

# Experimental diachronics: Investigating language change and evolution in the lab

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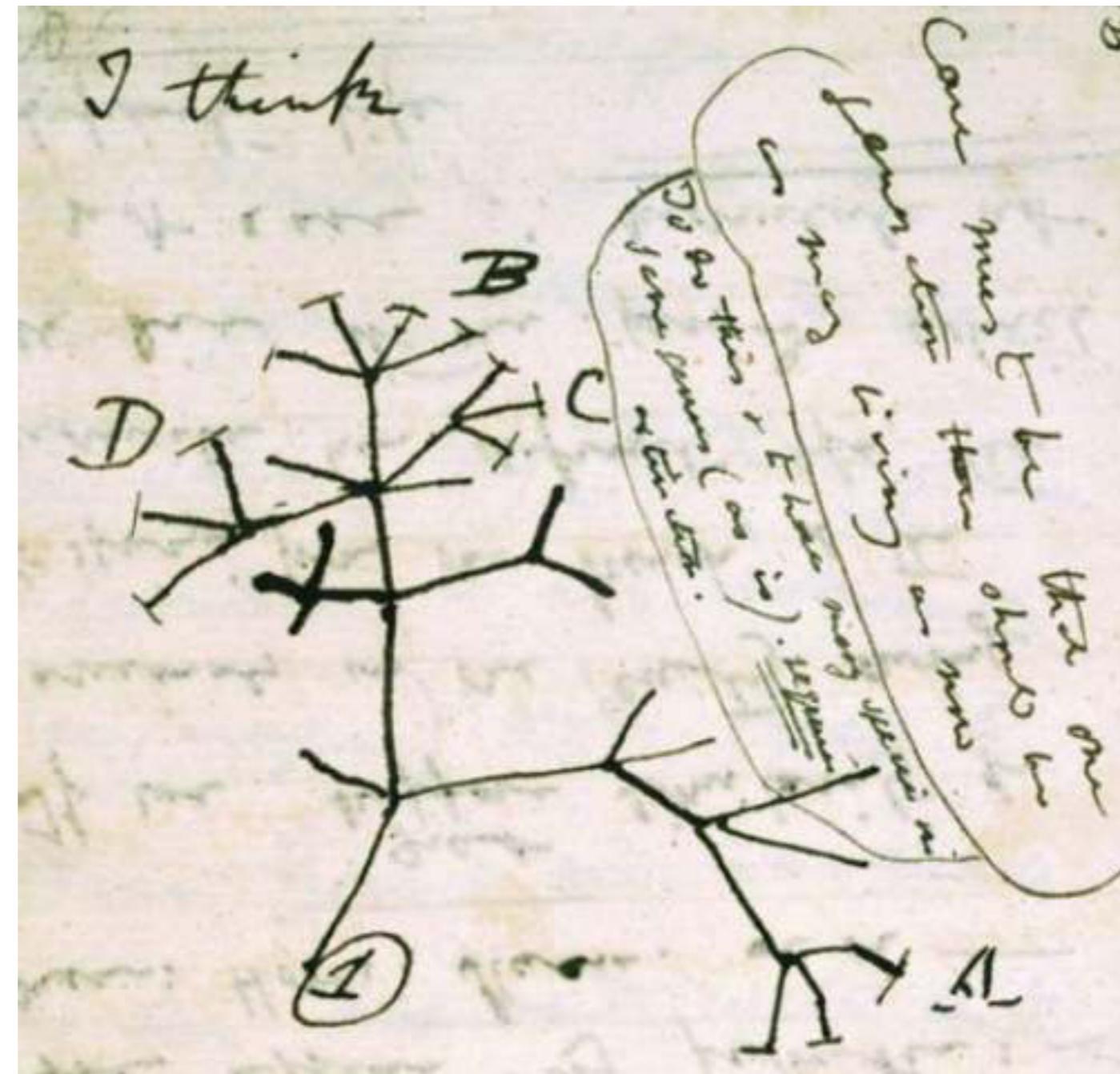


# Outline

What you will learn today:

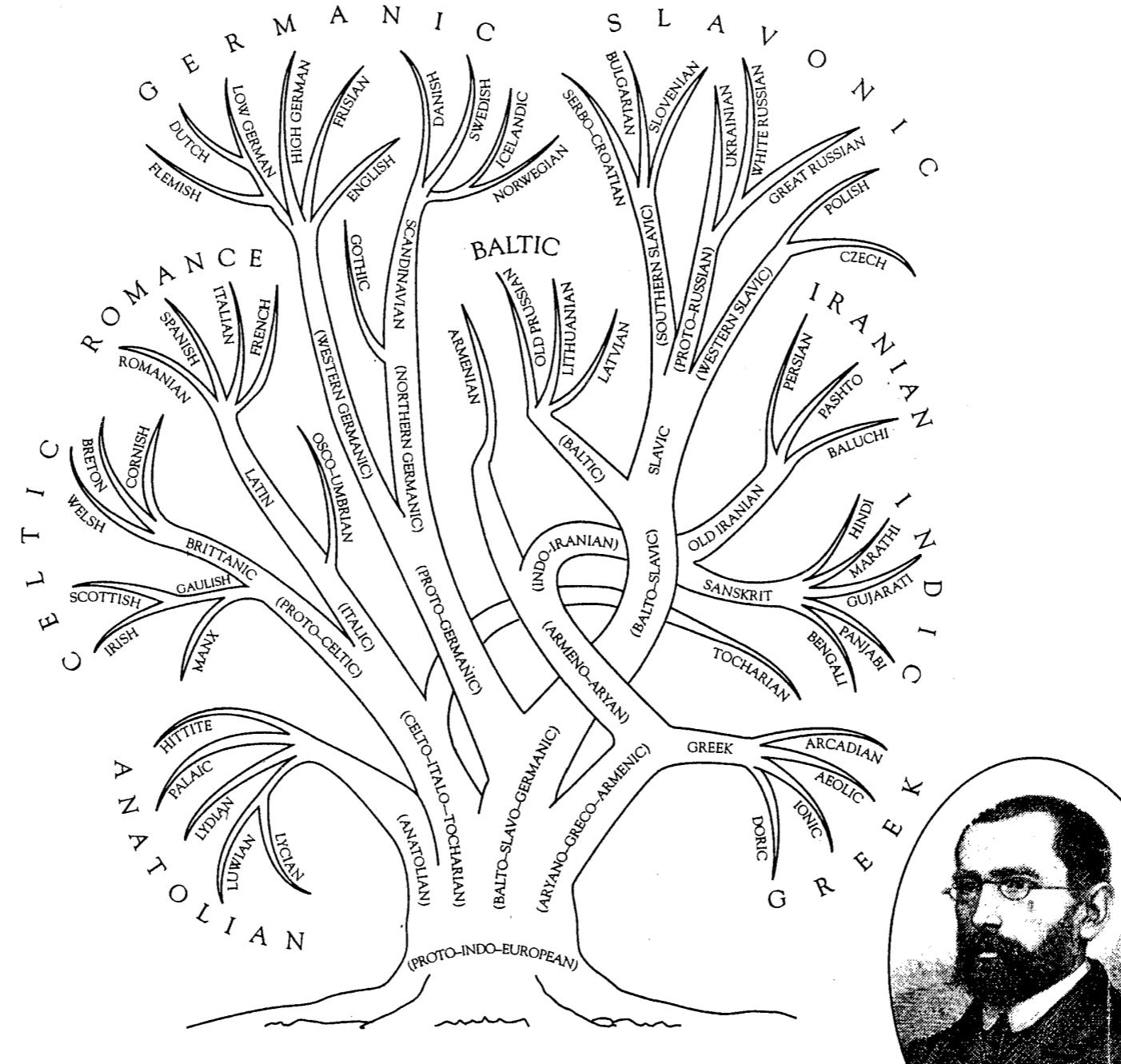
- What language change and evolution is
- Why we study it
- How to study it
- What studying it has shown us
- Why multi-disciplinary research is important

# What is language evolution?



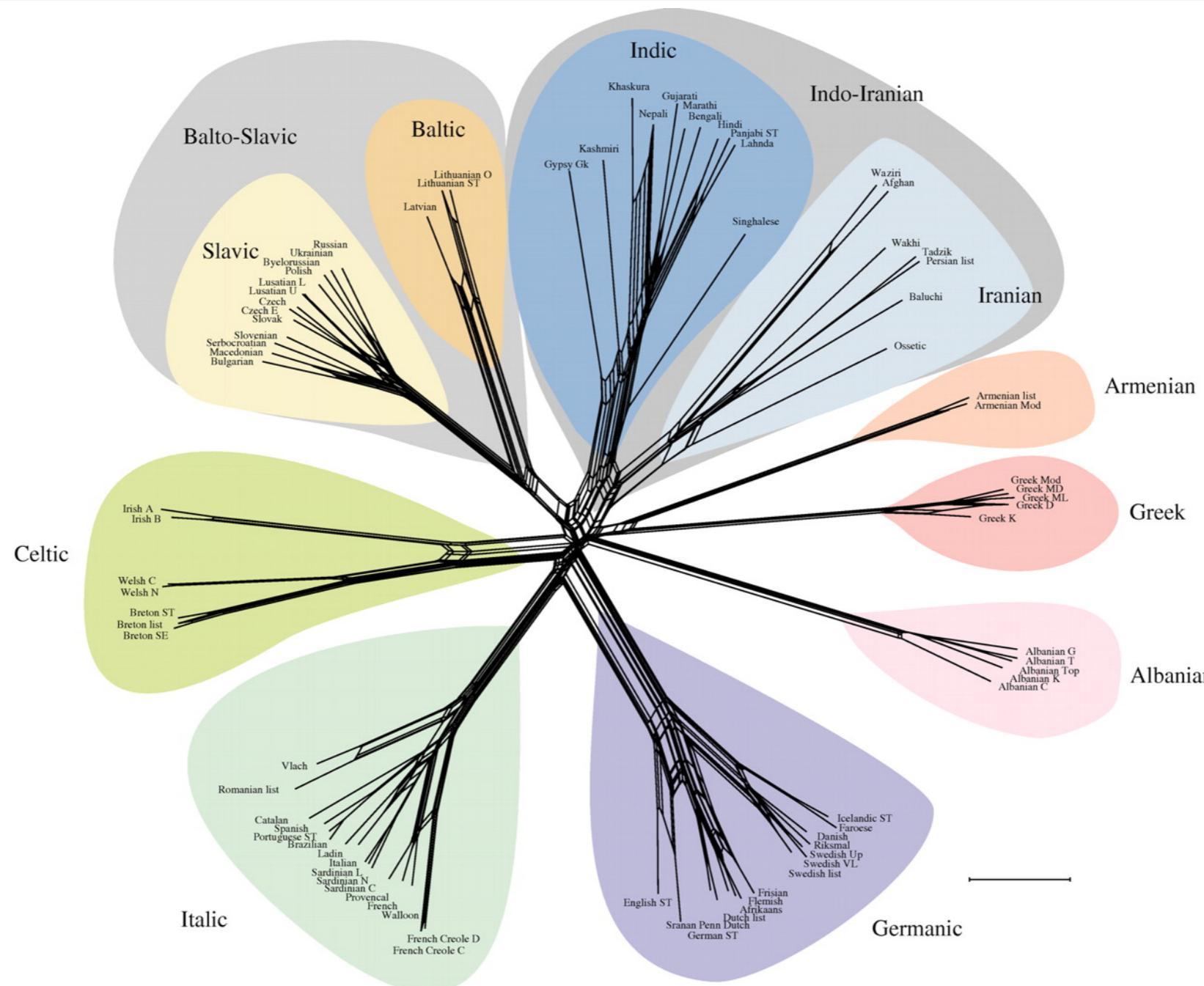
Darwin (1837)

# What is language evolution?



Schleicher (1863)

# What is language evolution?



Gray et al., 2010



# Why study language evolution?



<http://www.nytimes.com/2007/11/01/science/01chimp.html>

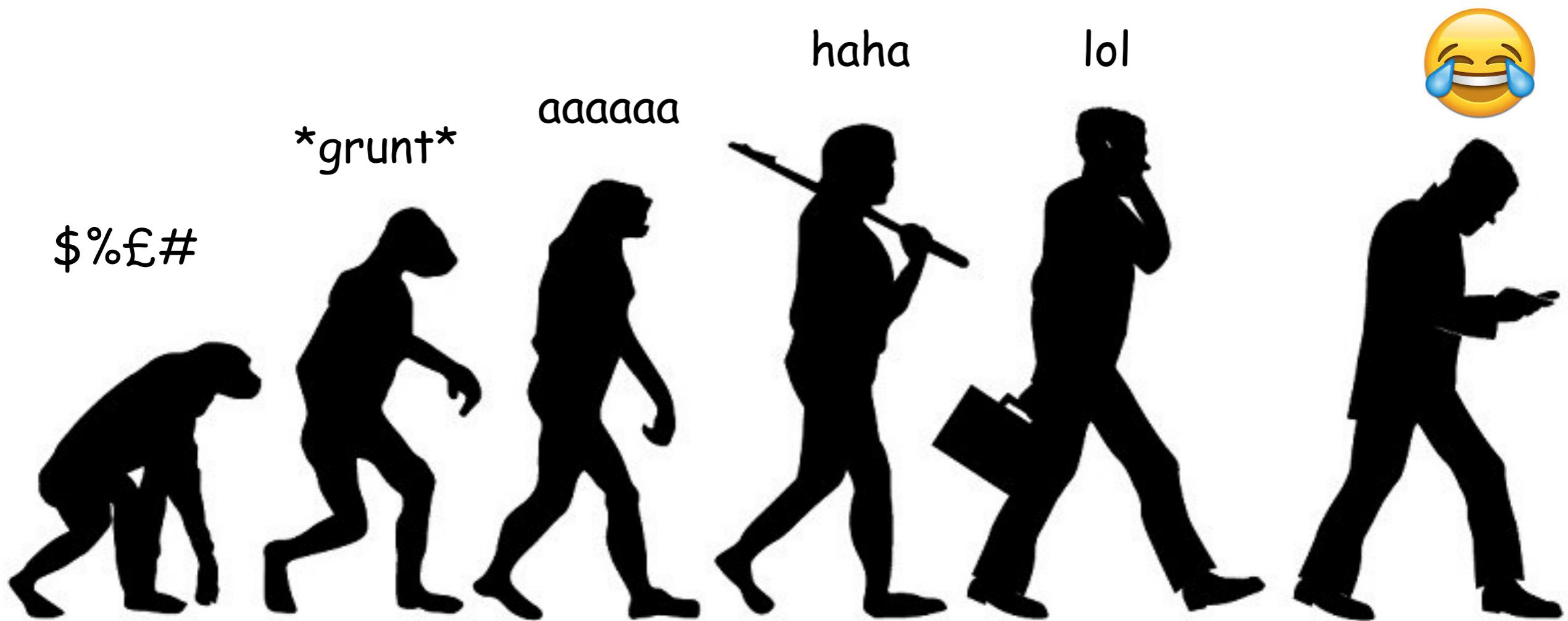
# Why study language evolution?



Rise of the Planet of the Apes (2011)



# Why study language evolution?



# Why study language evolution?

1

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## Language Evolution: The Hardest Problem in Science?

*Morten H. Christiansen and Simon Kirby*

In 1859, when Charles Darwin published his book *The Origin of Species*, there was already a great interest in the origin and evolution of language. A plethora of ideas and conjectures flourished, but with few hard constraints to limit the realm of possibility, the theorizing became plagued by outlandish speculations. By 1866 this situation had deteriorated to such a degree that the primary authority for the study of language at the time—the influential Société de Linguistique de Paris—felt compelled to impose a ban on all discussions of the origin and evolution of language.

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Christiansen & Kirby (2003)

# How to study language evolution



Gorilla



*Homo erectus*  
(*Sinanthropus*)



*Homo sapiens*

[https://startlediguana.files.wordpress.com/2013/10/boule\\_skulls.gif](https://startlediguana.files.wordpress.com/2013/10/boule_skulls.gif)

# How to study language evolution



Basalla (1988)

# How to study language evolution

BEHAVIORAL AND BRAIN SCIENCES (2008) 31, 489–558

*Printed in the United States of America*

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## Language as shaped by the brain

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**[http://www.psychol.ucl.ac.uk/people/profiles/chater\\_nick.htm](http://www.psychol.ucl.ac.uk/people/profiles/chater_nick.htm)**

Christiansen & Chater (2008)

# How to study language evolution

# How to study language evolution

1 8 5 0 3 7 6 2 4 9

# How to study language evolution

# How to study language evolution

0 1 2 3 4 5 6 7 8 9

# How to study language evolution

# How to study language evolution

icuetfsogrisoslimsncmh lou

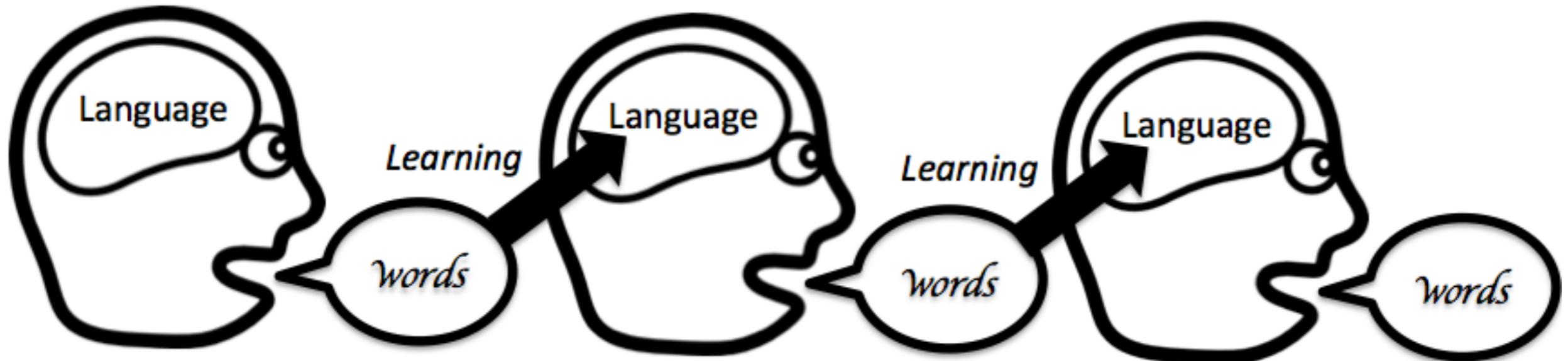
# How to study language evolution

## How to study language evolution

summerschooloflinguistics

# How to study language evolution

# How to study language evolution



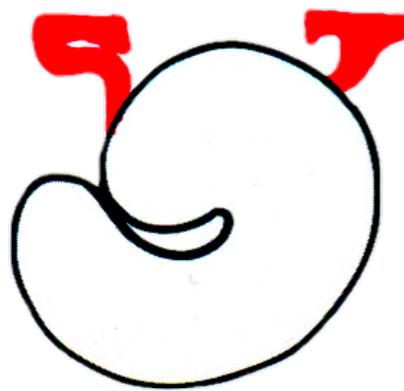
<http://www.replicatedtypo.com/iterated-learning-using-youtube-videos/6093.html>

# How to study language evolution

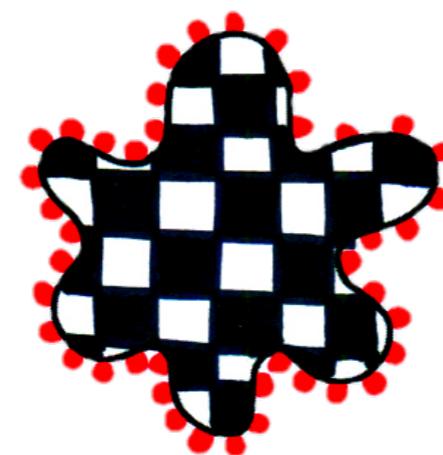


Arrival (2016)

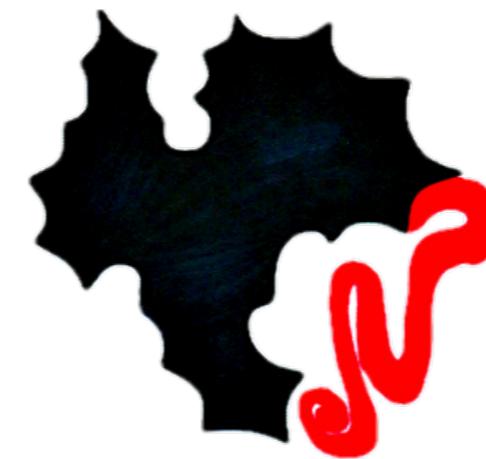
# How to study language evolution



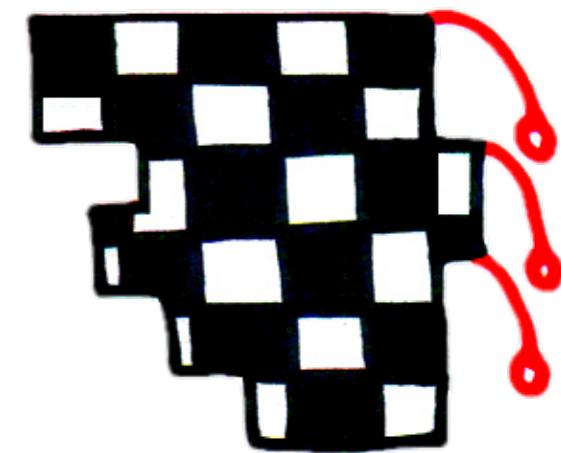
gahemi



hekipo



kilonu



lenoga

Brand &amp; Monaghan (in prep)

# How to study language evolution

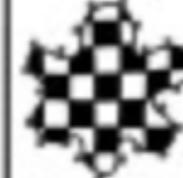
## Generation 1

	pihino		kapa		newhomo
	nemone		gakho		kamone
	piga		wuwele		gaku
	kawake		nepi		hokako

Kirby, Tamariz, Cornish & Smith (2015)

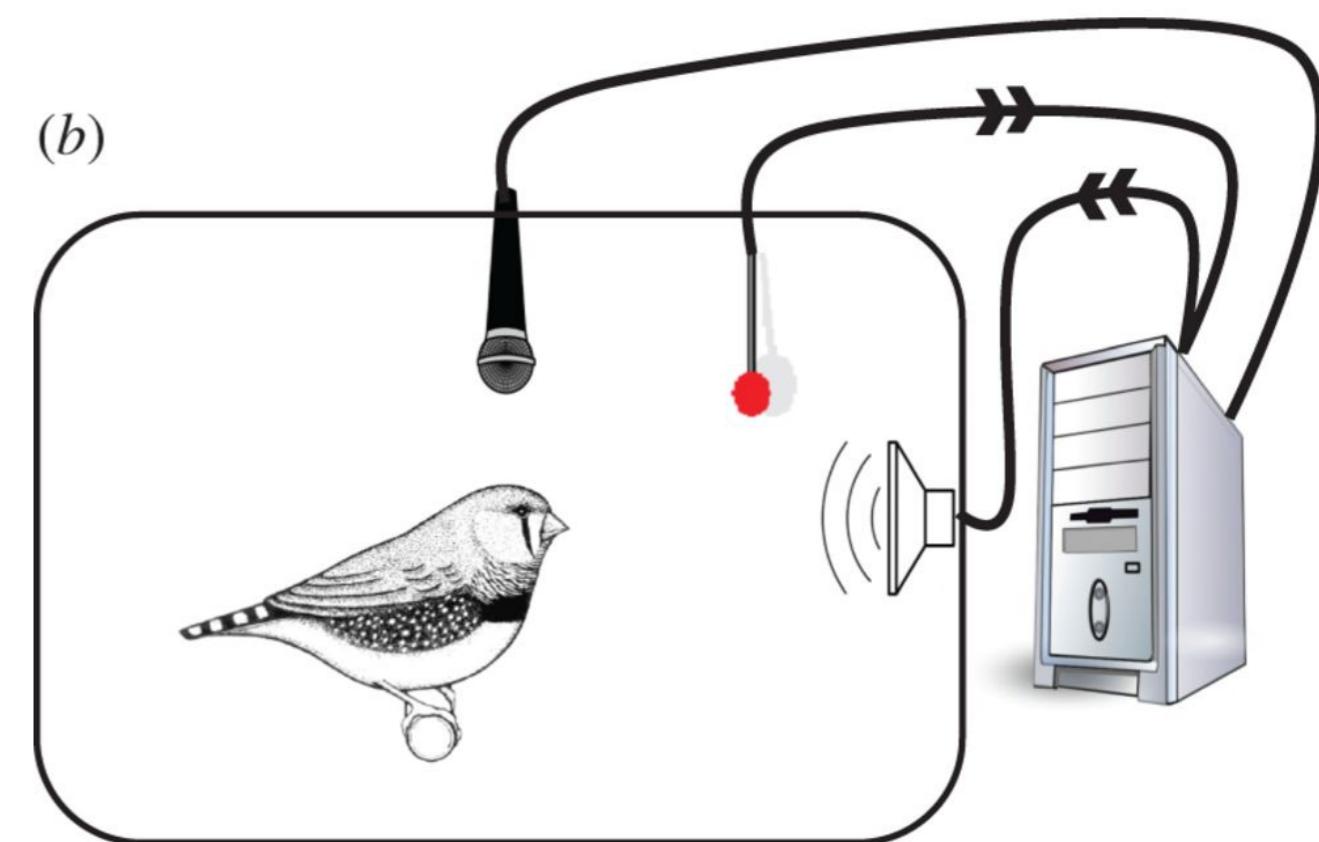
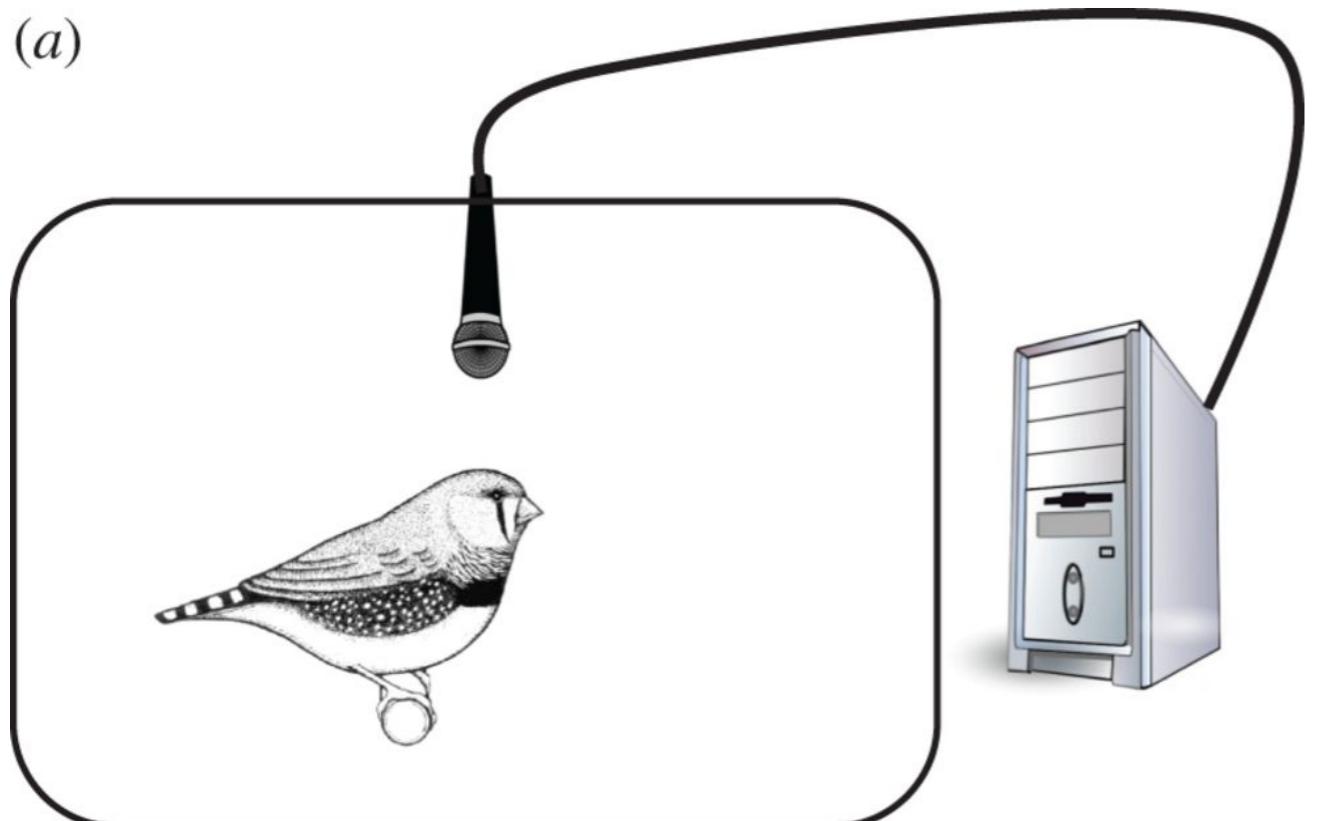
# How to study language evolution

## Generation 10

	ege-wawu		mega		gamene-wawu
	ege-wawa		mega-wawa		gamene-wawa
	ege-wuwu		mega-wuwu		gamene-wuwu
	ege		wulagi		gamane

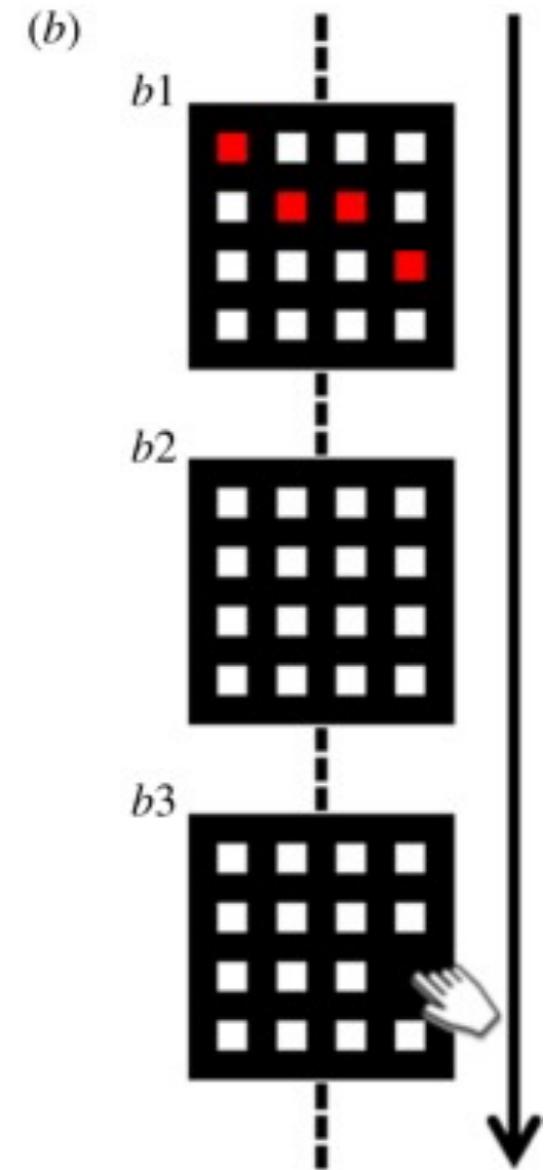
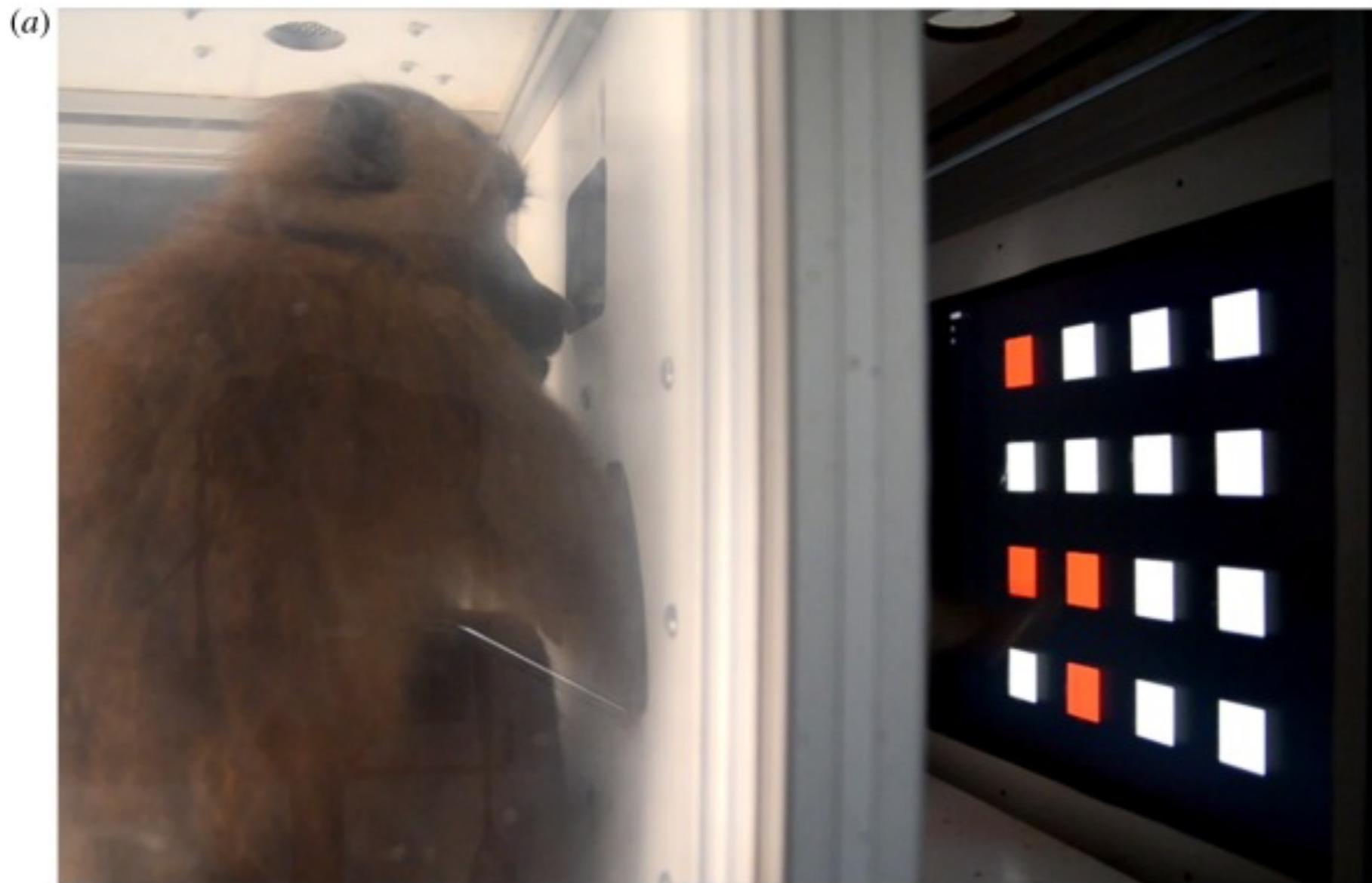
Kirby, Tamariz, Cornish & Smith (2015)

# How to study language evolution



Fehér et al (2017)

# How to study language evolution



Claidière et al (2014)

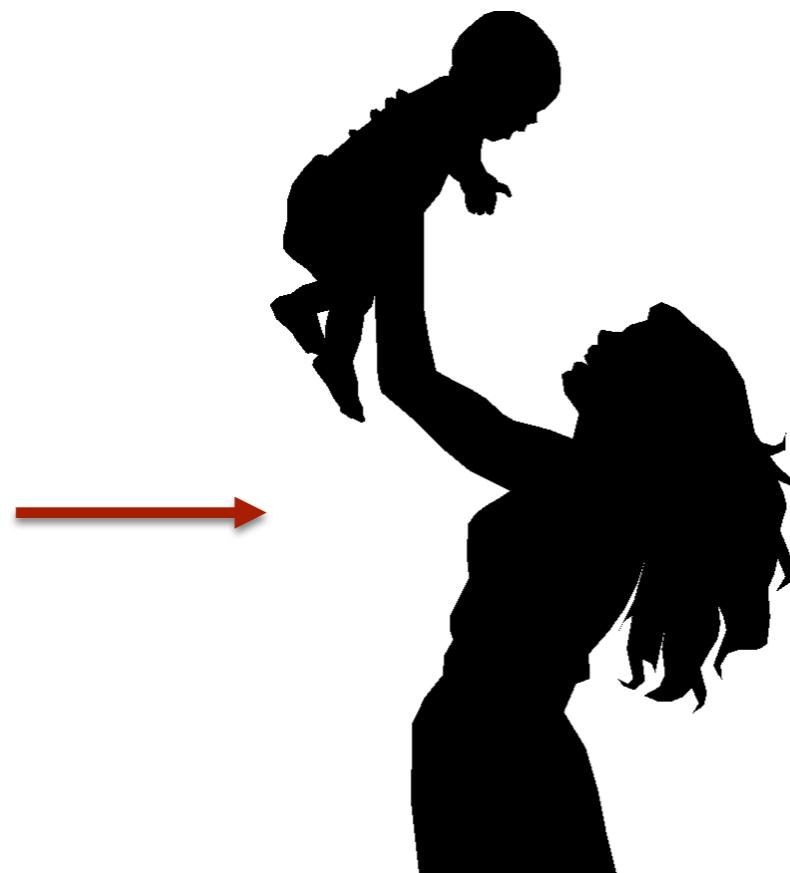
## Understanding why words change

Second, a theory of language change must explain why languages do NOT change in many ways, sometimes over many generations of speakers (see Milroy 1992b:10–13). Many theories of language change focus their attention on mechanisms to bring about change. But if those mechanisms were the only mechanisms around, then languages would be changing constantly in all of their respects. Yet they are not. A theory of language change must provide for mechanisms that act as forces for stability as well as for change, and ideally get the proper balance in order to account for rates of change. Another way of putting this desideratum is to say that a theory of language change must provide mechanisms of **NORMAL (identical) REPLICATION** as well as altered replication (and also mechanisms for nondifferential replication as well as differential replication).

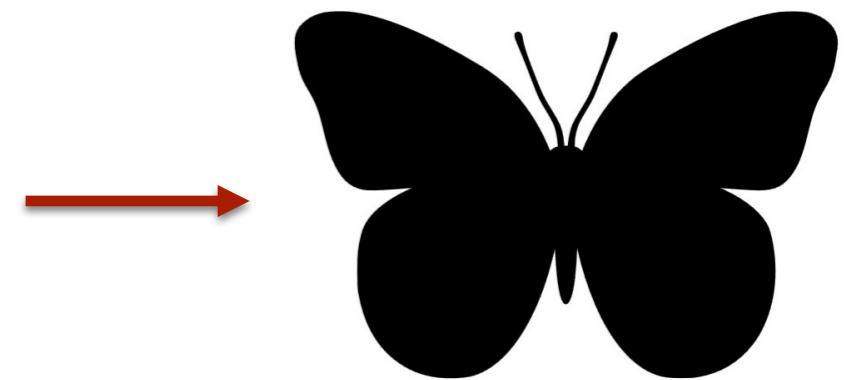
Croft (2000, p.4)

# Understanding why words change

mum  
μαμά  
mama  
maman  
mamá



butterfly  
Πεταλούδα  
schmetterling  
papillon  
mariposa



# Understanding why words change

*Ic ne secge*  
(Beowulf, 900)

ic ne secze



*Ic ne sege noht*  
(Ormulum, 1100)

ic ne sege noht



*I seye not*  
(Chaucer, 1400)

ſeſe not



*I doe not say*  
(Shakespeare, 1600)

I doe not say



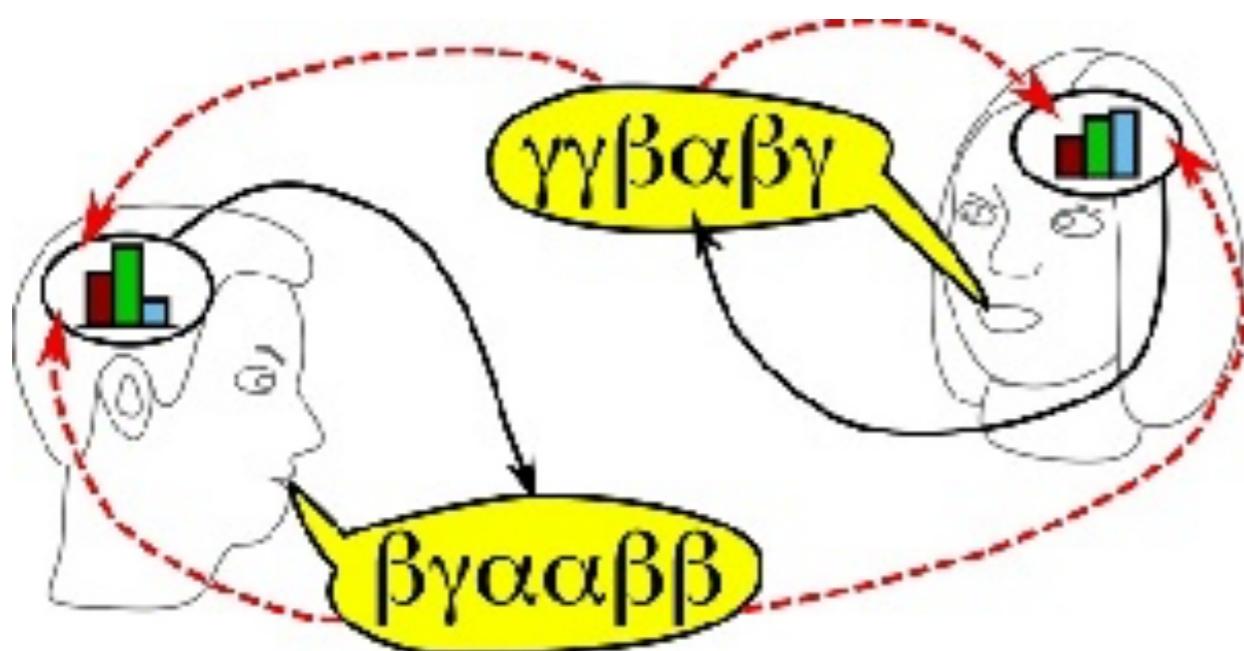
*I don't say*  
(Woolf, 1900)

I don't say

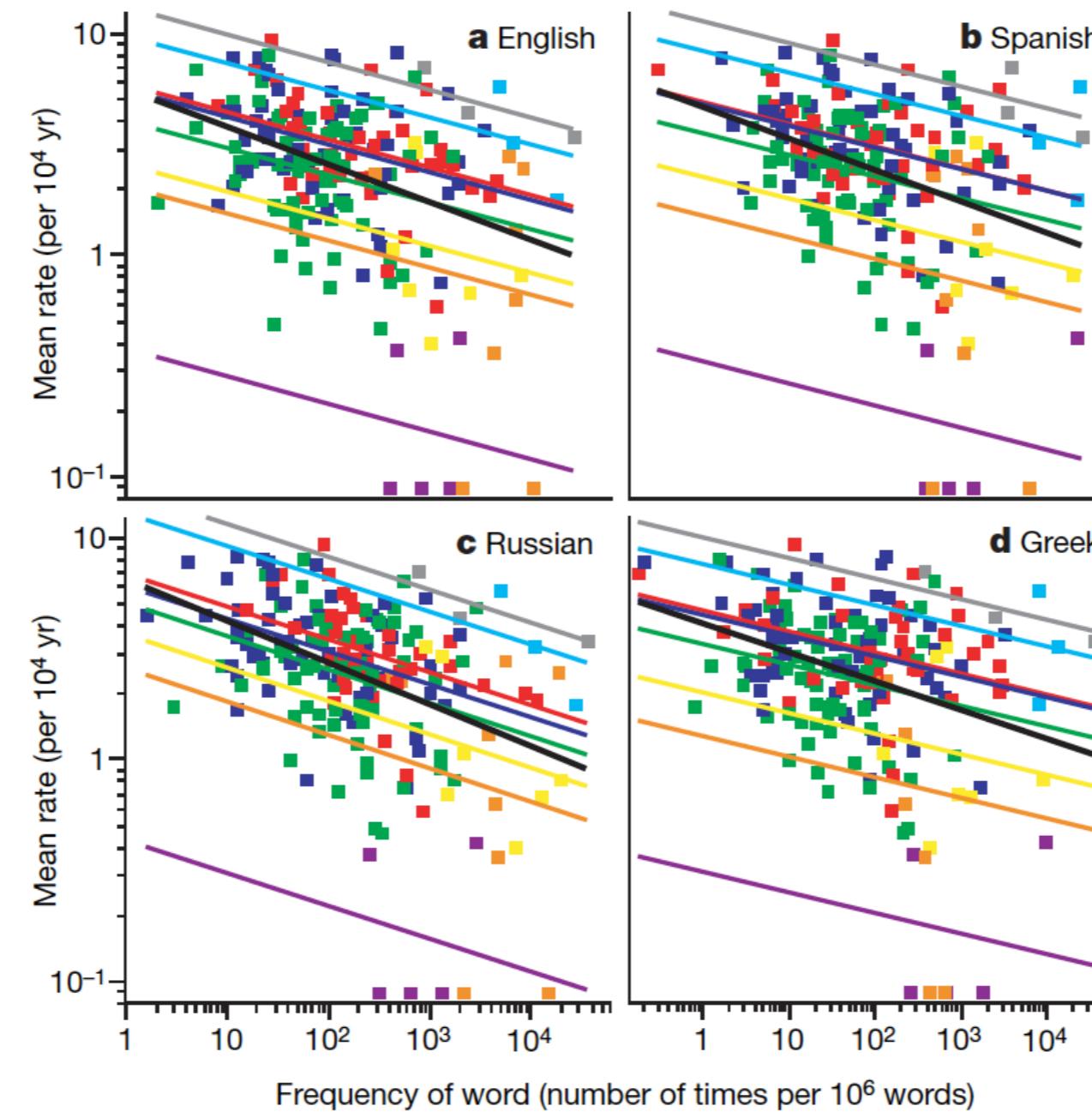


Dukelow (2017), Newberry (2017)

# Understanding why words change

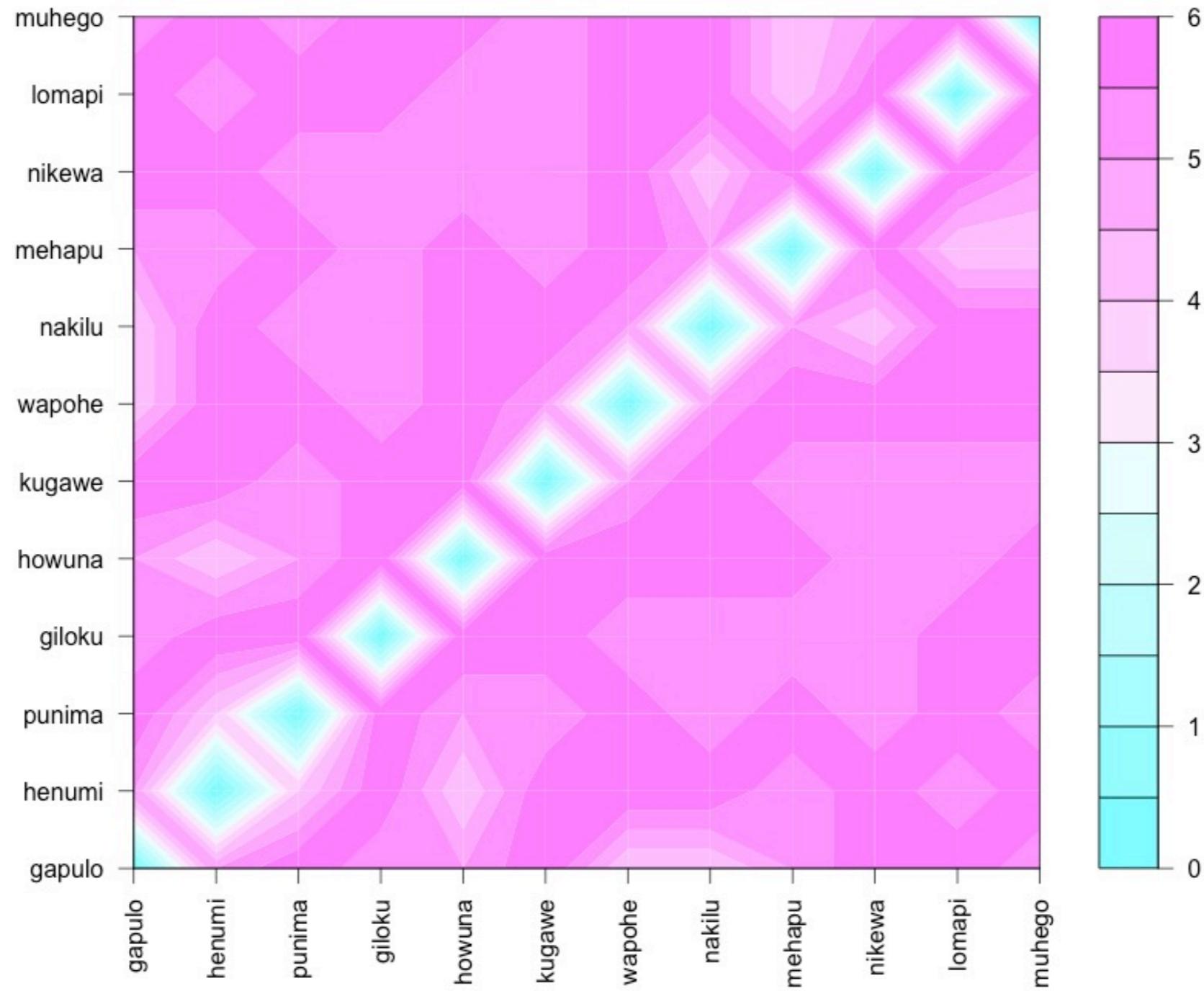


# Understanding why words change

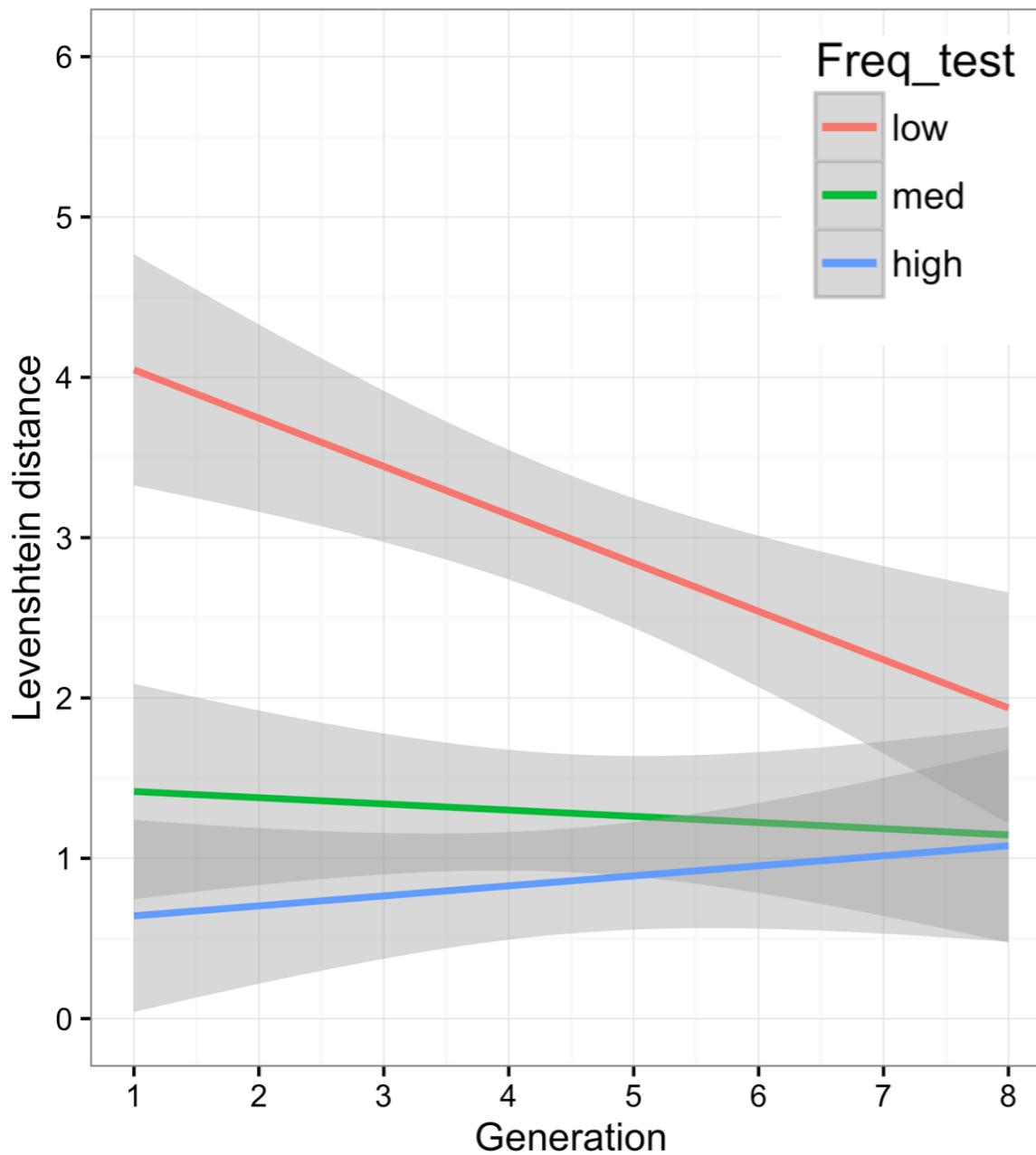


Pagel, Atkinson & Meade (2007)

# Understanding why words change



# Understanding why words change



Frequency	Generation 1	Generation 7
low	giloku	mihewu
low	howuna	mihuge
low	kugawe	nap <i>iwa</i>
low	lomapi	nok <i>iwa</i>
-----	-----	-----
med	nakilu	lilipe
med	wapohe	lamupo
med	muhego	hewino
med	punima	wopehu
-----	-----	-----
high	henumi	punima
high	gakulo	logopi
high	nipewa	henumi
high	mehapu	gakulo

Brand & Monaghan (in prep)

# Understanding why words change

Calculating the likelihood of replacement or adjustment  
(quantitatively)

MCMC sample of the characters in the language e.g. CVCVCV

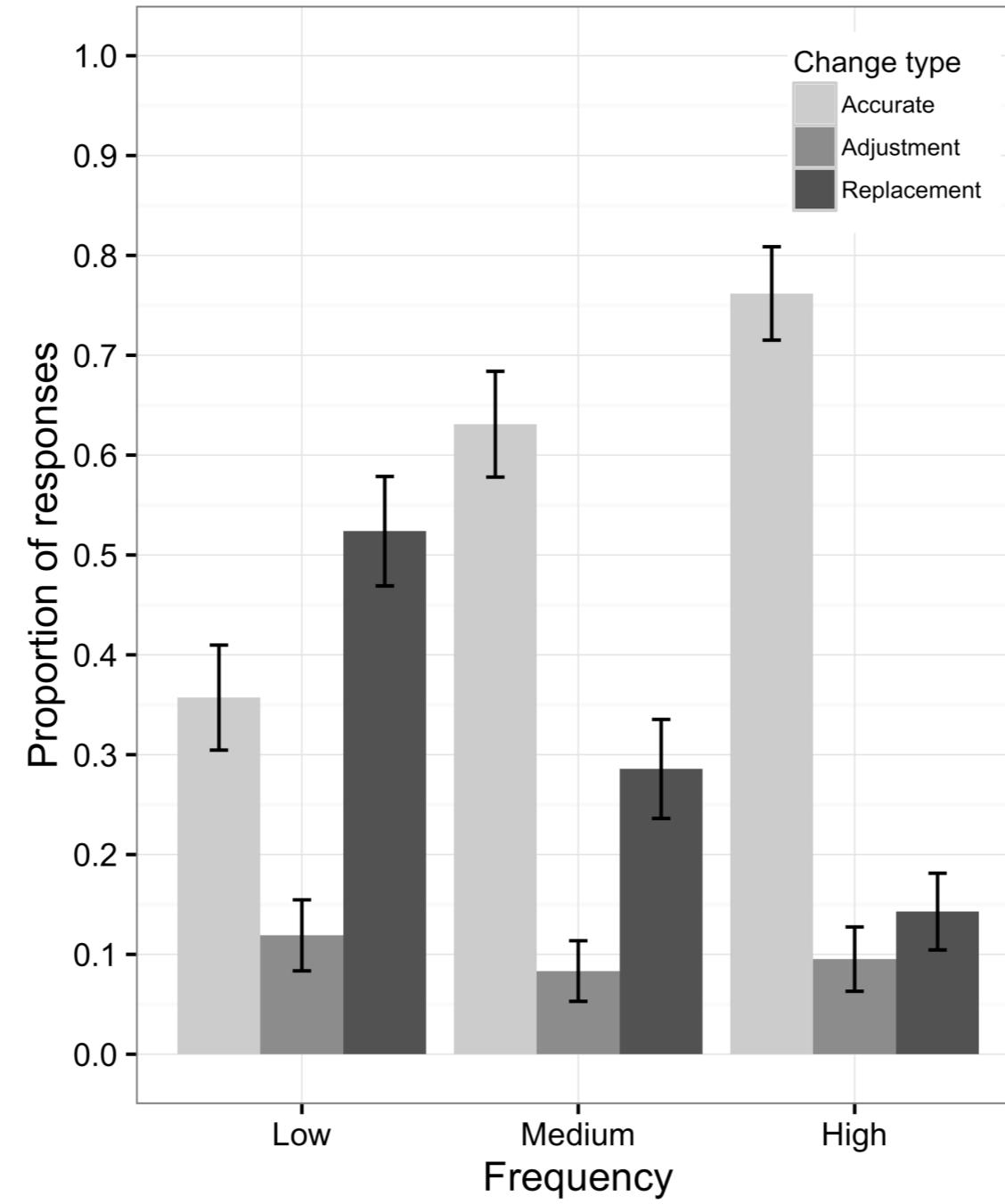
Provides 10,000 new random ‘words’ from which we can generate an average Levenshtein distance when compared to the experimental stimuli

Replacement: Levenshtein distance  $> 0.67$

Adjustment: Levenshtein distance  $< 0.67$

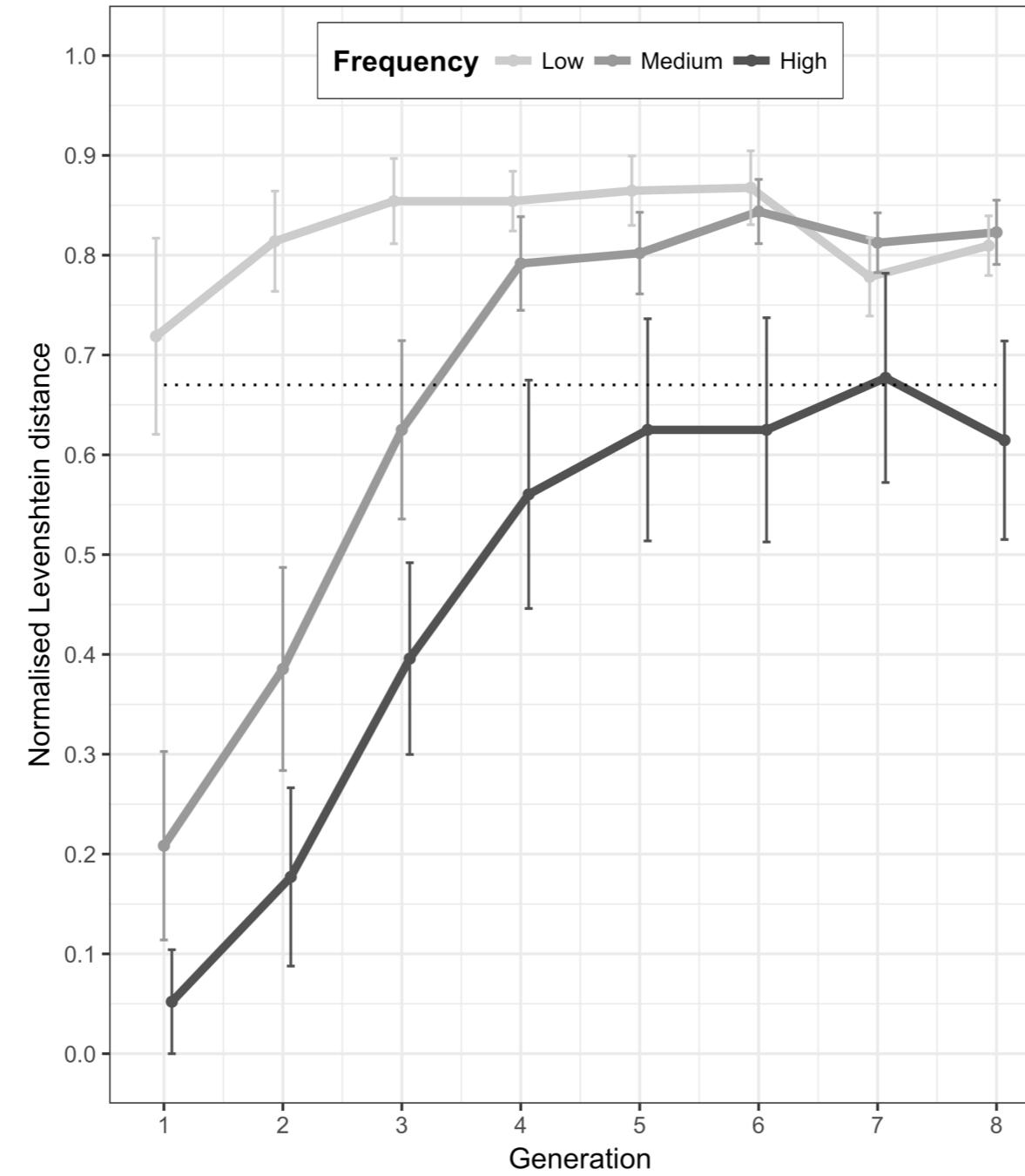
Brand & Monaghan (in prep)

# Understanding why words change



Brand & Monaghan (in prep)

# Understanding why words change



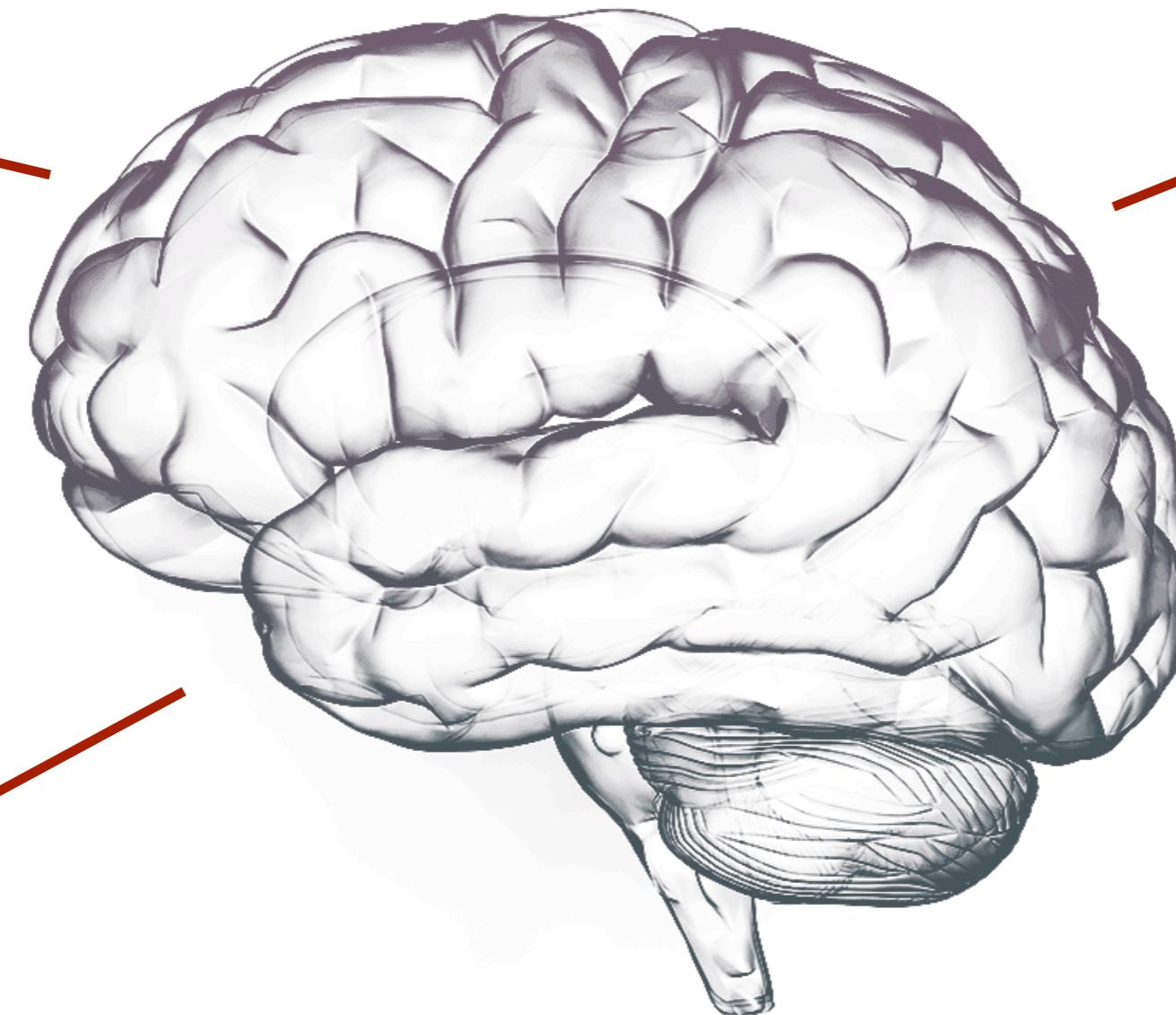
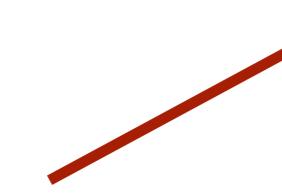
Brand & Monaghan (in prep)

# Understanding why words change

Word  
length



Age of  
acquisition



Semantics



Grammatical  
categories

# Conclusions

What you have learnt today:

- What language change and evolution is
- Why we study it
- How to study it
- What studying it has shown us
- Why multi-disciplinary research is important

# Questions / ?

Slides available at:

[https://github.com/jamesbrandscience/SSoL\\_2018](https://github.com/jamesbrandscience/SSoL_2018)

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## Further reading

- Croft, W. (2000). *Explaining language change: An evolutionary approach*. Pearson Education.
- Christiansen, M. H., & Kirby, S. (Eds.). (2003). *Language evolution*. OUP Oxford.
- Christiansen, M. H., & Chater, N. (2008). Language as shaped by the brain. *Behavioral and brain sciences*, 31(5), 489-509.
- Darwin, C. (1888). *The descent of man and selection in relation to sex* (Vol. 1). Murray.
- Fehér, O., Ljubičić, I., Suzuki, K., Okanoya, K., & Tchernichovski, O. (2017). Statistical learning in songbirds: from self-tutoring to song culture. *Phil. Trans. R. Soc. B*, 372(1711), 20160053.
- Kirby, S., Tamariz, M., Cornish, H., & Smith, K. (2015). Compression and communication in the cultural evolution of linguistic structure. *Cognition*, 141, 87-102.
- Pagel, M., Atkinson, Q. D., & Meade, A. (2007). Frequency of word-use predicts rates of lexical evolution throughout Indo-European history. *Nature*, 449(7163), 717.