Cognitive evolutionary linguistics

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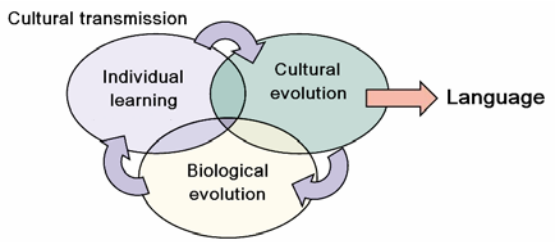
Cultural and biological evolution

- Languages as we know them: product of interacting processes at 3 time scales

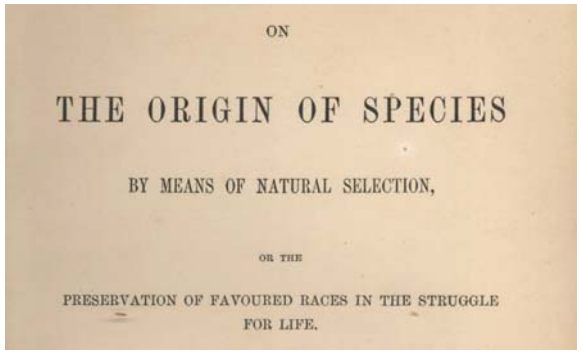


Cultural and biological evolution

- Is cultural evolution Darwinian?
  - (some) memeticists: Yes (memes replicate by means of brains, blindly)
  - (some) critics: No
    - Cf. [from a response to Blackmore 2000]: "I really like the idea of memes […] But it is only a metaphor. Culture is not Darwinian [...], just because natural selection is wonderfully successful at explaining elephants is no reason why it should explain circuses."
  - Shared presupposition: "Natural, i.e. blind, selection is an indispensable part of the concept of Darwinian evolution"

"Culture is (not) Darwinian"

- Darwinian = "by means of natural selection"?


ON

THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.

"Culture is (not) Darwinian"

- *Origin*:
  - breeding demonstrates power of selection to produce large scale differentiation over generations
  - replace artificial by natural selection: also produces large scale differentiation over time

  → two instantiations of the same principle

- "Natural selection"
  - "Lacking foresight": not itself explanatory (a causal factor)

Darwin's algorithm

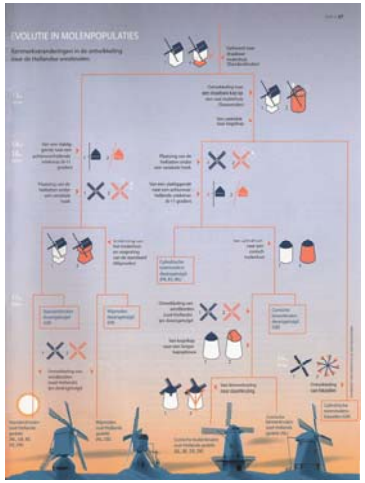
1. Variation (in a population)
2. Selection: variant with feature F has higher chance of being replicated than variant without
3. Heritability: Offspring resemble 'parents'

   → Frequency of F in population will increase, cumulatively: evolution

- "Populations evolve, individuals are selected"

- Algorithm is 'substrate neutral'

- Other (proposed) instantiations
  - sexual selection
  - immune systems, brains (Edelman)
  - cultural systems (Boyd&Richerson), e.g. technology
    - also in non-human animals
  - science (Hull)
  - niche construction (Odling-Smee e.a.)



Is X Darwinian?

- Considering "natural selection" an essential component of "Darwinian" is understandable, but misconstrues the Darwinian 'schema' (cf. Blackmore and her critic)
  - Non-essential addition to algorithm
- Also misconstruals that *leave out* parts of the algorithm (really metaphors!)
  - replication
  - population thinking

Darwin's algorithm

- 'Evolution' of solar system: variation (objects of different size, composition and position) and (blind!) selection (some have more chance of 'surviving').
- But no replication, so not 'Darwinian'

Darwin's algorithm

- Population thinking?

Darwin's algorithm

- Population thinking!
  - Evolution is change in relative frequencies of variants in population over generations
  - not dependent on change at individual level

"Populations evolve, individuals are selected"

Is a language Darwinian?

- Answering "yes" requires identification of
  - units and mechanisms of replication
  - selection forces
  - demonstration that interaction can produce change at population level (by "differential replication") independently of change at individual level
  - mechanism for creating variation (if the process is to continue)

Some answers

- (Minimal) units: words and constructions
- Mechanisms of replication:
  - usage events (follow conventions)
  - imitative learning (internalize conventions)
- Variation: both forms and functions
  - generated in replication: in usage events, i.e. utterances (learning??)
- Selection factors
  - ease of production, distinctiveness, prestige, usefulness, ease of learning, frequency, ... (cognitive, communicative, social factors)

Cultural selection

- Straightforward cases: disappearance of designated phenomena leads to disappearance of designating units
- Somewhat more subtle case: change of semantic profile of Dutch causative *doen*
  - originally for animate and inanimate causers
  - now specialized for inanimate causation
  - due to drop in frequency of use of [authority] in descriptions of human interactions over the last 300 years

Competition

- Competitive exclusion principle ("Gause's law")
  - "... as a result of competition two similar species scarcely ever occupy similar niches, but displace each other in such a manner that each takes possession of certain kinds of food and modes of life in which it has an advantage over its competitor" (Gause 1934)
  - Tendency for slightly different forms to occupy different niches in semantic space
  - but sometimes overlapping for considerable amount of time: conflicting pressures

Competition for meaning

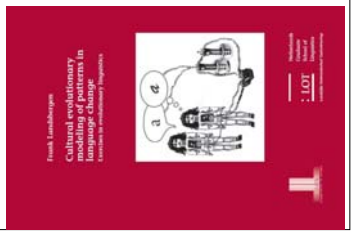
- Two grammatical types of A+N category names in English, Dutch, German
  - Phrases:
    - English: *high season, full moon, red wine, ...*
    - Dutch: *volle melk, wild zwijn, vreemde taal, ...*
    - German: *grüne Welle, kalter Krieg, saure Sahne, ...*
  - Compounds:
    - English: *hàrdwood, flàtscreen, fàst train, ...*
    - Dutch: *hoogseizoen, kleingeld, edelgas, ...*
    - German: *Rotwein, Fremdsprache, Vollmilch, ...*

Competition for meaning

- Productivity, relative frequencies differ
  - English: phrases >> compounds
  - Dutch: phrases ≈ compounds
  - German: phrases < compounds
- Factors
  - phrases formed more easily than compounds
  - formal variability dispreferred for names
    - high in German (case, gender!), quite low in Dutch, absent in English
  - semantic specialization
    - Metonymy: only in compounds (*fatass, ...*)
    - 'Exocentric modification': only in phrases (*cold turkey, ...*)

Competition for meaning

- Computational simulation (Landsbergen 2009)
  - Single evolutionary model allows for description of constructional possibilities 'in principle' and for variable ratio's of usage ('evolutionary change is change in relative frequencies of variants in populations')



Replication and innovation

- Mechanisms
  - "Speak like others" → use convention → replicate
  - "Draw attention (induce processing effort)" → do something unexpected
  - Combination: "slight change" → novel variant
- Sources of innovation
  - Knowledge of causal structure of the world
    - part indicates a whole, perception indicates a source object, behaviour indicates a mental state, …

  → metonymy
  - Capacity for structural mappings/associations

  → metaphor: life as a journey, state as a person, …

Individual variation

- Human cognitive systems, doing the selection, are not identical, but exhibit variation themselves
  - People differ somewhat in their knowledge of conventional meanings (e.g. causative *doen*)
  - No problem for communication: what one cannot get by system (rule, grammar), one may still get by inference
    - *We* still read the 18th century texts without real difficulties

Individual variation

- Usage-based model: speakers are expected to have (slightly) different mental grammars
  - learners construct mental grammar on basis of input (Tomasello 2003)

  1. different speakers 'inherit' different variants (dialects)
  2. because of (slightly) different linguistic experiences of speakers A and B, same process may lead to variation between mental grammars of A and B (even if the grammars underlying the production of the input to A and B are the same)

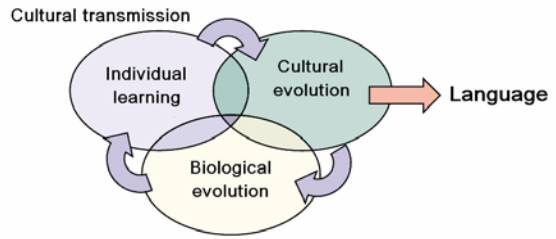
  - e.g. different (levels of) generalizations

Individual variation

- Different underlying cognitive systems ('I-grammars') may produce similar behaviour ('E-language'), especially sufficiently similar communicative behaviour
  - still a basis for linguistic divergence
  - production guided by I-grammars, may lead to increase or decrease of certain variants, which are in turn input to the next generation

Cultural and biological evolution

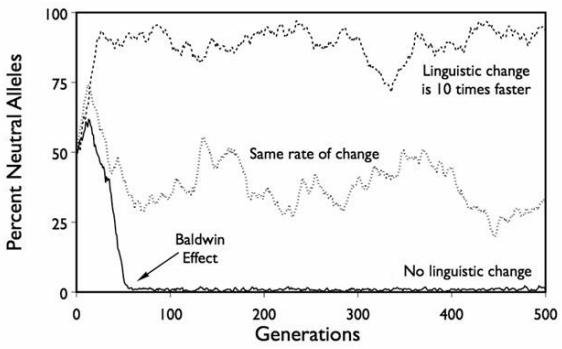
- No *direct* accounts of properties of languages in terms of biological fitness
- Cultural transmission



Cultural and biological evolution

- Advantage: natural selection alone can hardly have produced genetic encoding of grammatical information
  - Chance mutation (/drift): inconceivably small chance
    - If size UG = 1 page, 2500 bits, then required population size = 2^{2500}. Two million years of humans: 2^{35}.
  - Baldwin effect?
    - Languages, including grammars, change much more rapidly than genotypes: 'moving target'

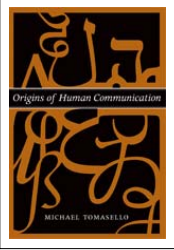
Cultural and biological evolution



Christiansen & Chater (2008)

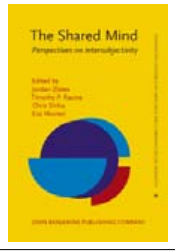
Cultural and biological evolution

- Biological cognitive specialization(s)
  - imitative learning
  - ultra-sociality, collaboration
  - cooperative communication, coordination
    - joint attention, shared intentions, joint goals, …
    - 'intersubjectivity'



→ mutual knowlegde, expectations

cultural conventions



To conclude

- CogL can inform EvoL
  - units (cxs, form-meaning pairings!)
  - mechanisms (UB, grammaticalization, metaphor, metonymy, …)
- EvoL can inform CogL
  - population thinking: distinguish & relate mental grammars and 'lingueme pool'
    - I-grammar/E-language ≠ competence/performance
  - several new research questions as well (e.g. relation population-individual: populations of linguemes – populations of speakers)
  - evolutionary 'model' patterns from biology