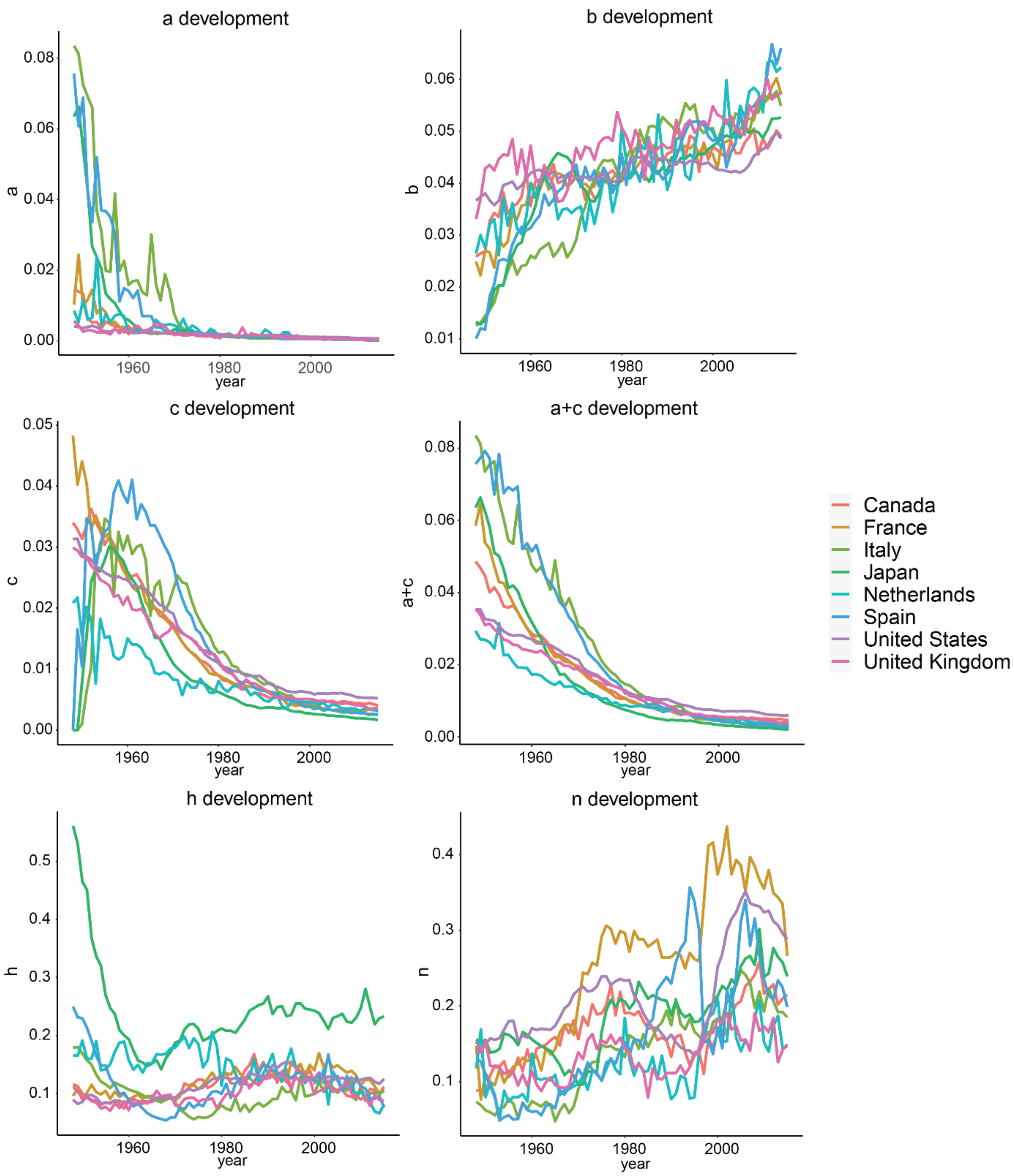
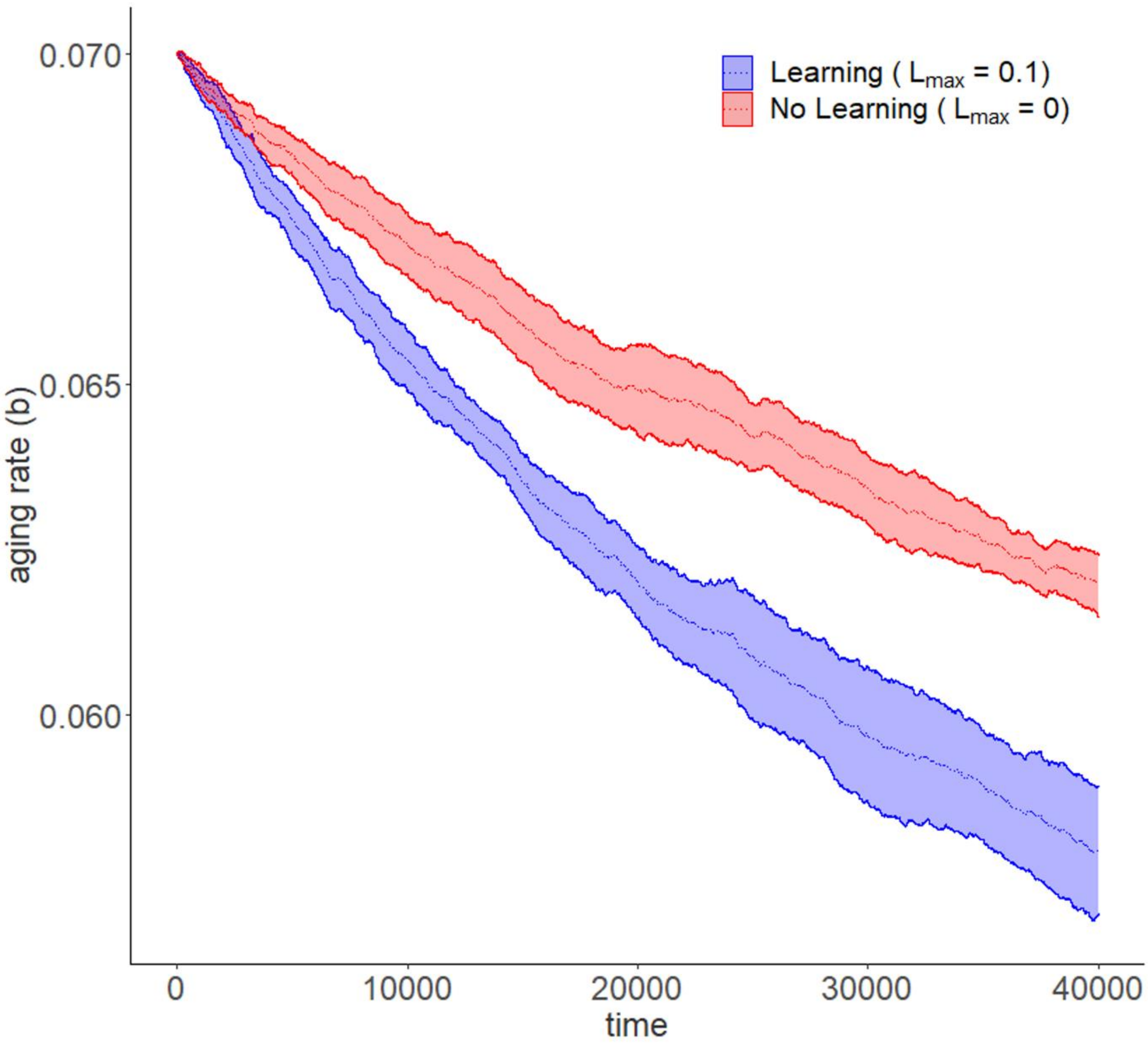
Supplementary information

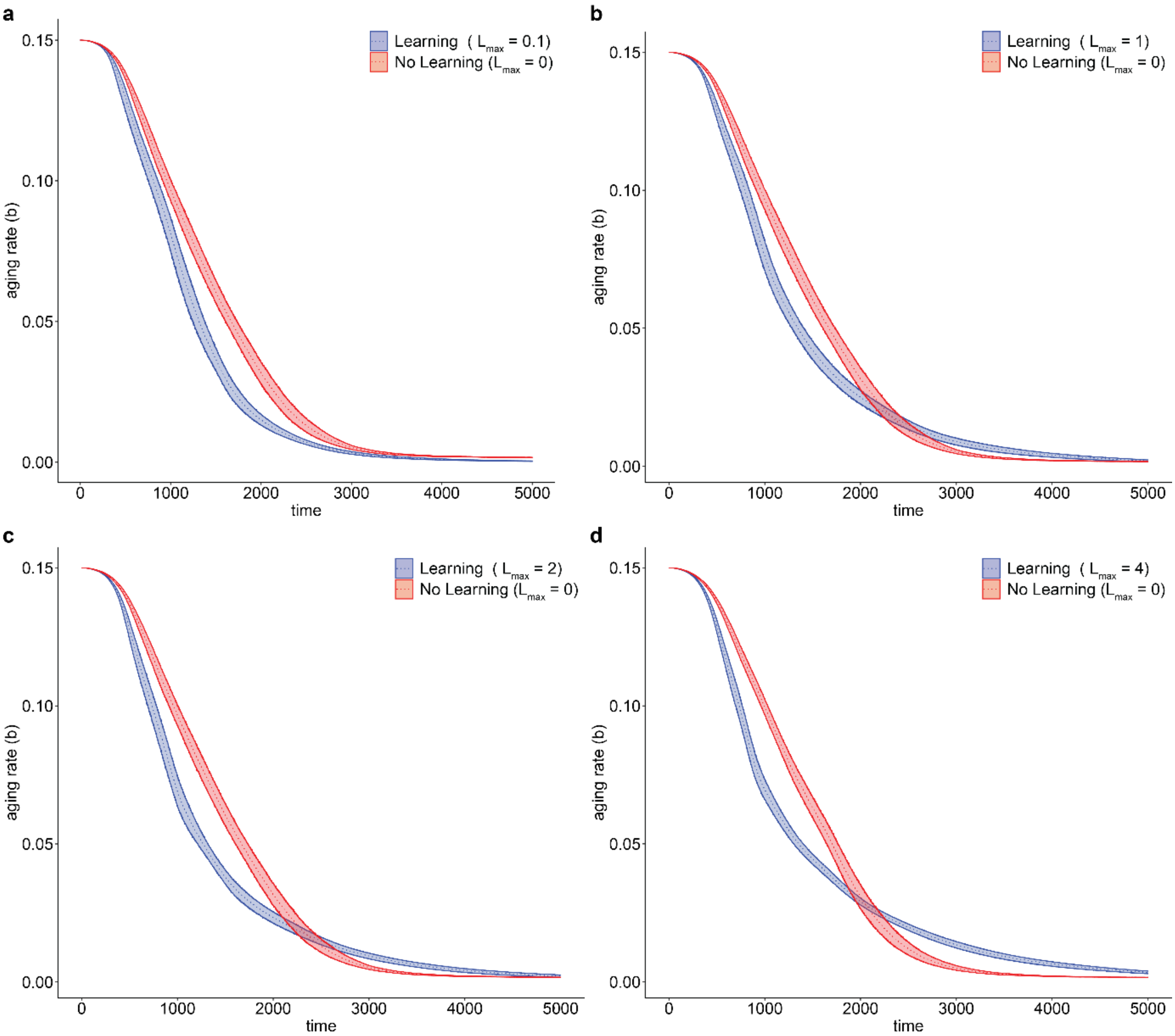


Supplemental Figure 1. Parameters of the GLA model follow systematic trends over time

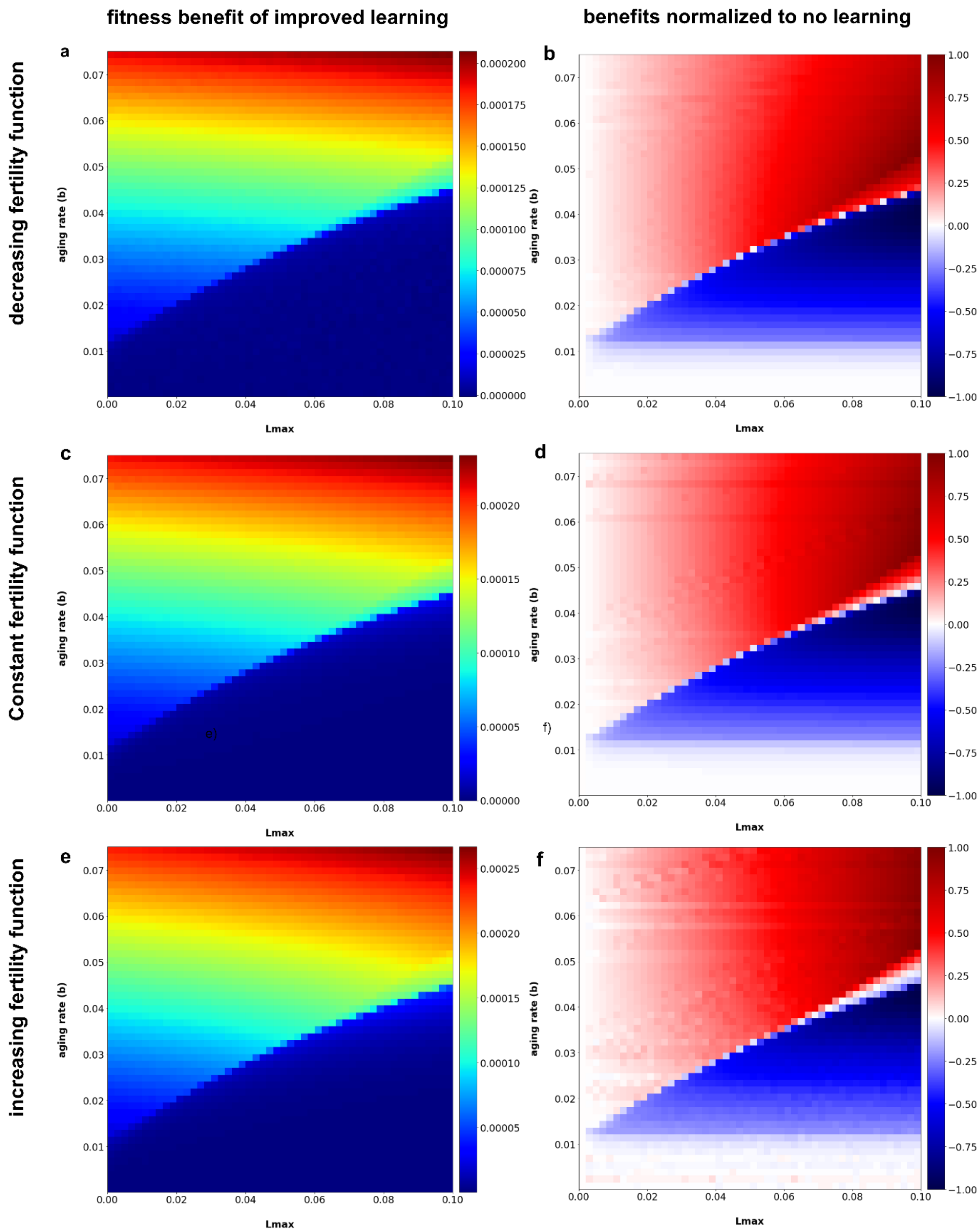
Panels show parameters of the GLA model. Colors represent different countries as indicated in the legend.



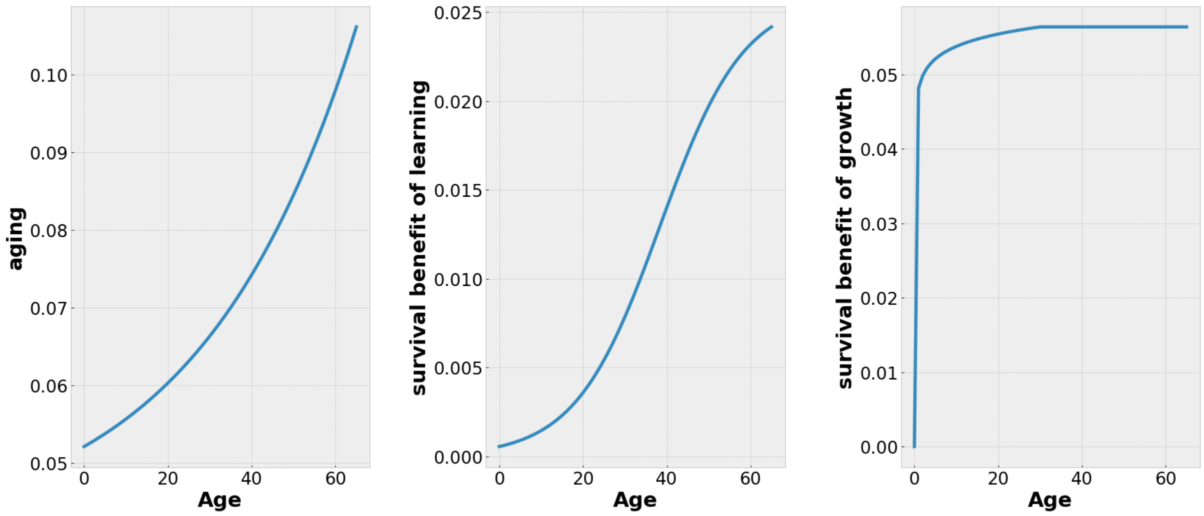
Supplemental Figure 2. Learning increases the evolution of faster aging in an agent-based model in sexual model with a linear trade-off between aging and reproduction. The trade-off was introduced by modifying the Brass Polynomial during the reproductive period to $\frac{b}{b_0} * c(x-d)(d+w-x)^2$ where b_0 corresponds to starting aging rate and b to current aging rate, i.e. there is a linear relation between the aging rate and the peak reproduction rate. All other parameters are identical to those described in the main text. Dotted line: mean of 10 simulations (10‘000 individuals each), filled area: 95% confidence interval.



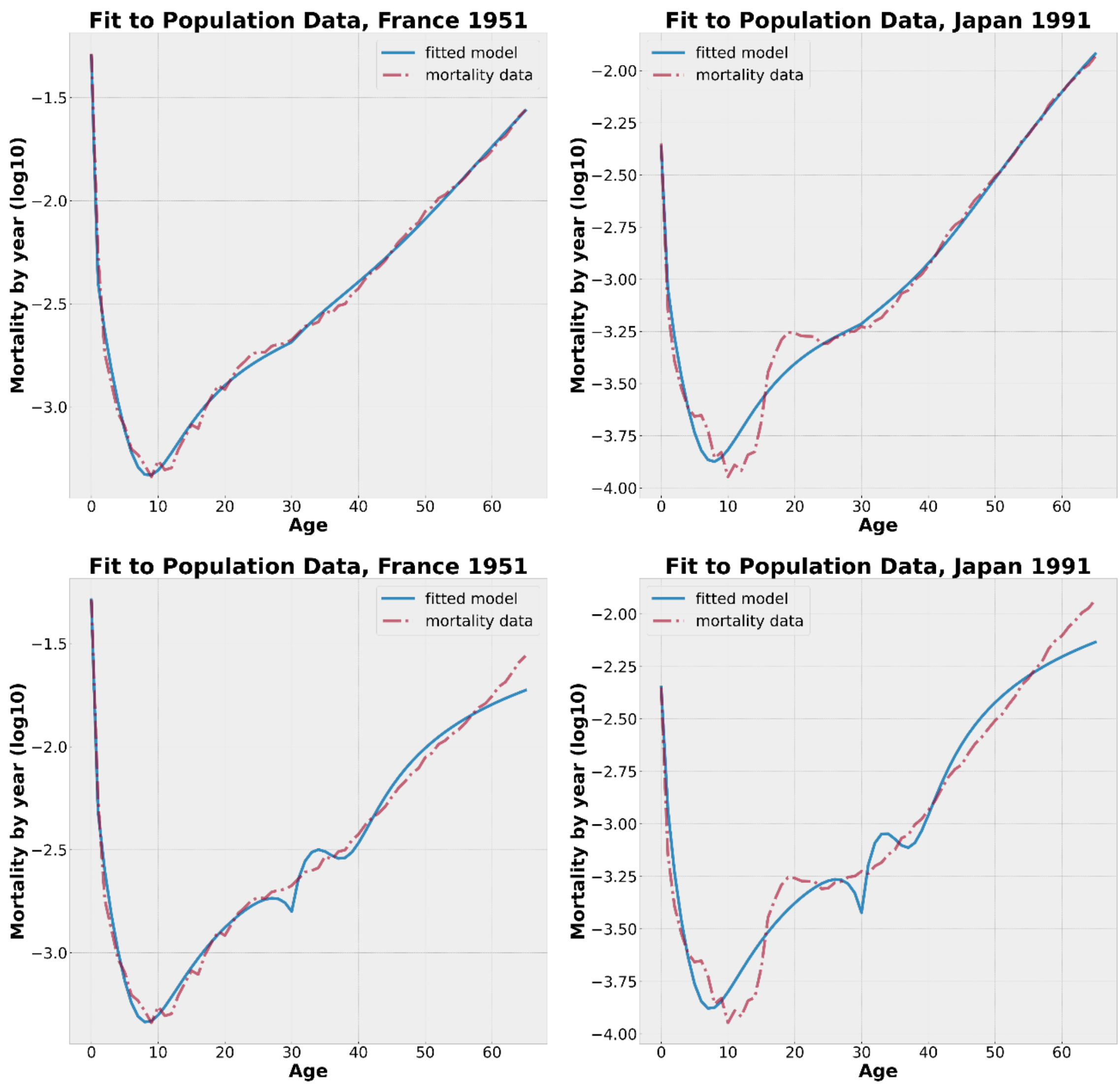
Supplemental Figure 3. Learning increases the evolution of faster aging in an agent-based model with asexual reproduction and constant population size. Agent-based simulations of evolution under the GLA model and asexual reproduction were run as described in methods with indicated values for L_{max} (blue) or $L_{max} = 0$ (red). Dotted line: mean of 20 simulations (20‘000 individuals each) Filled area: 95% confidence interval.



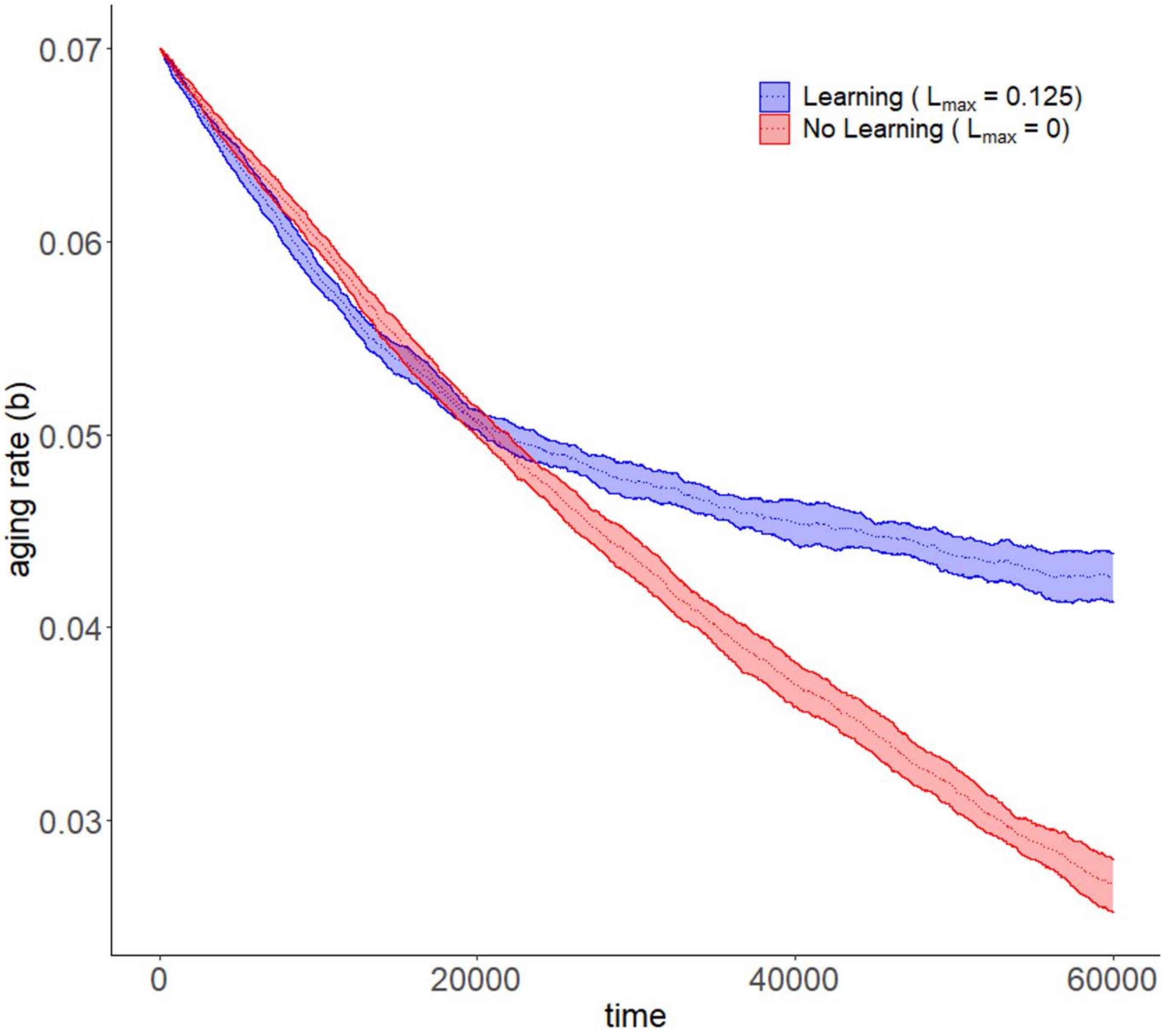
Supplemental Figure 4. Learning increases the fitness benefit of slower aging for decreasing, increasing, and constant fertility functions. a, c, e. Fitness benefit of reducing the aging rate by 1% as a function of maximal learning benefit L_{max} and aging rate b for indicated fertility functions. b, d, f. Same as a, c, e but relative to fitness benefit in the absence of aging (L_{max} = 0). The red color indicates that learning accelerates the evolution of slower aging. a, b. Fertility function decreases linearly with age ($m_x = \frac{b_0}{1+(0.05x)}$). c, d. Constant fertility function (mx = c). e, f. Fertility function increases with age ($m_x = b_0(1 + (0.05x))$).



Supplemental Figure 5 Functions used to model impact of aging, learning and growth on mortality. The panels show the shape of functions used in the model for parameters obtained by fitting population mortality data from France in 1951.



Supplemental Figure 6. GLA model is robust to the specific choice of the aging model. The two top panels show a fit of human mortality data with a version of GLA model using logistics instead of the Gompertz-Makeham function. The bottom panels show fit for the same data with a version of GLA model using Weibull instead of the Gompertz-Makeham function.



Supplemental Figure 7. Simulation behavior is robust to omitting removal of the post-reproduction individuals and growth in population size. Agent-based simulations were conducted using sexual reproduction as described in Figure 3 with two modifications: First, in the simulation shown here, post-reproductive individuals were not removed from the simulations. Second, population size was kept constant from the beginning of the simulation at 10‘000 agents. Dotted line shows mean of 10 replicates (10‘000 agents each). Shaded area represent 95% confidence interval.