Costly Signaling

Great! So, for my presentation I’m going to be talking about a topic that I find to be extraordinarily fascinating which, as you can see, is evolution. I’m not just going to be talking about survival of the fittest, but I’ll be talking about a topic that Darwin struggled with for many years while he was developing his theory which is the presence of seemingly fitness reducing traits in animals. So, with that intro, I’m going to be talking about costly signaling and the speed of evolution.

-Sexual Selection-

The classic example of costly signaling, actually comes from Darwin. He wrote to a college in 1860, one year after the publication of “On the Origin of Species” saying, “The sight of a feather in a peacock’s tail, whenever I gaze at it, makes me sick”. The reason being that the huge, ornamented tail takes resources to grow and maintain and it makes the peacock easier prey for predators like the tiger. Darwin eventually theorized that it must be the female’s preferences that select for this huge tail in males. Interestingly, this preference for long tails isn’t unique to peahens. Malte Andersson has a famous paper in 1982 about the long-tailed widowbird where he cut off the tails of all the male birds. These are examples of signaling that increases the fecundity of the signaler.

-Costly Behavior-

However, in the natural world not all costly signals are the result of sexual selection. Another classic example is stotting in gazelles which is the behavior where gazelles jump high when threatened by a predator. At its face, this is confusing behavior because jumping high in the air slows the gazelle down and allows the predator to close the gap. Initially, the theory was that this was altruistic behavior that evolved due to group selection. The idea being that by stotting the gazelle alerts the other gazelles to the presence of the predator. However, this behavior happened after the gazelles were already running away. Amotz Zahavi, who introduced the handicap principal in 1975, proposed that instead of acting altruistically the gazelle was actually sending a signal to the predator, essentially saying, “hey look how strong and fit I am. Don’t waste your time on me, go chase someone else.” The idea here is that how high the gazelle jumps is an honest signal of its fitness. The predators, knowing that, go after the less fit individuals. This is an example of a signal that increases the viability of the signaler.

-Costly Signals in Economics-

Although the biological literature gets a lot more citations in other fields, there is an economics literature on costly signaling. Those of you who took core micro with me will remember that we studied Michael Spence’s 1973 job market signaling model. In his model, education’s primary benefit is to signal that you are a high type. In all these examples the common thread is that the signal is costly. Therefore, if a signal is displayed, we know that the signal is an honest one which informs us about the individual’s fitness.

-Grafen 1990-

This idea of the handicap principal wasn’t really accepted until Alan Grafen developed a game theoretic model in 1990 which, is pretty similar to Michael Spence’s model. His model postulates that low types have a higher marginal cost to signaling than high types which allows the high types to signal that they are indeed high types. As you can see on the graph here, the high types are emitting a signal with higher intensity.

-Getty 2006-

My favorite model so far, though, comes from Thomas Getty in 2006 which is on the screen now. He shows that it is not necessary for the marginal costs to be higher for low types in order for high types to produce a larger signal. Here the green line represents fecundity, which is basically reproductive potential, the blue lines represent viability, which is how good one is at surviving, and those two multiplied together is fitness.

\*Maybe add info before\*

\*define high medium and low types\*

\*what is KB\*

- Rodríguez-Gironés et al. 1996 -

This is a paper examines a model of nesting begging calls and they show that there can be two potential equilibria - one with signaling and one without signaling. It is thought that it is the competition between the chicks that is the key to transitioning between the non-signaling equilibria to the signaling equilibria.