Acoustic adaptation in *Haemorhous mexicanus*: How does anthropogenic noise affect the structure of house finch songs?

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**Background**

The house finch (*Carpodacus mexicanus*) is a small bird native to Mexico and the southwestern United States that has since been successfully introduced to the East Coast. Male house finches sing elaborate songs in order to attract mates. Since these songs are learned, they can culturally evolve over time and space. The acoustic adaptation hypothesis suggests that house finches might adapt their songs so as to ensure transmission fidelity over long distances. Birds in noisy urban environments might change the average frequency and syllable structure of their songs to avoid overlapping with traffic sounds and to make their songs more easily transmissible.

**Methods**

My project aims to compare house finch songs in different geographic areas across California to see whether their songs change in different environments:

- Plot locations of males on Google Maps.
- Perform a spatial analysis to determine tree coverage, human population density, location of homes, and road density using ArcGIS software (these can act as proxies for the level of surrounding anthropogenic noise).
- Compare structure of songs using FinchCatcher software, developed by one of our lab’s Ph.D. students, Chenghui Ju.

**Research Questions**

- Do house finches modify the structure of their songs depending on the level of anthropogenic noise?
- Does the average frequency of their songs increase in noisier environments?
- What syllables do they use more often in noisier environments?
- What contributors of noise most strongly affect the structure of their songs?

**Implications**

If we find that anthropogenic noise is playing a huge role in the cultural evolution of house finch songs, there are broader conservation implications. We might start to consider ways of protecting bird habitats from noise pollution in order to protect the integrity of their cultural lineages.

Above: An example of a male HF song from Leeds, NY recorded in 1981 by the late Dr. Paul Mundinger and a modern day Google Maps image of the location where the bird was recorded. Note the tree density and nearby major roads.

Above: A house finch recording taken with low levels of background noise. B. House finch recording taken in an area with high levels of background noise (indicated by higher amplitude at lower frequencies). From Eira Bermúdez-Cuamatzi et al., 2008.

Right: A phylogenetic tree showing the evolution of human language. Culturally evolved bird lineages are likewise predicted to have a diverse and branching structure.