



# Introduction to Linguistic & Cultural Evolution

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MPI-SHH  
SUMMER SCHOOL  
2021

Doorway  
to Human History

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# Introduction

Linguistic Diversity, Cultural Diversity, and Evolution



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# Activity 1

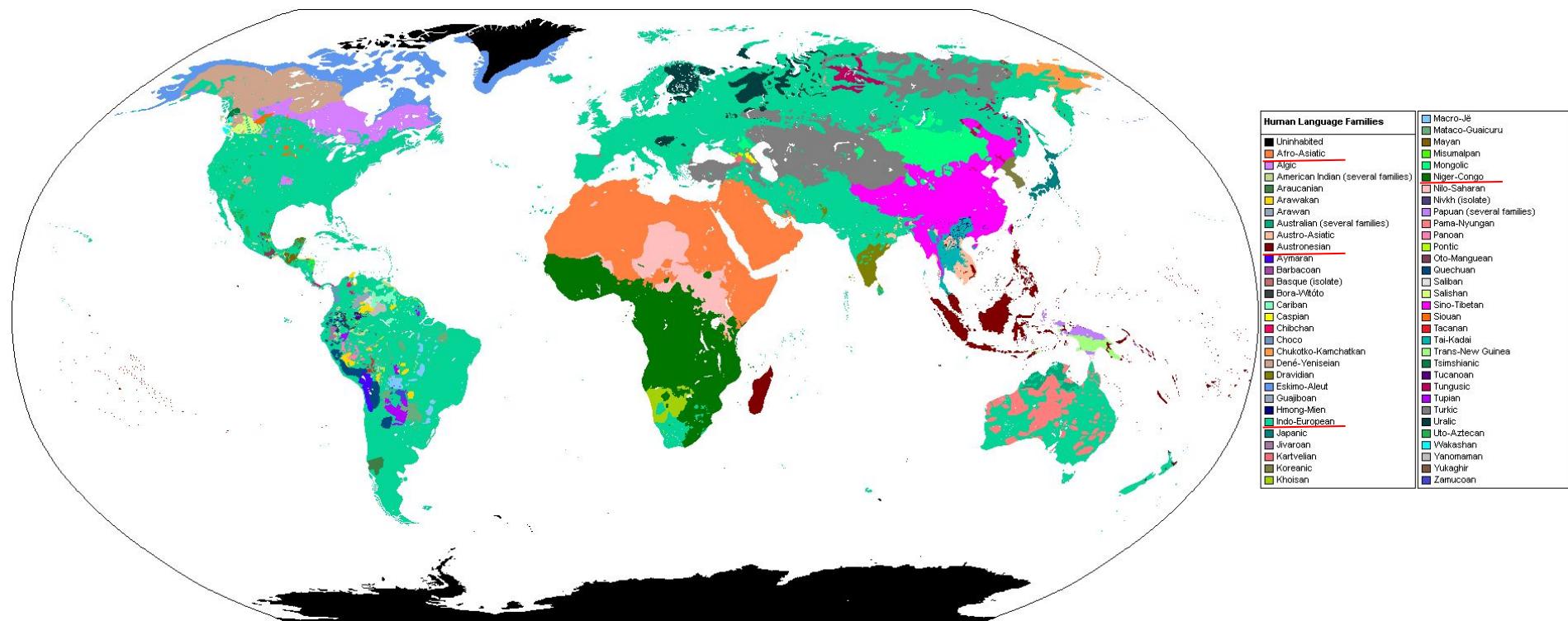
## What language(s) do you speak?

Use the following link or QR code to add your answer:

<https://www.menti.com/zbdk2fvxhu>



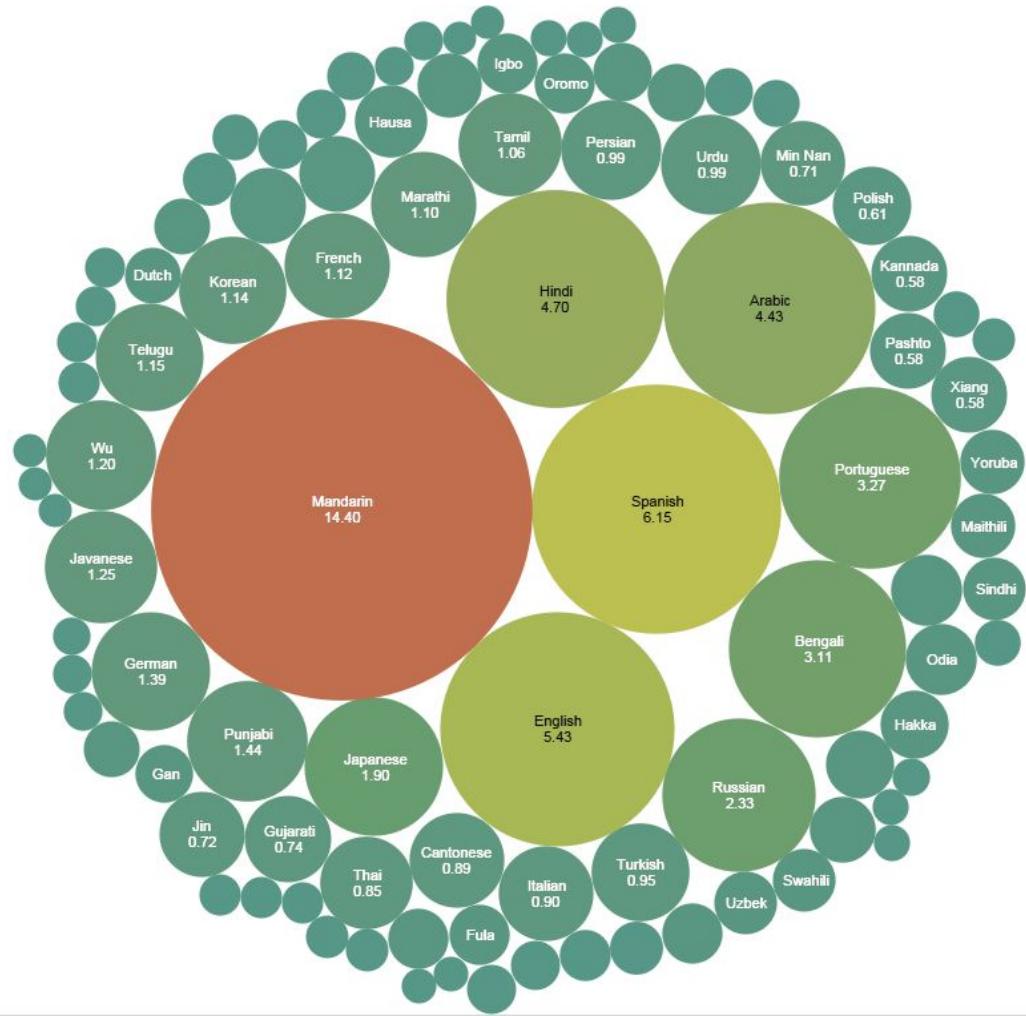
# Linguistic Diversity



A small selection of language families. By PiMaster3 - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=25125102>



# Linguistic Diversity



Percentage of the world's population  
that speaks a particular language.  
By Jroehl - Own work, CC BY-SA 4.0,  
<https://commons.wikimedia.org/w/index.php?curid=41715483>



# Linguistic Diversity in Numbers

Ethnologue 22 (2019)

- 7111 languages
- 142 language families
- largest language families:
  - Niger-Congo (1542 languages)
  - Austronesian (1257 languages)
  - Trans-New Guinea (482 languages)

Glottolog 4.4 (Hammarström et al. 2021)

- 8533 languages
- 427 language families
- largest language families:
  - Atlantic-Congo (1403 languages)
  - Austronesian (1274 languages)
  - Indo-European (583 languages)



# Linguistic Typology



Check out the class on “Linguistic Typology” taught by Dr. Hedvig Skirgård.  
**Tuesday, Aug 17 at 9am**



# Cultural Diversity

Can we do the same activity for culture?

What culture do you belong to?



# Cultural Diversity in Numbers

- Possible Variables in D-PLACE (Kirby et al. 2016)
  - Economy
  - Kinship
  - Marriage
  - Wealth Transactions
  - Housing
  - Settlement
  - Games
  - Rituals
  - Population
  - War
  - Ecology: aquatic mammals
  - Ecology: vegetation

Kirby, K.R., Gray, R. D., Greenhill, S. J., Jordan, F. M., Gomes-Ng, S., Bibiko, H-J, et al. (2016). D-PLACE: A Global Database of Cultural, Linguistic and Environmental Diversity. PLoS ONE, 11(7): e0158391. doi:10.1371/journal.pone.0158391. <https://d-place.org/>



# Evolution

- The basis of the theory of evolution was developed by Charles Darwin and Alfred Russel Wallace and manifested in “On the Origin of Species” (Darwin 1859).
- Darwin proclaimed that evolutionary processes operate based on natural selection.
- To illustrate his view on classification, Darwin used languages as an example (Darwin 1859: 439):

*The various degrees of difference between the languages of the same stock, would have to be expressed by groups subordinate to groups; but the proper or even only possible arrangement would still be genealogical; and this would be strictly natural, as it would connect together all languages, extinct and recent, by the closest affinities, and would give the filiation and origin of each tongue.*



# Linguistic and Cultural Evolution

Aim, Research Questions, and Methods



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# Aim



Evolution of Cultural Diversity in Vanuatu – Research Project <https://vimeo.com/486683510>



# Aim

- Describing and explaining the patterns of variation across the world
- Exploring the evolution of language, culture, and cognition
- Working across disciplines, i.e. anthropology, archaeology, computer science, evolutionary biology, genetics, linguistics, and the social sciences
- Using various methods, i.e. language documentation, global databases, and phylogenetic methods



# Research Questions

- What causes linguistic diversity?
  - Why are some areas of the world more diverse than others?
  - What motivates differences between languages?
- 
- What are the driving forces behind cultural diversity and how did it emerge?
  - Why do we lose cultural diversity?
- 
- What is the interplay between cultural and genetic diversity?
  - How can genetic histories inform insights from archaeology and historical linguistics?
- 
- How did different cognitive abilities evolve?



# Methods

- Language Documentation
- The Comparative Method
- Computer-Assisted Language Comparison
- Global Linguistic and Cultural Databases
- Bayesian Phylogenetic Methods
- Behavioral Experiments
- Neuroscientific Methods



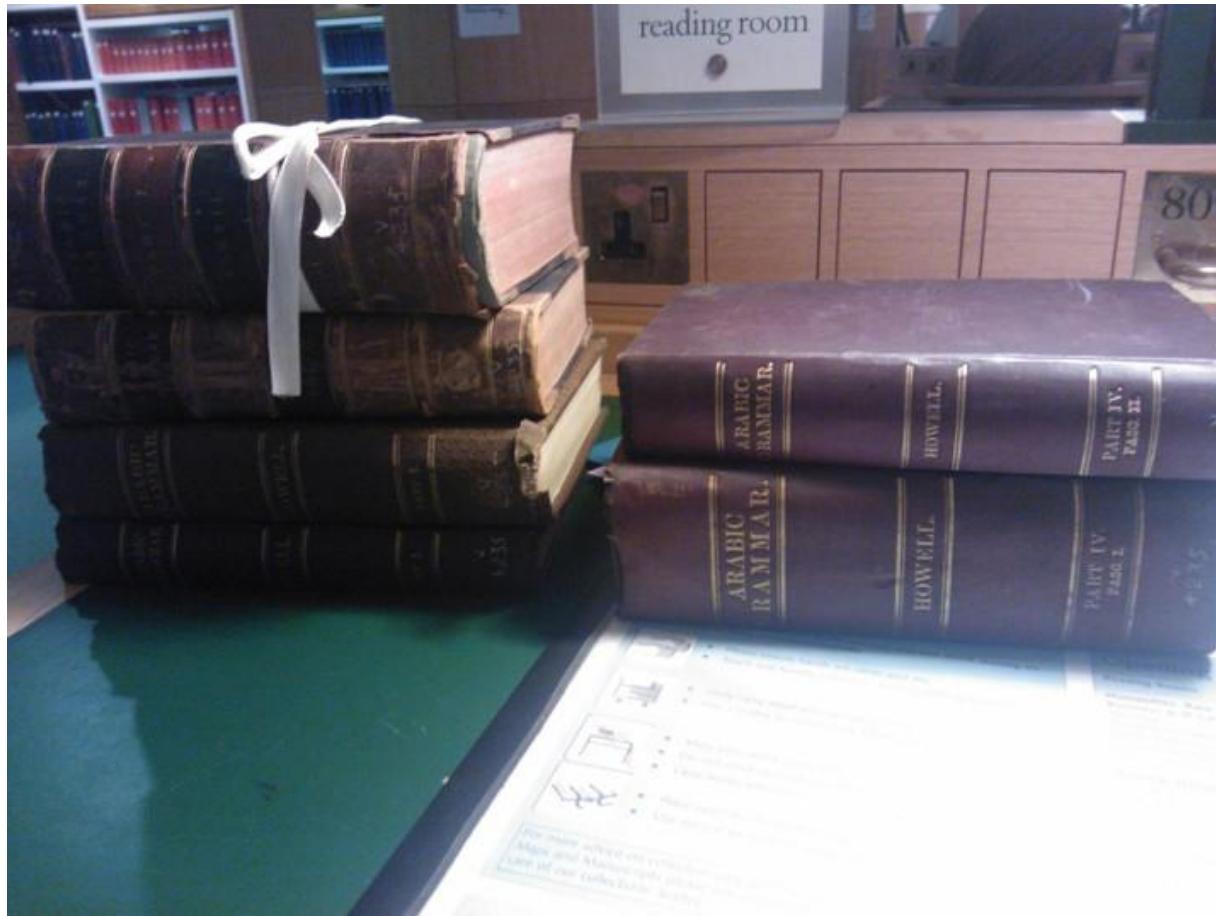
# Language Documentation



Photo credits: Mary Walworth



# Language Documentation



By Uq - Own work, CC BY-SA 3.0, <https://en.wikipedia.org/w/index.php?curid=40604721>



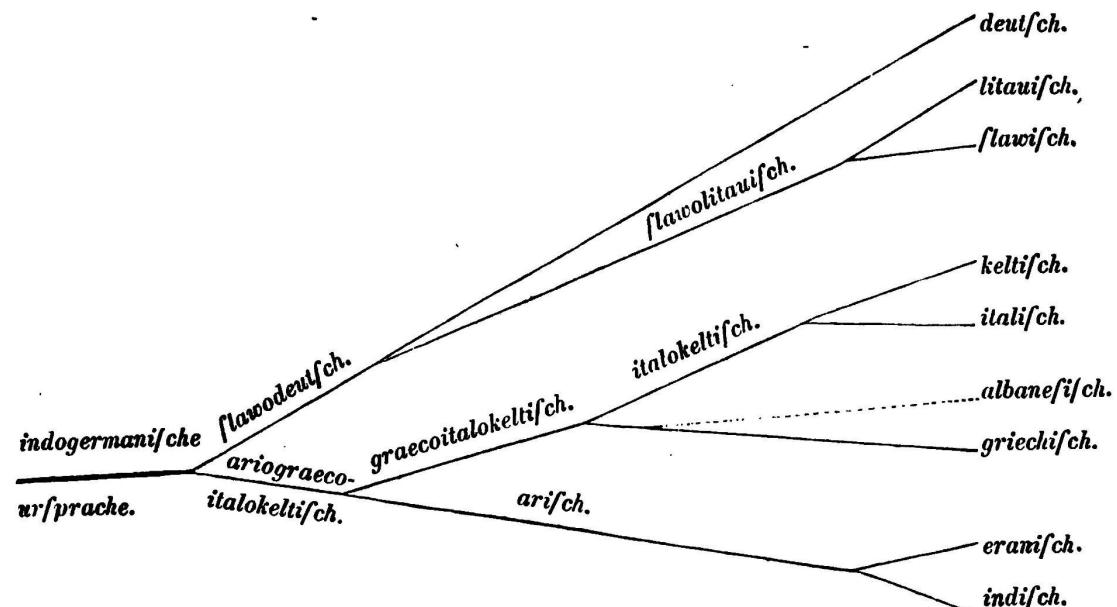
# The Comparative Method

- Reconstructing an earlier language or ancestral language (proto-language)
- Comparing features of (attested) languages with common descent to reconstruct their shared ancestor
- Discovering the relationship between languages
- Building language family trees



# The Comparative Method

- The first reconstruction of the Indo-Germanic languages by August Schleicher (1871):



By August Schleicher - Internet Archive, Public Domain,  
<https://commons.wikimedia.org/w/index.php?curid=46929716>



# The Comparative Method

- Many language family trees are based on ‘basic vocabulary’
- The task is to sort out the relationship between the words and group them into categories:
  - a. Unrelated/Chance (not related)
  - b. Common heritage (cognate)
    - direct inheritance
  - c. Borrowing (loans)
    - indirect inheritance



# Loanwords and Narrative Historical Linguistics



Check out the class on “Loanwords and Narrative Historical Linguistics” taught by Rasmus G. Bjørn.  
**Wednesday, Aug 18 at 9am**



# Activity 2

Break-out room task:

Write down 5 words that your group considers as basic vocabulary.

You have about 15 minutes time.

When you come back to the main room, paste your answer as a single message in the chat.

Example:

word1, word2, word3, word4, word5



# Lexical Data

Selected items from the Swadesh 100-list (Swadesh 1955):

head	hand	leaf	liver	hear	hair
green	egg	night	come	burning	dry
heart	cloud	person	meat	sand	root
good	seed	man	that	tail	swim
fire	star	small	blood	i	black
fish	many	sit	ash	big	sun
	eat	new	bark	belly	road
	give	sleep	stone	all	kill
	nose		bird	red	mouth
	skin		bite	die	feather
	cold		one	eye	neck
	bone		foot		ear
					mountain
					name
					dog
					long



# Computer-Assisted Language Comparison

- Enhancing historical linguistics with computational approaches
- Using methods from computer science and bioinformatics
- Developing interfaces that allow historical linguists to produce their data in machine readable formats

<https://digling.org/calc/>



# Computer-Assisted Language Comparison

COGID, CONCEPT, IPA, TAXON, TOKENS    DISPLAY ▾    EDIT ▾    ANALYZE ▾    CUSTOMIZE ▾    RELOAD    GitHub

Choose file No file chosen    JAP.tsv    <JAP.tsv> (1987 rows, 200 concepts, 10 doculects)

Select Doculects ▾    Select Concepts ▾    Select Columns ▾    OK    add column    COLUMN = value

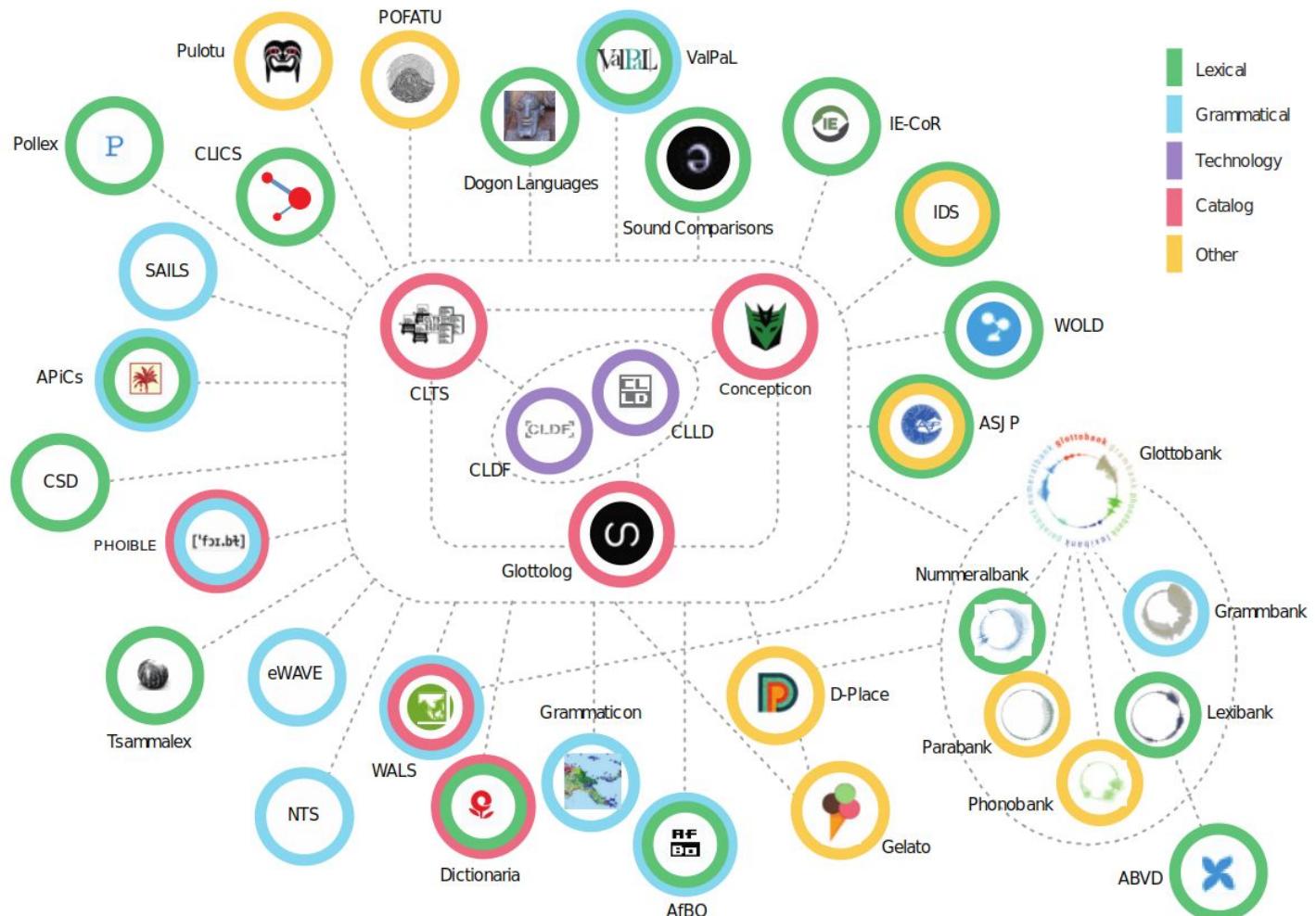
<JAP.tsv> Showing 1 - 10 of 10 entries START ← bark (of tree) (24/200) → ?

ID	TAXON	CONCEPT	IPA	TOKENS	COGID
233	Amami	bark (of tree)	x+Nxo	x   t   N   x   o	66
235	Hachijō	bark (of tree)	kua	k   ua	65 <sup>a</sup>
240	Kagoshima	bark (of tree)	kawa	k   a   w   a	65 <sup>a</sup>
237	Kōchi	bark (of tree)	kawa	k   a   w   a	65 <sup>a</sup>
234	Kyōto	bark (of tree)	kawa	k   a   w   a	65 <sup>a</sup>
231	Miyako	bark (of tree)	ka:	k   a:	65 <sup>a</sup>
239	Oki	bark (of tree)	kawa	k   a   w   a	65 <sup>a</sup>
238	Sado	bark (of tree)	kawa	k   a   w   a	65 <sup>a</sup>
236	Shuri	bark (of tree)	ka:	k   a:	65 <sup>a</sup>
232	Tōkyō	bark (of tree)	kawa	k   a   w   a	65 <sup>a</sup>

<https://digling.org/edictor/>  
For a tutorial, see List (2021).



# Databases

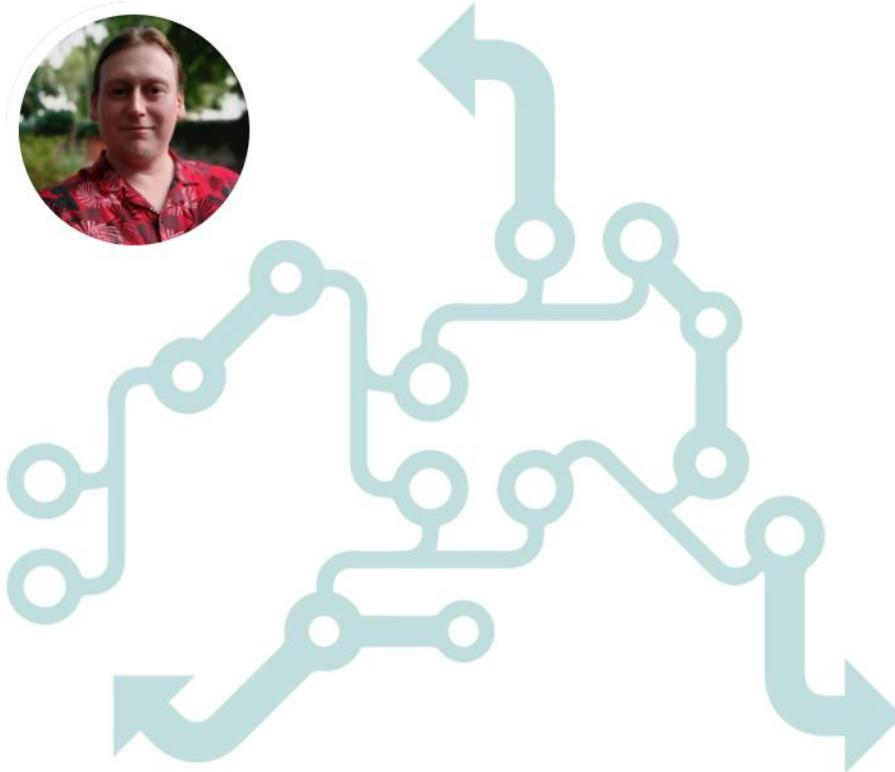


# Databases

- Glottolog <https://glottolog.org/>
- Concepticon <https://concepticon.clld.org/>
- Glottobank <https://glottobank.org/>
- CLICS <https://clics.clld.org/>
- IDS <https://ids.clld.org/>
- D-PLACE <https://d-place.org/>
- NoRaRe <https://digling.org/norare/>



# Version control and data curation with Git and GitHub

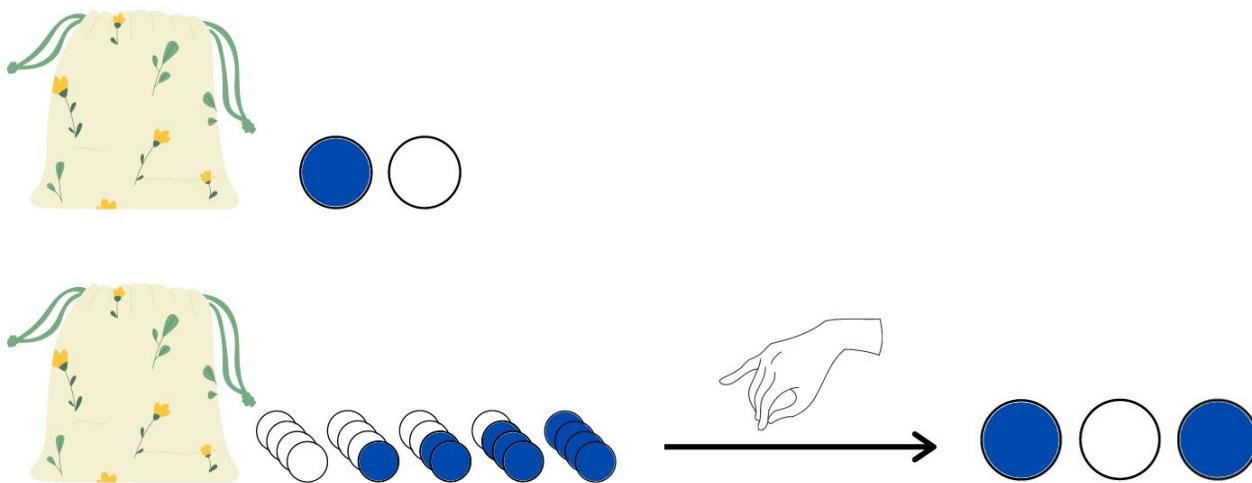


Check out the class on “Version control and data curation with Git and GitHub” taught by Johannes Englisch.  
**Friday, Aug 27 at 11am**



# Bayesian Phylogenetic Methods

- Testing the probability of how correct a tree is based on a given set of data
- Counting probabilities:

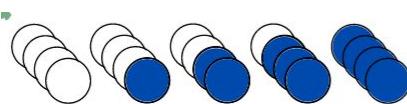


For a detailed explanation of Bayesian inference, see McElreath (2020, chapter 2).

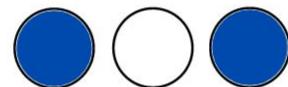


# Bayesian Phylogenetic Methods

Conjecture:



Ways to produce the sequence:



$$0 \times 4 \times 0 = 0$$

$$1 \times 3 \times 1 = 3$$

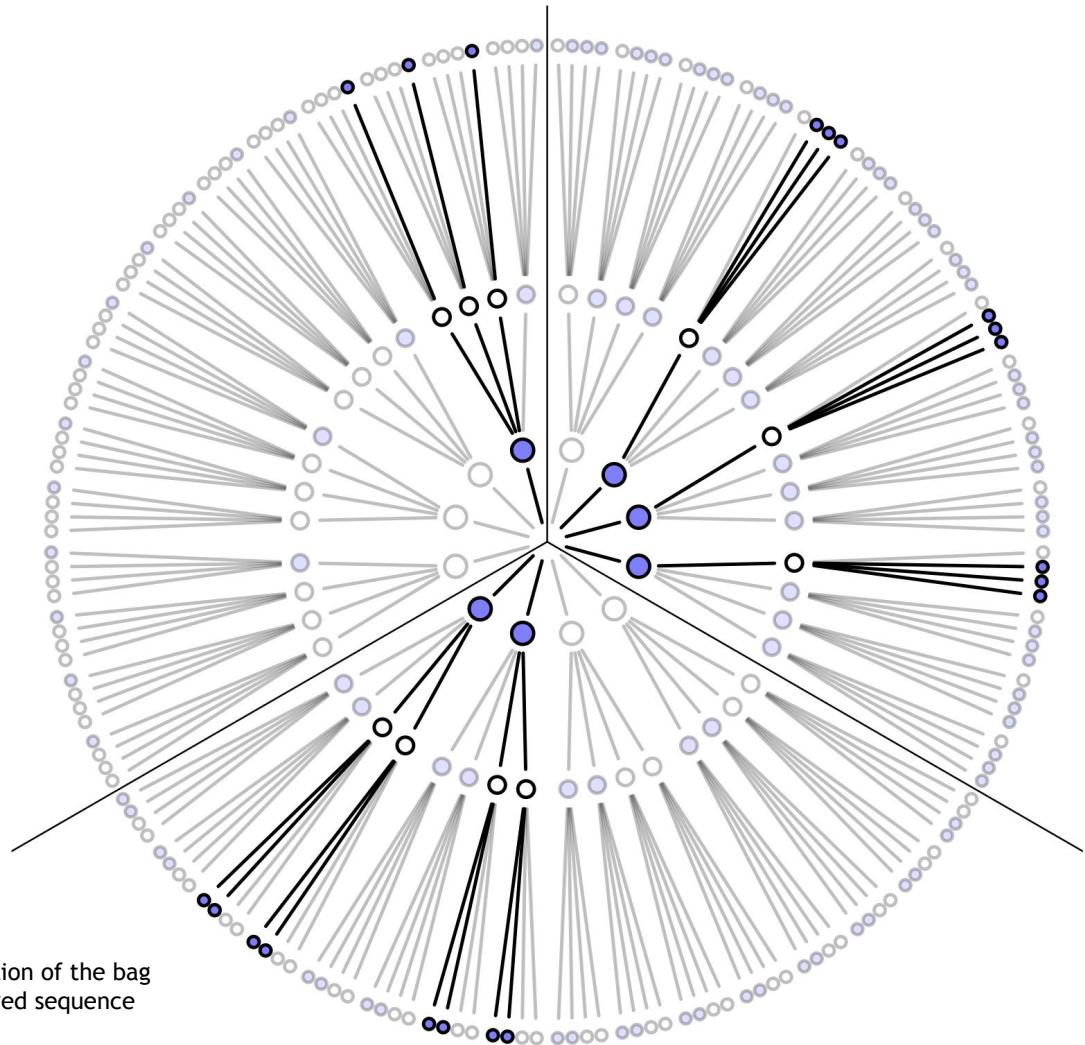
$$2 \times 2 \times 2 = 8$$

$$3 \times 1 \times 3 = 9$$

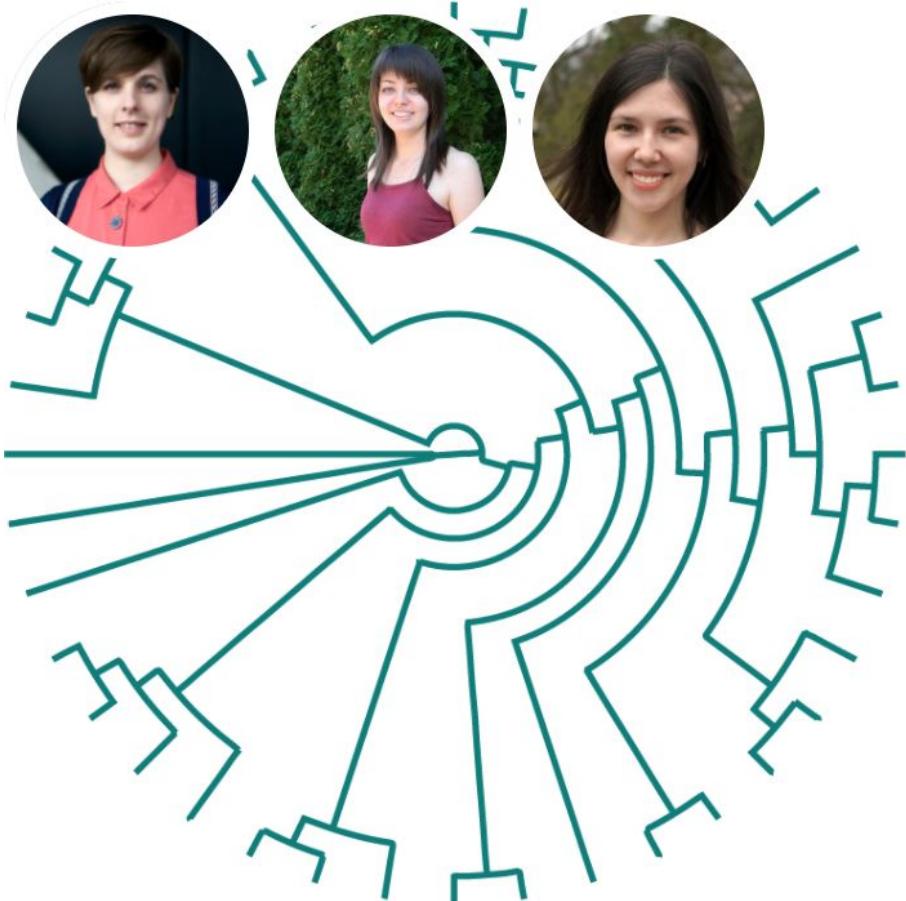
$$4 \times 0 \times 4 = 0$$



# Bayesian Phylogenetic Methods



# Bayesian Phylogenetic Linguistics

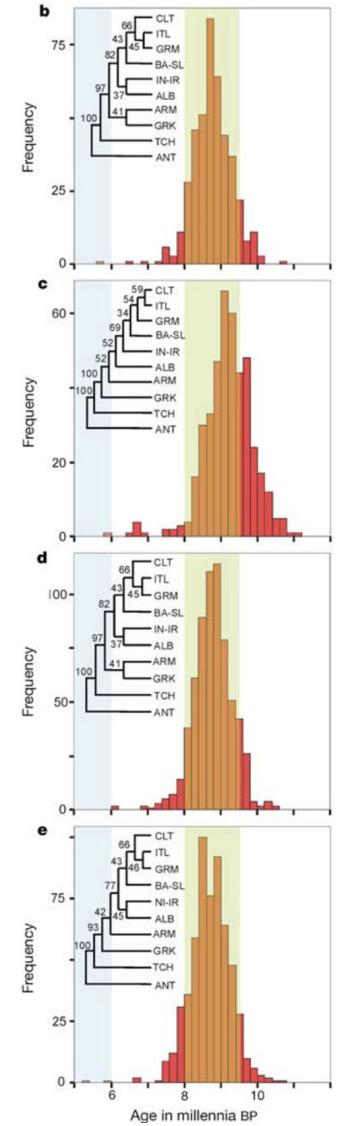
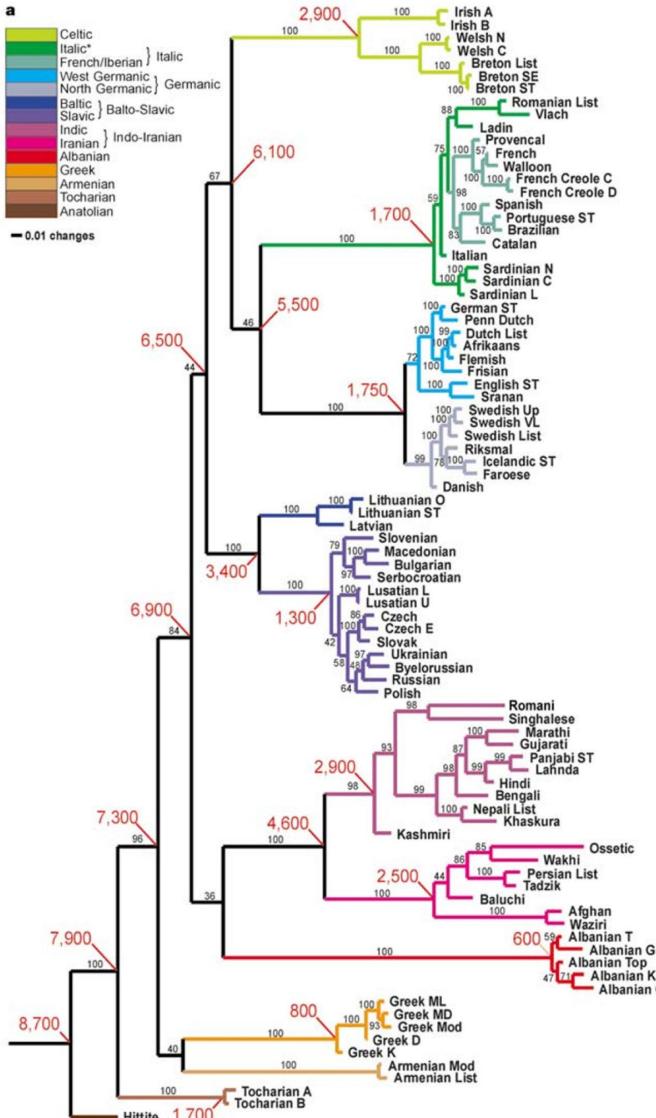


Check out the class on “Bayesian Phylogenetic Linguistics” taught by Annika Tjuka, Nataliia Hübler and Olena Shcherbakova.  
**Friday, Aug 20 at 9am**

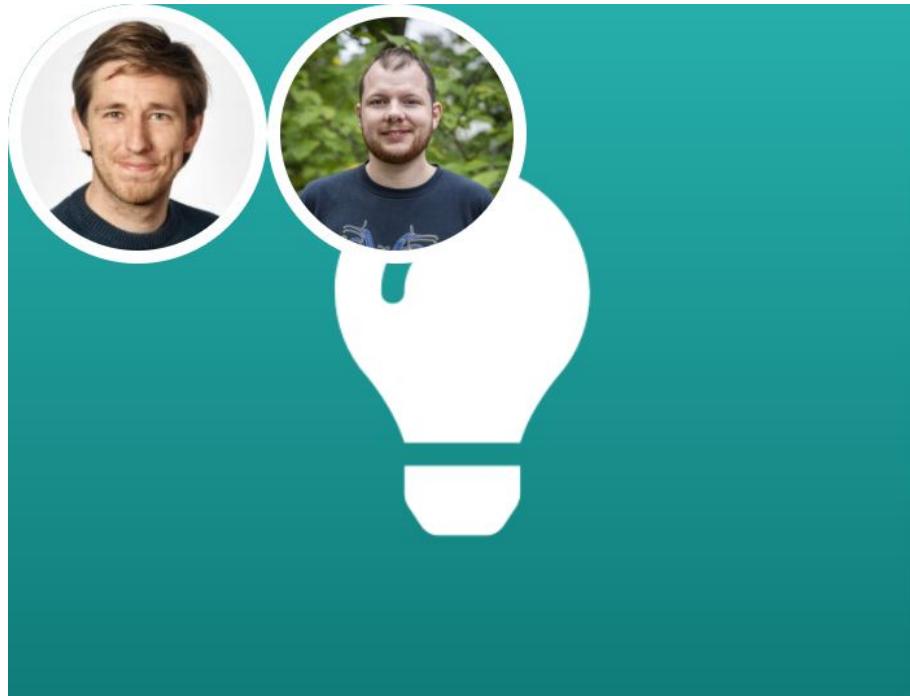


# Bayesian Phylogenetic Methods

Indo-European language family tree illustrating the majority-rule consensus tree based on the MCMC sample of 1,000 trees (Gray & Atkinson 2003).



# Case Studies



Check out the class on  
“Indo-European: The Homeland  
Debate Anno 2021” taught by Rasmus  
G. Bjørn and Robert Tegethoff.  
**Thursday, Aug 26 at 1.30pm**



# Behavioral Experiments

- Investigating the co-evolution of cognitive abilities of humans and dogs
- Dogs have been living with humans for at least 15.000 years.
- How do dogs understand humans' communicative cues?
- Do dogs know what we see?

[https://doglab.shh.mpg.de/dog-cognition\\_de.php](https://doglab.shh.mpg.de/dog-cognition_de.php)



# Behavioral Experiments



Photo credits: BR <https://www.br.de/fernsehen/ard-alpha/sendungen/campus/akademiker-sicherheit-uni-jobs-befristet-100.html>



# Neuroscientific Methods

- Studying the nervous system to understand behavior and learning
- Functional Magnetic Resonance Tomography (fMRT): measuring activity and structural changes of the brain
- Electroencephalography (EEG): measuring electrical brain activity
- Transcranial Magnetic Stimulation (TMS): measuring psychological processes after certain brain areas were stimulated



# Neuroscientific Methods



Check out the class on “Introduction to Cognitive Science and Neuroscientific Methods (EEG, fMRI, TMS etc...)” taught by Ayaka Tsuchiya and Dr. Yoolim Kim. **Thursday, Aug 19 at 9am**



# Reconstructing Human History

Case Study: Pacific Settlement



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# Activity 3

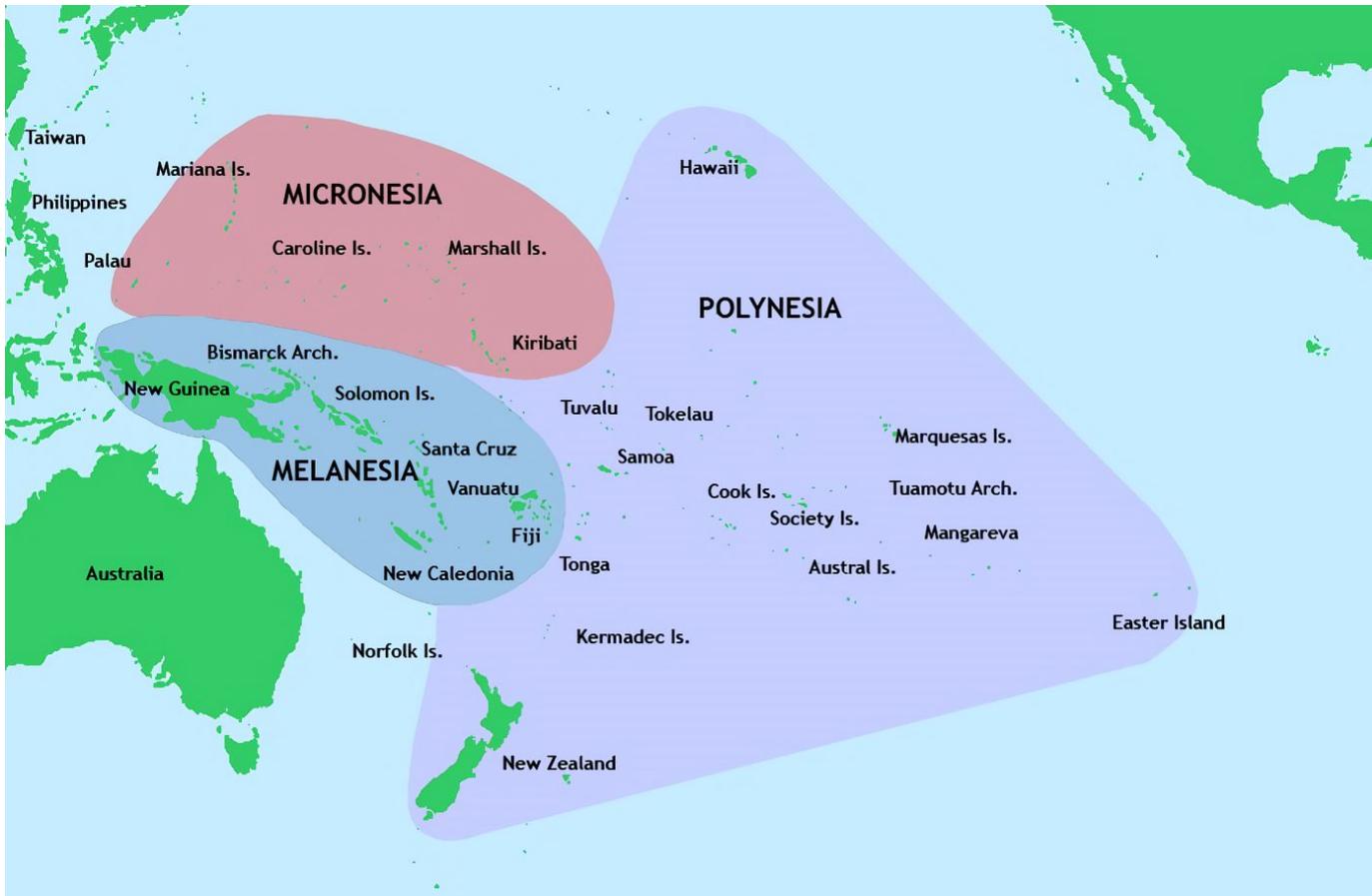
What types of data can we combine with language family trees to get a better insight into human history?

Can you think of a historical phenomenon that could benefit from the information in language family trees?

Write your answer in the chat.



# Pacific Settlement



By User:Kahuroa - Outline: File:World2Hires filled mercator.svg; Map information based on Vaka Moana: Voyages of the Ancestors - the discovery and settlement of the Pacific, ed K.R. Howe, 2008, p57., Public Domain, <https://commons.wikimedia.org/w/index.php?curid=61904861>



# Pacific Settlement

- Testing two hypothesis:

- a. **pulse-pause expansion:**

- Austronesians originated in Taiwan around 5500 years ago and spread through the Pacific in a sequence of expansion pulses and settlement pauses. After that they spread over 7000 km from the Philippines to Polynesia in less than 1200 years.
    - predicts an origin of Austronesian between 5000 to 6000 years B.P.

- b. **slow-boat diffusion:**

- extensive sociocultural network of maritime exchange in Wallacea (in the region of modern day Sulawesi and the Moluccas) around 13,000 to 17,000 years B.P.
    - predicts an origin of Austronesian between 13,000 to 17,000 years B.P.

Gray, Russell D., Alexei J. Drummond & Simon J. Greenhill. 2009. Language phylogenies reveal expansion pulses and pauses in pacific settlement. Science 323(5913). 479-483.



# Pacific Settlement

## Material:

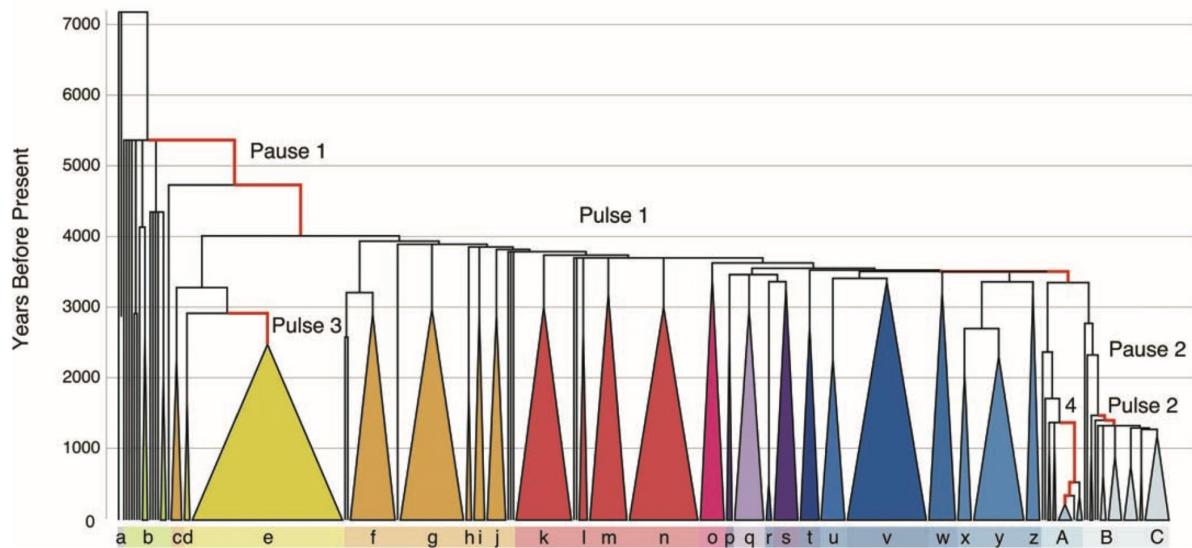
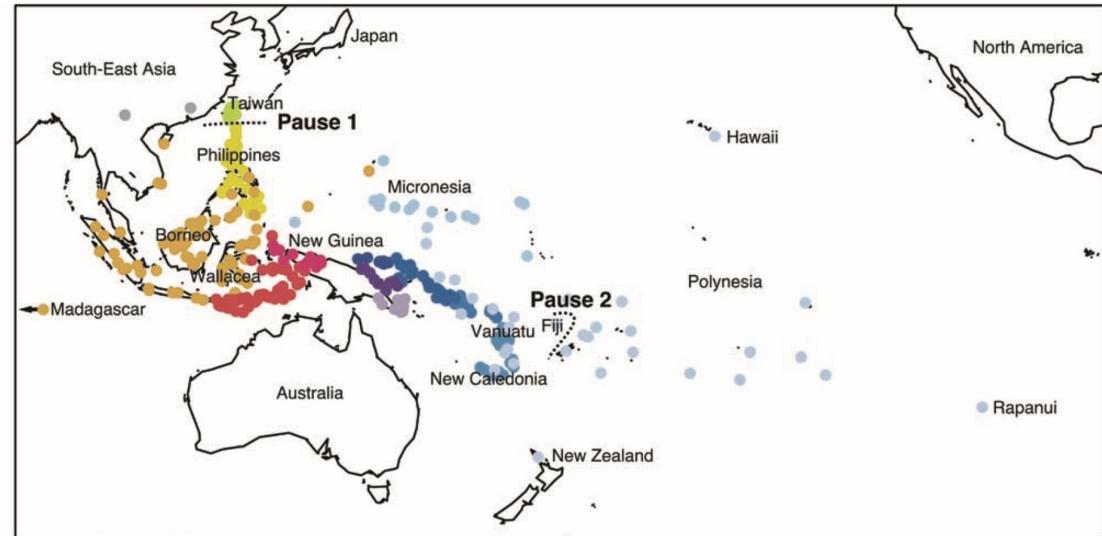
- 210 items of basic vocabulary
- cognate sets for 400 well-attested Austronesian languages  
(from a total of around 1200 Austronesian languages)

## Method:

- Models of cognate evolution based on Bayesian phylogenetic methods to define Austronesian language subgroups and linkages



# Pacific Settlement



The tree shows four major expansion pulses and two pauses in Pacific settlement. Branches colored red are those identified as having significant increases in language diversification rates. Major language subgroups are color-coded (Gray et al. 2009).



# Pacific Settlement

## Results:

- The chained topology supports the structure predicted by the pulse-pause expansion (hypothesis 1).
- A mean of 5230 years for the origin of Austronesian was established.
- The branch lengths support the occurrence of two pauses:
  - a. before the settlement of the Philippines and corresponding with the development of the Proto-Malayo-Polynesian language around 3800 to 4500 years B.P.
  - b. after the settlement of Western Polynesia by 2800 years B.P., before the expansion into Central and Marginal Eastern Polynesia



# Summary



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# Summary

- The goal of studies in Linguistic and Cultural Evolution is to understand and explain diversity in language and culture.
- Researchers also explore the processes and causes of linguistic and cultural diversification.
- To find out more about the human past, we use methods ranging from the qualitative analysis of language features to the creation of databases and large-scale phylogenetic studies.
- Different types of evidence from archeology, genetics, and linguistics can shed light on fundamental questions about human history.



# Outlook

Keynote, Round Table, and Case Studies



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# Keynote



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University of  
Zurich<sup>UZH</sup>

Keynote Lecture

## Nature and Culture in Language Evolution

**Prof. Dr. Balthasar Bickel**

Department of Comparative Language Science, University of Zurich

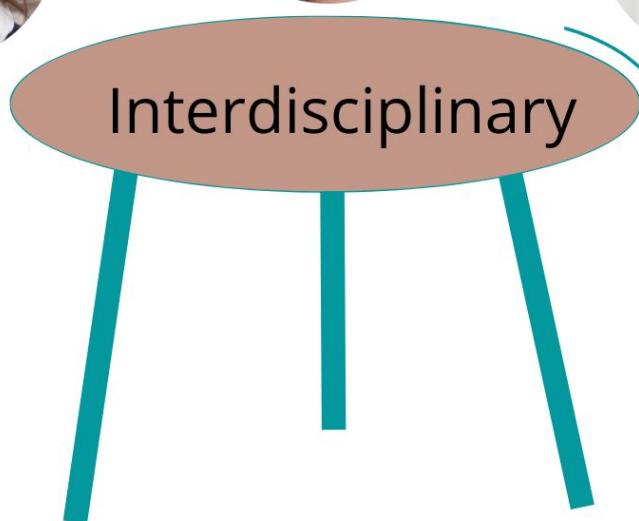
Check out the keynote lecture by  
Prof. Dr. Balthasar Bickel.  
**Monday, Aug 23 at 11am**



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# Round Table Discussion



Check out the round table on “Why do we need interdisciplinary research?” with Dr. Katerina Douka, Dr. Mary Walworth, and Dr. Wolfgang Haak.

**Thursday, Aug 19 at 5pm**



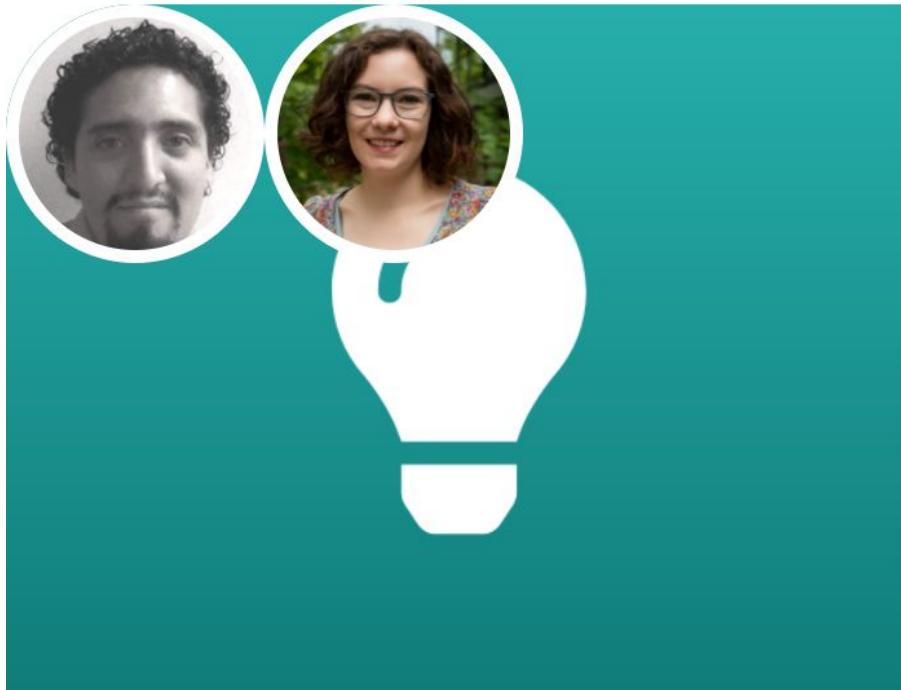
# Case Studies and Methodologies



Check out the class on  
“Archaeolinguistics: the  
Transeurasian case” taught by Prof.  
Dr. Martine Robbeets.  
**Thursday, Aug 19 at 3.30pm**



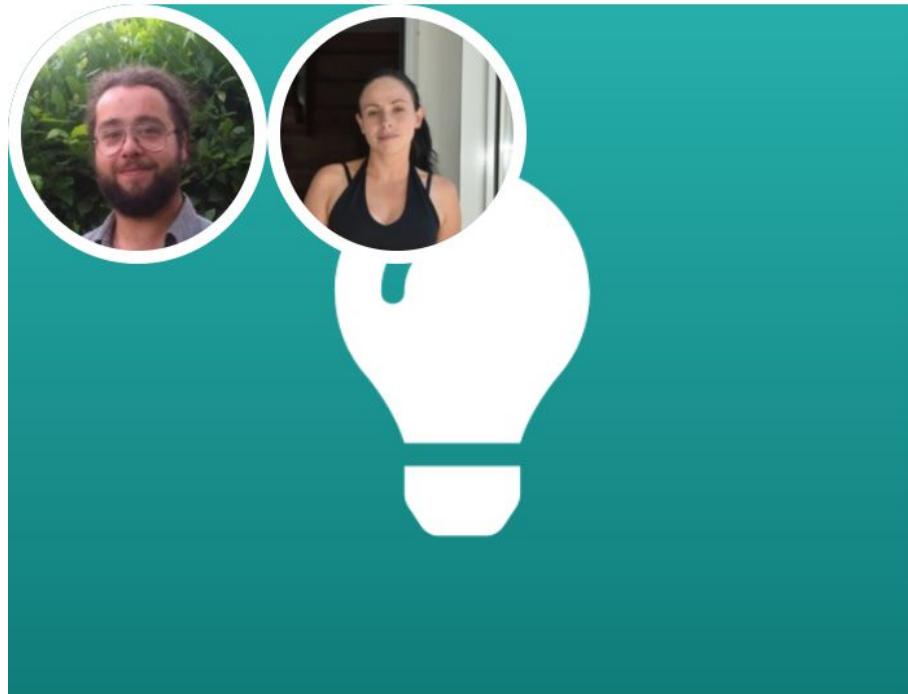
# Case Studies and Methodologies



Check out the class on “Case study: Genetic and Linguistic relationships in the Americas” taught by Rodrigo Barquera and Sandra Auderset.  
**Wednesday, Aug 25 at 9am**



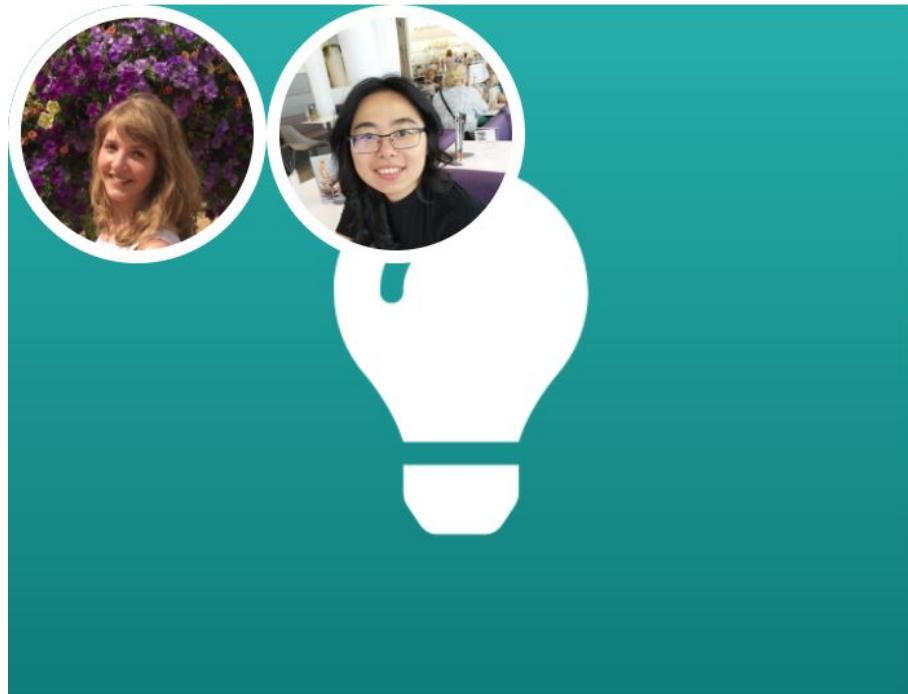
# Case Studies and Methodologies



Check out the class on “Case study: Bantu Languages & Archaeology” taught by Jacopo Niccolò Cerasoni and Dr. Anne-Maria Fehn.  
**Thursday, Aug 26 at 9am**



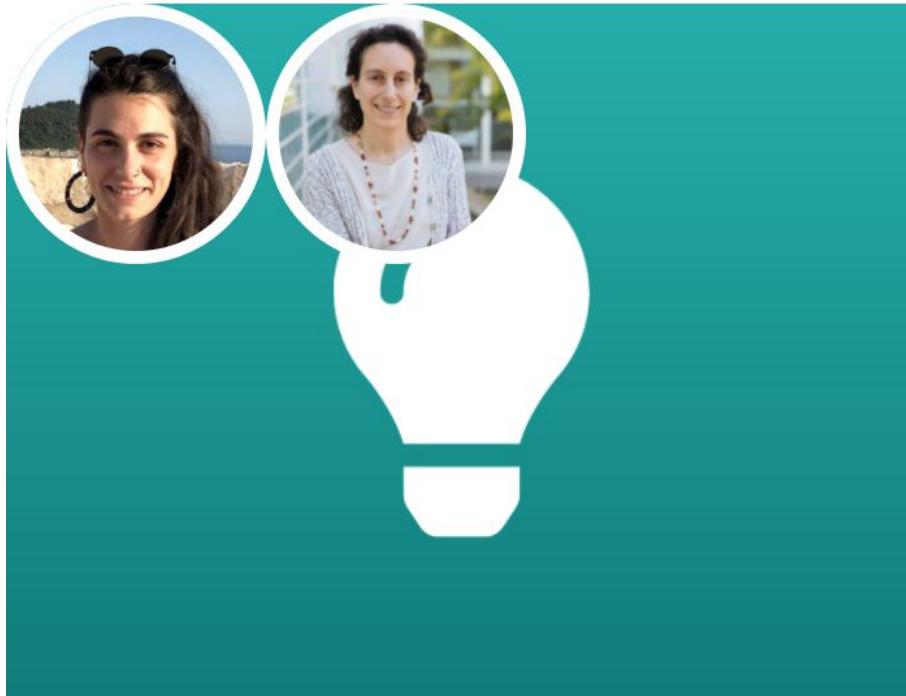
# Case Studies and Methodologies



Check out the class on “Case study: Hmong-Mien (Southeast Asia linguistic area)” taught by Selina Carlhoff and Mei-Shin Wu.  
**Thursday, Aug 26 at 11am**



# Case Studies and Methodologies



Check out the class on  
“Interdisciplinary Working” taught by  
Eleftheria Orfanou and Dr. Natalie  
Uomini.  
**Friday, Aug 27 at 1.30pm**



# Questions?



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# References

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