Interview with Clinton Francis for data viz, April 21 **call at 12:30**!

<http://rsbl.royalsocietypublishing.org/content/early/2012/07/25/rsbl.2012.0522.abstract>

🡪 You can think variation due to random changes in songs or calls, but there might actually be natural selection or sexual selection driving the change in those calls across space as well.

There’s one hypothesis that deals with bird songs in particular, but also deals with frog calls and other vocalizations: “Acoustic adaption hypothesis.” The basic idea is that songs and calls of different species should eventually change to the point that they maximize propagation—this is especially true for bird songs and frog calls that are used over longer distances—used for communication between individuals that are not right next to one another.

**Sound through environments (me: look at tree distribution map on HuffPost)**

We know something about how different sounds travel through environments. Generalizations:

\*Low freq or low pitch sounds travel much better through dense vegetation

\*High freq or high pitch are subject to scatter when hit the leaves and needles of trees.

\*When a bird is singing, the high-pitched parts of its song will not travel as far as the low-pitched parts of its song

\*You might expect these deciduous forests of the East, some of these species may have lower-pitched vocalizations than the more open spaces in the West, for example

**Sexual selection’s role**

Females are also going to be hearing and responding to the sounds they end up perceiving. There’s an interaction between the sounds that do well in an environment and what they actually can hear: “Sensory Drive”—should give rise to this acoustic adaptation kind of idea.

**Species types**

**Crow** is an interesting one because a lot of their vocalizations aren’t typically for a really long distance. You may not see as much change with environment. Interesting to see if you do see as much variation in their calls as you do in the more complex, sexual signals that other songbirds give – like goldfinches or robins.

**Eagle and mourning dove**—might not expect to see too much variation. This is because (many researchers think their calls are innate, essentially genetically engrained. Crows, too, learn many of their vocalizations when very young.

**Clinton’s Research**: Do bird species that live in very diverse environments have more diverse call repertoire? Yes, they do! One of things you can think about, if you see a lot of variation, it may not be due entirely to adaptation –in terms of genetic change—what you might be seeing is that birds are pretty good at knowing which sounds transmit well in their local environment—they’re making those adjustments to their behavior on a short-term basis. This would make sense because we have a lot of environments that are really windy at times…deciduous trees in North America… when a lot of the birds arrive and start singing, there’s absolutely no leaves on trees and by the time females are picking their mates, three weeks later, the trees have huge leaves on them. “The acoustical properties of those environments are changing pretty quickly. And it makes sense that there’s a lot of species that have some flexibility to change their songs with those changing conditions.”

**Genetic vs. Learned Songs**

In eagles and doves, which are not songbirds, the sounds that they make are thought to be genetically programmed. They don’t much flexibility in what they sound like—people did all these crazy experiments where they would experimentally deafen birds early in life and their calls would develop normally. Whereas if you did that to a songbird, if you experimentally deafen a bird, by the time it’s old enough to start singing, it’s song sounds like absolute jibberish. Certainly could still be environmentally influenced. But eagle calls not thought to be used over very long distances. It may not give the environment an opportunity to select for lower-frequency calls in really wooded areas, for example. And think about the context—A lot of eagles, they’re most often using their calls way up in the air when there’s actually nothing in the way, interfering with them to communicate with another eagle.

**Altitude where birds are found**?

**Factors that affect frequency**

Areas with low frequency noise from traffic or even running water—might expect higher frequency songs.

But in areas where there’s really strong cicada choruses, for example, you might expect birds that sing below, drop their vocalizations lower to get out of the same bandwidth as the cicadas.

**Competing for bandwidth**

-Bernie Krauss, “acoustic niche.” 1970s. “**People are starting to realize that acoustics really are a critical part to a lot of organisms’ lives and if you essentially jam up the airways, or the frequency bandwidths that they use, that’s just as detrimental as removing some kind of critical vegetation that they depend on**.” Also cutting down trees..

\*\*LOOK AT HIS ARTICLE\*\* “We can see that with all else being equal, we can see that noise does exclude a lot of these species and it tends to be the ones that are very low frequency singes.”

-**Cities filter birds for a lot of reasons**, changes in food resources, and changes in predators, changes in habitat structure and changes in noise. At least in some of these areas out in the West, and probably growing in the Marsella shale in the East with coal development, there are not many other changes in the environment.

“Sound is a really important component of their daily lives.”

\*rocky mountains and sierras—stands of conifers that are so tight that you can’t even walk thorugh them—essentialluy their branches are overlapping. Environments shoul select for lower pitched

\*Sexual selection also plays into this… females are also going to be hearding and responding to the sounds they receive. The sounds that do well in an environment. “Sensory drive.” = give rise to.

\*American Robin: more variable

\*American Goldfich:

\*American crow—aren’t typically for really long distances—may not see as much change for environment—do you see as much variation?

\*True song birds = more variation

\*Local adaptation, acoustic adaptation… distinctively different songs across space

\*We thought about how variable is the environment—across their entire ranges.. Same bird songs across a recording… maybe we’ll see a lot more variation in each individual song-

🡪 It may not be due to adaptation (genetic change). What you might be seeing which birds transmit well, they’re making those adjustments through modifications of their behavior.

\*Windy

\*Deciduous trees – seasons of leaves

\*Females picking their mates—acoustical properties some flexibility

\* Human

\*Insect noise – strong cicada noise, birds drop their frequency

\*Low frequency noise from traffic, running water (sing higher frequncy)

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\*Something that you might try—evolutionary changes in animals in response to noise and light pollution—getting citizens to go out and record

Mccally library of sound at Cornell—better about exact conditions

Filtered files?

Biological basis?

\*In eagles and in doves (not songbirds) the sounds that they make are thought to be genetically programmed. Experimentally deafen birds vs. experimentally deafen birds.

\*A lot of eagles are using their calls when they’re on the ground or on a perch—too high

\*Bernie Crause--- “acoustic niche”—acoustics really are a critical part to an organisms’ lives. That’s just as detrimental,

\*With all else being equal…

It’s a really important com