MIMICRY IN LINGUISTIC EVOLUTION

A LOTKA-VOLTERRA MODEL OF THE EVOLUTIONARY DYNAMICS OF COMPOSITIONALITY MARKERS

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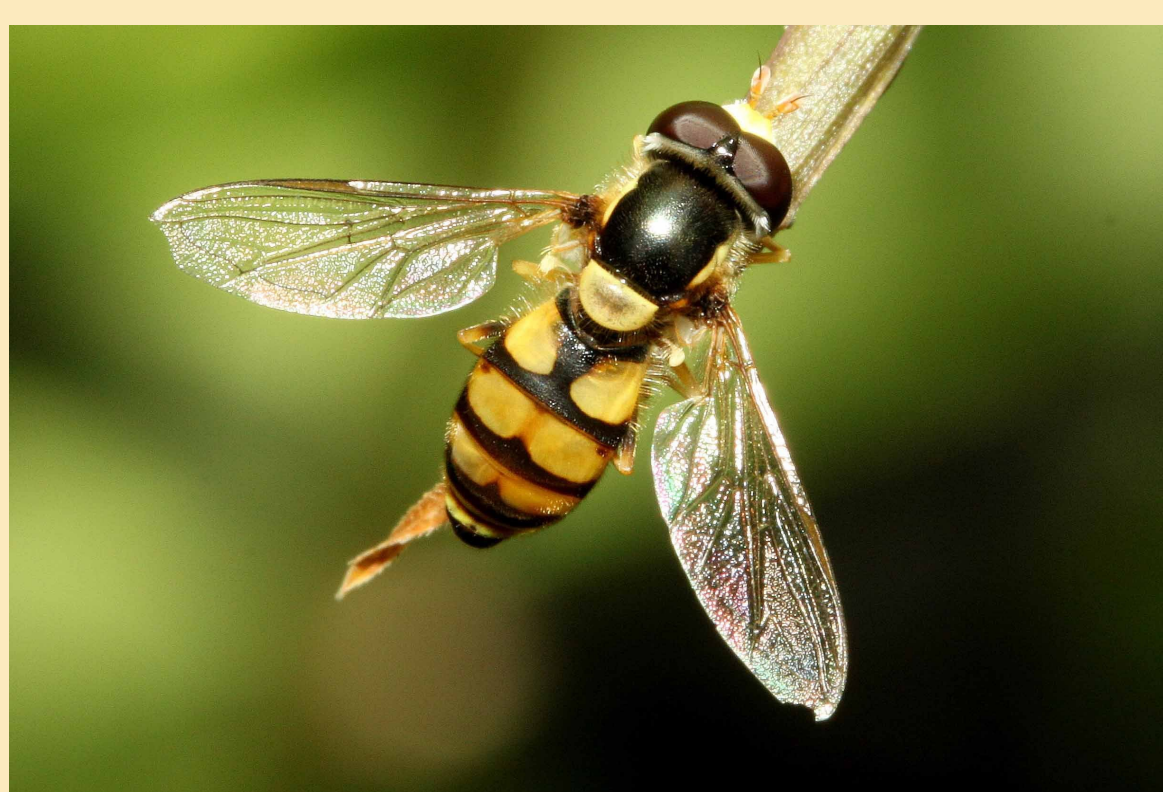Ambiguity should not be selected for in semiotic systems. But why does it sometimes still occur?
A story about consonant clusters, morphological complexity, and mimicry.

Biological Mimicry
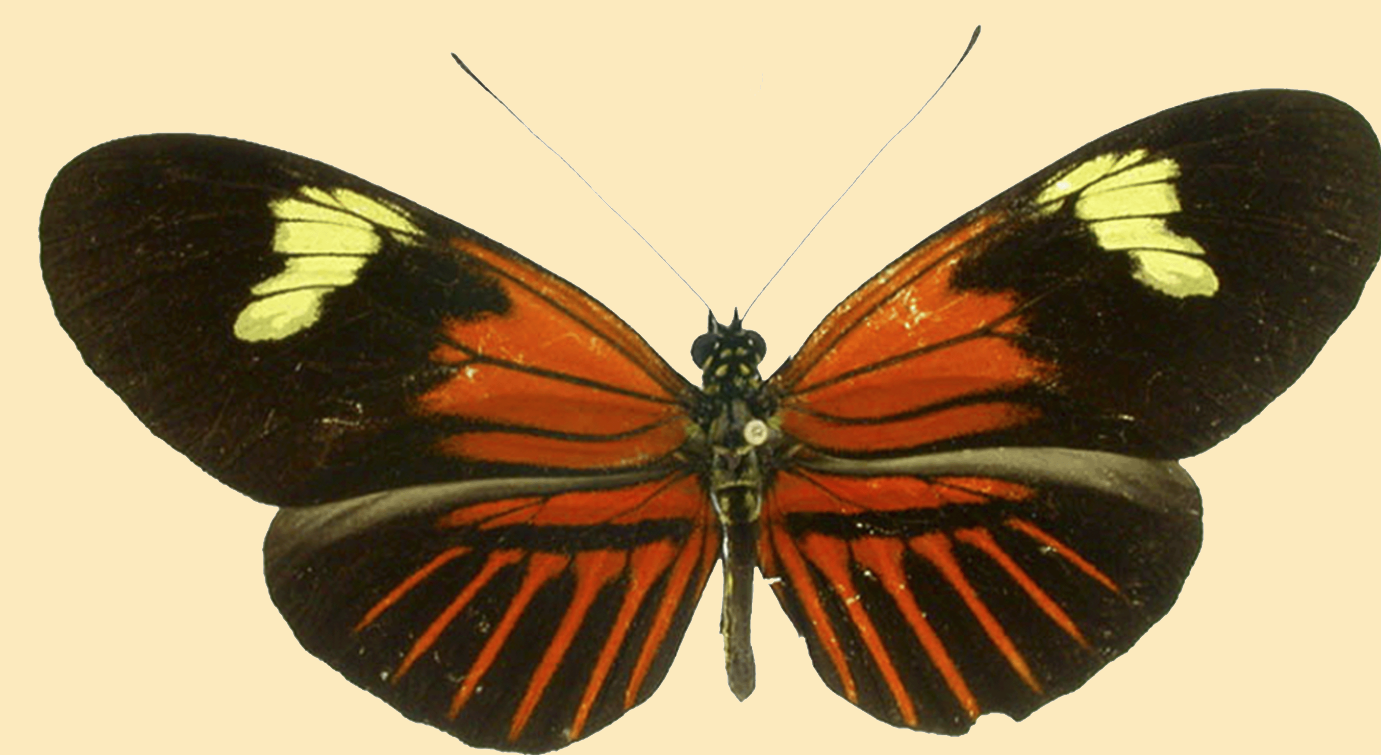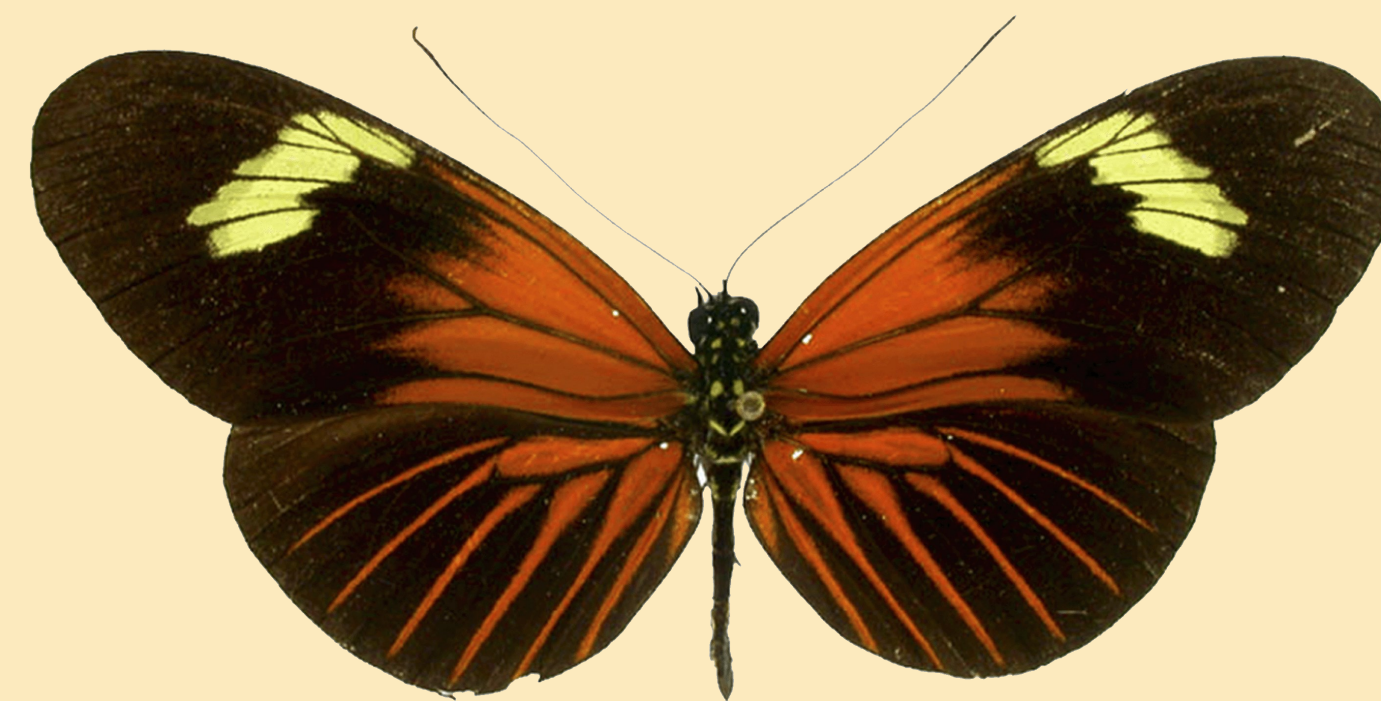
Batesian Mimicry

1a. The model: Wasps signal their poisonousness via colour patterns.

1b. The mimic: Hoverflies, among other species, imitate colour pattern to feign model's characteristics.

Model's signalling function decreases with the number of mimicing species.

Müllerian Mimicry

2. Two types of Heliconius butterflies mimic each other to confuse predators.

Both species support each other. An equal number of mimics and models is expected to be optimal.

Linguistic Mimicry

$$[\text{sʌɪ}\textbf{n-d}]$$

COMPLEX. The cluster [nd] stretches a morpheme boundary between the base *sign* and the suffix *-ed*, and consequently functions as a compositionality marker signalling morphological complexity.

$$[\text{fʌɪ}\textbf{nd}]$$

SIMPLE. The cluster [nd] occurs within the morphologically simple form *find* and thus does not function as a compositionality marker.

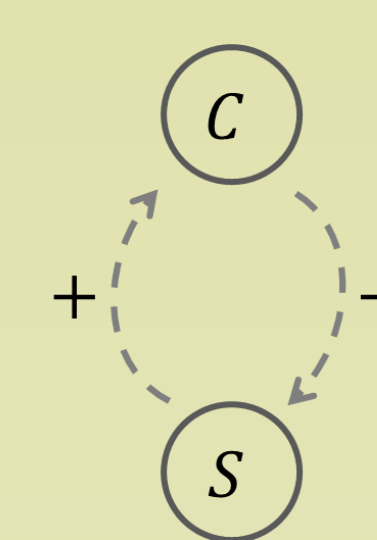### Some facts about consonant clusters

- function as compositionality marker by signalling both word and morpheme boundaries
- abundantly produced by schwa loss in the Middle English period
- typologically rare and phonotactically marked
- dispreferred articulatorily and perceptually
- frequently subject to phonological repair processes such as consonant deletion or schwa epenthesis

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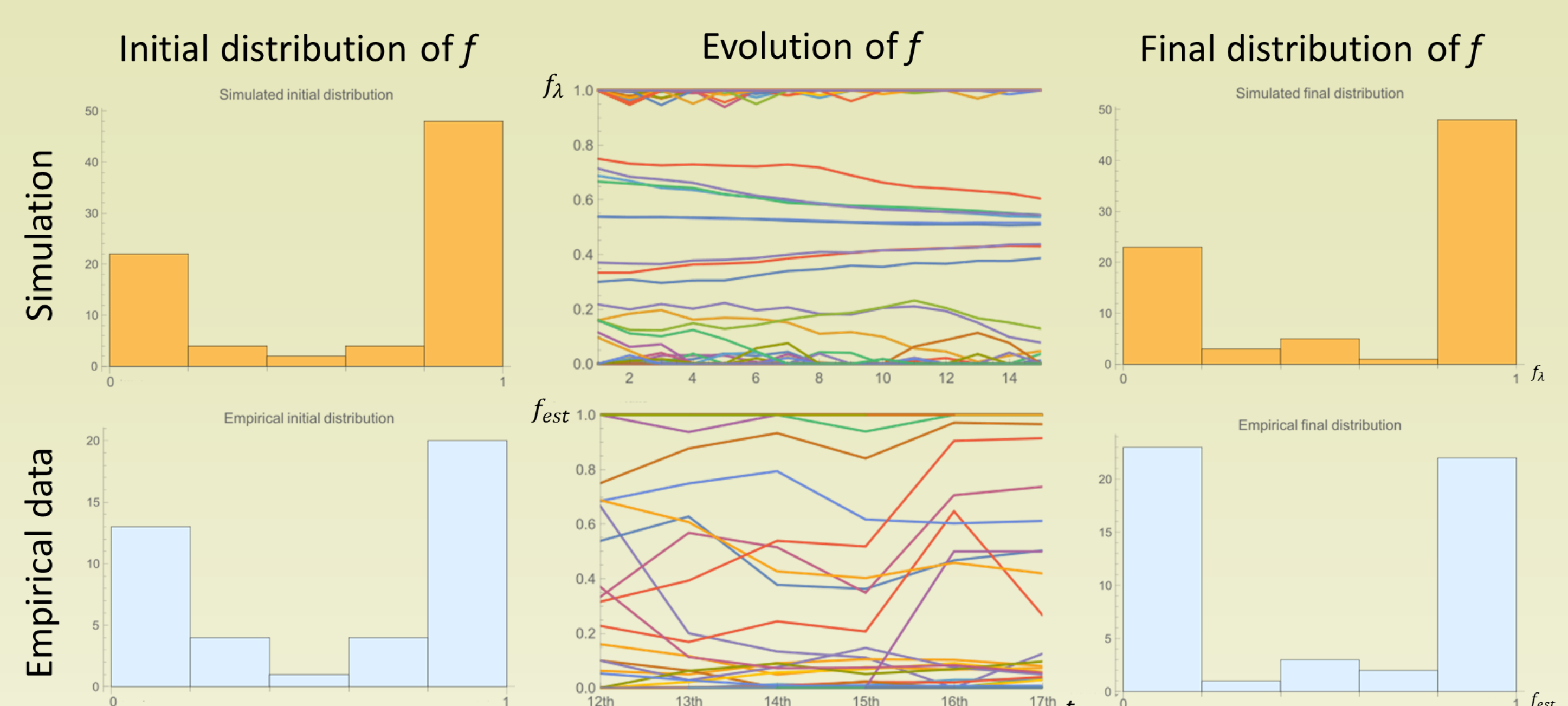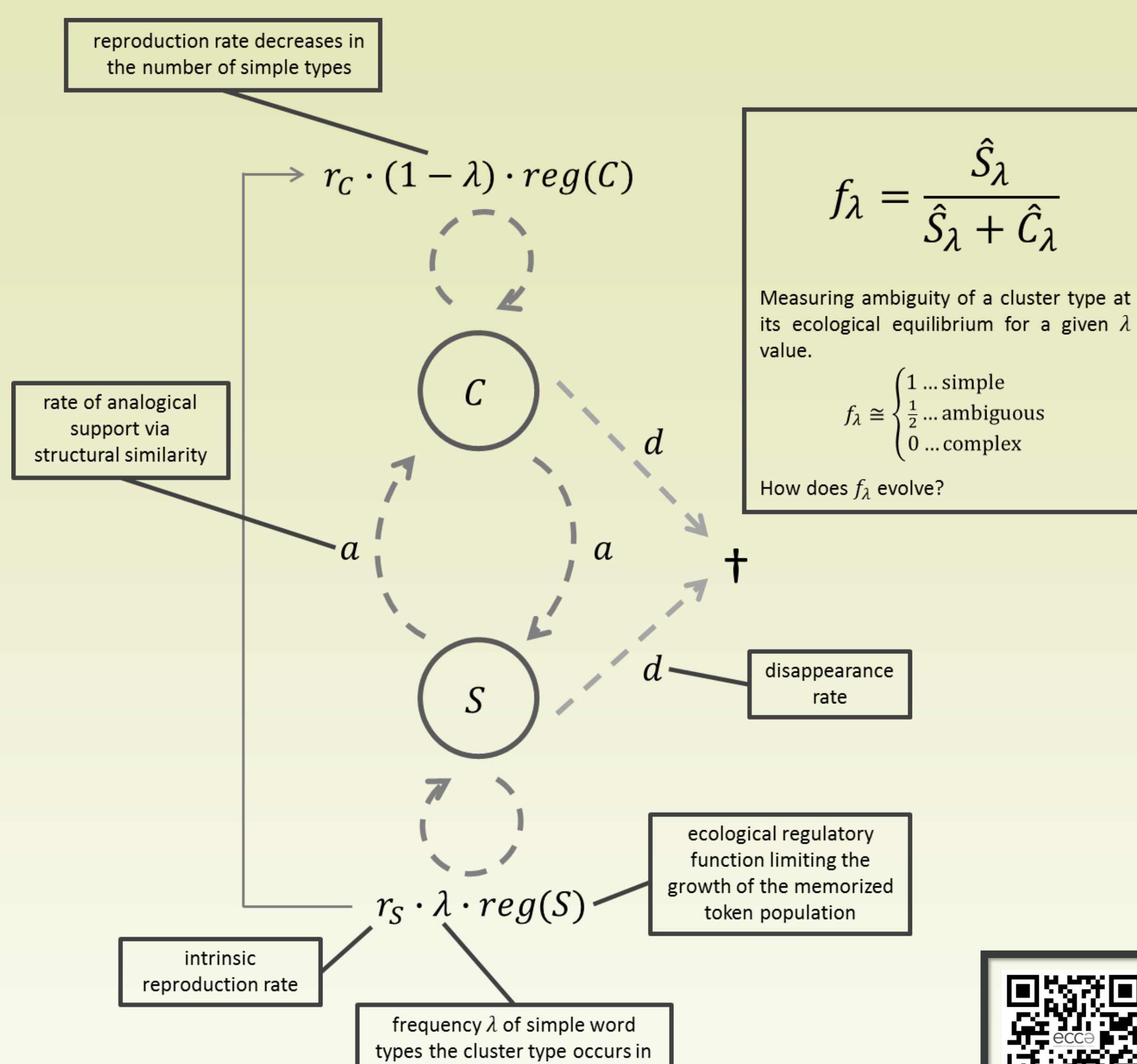## Linguistic compositionality markers show features of Batesian and Müllerian Mimicry

Signalling function of compositionality markers decreases with amount of simple forms. They become more ambiguous the more often structurally similar forms appear in a simple item.
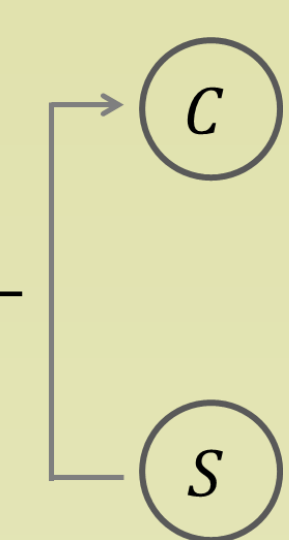
Clusters in simple forms and complex items benefit from each other because of structural similarity (through structural priming and analogy).

How does ambiguity of compositionality markers evolve? A modelling approach:

reproduction rate decreases in the number of simple types

$$r_C \cdot (1 - \lambda) \cdot reg(C)$$

rate of analogical support via structural similarity

$$f_\lambda = \frac{\hat{S}_\lambda}{\hat{S}_\lambda + \hat{C}_\lambda}$$

Measuring ambiguity of a cluster type at its ecological equilibrium for a given λ value.

$$f_\lambda \cong \begin{cases} 1 & \text{... simple} \\ \frac{1}{2} & \text{... ambiguous} \\ 0 & \text{... complex} \end{cases}$$

How does f_λ evolve?

disappearance rate

$$r_S \cdot \lambda \cdot reg(S)$$

ecological regulatory function limiting the growth of the memorized token population

intrinsic reproduction rate

frequency λ of simple word types the cluster type occurs in

Outline of a cooperative two-dimensional Lotka-Volterra system. Equilibrium densities depend on the evolving parameter λ, which changes if cluster-repair processes are at work in lexical items (see consonant-cluster fact box).

Initial distribution of f

Simulated initial distribution

Empirical initial distribution

Evolution of f

Final distribution of f

Simulated final distribution

Empirical final distribution

Simulation

Empirical data

The interaction of supporting and inhibiting effects leads to stable disambiguated as well as ambiguous configurations.