reinvent. Importantly, the archaeological record typically provides evidence of common, rather than rare or unique, behaviors. A less rigid, parsimony-based approach would recognize archaeological behaviors as cultural if the likely frequency of individual reinvention is insufficient to explain the behavior's observed prevalence (Byrne 2007; Stout et al. 2010). The most appropriate focus for such investigation is on specific knapping methods (i.e., imitated means), such as platform preparation (Stout et al. 2014) or debitage organization (Stout et al. 2010), rather than on the presence, absence, or morphology of archaeologically defined tool types (i.e., emulated goals). Comparative evidence indicates that the presence of high-fidelity transmission in the Early Stone Age is not an exceptional claim; exceptional evidence should not be required.

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In the last few years, some interesting works are transcending the usual typological/technological study of Early Stone Age assemblages and attempting to provide insights into early human cognition and culture from a number of perspectives that are not strictly archaeological (e.g., Morgan et al. 2015; Stout and Chaminade 2012; Whiten 2011; Wynn et al. 2011). Although I am unsure about how much new material or how many new ideas are in this paper that are not in another one recently published by the same authors (Tennie et al. 2016), I find their premises interesting and challenging. Thus, I agree that those of us interested in early human behavior should be more careful in taking for granted that cumulative cultural learning is responsible for all of what we see in the archaeological record.

The latent-solutions and island hypotheses are appealing as far as earliest Mode 1 technologies (Lomekwian and African early Oldowan) are concerned, particularly with regard to the very first records; given that, for now, no archaeological sites have been documented in the time interval between the Lomekwian at 3.3 million years ago (Harmand et al. 2015) and the earliest Oldowan at 2.6 million years ago (Semaw et al. 2003), it is tempting to picture a scenario where stone tool flaking was (re)discovered once and again by, perhaps, several hominin species. To some extent, the Oldowan record earlier than 2 million years ago, for which we have only a handful of sites,

could be interpreted in a similar manner, although it is still unclear whether the discontinuity of the early Oldowan record represents real gaps (and thus latent-solutions mechanisms could be set in motion) or whether it is just an artefact of entropy and the nature of the sedimentary record. For the Oldowan that is less than 2 million years ago, however, I find it more difficult to challenge, as the authors do, that "artifacts in the earliest archaeological record are products of culturally transmitted information." How would we otherwise explain the continuity of the record in those regions where hominins shared particular behavioral patterns over hundreds of thousands of years? The authors might reply that hive making is also patterned but is genetically rather than culturally controlled. But culture is not just an equivalent of hive making (or stone tool making, for that matter) and comprehends many other dimensions; Oldowan assemblages are characterized not only by (relatively simple) cores and flakes but also by specific raw material acquisition patterns, home range, and subsistence (normally through scavenging) strategies; such strategies are regionally variable but, on the other hand, are often quite consistent within each region through time. This all suggests to me that there must have been socially transmitted information that was passed through thousands of generations. I am unsure whether that should be called high-fidelity cultural transmission, but I am also hesitant to admit there is a latent solution for each and every decision regarding what rocks to transport and for how long, how to flake them, and how to use them on specific plant and animal resources acquired through specific subsistence strategies.

While the Oldowan record may lack the level of resolution required to explore what is genetically coded and what requires socially transmitted information, modern primates provide an excellent framework to discuss aspects arising from this paper. As an archaeologist, I shall leave to the specialists the relevance of latent solutions among modern primates. Still, I would like to learn more about how the authors explain (beyond the presence of stimulus enhancement) the existence of distinctive cultural traits that have proved to be transmitted through generations among regionally specific great ape groups (e.g., Whiten et al. 1999).

While I find a latent-solutions option compelling to consider (at least in part) for the earliest archaeological sites (some of the simplest Mode 1 lithics might be little more than conchoidally fractured rocks, and eventually we may even find out that production of conchoidal flakes through intentional stone breaking is not exclusive of our direct evolutionary lineage), we should avoid generalizations; hinting, as the authors do, that other Early Stone Age technologies, such as the Acheulean or even the Middle Palaeolithic/Middle Stone Age lithic technology, could be explained by latent solutions is, in my opinion, overstretching the argument. There is no space here to elaborate on the conceptual and motor skills involved in handaxe making or to delve into the (apparently endless) discussion on the meaning of biface morphology variability. Still, the exquisite expertise that is required for a (modern) knapper to make a Kombewa cleaver, a Levallois preferential flake, or a Tabelbala-Tachenghit handaxe is well known to archaeologists. For many years, I have attempted to raise my latent solutions and make a handaxe like the one in figure 2, with no luck so far, and I fear that, no matter how many times the authors left me on their island, I would never be able to make it.

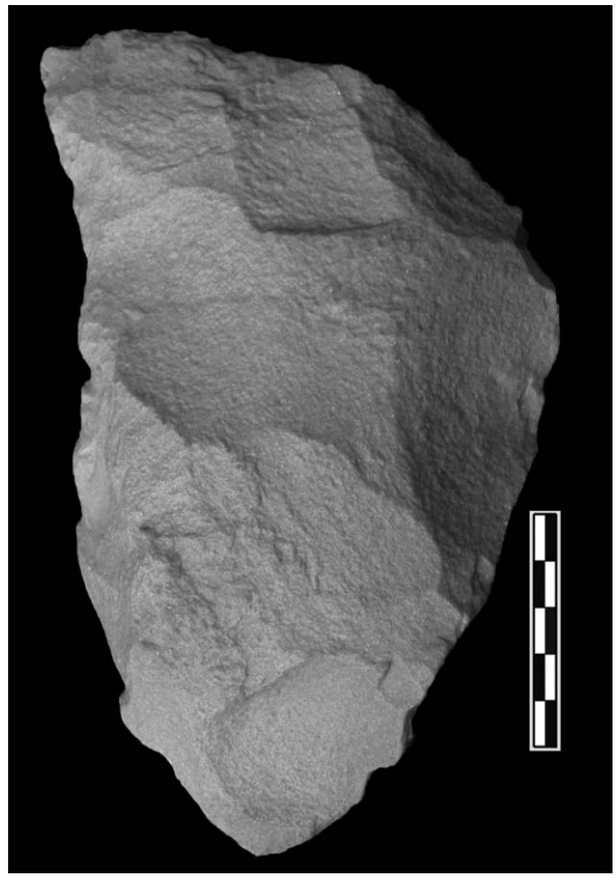

Figure 2. Tabelbala-Tachenghit technique cleaver from Tachenghit (photograph by I. de la Torre, Collection Cesar 1915, Institut de Paléontologie Humaine, Paris). A color version of this figure is available online.

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I strongly support Tennie et al.'s call for a null hypothesis to guide research into early lithic technology but suggest that the null could be more broadly stated. Instead of focusing narrowly on social learning, the hypothesis should instead be formulated in more general cognitive or behavioral terms, such as "early lithic technology was well within the cognitive capacities of apes." Paleoanthropologists would then need to