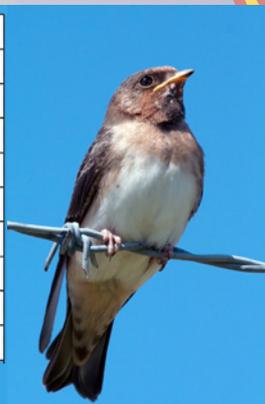
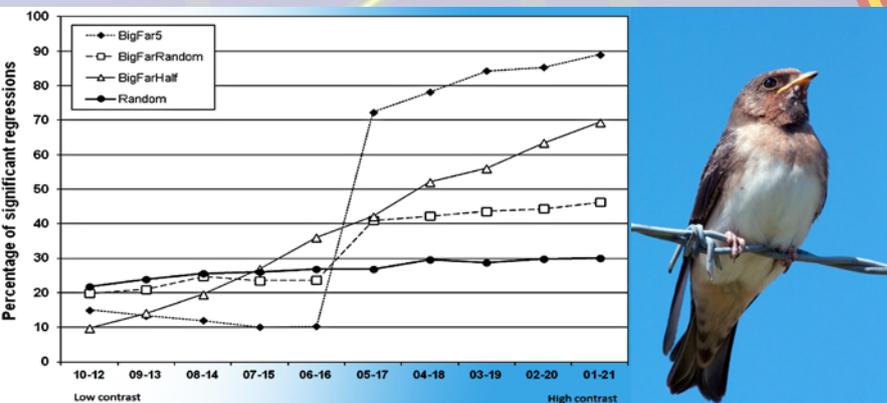


# Avoiding pitfalls in estimating heritability with the common options approach

Heritability (i.e. the heredity of differences) is a central parameter of evolutionary sciences, as evolution by natural selection or drift can only occur in traits that are heritable. However, in many circumstances, heritability estimates are subject to two potentially interacting pitfalls: the spatial and the regression to the mean (RTM) fallacies. The spatial fallacy occurs when the set of potential movement options differs among individuals according to where individuals depart.

The RTM fallacy occurs when extreme measurements are followed by measurements that are closer to the mean. It results from the fact that uncommonly large or small measurements are generally followed by measurements that are statistically closer to the mean simply because average values are far more common than extreme ones. We simulated data from the largest published heritability study of a behavioural trait, colony size choice, to examine the operation of the two fallacies. We found that spurious heritabilities are generated under a wide range of conditions both in experimental and correlative estimates of heritability. Classically designed cross-foster experiments can actually increase the frequency of spurious heritabilities. Simulations showed that experiments providing all individuals with the identical set of options, such as by fostering all offspring in the same breeding location, are immune to the two pitfalls.

Conception: G.Esteve - Other credits: Dori - Wikimedia (Cliff swallow)



Contrast in colony size ranks between birth and foster colonies: The effect of contrasts in colony size ranks between birth and foster colonies on the percentage of significant parent-offspring regressions. All simulations mimic situations of the original cliff swallow study. Recruitment was according to a random walk. Each point results from 2,000 simulations. The four regressions depicted here were significant. Standard errors are too small to be shown.

Top-right: A cliff swallow, the colonially breeding species that inspired this study