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### Journal

PLOS One, 6(3)

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### Publication Date

2012-12-28

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# Band-Aids Versus Structural Corrections

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## Abstract

Alex Mesoudi observes that the “treadmill” model for relating average skill level achieved through imitation to demographic factors implies, incorrectly, that skill levels will increase without bound. Rather than correcting the structural problem with the model, he applies a “Band-Aid” in the form of an imitation cost to the model to force the average skill level to reach a plateau. The model, however, incorrectly assumes that the imitation bias remains constant with increasing average skill level and, when corrected, average skill level will reach a plateau even without the added cost factor.

Mesoudi [1] observes that the “treadmill” model [2] for skill imitation implies skill levels will increase without bound with “direct bias” imitation when the model parameter values correspond to  $\Delta \bar{z} > 0$  (see his Figure 3). This means that a population of  $n = 100$  naive individuals who have not yet, say, learned berry picking -- a skill we will assume, so as to use the parameter values from Mesoudi’s Figure 3, has  $\alpha = 0.2$  and  $\beta = 0.05$ ; that is, naive individuals easily imitate berry picking with little “noise” -- will have  $\Delta \bar{z} > 0$ . Therefore, the “treadmill” model implies that imitation starting with berry picking leads to unconstrained skill accumulation. The implication does not make sense, hence there may be a structural problem with the model.

Mesoudi observes that the “treadmill” model [2] for skill imitation implies skill levels will increase without bound of determining the structural problem with the model, though, Mesoudi uses a “Band-Aid” approach to make the model converge to an equilibrium value by multiplying  $\alpha$  with a cost factor proportional to the average skill level from the last round of imitating. Other Band-Aids are possible, such as a Pay Attention factor based on the tendency of an imitator to pay less attention when the target is complex, as we know from our classroom experience when the lecture topic is complex and we see the attention of our students beginning to wane.

However, we do not need Band-Aids but reevaluation of the structural assumptions incorporated in the implementation of the model. The structural problem (discussed in [3-5]) is the (implicit) assumption underlying the accumulation line in Figure 3, namely that the imitation bias,  $\alpha$ , remains constant even when the target requires greater skills for successful imitation, contrary to Henrich’s statement: “If something is easy to imitate [then]  $\alpha$  ... will be small. If something is hard to imitate ... then  $\alpha$  will be large” [2, p. 201]. The target requires greater skills as the average skill level increases since the latter implies that there will be individuals skills greater than was required for the previous target, hence the target being imitated will now require greater skills, and  $\alpha$  will also increase.

With the model adjusted to allow for an increase in  $\alpha$ , we can view it as describing a learning process that reaches an equilibrium value. With berry picking, for example, the first few rounds of imitation involve learning some skills that can be used for other tasks; that is, as a young child learns to pick berries, s(he) is learning new skills that can be applied to other, more complex imitation targets. Then, by doing these more complex instances of imitation, the child learns additional skills, and so on. The value for  $\alpha$  increases with more complex targets and the developing child will reach a learning equilibrium when the skill level of the target and his/her  $\alpha$  for that skill level leads to no increase in the his/her skill level through imitation. In other words, learning by an individual does not lead to an indefinite accumulation of skill level, but reaches a plateau. This does not preclude the cost factor that Mesoudi introduces -- previously discussed in [3] -- but the latter is not necessary to see that the imitation/learning process will eventually reach a plateau since the  $\alpha$  value increases with the complexity of the imitation target even if there is no external learning cost.

Just adding a learning cost based on the average skill level achieved in the previous round of imitation ignores the concomitant change in  $\alpha$ . Accordingly, his modification of the “treadmill” model still has the same problem of implicitly assuming that the  $\alpha$  value due to imitation process remains constant even when the target becomes more complex. It is only for this reason that his modified model still implies, as shown in his Figure 5, the average skill level will in-

crease indefinitely with  $n$ , where the increase in  $n$  is the source for a more skilled target person for imitation. However, if each of the individuals in the population of imitators has reached a plateau in her/his imitation/learning as discussed above, then introducing a target person with still greater skills -- whether through an increased population size or through migration -- will not lead to an increase in the average skill level of the population. Thus, the “treadmill” model is really a model about skill learning as part of a person’s development through learning and not, as claimed, a model for increase in average skill levels due to demographic factors alone.

That there is an interplay between population size and complexity of knowledge and/or complexity of artifacts that can be maintained in a population is evident; complex technologies have been developed that depend upon the integration of specialized labor in various subtasks for the technology to be implemented, for example. It is equally evident that technologies and knowledge can be lost when there is demographic collapse or some other stochastic event. When knowledge is the province of a few individuals, for example, the smaller the group of persons with that knowledge the more likely it is to be lost by chance failure to pass that knowledge on to other individuals. The “treadmill” model, though, does not deal with these situations.

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