Language and sexual selection

LLcD Table ronde/Round table: Évolution linguistique et évolution biologique / Linguistic and Biological evolution, Paris, Sorbonne, 11 September 2024

Freek Van de Velde

freek.vandevelde@kuleuven.be

KU LEUVEN

Quantitative Lexicology and Variational Linguistics

Evolutionary linguistics

- Generalized Darwinism, cultural evolution (Boyd & Richerson 1985; Croft 2000; Richerson & Boyd 2005; Mesoudi 2011; Henrich 2016, 2020)

- Languages are adaptive (Lupyan & Dale 2016)

    - At the level of languages (across languages). 'Linguistic niche hypothesis': languages adapt to the demographic, climatic, topographic... environment.

    - At the level of linguemes (within languages). Linguistic elements (phonemes, morphemes, constructions) are subject to variation, inheritance, selection (all three are necessary for evolution).

- Boyd, R. & P.J. Richerson. 1985. *Culture and the evolutionary process*. Chicago: University of Chicago Press.
- Croft, W. 2000. *Explaining language change. An evolutionary approach*. Harlow: Longman.
- Henrich, J. 2016. *The secret of our success. How culture is driving human evolution, domesticating our species, and making us smarter*. Princeton: Princeton U. Press.
- Henrich, J. 2020. *The WEIRDest people in the world. How the West became psychologically peculiar and particularly prosperous*. New York: Farrar, Straus & Giroux.
- Lupyan, G. & R. Dale. 2016. 'Why are there different languages? The role of adaptation in linguistic diversity'. *Trends in Cognitive Science* 20(9): 649-660.
- Richerson, P.J. & R. Boyd. 2005. *Not by genes alone: how culture transformed human evolution*. Chicago: U. of Chicago Press.
- Mesoudi, A. 2011. *Cultural evolution. How Darwinian theory can explain human culture and synthesize the social sciences*. Chicago: U. of Chicago Press.

Evolutionary linguistics

- Selection pressures: from social and natural environment (from network structure to air density)
- Language evolution: higher fitness within a certain context. By replicator selection (Blythe & Croft 2012) or content bias (Mesoudi 2011), yielding s-curves (fitted by logit or probit function).
- E.g. the rise of NP structure (Himmelmann 1997; Hawkins 2004; Steels & Garcia Casademont 2015; Van Eecke 2018; Van de Velde 2009a,b, 2010; Sommerer 2018):
  - Reduce referential ambiguity
  - Increase communicative success
  - Decrease processing effort

- Blythe, R. & W. Croft.2012. 'S-curves and the mechanisms of propagation in language change'. *Language* 88(2): 269-304.
- Hawkins, J.A. 2004. *Efficiency and complexity in grammars.* Oxford: Oxford University Press.
- Himmelmann, N.P. 1997. *Deiktikon, Artikel, Nominalphrase. Zur Emergenz syntaktischer Struktur.* Tübingen: Max Niemeyer.
- Sommerer, L. 2018. *Article emergence in Old English: a construction grammar approach*. Berlin: de Gruyter.
- Steels, L. & E. Garcia Casademont. 2015. 'Ambiguity and the origin of syntax'. *The Linguistic Review* 32(1): 37-60.
- Van de Velde, F. 2009a. 'The emergence of modification patterns in the Dutch noun phrase'. *Linguistics* 47(4): 1021-1049.
- Van de Velde, F. 2009b. *De nominale constituent. Structuur en geschiedenis*. Leuven: Leuven University Press.
- Van de Velde, F. 2010. 'The emergence of the determiner in the Dutch NP'. *Linguistics* 48(2): 263-299
- Van Eecke, P. 2018. *Generalisation and specialisation operators for computational construction grammar and their application in evolutionary linguistics research*. PhD Dissertation VUB, Brussels.

Evolutionary linguistics

- Assumptions:
  - Language is a tool for transmitting information
  - Language evolution is geared toward optimal information (efficiency)

- These assumptions raise a number of issues

Issues

1. Language variation:

   While there is convergent evolution, a.k.a. *homoplasy* (both *across languages*, Haspelmath, Hawkins ... and *within languages*, Van de Velde & Van der Horst 2013), there is mindboggling variation (Evans & Levinson 2009). If languages are adaptive, why do they not converge on the same strategies?

   - Answers:
     - different sources (Cristofaro's 'source-oriented' explanations)
     - different peaks in the fitness landscape
     - competing pressures (speaker-hearer, adult-child, L1-L2)

- Evans, N. & S.C. Levinson. 2009. 'The myth of language universals: Language diversity and its importance for cognitive science'. *Behavioral and Brain Sciences* 32: 429-492.
- Van de Velde, F. & J. van der Horst. 2013. 'Homoplasy in diachronic grammar'. *Language Sciences* 36(1): 66-77.

Issues

2. Areal tendencies

   Universal areality / Sprachbund effects: languages in contiguous areas look alike, above and beyond their genetic affiliation (Balkan Sprachbund, Circumbaltic Area, South-East Asian tone languages, root vowel apophony in Semitic and Indo-European ...)

   - Answer: language contact

Issues

3. Altruism problem
   - Optimal efficiency is hearer-driven
   - Hearer-driven explanations are suspicious in evolutionary theory, because they rely on altruism (Kirby 1999).

- Kirby, S. 1999. *Function, selection, and innateness: the emergence of language universals*. Oxford: Oxford University Press.

Issues

4. Language complexity:

   Languages are unnecessarily complex (Gil 2009).

   Examples:

   - Case systems and inflectional paradigms
   - Irregular morphology, suppletion (Fur: *tóŋ* 'antilope:SG', *pira* 'antilope:PL'; Gothic *gaggan* 'go', *iddja* 'went')
   - Gender and noun classes
   - tail-head linkage
   - differential object marking (Witzlack-Makarevich & Seržant 2017)
   - irreducible lexical biases in alternations (Sevenants, Van de Velde & Speelman, under review)
   - ...

- Gil, D. 2009. 'How much grammar does it take to sail a boat?'. In: G. Sampson, D. Gil & P. Trudgill (eds.), *Language complexity as an evolving variable*. Oxford: Oxford University Press.
- Sevenants, A., F. Van de Velde & D. Speelman. Under review. 'Investigating lexical-semantic effects on morphosyntactic variation using elastic net regression'.
- Witzlack-Makarevich, A. & I.A. Seržant. 2017. 'Differential argument marking: patterns of variation'. In: I.A. Seržant & A. Witzlack-Makarevich (eds.), *The diachronic typology of differential argument marking*. Berlin: Language Sciences Press. 1-40.

Unnecessary complexity

- Explanations:
  - Accretion of historical debris (entropy rises with the passing of time)
  - Orgel's Second Rule: "Evolution is cleverer than you are."

Sexual selection: the blind spot in evolutionary linguistics

- Seemingly dysfunctional traits as reliable fitness indicators
- Linguistic complexity as a Zahavi handicap (Zahavi 1997)
- Ostentatious display in a moderate tournament species

> "Effective verbal courtship is a reliable fitness indicator precisely because it is costly and difficult." (Miller 2000: 382)
>
> "[T]he idea that language evolved for verbal courtship solves the altruism problem by identifying a sexual payoff for speaking well. (...) Language complexity could have evolved through a combination of runaway sexual selection, mental biases in favor of well-articulated thoughts, and fitness indicator effects." (Miller 2000: 353)
>
> "Good language skills may indeed enhance reproductive success." (Christiansen & Chater 2008: 498)

- Christiansen, M.H. & N. Chater. 2008. 'Language as shaped by the brain'. *Behavioral and Brain Sciences* 31: 489-558.
- Miller, G. 2002. *The mating mind: How sexual choice shaped the evolution of human nature*. New York: Doubleday.
- Zahavi, A. 1997. *The handicap principle: a missing piece of Darwin's puzzle*. Oxford: Oxford University Press.

Sexual selection

- Potentially powerful explanation for:
  - unnecessary language complexity (runaway Fisherian selection)
  - altruism problem (see e.g. mansplaining as display)
  - areality (local differences in sexual selection)
  - the crucial role of extravagance (Keller 1994; Haspelmath 1999; Detges & Waltereit 2002; Petré & Van de Velde 2018)

- Detges, U. & R. Waltereit. 2002. 'Grammaticalization vs. reanalysis: a semantic-pragmatic account of functional change in grammar'. *Zeitschrift für Sprachwissenschaft* 21: 151-195.
- Keller, R. 1994. *On language change: the invisible hand in language*. London: Routledge.
- Haspelmath, M. 1999. 'Why is grammaticalization irreversible?'. *Linguistics* 37(6):1043-1068.
- Petré, P. & F. Van de Velde. 2018. 'The real-time dynamics of the individual and the community in grammaticalization'. *Language* 94(4): 867-901.

Predictions

- Complexity has an effect on reproductive success
- Complexity is a function of context (mating)
- (Moderate) behavioral dimorphism in complexity

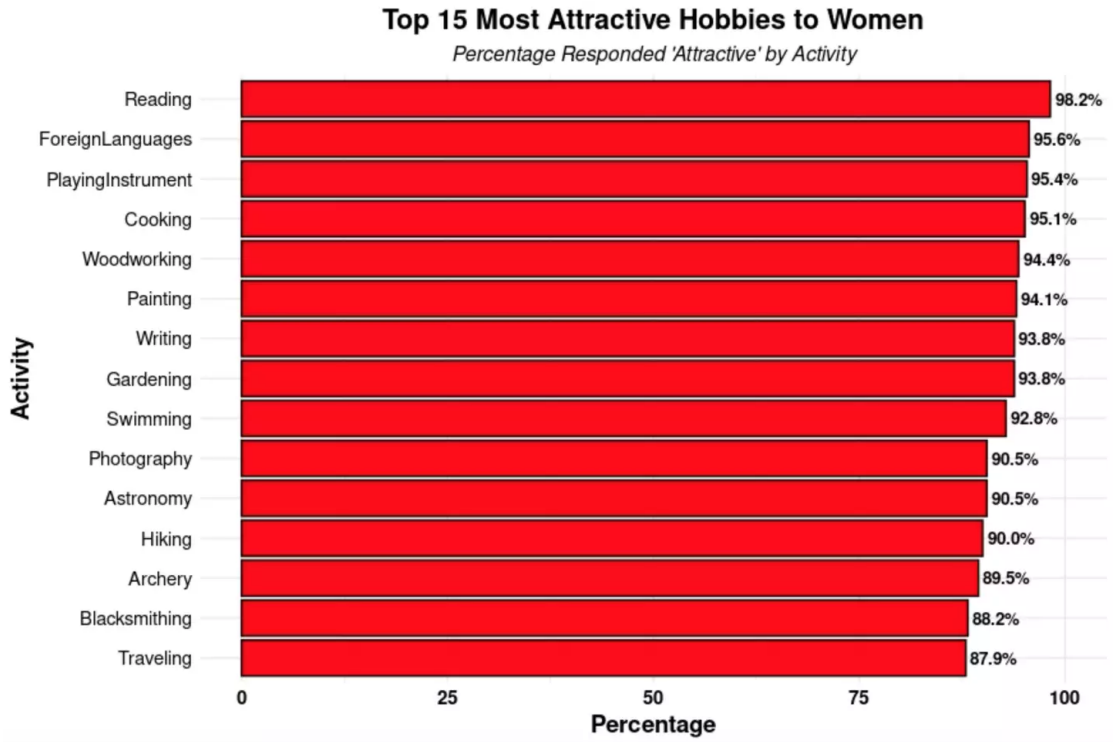
Behavioral dimorphism

- General idea
  - Women as the limiting sex. 'Anisogamy': larger gametes, differential parent investment, more selective (Trivers 1972; Dawkins 1989; Buss 2016)
  - Language is unreasonably complex
  - Ostentatious verbal display

- Buss, D. 2016. *The evolution of desire: Strategies of human mating.* Revised and updated edn. New York: Basic Books.
- Dawkins, R. 1989. *The selfish gene*. 2nd edn. Oxford: Oxford University Press.
- Trivers, R. 1972. 'Parental investment and sexual selection'. In: B. Campbell (ed.), *Sexual selection and the descent of man*. New York: Aldine de Gruyter. 136-179.

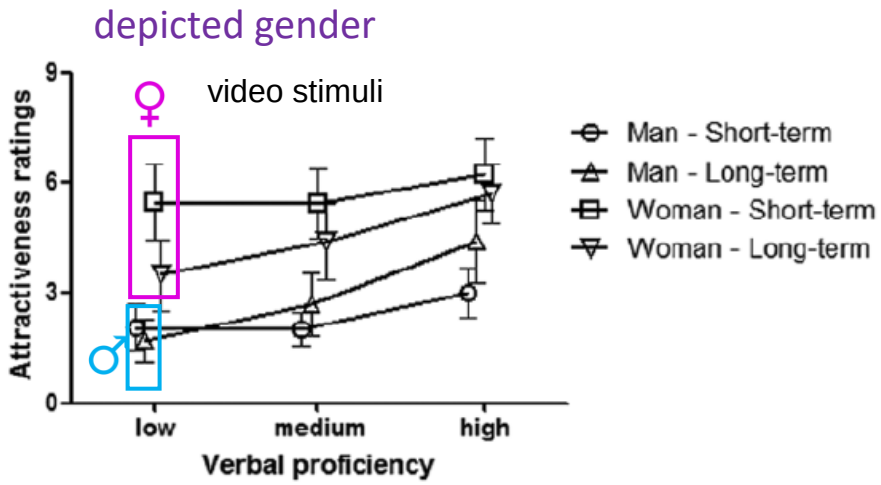
Language skill as a selection criterion

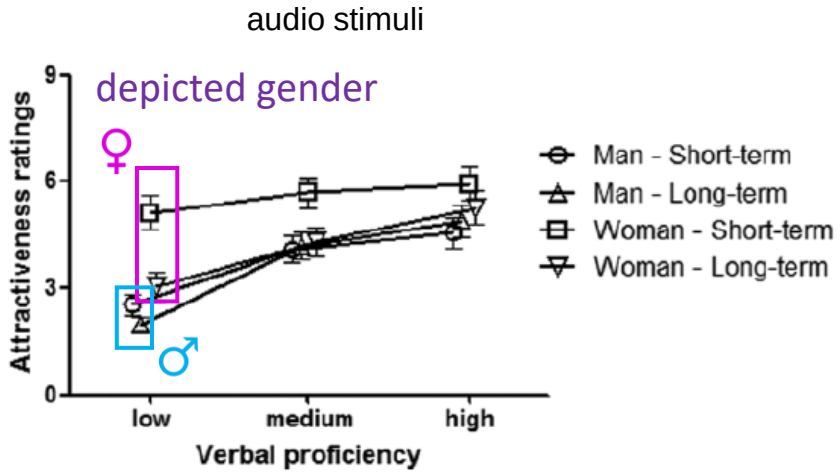
Weakly controlled studies:



Language skill as a selection criterion

- Women are more attracted to verbal display (according to themselves) (Cohen's d 0.24, $p < 0.05$) (Lange 2011)
- Language proficiency is an important factor in attraction, especially with female assessors (Lange et al. 2014)

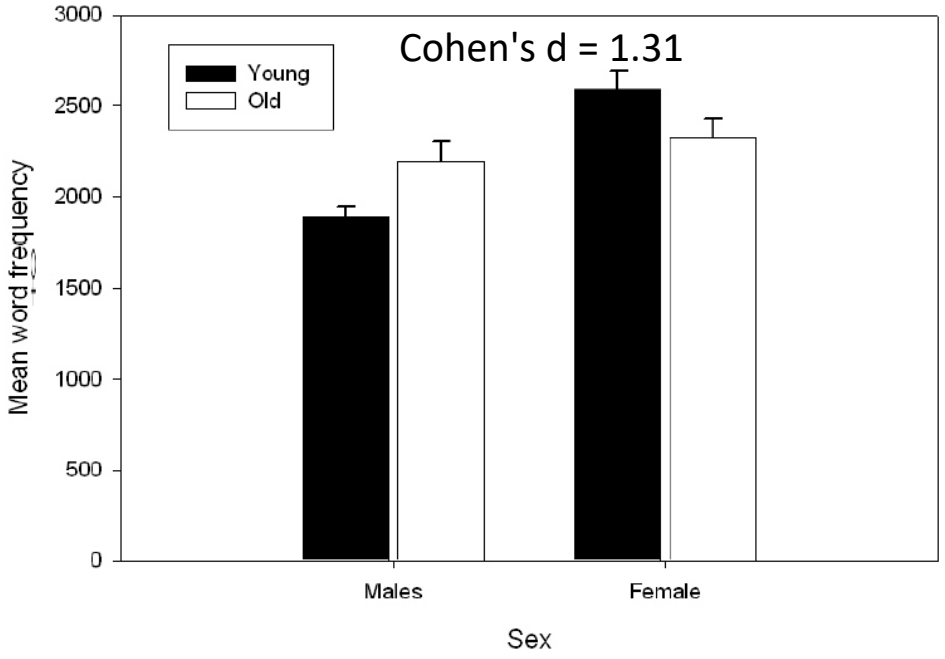


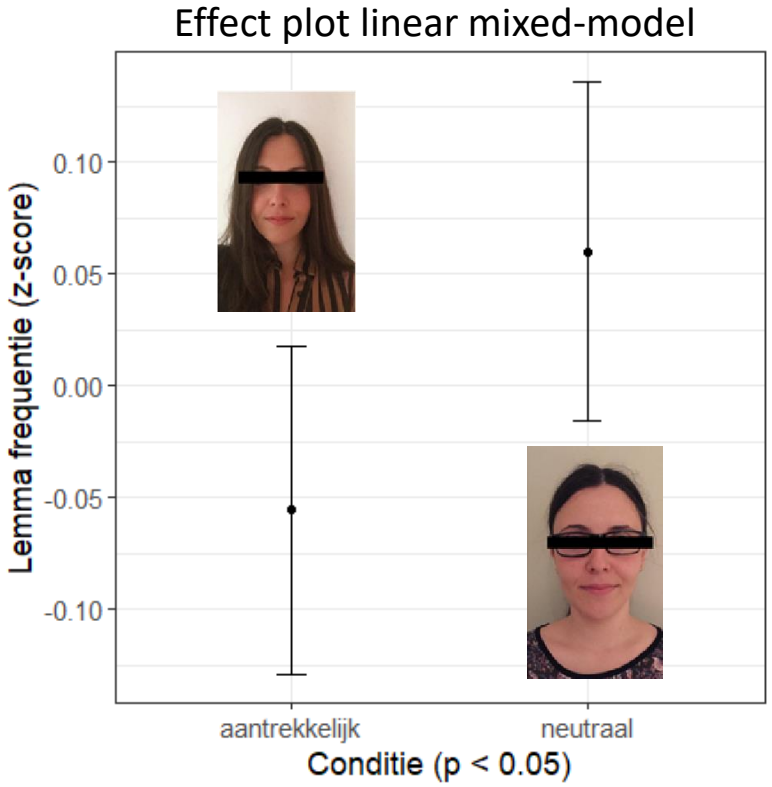


- Lange, B.P. 2011. 'Male proneness to verbal display production'. *Acta Linguistica* 5: 97-104.
- Lange, B.P., E. Zaretsky, S. Schwarz & H.A. Euler. 2014. 'Words won't fail: experimental evidence on the role of verbal proficiency in mate choice'. *Journal of Language and Social Psychology* 33(5): 482-499.

Verbal display

- Men use more complex words in flirtatious contexts (Rosenberg & Tunney 2008), and non-flirtatious contexts (Essers & Van de Velde 2020)



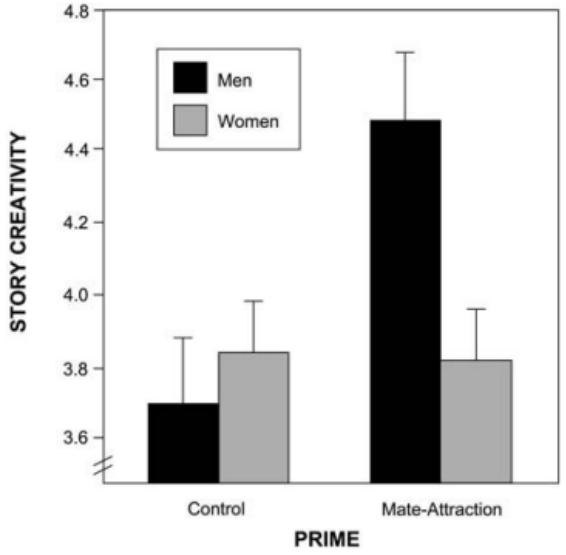


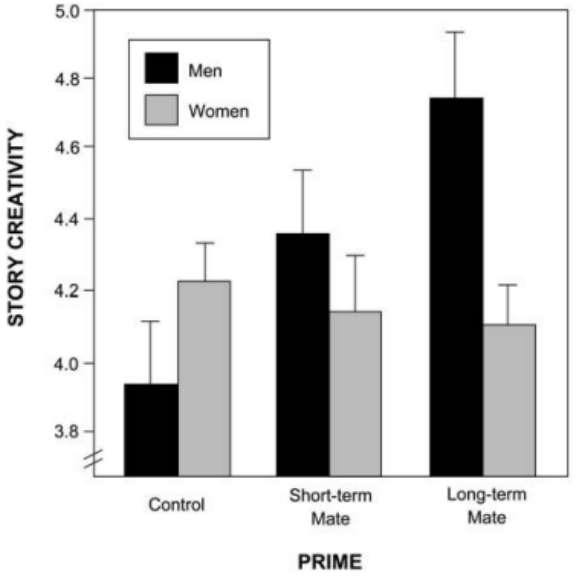
Cohen's d = 0.11

- Essers, C. & F. Van de Velde. 2020. 'Linguistic complexity increases as a function of attractiveness in intersexual communication. Tentative experimental support'. In: M. Flaherty, K. Mudd, H. Little, T. Verhoef, A. Ravignani, C. Barbieri, Y. Jadoul, E. Lattenkamp & M. Martins (eds.), *The evolution of language. Proceedings of the 13th International Conference on the Evolution of Language (EvoLang13)*. 87-89
- Rosenberg, J. & R.J. Tunney. 2008. 'Human vocabulary use as display'. *Evolutionary Psychology* 6(3): 538-549.

Verbal display

- (Young urban) men use more English code-switching / nonce borrowings in mixed-gender settings (Zenner et al. 2014)
- Men's loquatiousness decreases after pairbonding (Miller 2002: 338)
- Effect of attraction on story telling creativity (Griskevicius 2006)





- Griskevicius, V., R.B. Cialdini & D.T. Kenrick. 2006. 'Peacocks, Picasso, and parental investment: the effects of romantic motives on creativity'. *Journal of Personality and Social Psychology* 91(1): 63-76.
- Zenner, E., D. Speelman & D. Geeraerts. 2014. 'A sociolinguistic analysis of borrowing in weak contact situations: English loanwords and phrases in expressive utterances in a Dutch reality TV show'. *International Journal Of Bilingualism* 19(3): 333-346

Differential reproductive success

- Higher reproductive rates for experienced storytellers: 0.53 more children under multivariate control (age, gender, camp site), with the Agta, Philippines (Smith, Schlaepfer, Major et al. 2017)

- Smith, D., P. Schlaepfer, K. Major et al. 2017. 'Cooperation and the evolution of hunter-gatherer storytelling'. *Nature Communications* 8: 1853.

Complexity

- Diachronic study (Piersoul & Van de Velde 2023)
- Study on 120 years of written prose (1880-1999) (CCLAMP corpus, Piersoul, De Troij & Van de Velde 2021)
- 117 articles, 80611 words, 59 female authors, 58 male authors
- Tscan software (Pander Maat et al. 2014)
- Complexity measures:
  - morphological complexity: size (characters, morphemes)
  - frequency
  - semantics (abstract – concrete)
  - syntax (D-level, (multiple) subordination, clause length)

- Pander Maat, H., R. Kraft, A. Van den Bosch, M. Van Gompel, S. Kleijn, T. Sanders & K. Van der Sloot. 2014. 'T-Scan: a new tool for analyzing Dutch text'. *Computational Linguistics in the Netherlands Journal* 4: 53-74.
- Piersoul, J., R. De Troij & F. Van de Velde. 2021. '150 Years of written Dutch: the construction of the Dutch corpus of contemporary and late modern periodicals'. *Nederlandse Taalkunde* 26(3): 339-362.
- Piersoul, J. & F. Van de Velde. 2023. ‘Men use more complex language than women, but the difference has decreased over time. A study on 120 years of written Dutch’. *Linguistics* 61(3): 725-747.

Linear mixed models

- Linear Mixed Models
  - scale($Complexity_{Size}$)~ scale(YEAR, center=TRUE, scale=FALSE) + (1|AUTHOR)
  - scale($Complexity_{Freq}$) ~ scale(YEAR, center=TRUE, scale=FALSE) + (1|AUTHOR)
  - scale($Complexity_{D\text{-}level}$) ~ scale(YEAR, center=TRUE, scale=FALSE) + (1|AUTHOR)
  - …

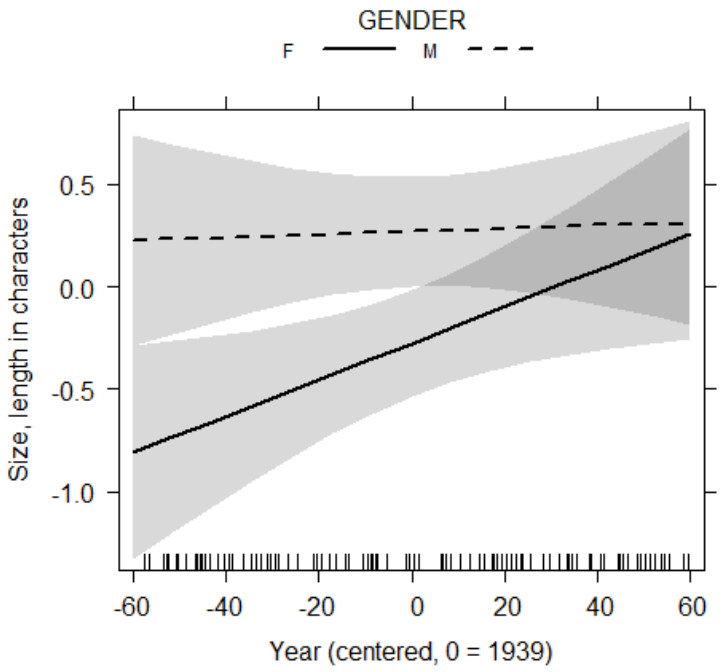
$$\frac{(C_{ij} - \overline{C_{ij}})}{\sigma_{C_{ij}}} = (\beta_0 + u_{0ij}) + \beta_1(Year_{ij} - \overline{Year}) + \varepsilon_{ij}$$

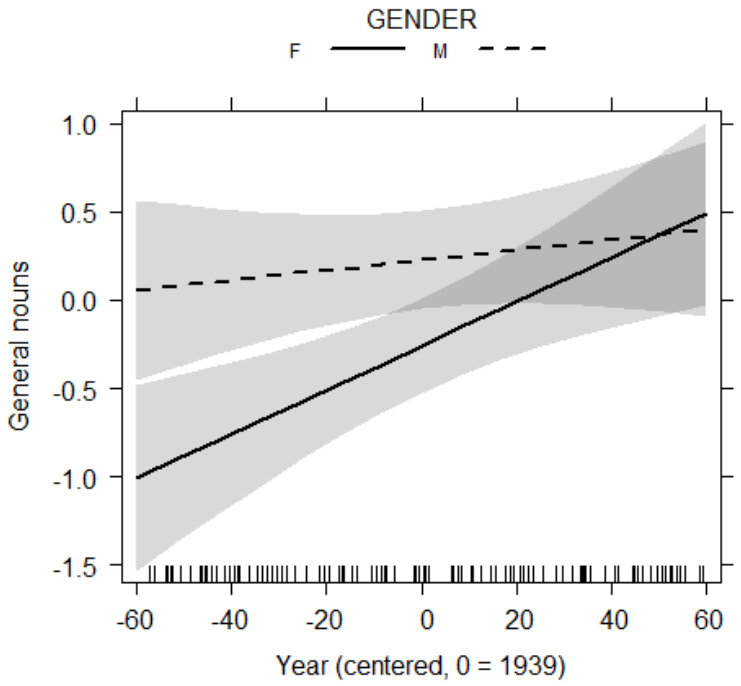
$$u_{0,i} \sim N(0, \sigma_{u_0}^2)$$
$$\varepsilon_{1,i} \sim N(0, \sigma_{\varepsilon}^2)$$

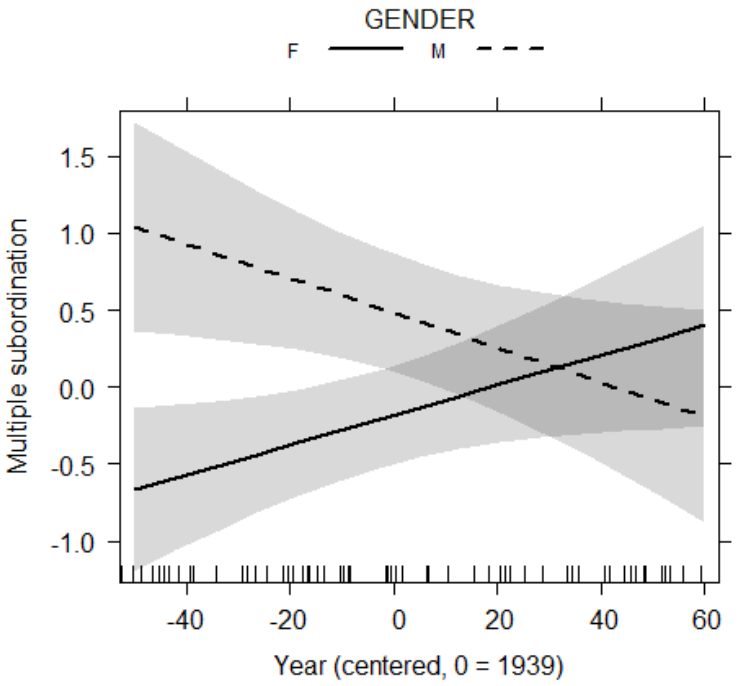
- z-scored complexity metric C for author i, observation j
- intercept
- by-author intercept adjustment
- coefficient for Year (centerred)
- error term

Results

- Men use more complex language than women (apart for lexical diversity measures)
- Difference has decreased over time, maybe in response to decreasing behavioral dimorphism







Conclusions

- Sexual selection is the blind spot in evolutionary linguistics
- Language as a communicative tool by replicator selection and language as verbal display by sexual selection are not mutually exclusive.
- compare birds of paradise: feathers are used for thermoregulation and flight (under natural selection), but this does not preclude its role in sexual selection