# What is cumulative culture, and how should it be tested?

A comment on Vaesen & Houkes (2020) Is human culture cumulative? Current Anthropology.

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I agree with the general point made by Vaesen & Houkes (henceforth V&H): we need more fine-grained, quantitative, cross-cultural data regarding human cumulative cultural evolution (CCE), which tracks the effectiveness or efficiency of a socially learned trait over successive generations within cultural lineages. However, I take issue with some of their specific points. V&H seem to set the evidential bar so high for CCE that it is unreachable, and define CCE in ways that do not always match the literature.

First, V&H argue that "If cumulativeness is to qualify as a general characteristic of human culture (see the quotes in fn. 1), it is not enough to show that *some* human cultural behaviors result from CCE; rather, one must show that *a large fraction* of such behaviors result from CCE.". I do not fully understand what is meant by 'a general characteristic', but I do not know of any such claim in the literature. None of the quotes in their footnote make any claims about how much of human culture must be cumulative. They simply assert that human culture exhibits the property of being cumulative in at least some instances. As V&H point out, technology is the best and most often cited example of a domain that is cumulative. Yet much of human culture is clearly non-cumulative. Cultural traits such as pottery decorations, choices of pet breeds and first names exhibit dynamics consistent with neutral drift (Bentley, Hahn, and Shennan 2004; although see Kandler and Crema 2019), which by definition is non-cumulative. Convergence on intuitive, cognitively attractive representations such as blood-letting (Miton, Claidière, and Mercier 2015) is also a common form of non-cumulative cultural evolution. In this, cultural evolution is really no different to genetic evolution, which may sometimes be cumulative, producing complex adaptations such as eyes, but is often characterised by drift. We should not expect more from cultural evolution than we do from genetic evolution.

Consequently, to demand that "a proper test" of CCE requires data "that is representative of all of the cultural-evolutionary processes that have taken place in our species" surely sets the bar unecessarily high. There is no reason to expect that all cultural evolutionary processes in our species should be cumulative, only those in which selection pressures favour increasing effectiveness or efficiency.

Second, V&H discount evidence because it comes from WEIRD samples (e.g. dismissing experiments because "all were performed on WEIRD subjects."). I am all for diversifying samples beyond

WEIRD countries (Mesoudi et al. 2015, 2016). But that does not mean we can discount evidence *because* it comes from WEIRD samples. WEIRD people are people too. V&H seem to imply that CCE must be demonstrated in every society world-wide before we can accept it as a valid concept - surely far too high a bar for an idea that emerged in the late 1990s. Most examples of CCE in the literature do indeed involve historical trajectories or samples from WEIRD countries, probably because written historical records are more readily available, and experiments more feasible, in such societies. However, Henrich (2015) and Boyd (2018) provide examples of complex technologies and customs found in hunter-gatherer and other small-scale societies that seem to exceed individual learning and are therefore suggestive of CCE. No doubt future empirical research will provide better evidence across more diverse contexts, but requiring universality seems unreasonable.

Third, V&H ignore recent evidence regarding non-human CCE. While many authors have indeed claimed that CCE is unique to humans, others have claimed to have shown CCE in non-human species. Sasaki and Biro (2017) showed how homing pigeons improve the efficiency of their route over successive generations due to repeated social learning. This exactly fits V&H's definition of CCE, requiring "individuals, across generations, [to] gradually improve their behavior, through social transmission of beneficial modifications". By their own definition, then, it has already been demonstrated that CCE is not unique to humans. Mesoudi and Thornton (2018) argued that the concept of CCE should be unpacked: we described the repeated improvement of a socially learned trait as the 'core criteria' for CCE, and identified several 'extended criteria' which may be what distinguish human CCE from that of other species (or at least pigeons).

Fourth, V&H do not present any alternatives to CCE for the technological and socio-political complexity that our species has produced. Are such complex traits instead the product of individual learning (e.g. the 'improvisational intelligence' of Pinker (2010))? Or genetically encoded responses 'evoked' by different environments (Tooby and Cosmides 1992)? Scientific progress requires testing between alternative explanations.

Fifth, V&H criticise experiments for finding that "CCE occurs in some conditions, but not in others". Yet this is not a problem. Models demonstrate how cultural complexity can be lost under various conditions (e.g. small population sizes: Henrich (2004)) or plateau due to learning costs (Mesoudi 2011). Contrary to 19th century unilinear social evolutionism, the modern concept of CCE does not

predict inevitable and unidirectional cultural change. The accumulation of cultural modifications, just like the accumulation of genetic modifications, is reversible and subject to demographic and other constraints.

Finally, the examples V&H provide from the literature are somewhat limited. V&H are correct that Morris (2013) conflates multiple cultural lineages and uses coarse-grained data subject to substantial error. But several other studies exist which track increases in effectiveness or efficiency within specific cultural lineages: Nia et al. (2015) showed that violins gradually improved in acoustic conductance over several centuries; Miu et al. (2018) showed how solutions to maths problems improved within a programming community via successive bouts of copying and innovating; several studies have traced the evolution of increasingly energy-efficient bicycle designs (Lake and Venti 2009; Minetti, Pinkerton, and Zamparo 2001; Van Nierop, Blankendaal, and Overbeeke 1997). To return to my initial point: more such evidence is definitely needed, and from more diverse sources and samples. But let's not ignore or dismiss the evidence that does exist, nor make requirements (e.g. that all human culture is cumulative, or that CCE should be unidirectional) that are not warranted by theory.

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