

Evolution of learning abilities: a theoretical model

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## Abstract

The human has high ability of individual and social learning and strongly depends on both modes of learning. I study the effects of environmental change on learning abilities and the number of pieces of information learned individually (the number of individual learnings) and that learned socially by analyzing a mathematical model. I show that the number of individual learnings decreases and that of social learnings increases as environmental stability increases, and both numbers decrease as the environment becomes milder. I also show that the number of individual learnings increases as individual learning ability increases or social learning ability decreases, and that of social learnings increases as individual or social learning ability increases. The evolution of high learning abilities can be triggered when the environment changes to be severe, but high social learning ability can evolve only when high individual learning ability can simultaneously evolve.

Key words: Evolutionarily stable strategy (ESS), Convergence stability (CS), Continuously stable strategy (CSS), Environmental change, Human evolution, Enlargement of the brain