The Evolution of Covert Signaling

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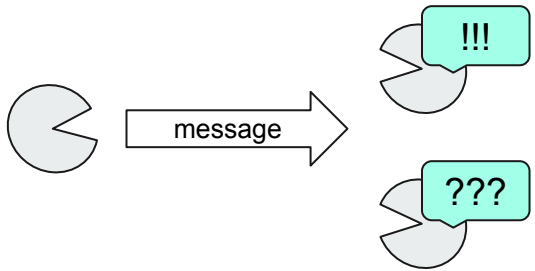
Presentation agenda

I. Introduction
II. Model Description
III. Analysis and Results
IV. Discussion

I. Introduction

Covert signaling

- “Covert signaling is the transmission of information that is accurately received by its intended audience but obscured when perceived by others.”
- E.g. “dog whistles” and inside jokes. A kind of decryption.
- Covert signaling can facilitate effective cooperation within groups
  - Allows individuals to assort on norms when possible
  - Can also help avoid conflict with dissimilar individuals when their help is necessary
- Not always advantageous



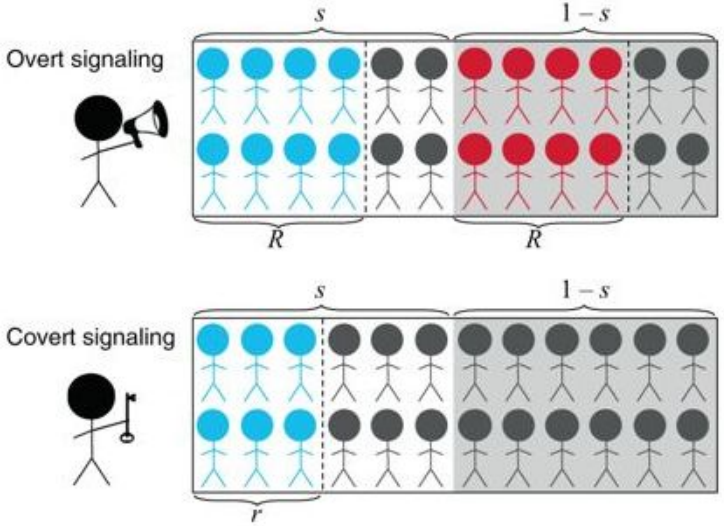
II. Model Description

Model overview

- Large number of individuals who are part of the same group, but have varying traits.
- A pair of any two individuals may be *similar* or *dissimilar* based on traits.
- Let ***s*** be the probability that any two individuals are similar.
- Model proceeds through discrete generations, each with two stages
    - Stage 1: Signaling
    - Stage 2: Interaction

Stage 1: Signaling (signal generation)

- Individuals produce a signal describing their traits; can be overt or covert.
- Overt signals
  - Explicitly signals similarity or dissimilarity to a receiver.
  - Received by a fraction R of the population
- Covert signals
  - If receiver is similar, signal received; else signal ignored.
  - Received by a fraction r of the population where r < R.
- Signaling strategy: produce covert signal with probability *p*.



Stage 1: Signaling (receiver strategies)

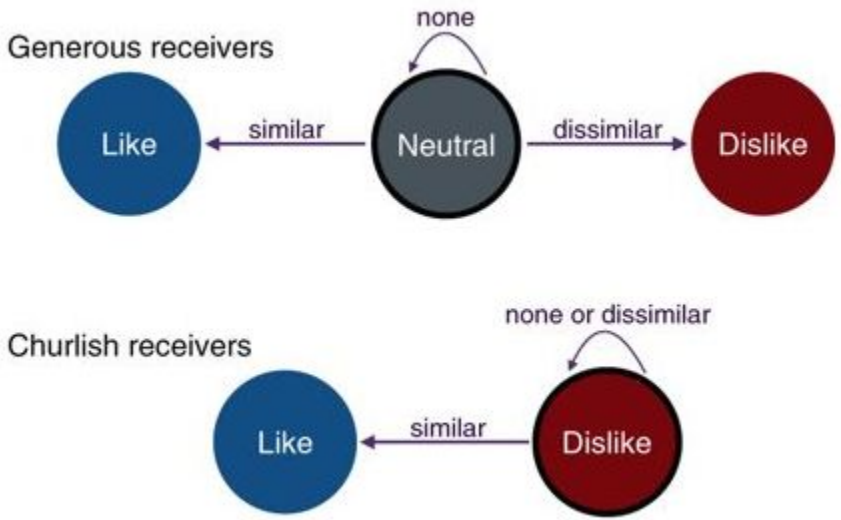
- Individuals possess one of three attitudes about each other: like, dislike, or neutral.
- A received signal has one of three states: similar, dissimilar, no signal.
- Receiver strategies map a signal state to an attitude.
- Strategy parameters, a_{XY}, indicate the probability of mapping signal X to attitude Y.

	Like	Neutral	Dislike
Similar	a_{SL}	a_{SN}	a_{SD}
None	a_{NL}	a_{NN}	a_{ND}
Dissimilar	a_{DL}	a_{DN}	a_{DD}

Note: Each row must sum to one.

Stage 1: Signaling (extreme strategies)

- **Generous receivers** default to neutral attitude in the absence of a signal.
- **Churlish receivers** dislike the signaler unless they receive a signal of similarity.



Stage 2: Interaction (dyad formation)

- Pairs of individuals now interact within one of two contexts of dyad formation: free choice scenario and forced choice scenario.
- **Free choice scenario**
  - Dyads form conditional on attitudes of both individuals.
  - Akin to choosing partners based on prior knowledge or established relationships.
  - E.g., students get to choose partners for a project.
- **Forced choice scenario**
  - Individual must seek help from whomever happens to be around.
  - Not conditional on shared attitudes.
  - E.g., two students are paired by a teacher to collaborate on a project.
  - Probably don't want to have burned any bridges with anyone.

Stage 2: Interaction (payoffs)

- Free choice scenario
  - Payoff determined by similarity of the dyad.
  - Similar dyads receive payoff of 1. Dissimilar dyads receive payoff of 0.
  - Probability of individuals being chosen for a dyad are positively weighted if one likes the other and negatively weighted if one dislikes the other.
- Forced choice scenario
  - Payoff depends on attitudes.
  - Baseline payoff is 1 for both individuals. If an individual in the dyad doesn't like the other, payoff is reduced.
  - Dyads are formed at random.

III. Analysis and Results

Motivating hypothesis:

“... covert signals can proliferate because they allow sufficient assortment in the free choice context and also reduce being disliked in the forced choice context.”

Conditions that favor covert signaling

1. Covert signals require a sufficient proportion of individuals to default to neutral attitudes. If everyone defaults to disliking each other, there's no benefit to covert signaling.
2. Covert signals require that the cost of being disliked in the forced choice context is sufficiently high.
3. Overt signalers cannot have too large an advantage in the free choice context.

Evolutionary dynamics

- A rare, invading strategy may increase in frequency if its payoff become higher than common strategies.
- Gradients are defined for both signaling strategies and receiver strategies, which control strategy changes.
- In the forced choice context, the free choice context, and a combination of both, these gradients allow the conditions for signaling strategies to be analyzed.

Dynamics of the forced choice context

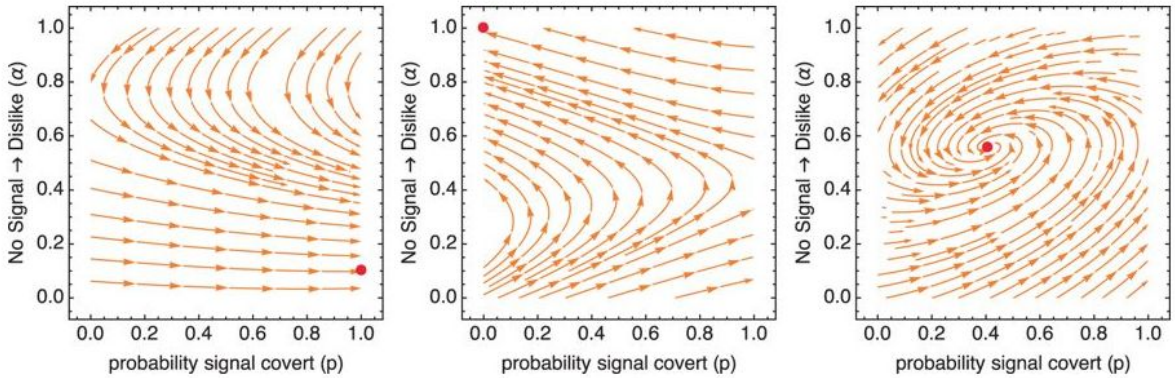
- Incentives favor covert signaling because such signals are better at avoiding being disliked.
- This advantage depends on receivers not defaulting to *dislike* attitude when no signal is perceived (otherwise there is no point in being covert), which is the churlish receiver strategy.
- Receiver incentives always favor generous receiver strategies as long as there is some punishment incurred when an individual dislikes the other in a dyad.
- Therefore covert signaling is always optimal in this context.

Dynamics of the free choice context

- In this context, attitudes influence assortment, but do not influence payoffs.
- Overt signaling is favored because it increases assortment (i.e., makes it easier to discriminate similarity).
- Receiver incentives favor churlish strategies because this also increases assortment with similar individuals.
- Strength of these incentives depends on variance of similarity, s(1 - s). More variance means bigger advantage of efficient assortment.

Joint dynamics: When do covert signals evolve?

- Three characteristic regimes emerge when both contexts matter equally:
  - 1) covert signals invade and are evolutionary stable
  - 2) overt signals invade and are evolutionary stable
  - 3) a mixed equilibrium exists at which covert and overt signals coexist



IV. Discussion

Summary

- Covert signaling is favored in forced choice scenarios when the cost of being disliked is high.
- If individuals change over time, covert signaling may also help in maintaining relationships as individuals become dissimilar.
- In more complex societies, covert signaling may aid social cohesion.
- Relevance to political psychology: conservatives may favor churlish strategy leading to overt signaling whereas liberals may favor generous strategy leading to covert signaling.
- Future work may allow covert signals to be decoded by some not in the intended target audience according to some probability.

“In a population where individuals vary and burning bridges is costly, overtly announcing precisely where one stands entails venturing into a zone of danger. Covert signaling, as in the case of humor or otherwise encrypted language, allows individuals to effectively assort when possible while avoiding burned bridges when the situation calls for partnerships of necessity.”

Questions?