Communication: Dealing with Deceit

Ethology & Behavioral Ecology

Ignoring the signal:

Recall that deceitful communication evolves to exploit already in place cooperative communication. Whenever it appears the receiver is hurt. Obviously, the best thing to do would be to discern the difference between the honest and dishonest signals. But often that is not possible for any number of reasons. From your own experience you know that a skillful lie is often very difficult to see through. So what should you do? The only strategies remaining are to either put up with the lie or ignore all signals of this type, including the honest ones. When should this happen -- in other words, when should a receiver give up entirely on a certain type of communication that has served it well, in many cases, in the past?

The answer is not simple -- one cannot make rules like give up when the lies are more common than 50% or give up when a lie is more costly than an honest communication. In fact, we are most likely talking about repeated communications and repeated chances to be exploited. What will matter then are the benefits and costs from each type of signal and their frequencies. All of these factors will matter in whether or not selection will appear that tends to cause the abandonment of a signal.

An example is with **Batesian mimicry**. In this type of mimicry, an honest signal, often that is a warning (**aposomatic**) is mimicked by another individual that is not dangerous or associated with some annoyance such as being distasteful. Thus the mimic is presenting a dishonest communication. Usually the signals are a mix of morphological and behavioral characteristics. Famous examples are in butterflies (Monarchs -- the <u>model</u>, with a color pattern that has come to be an honest signal of distaste and Viceroys -- unrelated species that mimic Monarchs and taste good) or with poisonous snakes - famously in the USA with coral snakes (aposomatic model) and scarlet king snake and scarlet snake (unrelated mimics).

Let's look at this mathematically: This example was given by Harper (in *Behavioural Ecology*, 3rd ed. J. R. Krebs and N. B. Davies eds. Blackwell Scientific Publ.). Let's suppose the following:

C = <u>cost to the receiver of the falling for a single dishonest signal</u>. We will assign it increasingly **<u>negative numbers</u>** to indicate higher and higher fitness costs for a single interaction.

B = benefit to the receiver for heeding an honest signal. We'll assign this one a positive number -- the more positive, the better the signal's benefits.

Let **f =** the frequency of dishonest signals and therefore

1-*f* is the frequency of honest encounters.

Now, there should exist a point, where an animal that does not ignore and cannot tell honest from dishonest will exactly break even. At this point the total gain in fitness of responding to honest communication should equal the total fitness cost of responding to a dishonest communication:

$$W_H + W_D = 0 \quad \text{or } W_H = -W_D$$

Let's expand this by writing expressions for the fitness consequences of a large number of honest and dishonest signals

W_H = fitness gain from honest signals = $B(1 - f)$

$W_D = -Cf$

Since $W_H = W_D$ then by substitution:

$B(1-f) = -Cf$

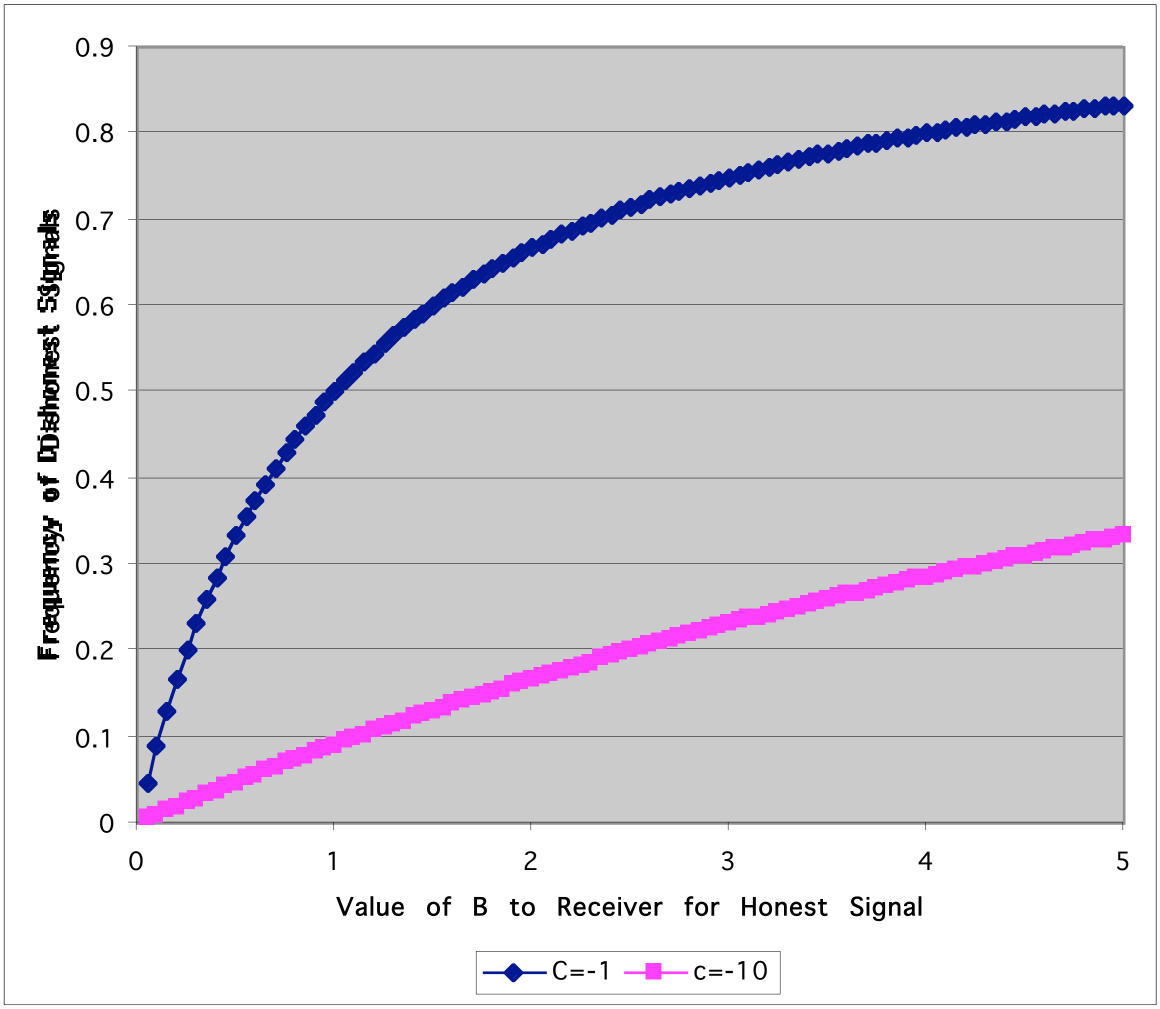
If we solve for f (since we would like to know the critical frequency for dishonesty -- the highest frequency where dishonesty will not cause a net fitness loss to animals that use the signal and can't tell lies from the truth):

$B - Bf = -Cf$

$B = f(B - C)$

$$f = \frac{B}{B-C}$$

Substitution will yield a number of results. First, let's assume that the value of C is very large compared to B, put another way, the dishonest signal is very costly in comparison with what is gained by following the honest signal. On the next page there is plot for a series of values of B where the cost is either -1 or -10:



(The lower plot simply shows the effects of much larger values of *C* relative to a given value of B)

In both cases the highest tolerance to dishonest signals will reach 0.5 when the absolute value of the cost of a dishonest signal equals the benefit of an honest one (for a single signal). However, notice that if:

- *B* >> *C* then relatively high frequencies of dishonest communication will be tolerated; by contrast
- if *C* >>*B* the opposite will be the case.

Thus, not surprisingly one would predict:

1. Dishonest signals that do little harm will be tolerated (listened to) at high frequencies.
2. If the honest signal is relatively very valuable, *i.e*., *B* >>*C*, then high frequencies of dishonesty are tolerated.
3. That if some factor keeps the frequency of the dishonest signal well below the isofitness boundary (the plots for a given *B* and *C*), one would not expect to see the evolution of behavior to ignore the signals. The pressure to ignore becomes greater as the boundary is approached and becomes critical once we pass above the line (cheaters are now just too common!).

Would ignoring the signals -- good and bad when dishonest signals are more common than the "break even" frequency be spiteful behavior? What about if below the break-even point? Explain.

Note: What we have just seen is an excellent example of a type of frequency dependent selection. We will see another type shortly when we begin to investigate game theory.

Other responses to deceit, continued

There are a number of other evolutionary (or learned) strategies that can be used when faced with dishonest signals. These include:

- Devalue the signal -- this will force honest signalers to increasingly exaggerate their signals -- either it will become too expensive and an alternative will be searched for or it will persist. This also works the same way on dishonest signalers -- they will be selected to drop out of any arms race when the benefit their receive becomes less than the cost of the signal. ***Note that this is an extension of Zahavi's idea of selection for honesty.***
- Pick new cues -- This example can go hand in hand with the previous. Look for other aspects of the signal that might allow discernment between honest and dishonest signals. However, if an arms race starts between the honest and dishonest signaler, eventually the receiver may run out of potential cues and we are left with a highly exaggerated display in the face of nearly total indifference by the receiver -- ex: many aspects of some courtship displays. Thus, not everything about courtship is honest communication!
- Probe the signaler -- Force additional "feats" beyond the signal -- very similar to devaluing the signal but this one implies adding something new, not just more of the same.
- Have a third party reveal the deceit -- Cox and LeBoeuf (1977) showed that when juvenile elephant seals try to sneak matings by acting like females that they are usually given up to the alpha male when the real females protest. Note the alpha male is the one being deceived -- the juveniles are acting like females to gain access to a stretch of the beach that the alpha male will only allow females on!

The effects of and counter measures to unintended receivers are similar to those involving deceitful communication except now they are acting on the sender. The question now comes down to either not making the signal or redesigning it in a way that is acceptable to the intended receiver but not useful to the unintended receiver.