

Trade-off between learning and exploitation in cumulative cultural  
evolution:  
the Pareto-optimal versus evolutionarily stable learning schedule

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ABSTRACT

Inheritance of culture is realized by social learning and improvement is realized by individual learning. To realize cumulative cultural evolution, social and individual learning should be performed in this order in one's life. However, it is not clear whether such learning schedule evolves as the maximization of individual fitness. Here we study optimal allocation of life time to learning and exploitation in a two-staged life history model under constant environment. We show that the learning schedule by which high cultural level is achieved through cumulative cultural evolution is difficult to evolve as a result of the maximization of individual fitness, if there exists trade-off between the time spent in learning and the time spent in exploiting the knowledge that has been learned in earlier stages of one's life. Such "collapse" of fully developed culture seems unavoidable if individuals can behave selfishly, e.g., less learning and more exploiting. The present study suggests that some factors like group selection, the ability of learning-while-working, or environmental fluctuation might be important for rapid and cumulative cultural evolution observed in humans.