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Abstract

Comparing the effect of statistical distributions on the outcome of the "treadmill" model relating average skill level achieved through imitation to demogaphic factors is premature as the model incorporates an invalid assumption. The model incorrectly assumes that the imitation bias remains constant with increasing average skill level and is contradicted by data on hunter-gatherer and oceanic fishing groups showing that for these groups there is no relationship between the interacting population size and tool complexity.

Comparing the implications for Henrich's model [1] – including model modifications in [2, 3] -- of different statistical distributions for skill levels in a population is premature since Vaesen's [4] claim that the model implies "only sizable populations of social learners are able to sustain processes of technological accumulation" already depends on an erroneous, implicit assumption. That something is amiss can be seen by the fact that there is no correlation between population size or population interaction rates and tool complexity, keeping fixed the socio-economic system ([5], [6], [7], [8] for hunter-gatherer groups; [8] for Oceanic fishing groups [*contra* 9]). As Henrich now recognizes (see Supporting Materials in [8]), the Inuit groups of the Arctic had both small interacting population sizes and highly complex tools, with the latter reflecting the environmental conditions with which they coped and not their interacting population size as required by the model.

Implicitly assumed in the above quote is the assumption that transmission bias does not vary with change in the population size. However, consider a population size N in equilibrium for tool complexity: $\Delta\bar{z} = 0 = -\alpha + \beta(\varepsilon + \log N)$. The quote assumes that increase in N leads to $\Delta\bar{z} > 0$ and so there will now be "technological accumulation" and, conversely, if N decreases then $\Delta\bar{z} < 0$ and there will be technological loss, supposedly the case with Tasmania despite the fact that there is nothing anomalous about the level of tool complexity among the Tasmanians [7]. But this assumes (keeping β fixed for simplicity) that α does not increase or decrease with N. However, the role of N in the model is to increase the skill level of the target person and change in the skill level of the target person leads to change in α.

If the assumed relationship between population size and $\Delta\bar{z}$ were true, then cultural complexity would increase indefinitely: "[Henrich's] model exhibits a linear increase in cultural complexity continuing to infinity" [3]. Mesoudi [3] attempted to resolve the problem by adding an imitation cost proportional to the current mean skill level of the population. However, it is the skill level of the target that determines the transmission bias, not the average skill level of the population of imitators. As Vaesen states: "a complex skill is a skill that is difficult to learn, and hence, one that is associated with high transmission inaccuracy" [4].

For a population in which individuals have already reached their maximum skill level, merely imitating a target requiring a greater skill level than the current target will not increase their average skill level. If the imitators already have problems imitating, say, a potter making pottery objects requiring a moderate level of skill, then they will not do better merely by imitating, instead, a potter making objects requiring a higher level of skill.

If the population of imitators is already doing as well as they can when imitating a target requiring skill level z, then simply switching to a target requiring skill level $z^* > z$ will not increase the average skill level and so the transmission bias will increase by the amount $z^* - z$, hence there will be no increase in average skill level. In addition, the model assumes that skilled individuals will only be found in large populations, but even with the small population size of hunter-gatherer groups of around 500 persons, there will, on average, be at least one person whose skill level is in the top 0.5^{th} percentile, which corresponds, using IQ scores heuristically, to an IQ score of about 140; that is, to a moderately gifted individual. For the 4,000 Tasmanians supposedly not having any person with the skills needed to make a simple bone point and simple clothing, there would be one person, on average, with an IQ score of about 150; that is, to a highly gifted individual. In other words, there is no lack of highly skilled individuals even in small populations.

In sum, the claim quoted above assumes that the transmission bias α does not change with the population size (which is assumed to be the driver for the skill level of the target), ignores the fact that highly skilled individuals will be found in small populations, and is contradicted by data on hunter-gatherer and Oceanic fishing groups showing that there is no relationship between population size and/or interacting population size and complexity of tools.

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