Origins and Evolution of Language
Week 1: Introduction

Kenny Smith

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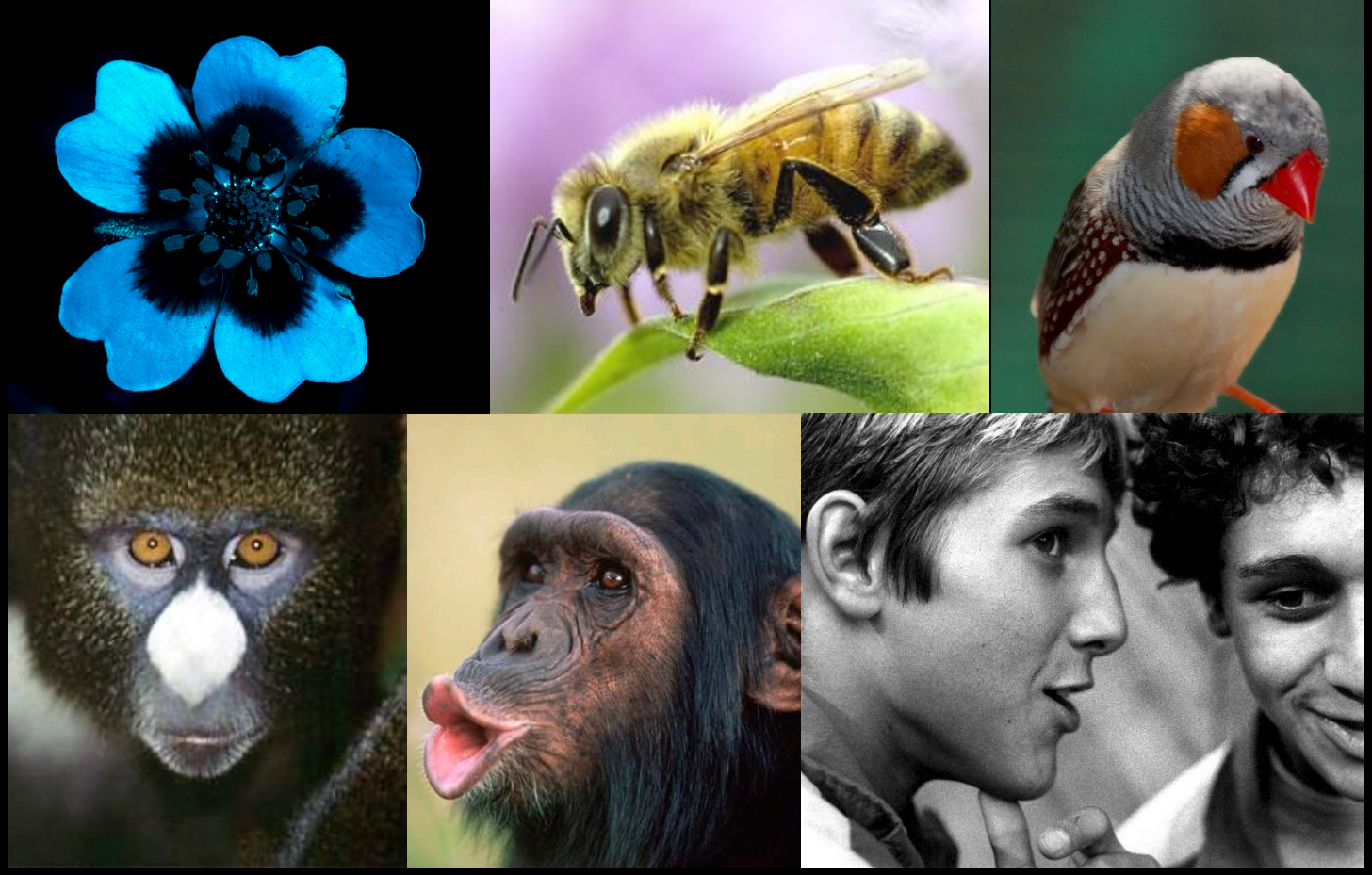
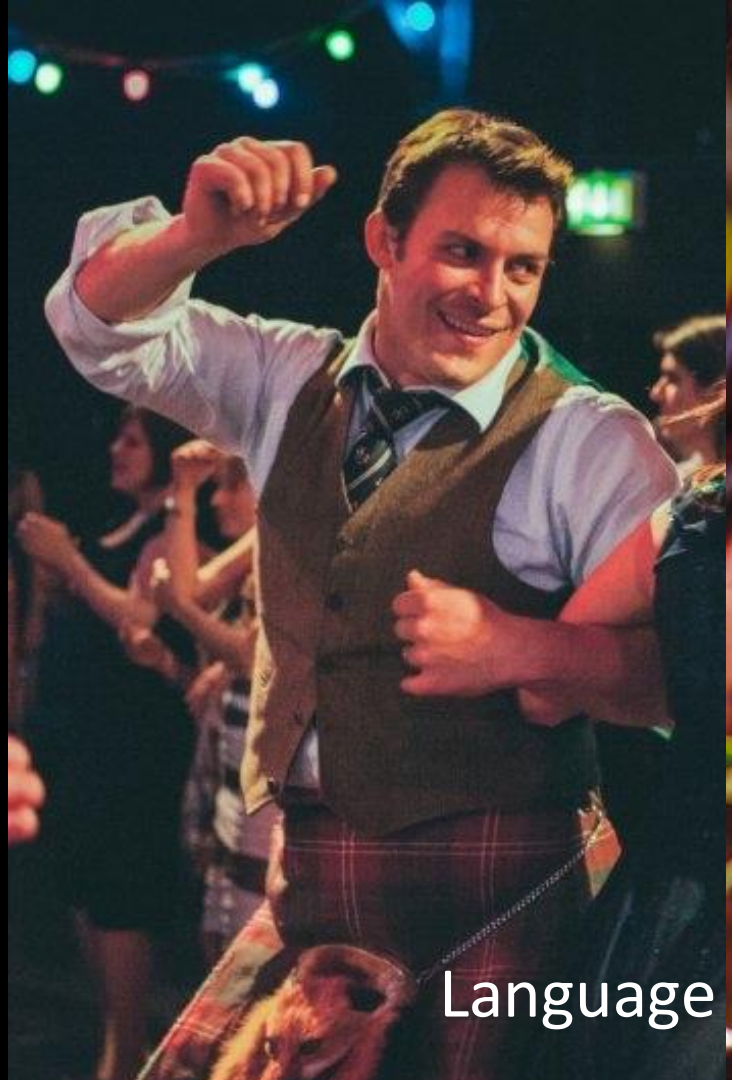


Communication is widespread, but language is unique

How did language evolve?



Language is **universal** in our species

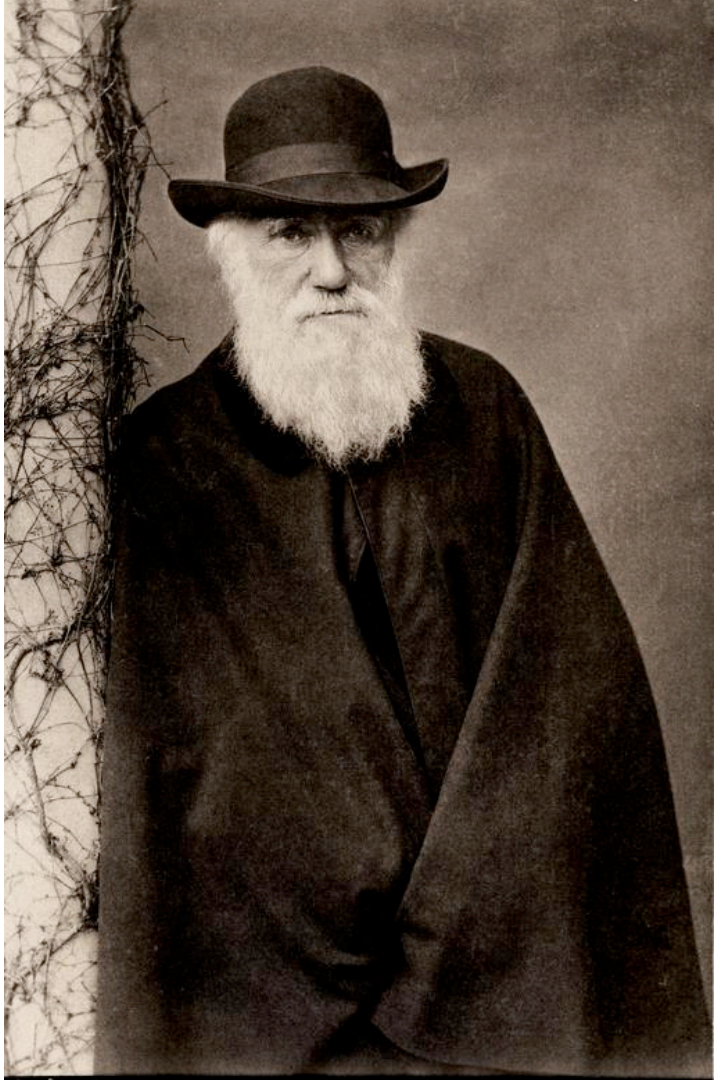
Language is a hugely **adaptive** trait

A tool for the communication of knowledge and internal states

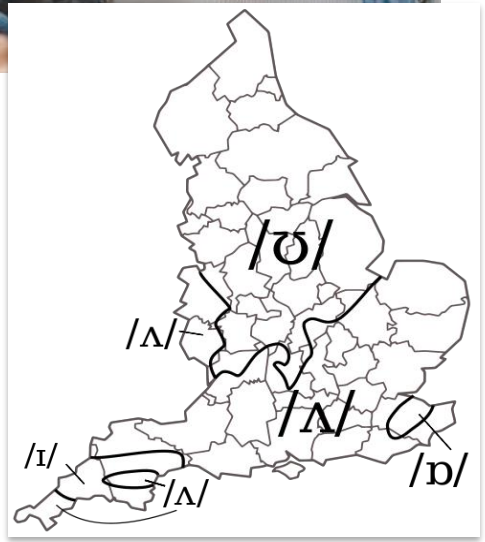
One possible explanation

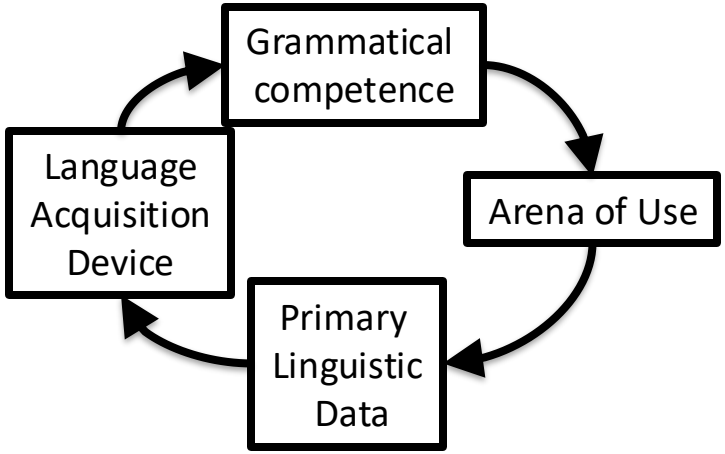
- Language is just like any other adaptive feature of an organism's biology
- It's an **innate** feature of the human mind
- It evolved by natural selection under pressure for communication

More on this next week



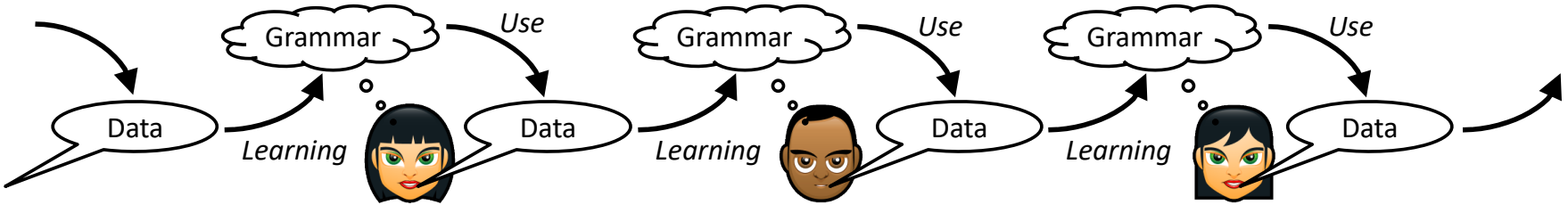
Social learning is ubiquitous in humans





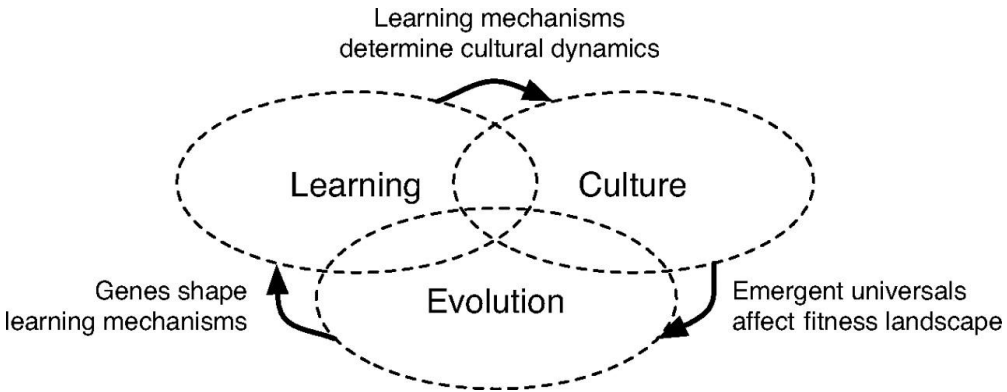
Language is transmitted via repeated **learning** and **use**

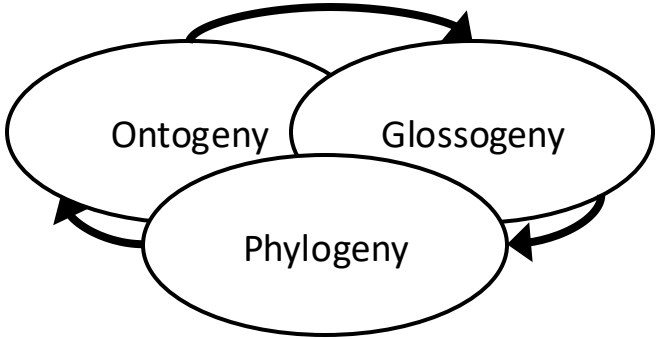
Language is shaped as a consequence of these processes



Upper: from Hurford, J. R. (1990). Nativist and functional explanations in language acquisition. In I. M. Roca (Ed.), *Logical issues in language acquisition* (pp. 85–136). Dordrecht: Foris.
Lower: from Smith, K. (2022). How language learning and language use create linguistic structure. *Current Directions in Psychological Science, 31,* 177-186.

Learning, **culture** and biology





Upper: from Kirby, S., Dowman, M., & Griffiths, T. (2007). Innateness and culture in the evolution of language. *PNAS, 104,* 5241-5245.
Lower: adapted from Fitch, W. T. (2010). *The Evolution of Language.* Cambridge: Cambridge University Press

https://kennysmithed.github.io/origins24/

Schedule

Week	Topic
1	Introduction
2	Natural selection, adaptation and language
3	Intention and structure in animal communication
4	Social learning and cumulative culture
5	Vocal learning, grammar learning
6	Evolution of social cognition
7	Cultural evolution of language
8	Sign language and language origins
9	Gene-culture co-evolution

Pre-lecture preparation

- **Readings must be done in advance**
- Do the reading, answer the quiz questions on Learn
  - Most useful bit for me is the free comment box at the end
- I will assume you have done the readings, we'll talk about them in class

Tutorials

- Tutorials start in week 2
- First tutorial: evolution games
- Later weeks: usually paper discussion / evaluation
- **Attendance will be taken**

Maisy Hallam

Lauren Fletcher

Claire Graf

+ me for MScs

Be prepared for tutorials

Assessment

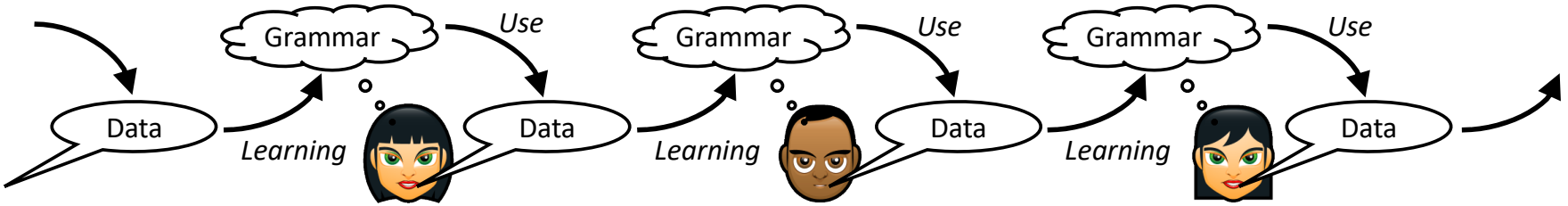
- 1.5k word essay (50% for undergrads, 40% for postgrads)
  - List of topics to be provided (end of week 3 at the latest)
  - **Due 24th October**

- 1.5k word essay (50% for undergrads, 60% for postgrads)
  - Same list of topics, postgrads can set their own topic (see instructions)
  - **Due 12th December**

Any questions on course structure, assessment, admin etc?

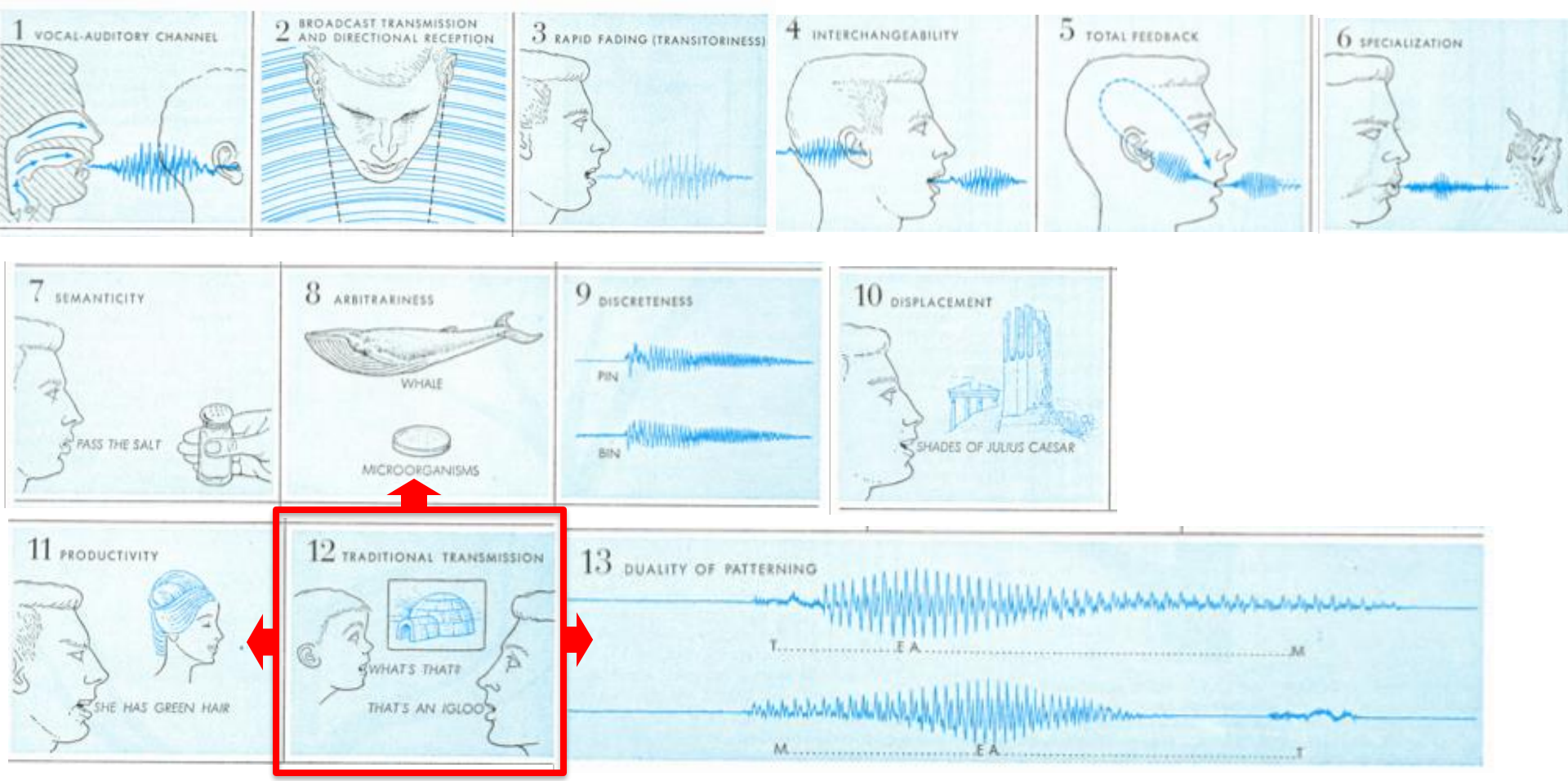
A short preview of where we are headed

Learning, use, and language design



- Language is passed from person to person by **learning**
- People learn from language as it is **used in communication**
- Language **evolves** in response to its learning and use

Rather than us being adapted for language, language has adapted to us



Hockett's **design features**

Hockett, C. F. (1960). The origin of speech. *Scientific American, 203,* 88–96.

What’s required for this to happen?

Social learning,
vocal learning,
grammar learning

Mitteilungsbedürfnis
and mindreading

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Social learning,
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Mitteilungsbedürfnis
and mindreading

The idea

- Humans ended up with an unusual combination of traits: ubiquitous social learning (including of vocal signalling) and deep mental interpenetration
  - We can see similar capacities in non-human animals, allowing us to understand the evolutionary history of these traits
- This set in place a cultural evolutionary process that shaped how language works
  - We can study these processes in the historical record and in the lab

What's the evidence?

- We'll look at social learning and mental interpenetration in humans **and other animals**
- We'll look at how learning and use of linguistic (or pseudo-linguistic) systems shapes their structure

A word about the bad old days of evolutionary linguistics

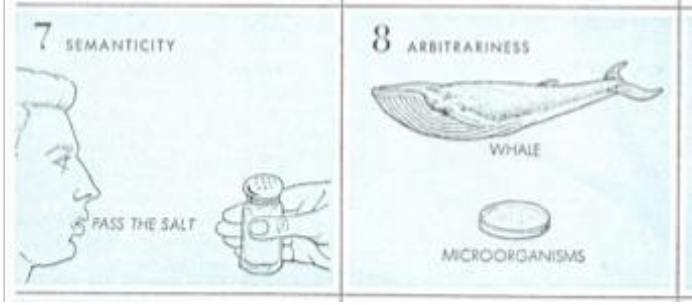
"the field has certain advantages. […] To enter it costs little: you can't do experiments, so no expensive equipment is required […] It's still a pencil-and-paper field, though with immeasurable amounts of reading and thinking involved. It is, accordingly, an ideal field for any ambitious young scholar itching to make his [sic] academic bones." (Bickerton, 2007, *Lingua,* p. 525)

Modern evolutionary linguistics is a data-driven, empirical field

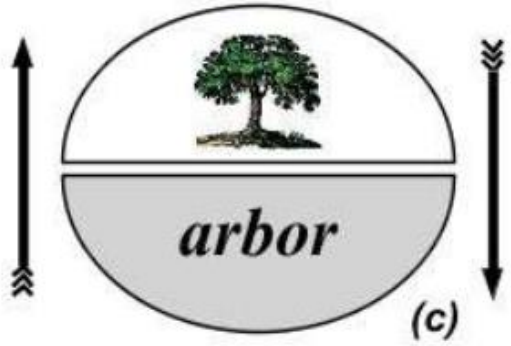
(It already was in 2007, but Bickerton was behind the times)

Some fun examples of what learning and use can do (with a focus on Hockett's design features)

Where do symbols come from?



- **Icon:** signals resemble meanings
- **Symbol:** *arbitrary* relationship between signal and meaning



Ritualization in the lab, with humans

Repeated interaction in a Pictionary-like communication task

Garrod, S. et al. (2007). Foundations of Representation: Where Might Graphical Symbol Systems Come From? *Cognitive Science, 31*, 961-987

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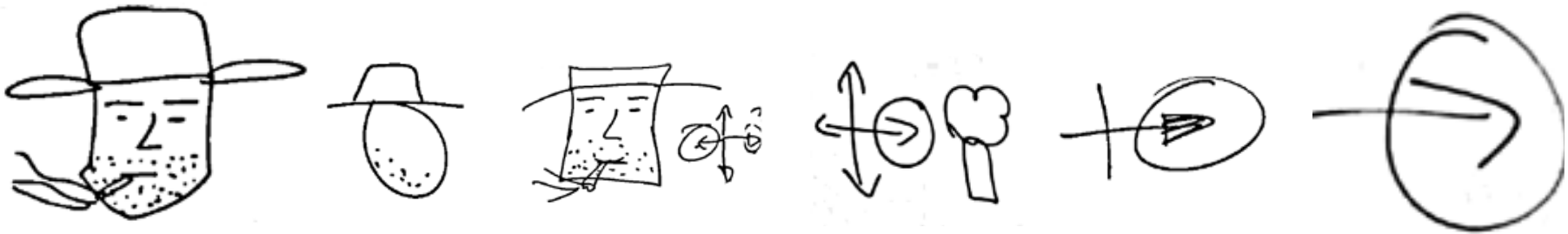
Ritualization in the lab



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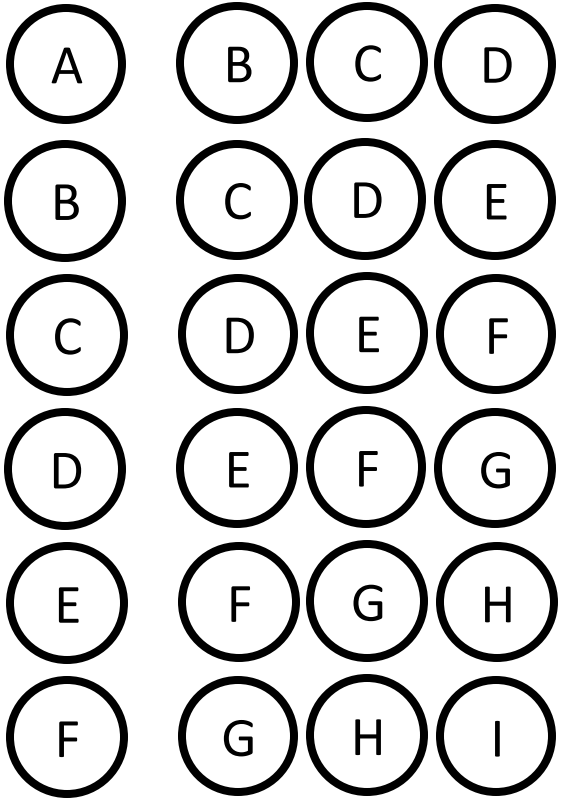
Transmission in laboratory ‘societies’



Caldwell, C. A., & Smith, K. (2012). Cultural evolution and the perpetuation of arbitrary communicative conventions in experimental microsocieties. *PLoS ONE, 7,* e43807.

Transmission in laboratory ‘societies’

(Round 6)

Caldwell, C. A., & Smith, K. (2012). Cultural evolution and the perpetuation of arbitrary communicative conventions in experimental microsocieties. *PLoS ONE, 7,* e43807.

Transmission in laboratory ‘societies’

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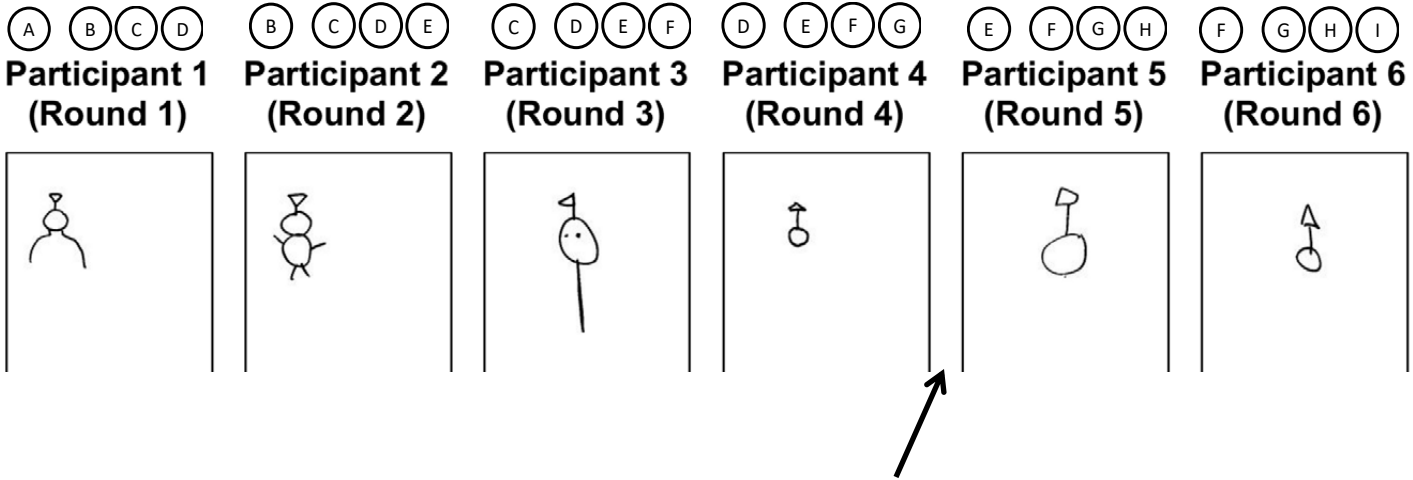
Transmission in laboratory ‘societies’



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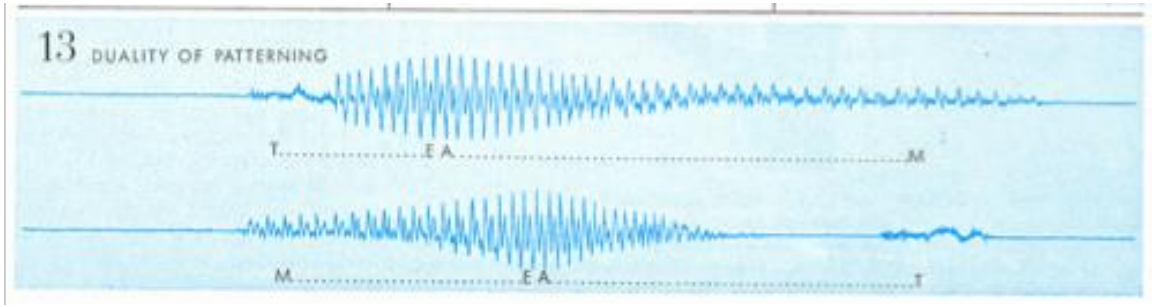
So much for symbols – how about structure?



Language's communicative power comes (in part) from its **structure**

Inventory of meaningless units (10s)

p t d s ð k g ɔ ə a …

Inventory of meaningful units (1000s)

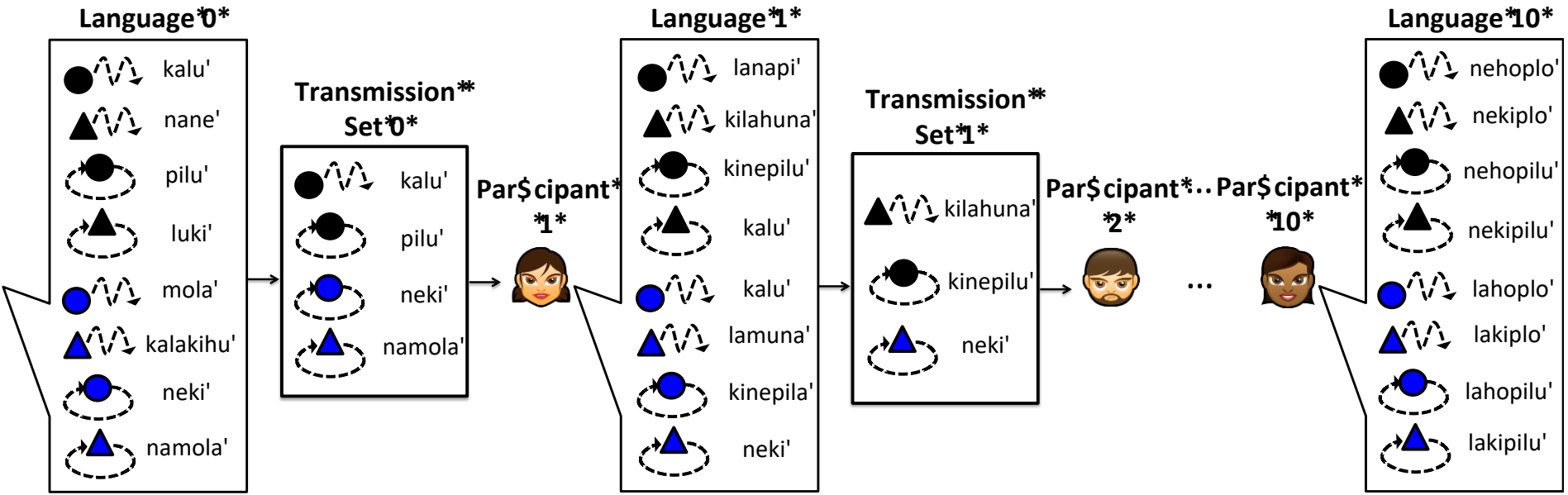
ə ðə -əd dɔg kat ðat spɔt …

(a) (the) (past tense) (dog) (cat) (that) (spot)

Inventory of meaningful sentences (∞)

the cat spotted the dog
a dog spotted the cat
a cat spotted the dog
the dog spotted the cat
the cat spotted the cat that spotted a dog
the dog spotted the cat that spotted the dog
…

Studying language transmission in the lab

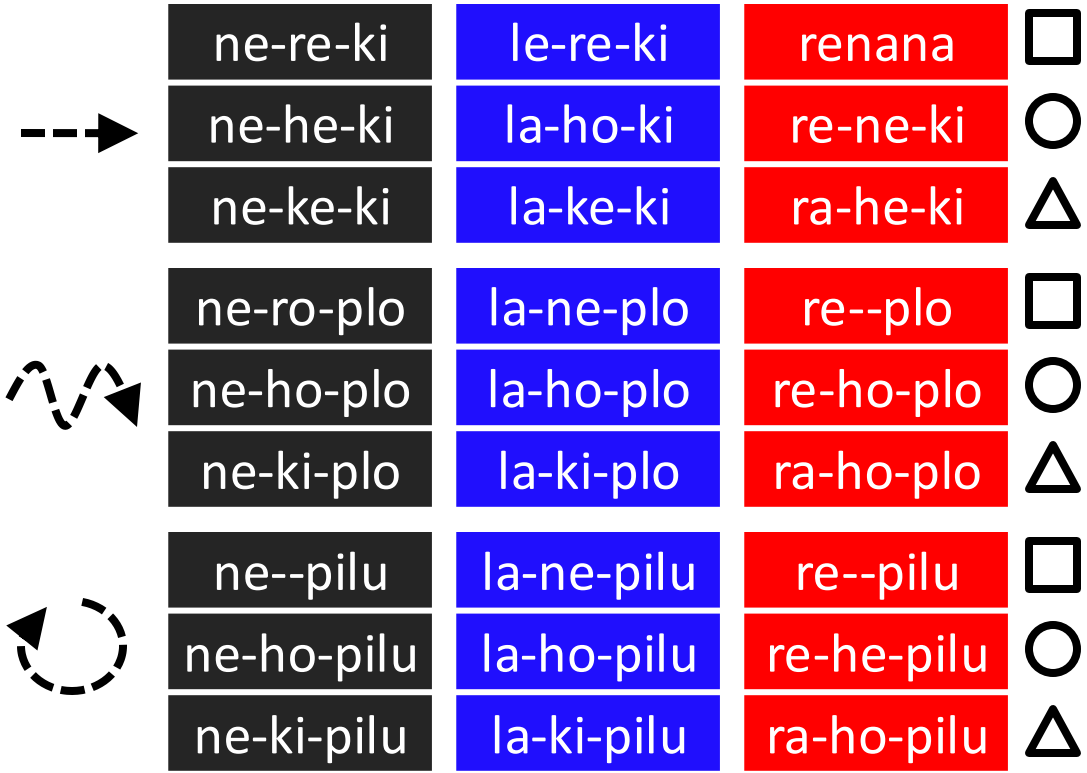


Kirby, S., Cornish, H., & Smith, K. (2008). Cumulative cultural evolution in the laboratory: an experimental approach to the origins of structure in human language. *Proceedings of the National Academy of Sciences, USA, 105,* 10681-10686.

Figure from Kirby, S., Griffiths, T. L., & Smith, K. (2014). Iterated learning and the evolution of language. *Current Opinion in Neurobiology, 28,* 108-114.

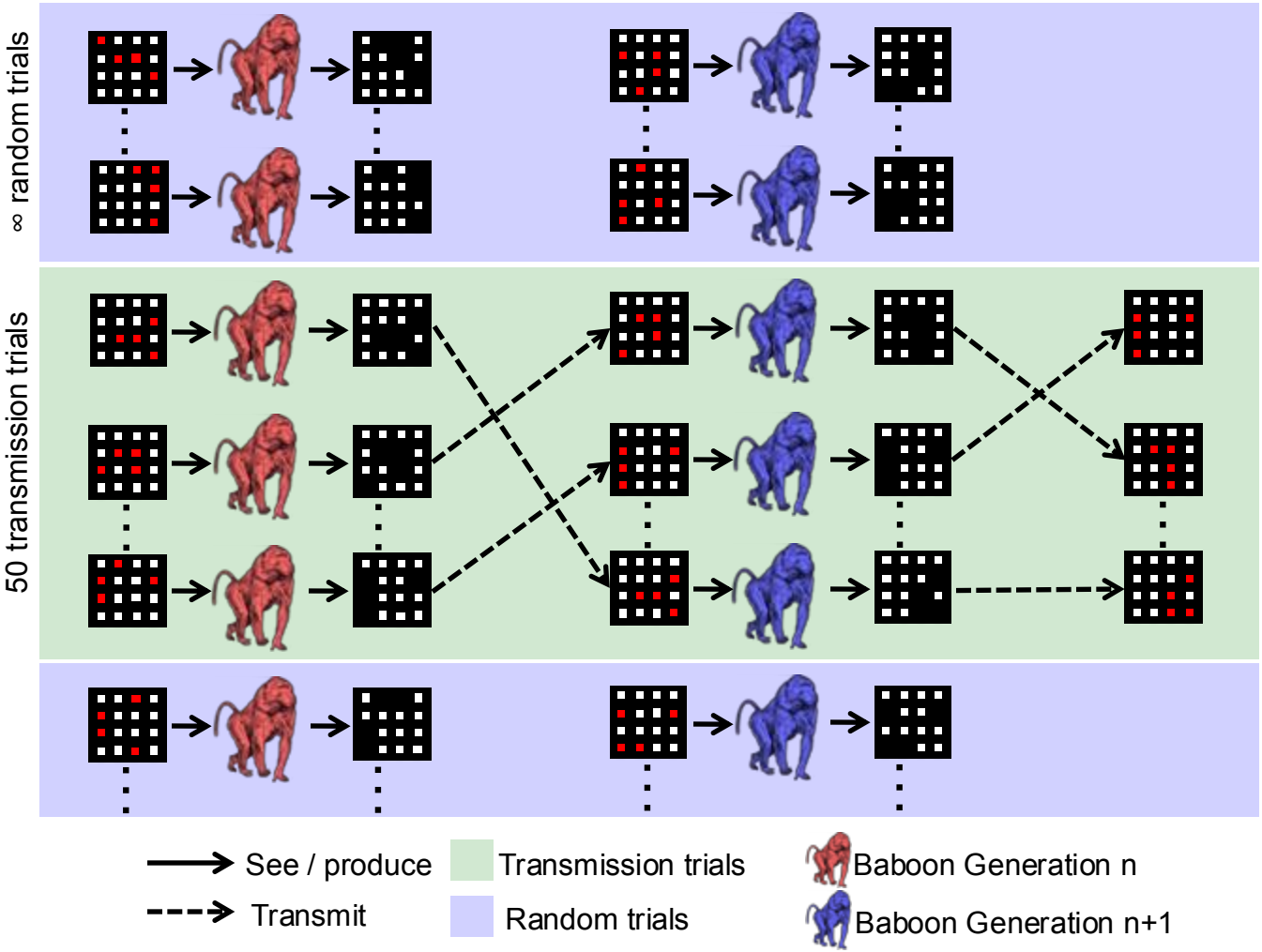
An initial **holistic** language

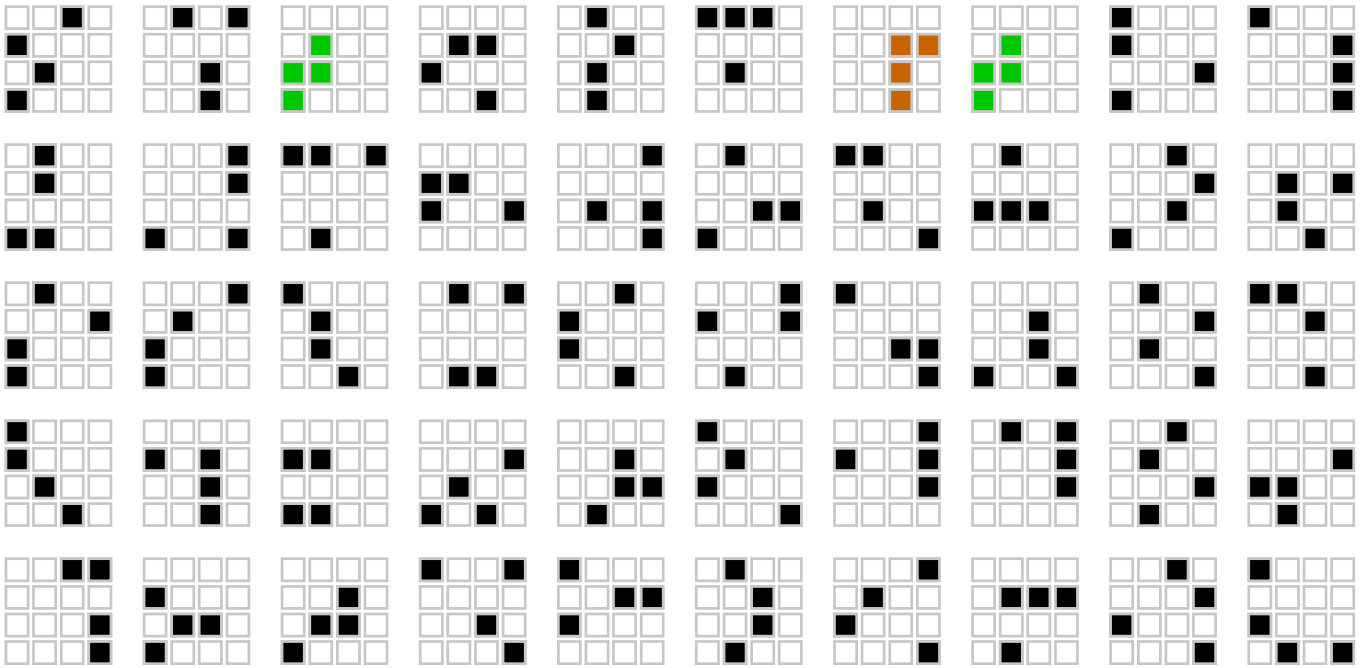
10 generations later…



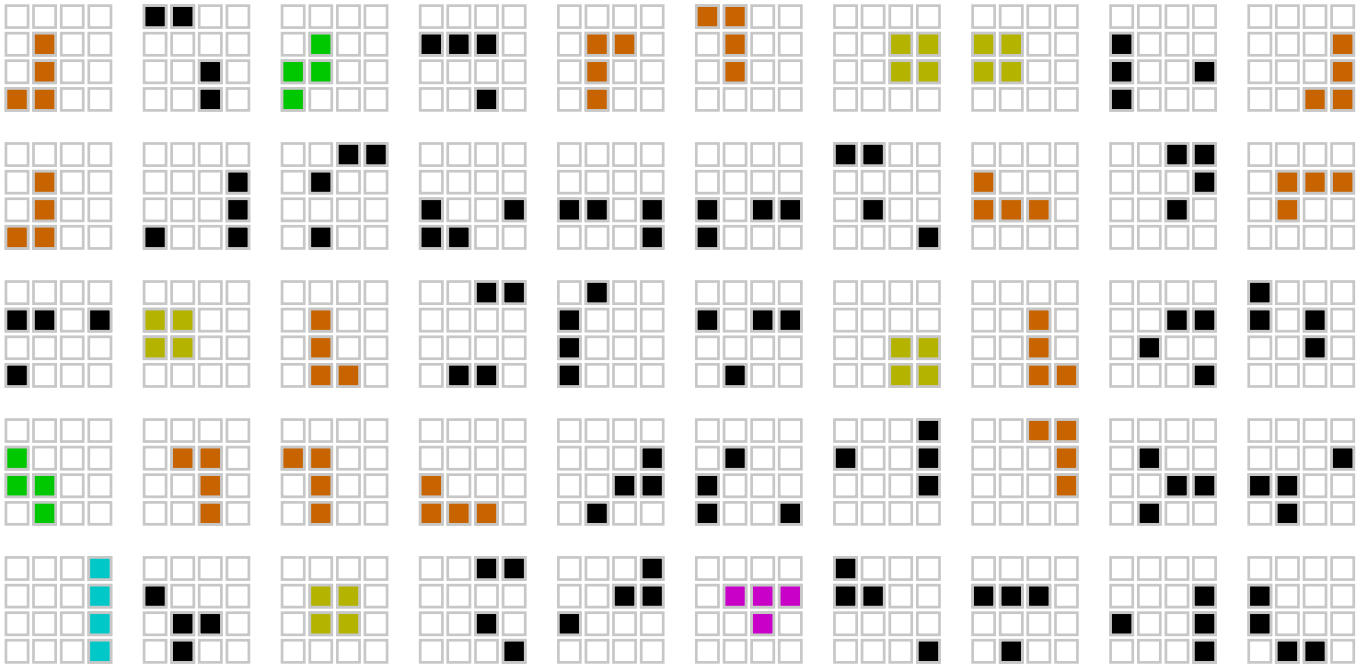
If structure arises from social learning, why isn’t it more common?

Claidière, N., Smith, K., Kirby, S., & Fagot, J. (2014). Cultural evolution of a systematically structured behaviour in a non-human primate. *Proceedings of the Royal Society B, 281,* 20141541.

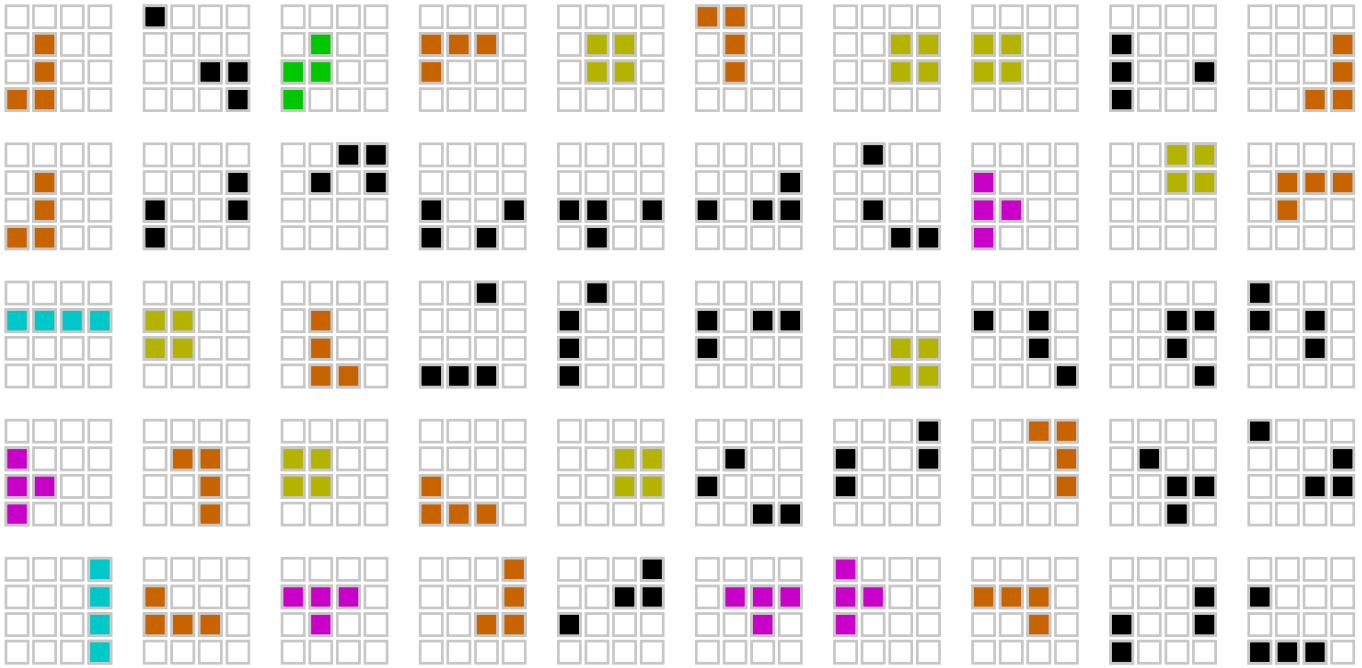

∞ random trials
50 transmission trials
See / produce
Transmit
Transmission trials
Random trials
Baboon Generation n
Baboon Generation n+1



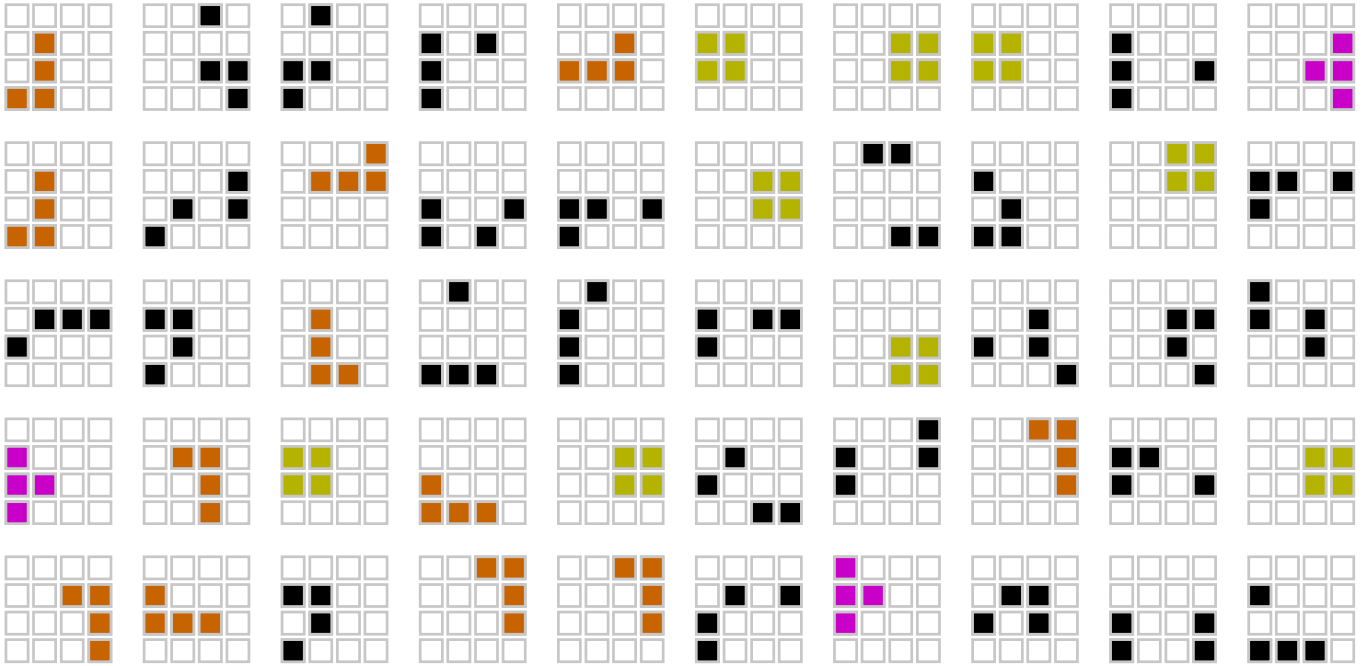
Random grids



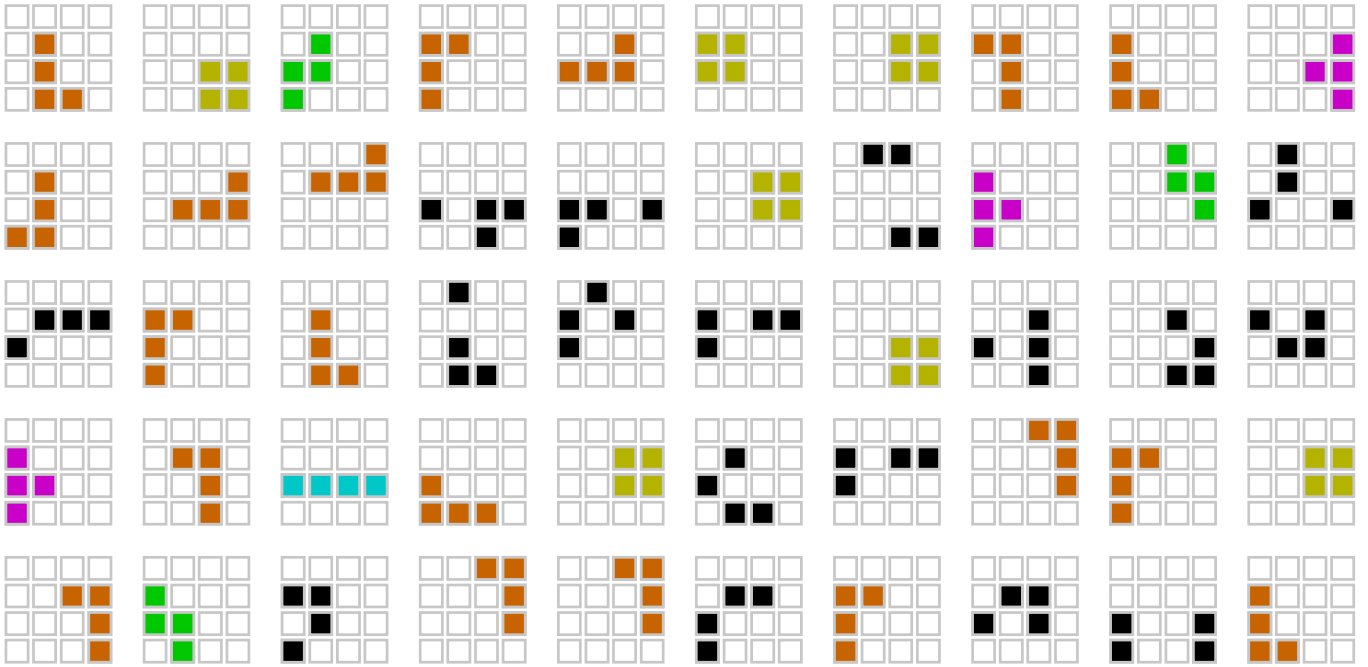
Generation 1



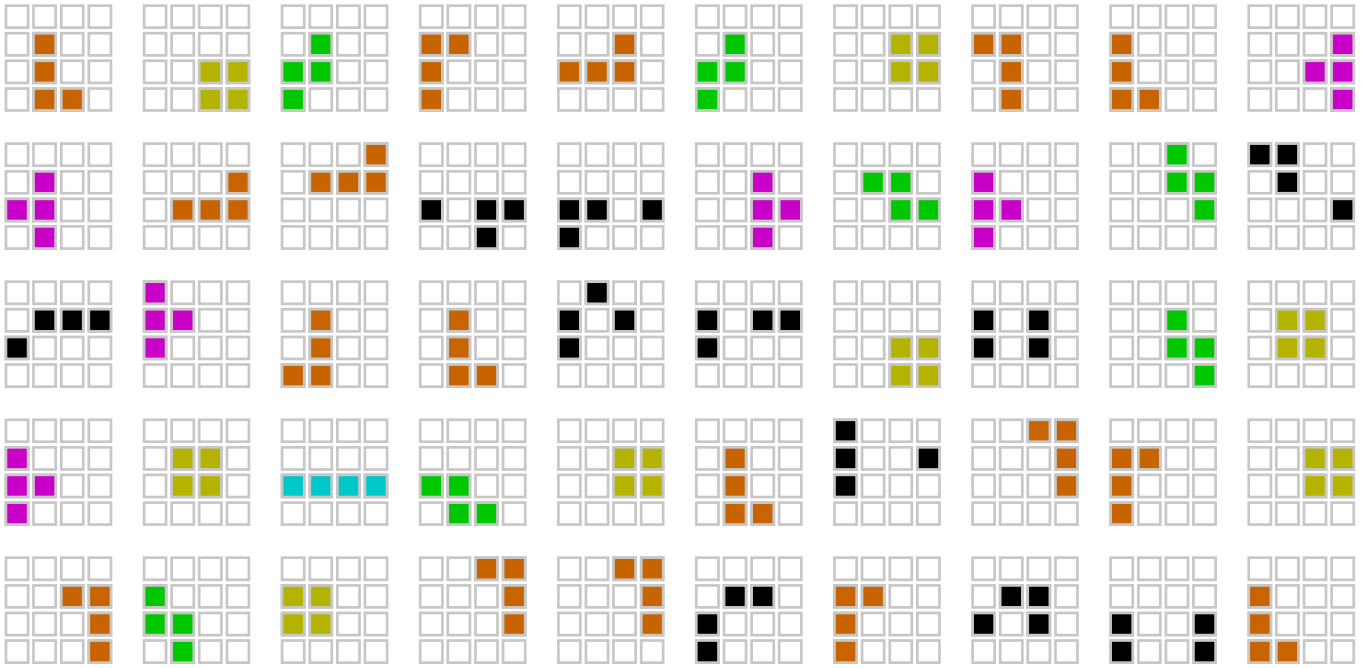
Generation 2



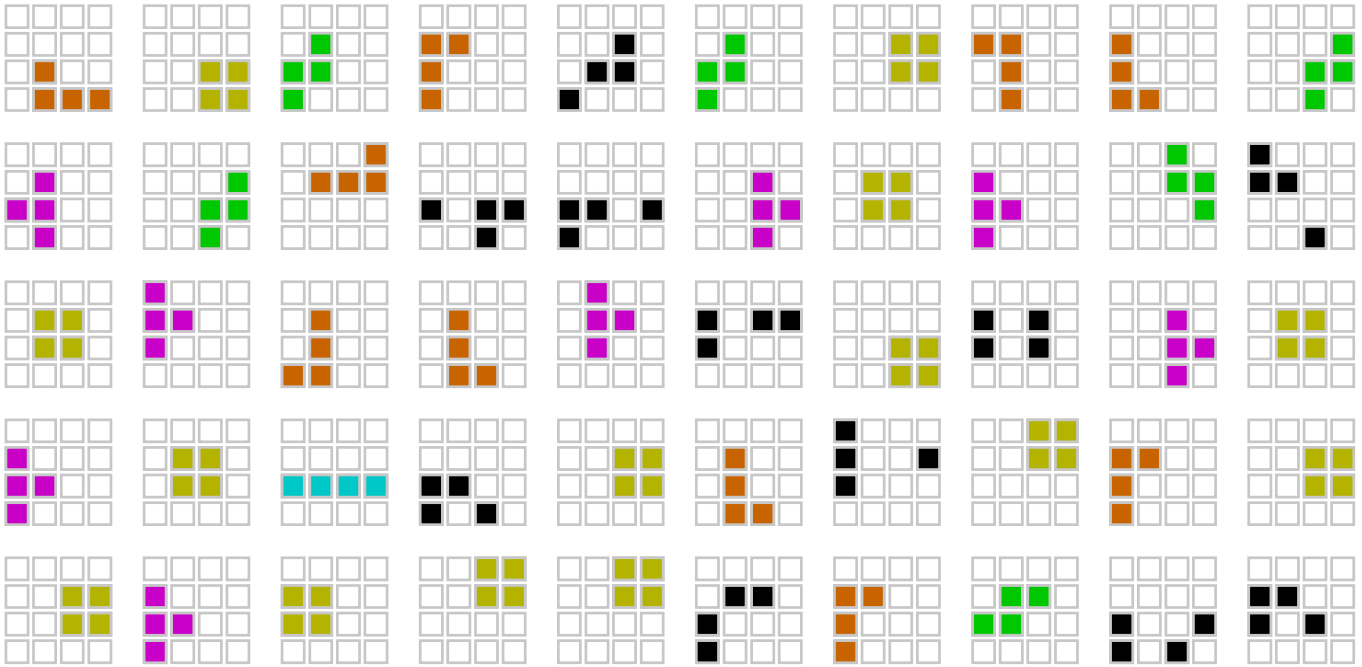
Generation 3



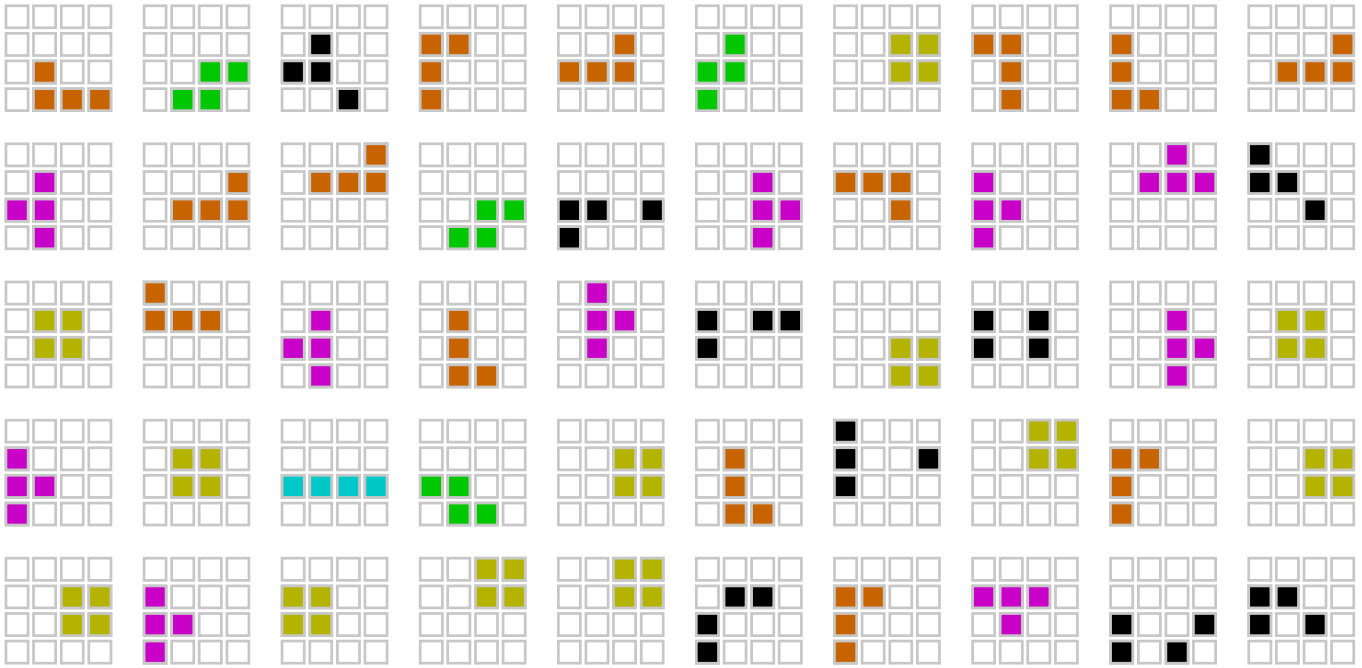
Generation 4



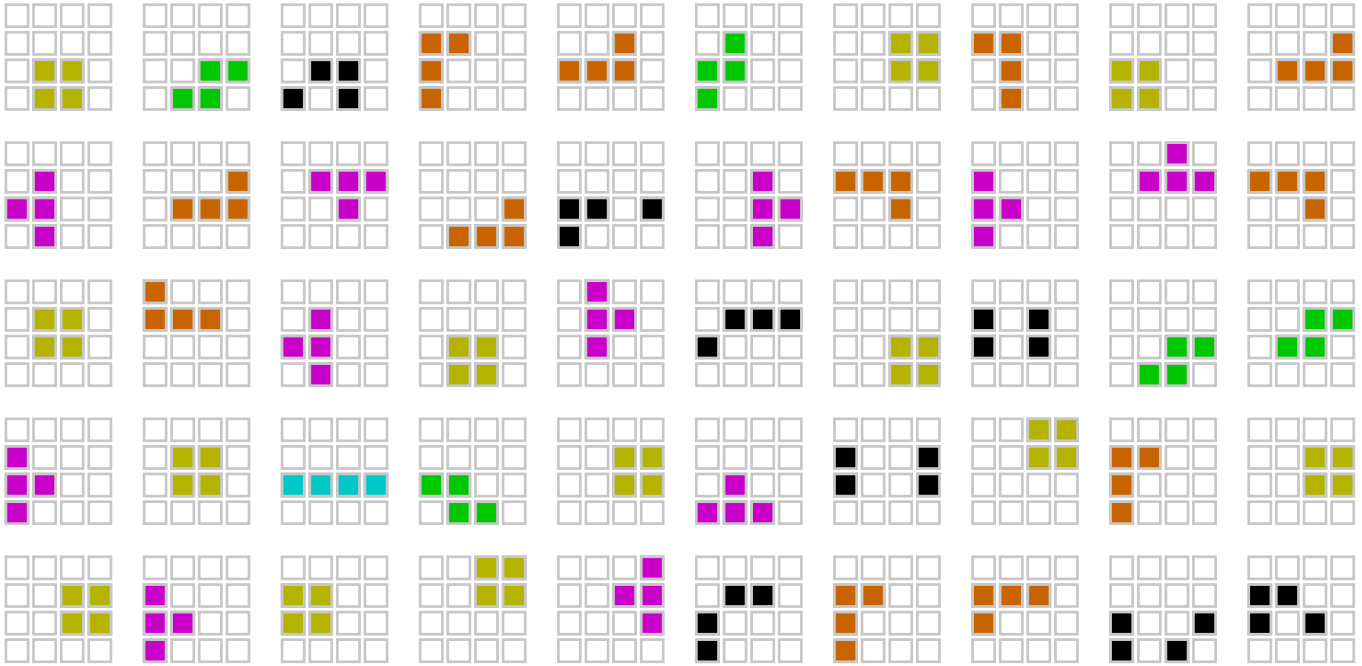
Generation 5



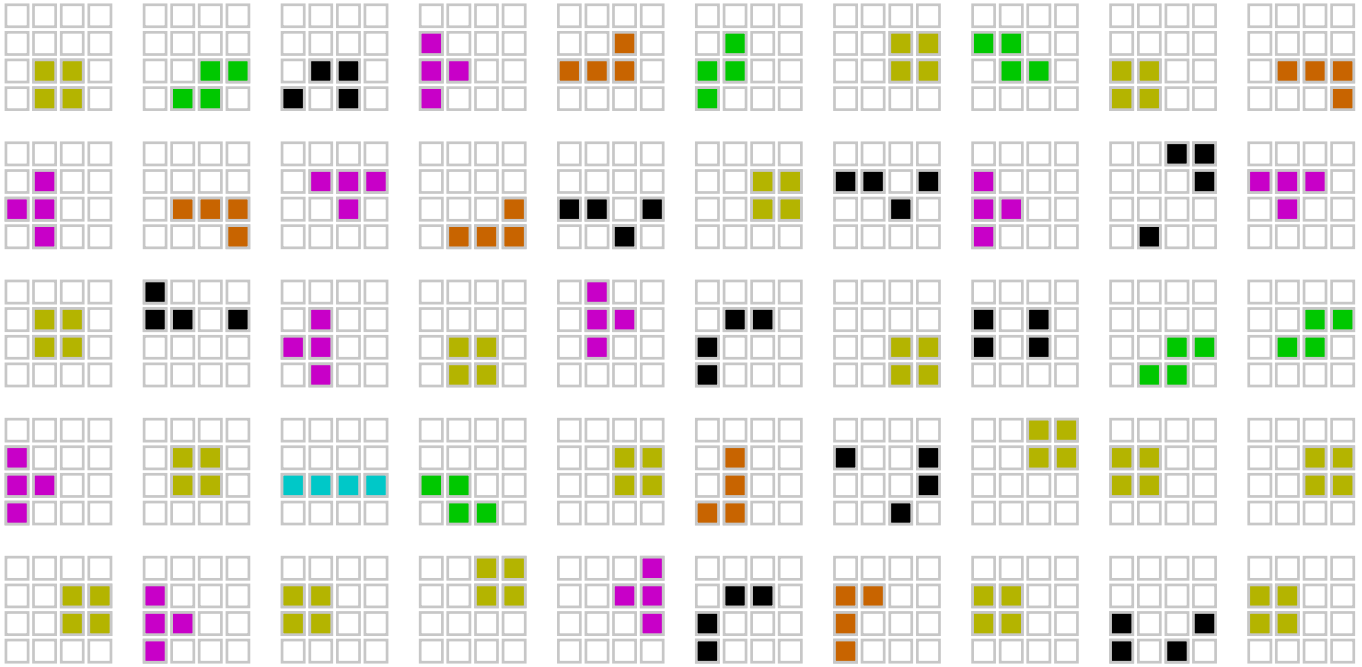
Generation 6



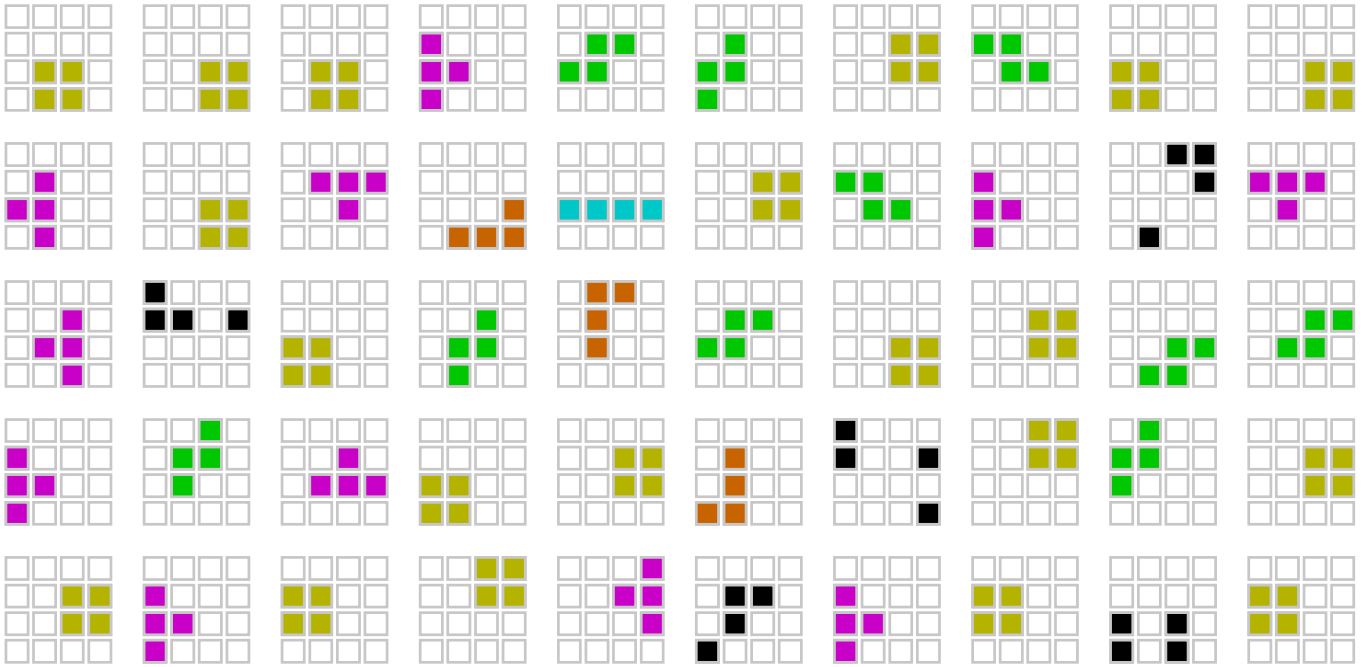
Generation 7



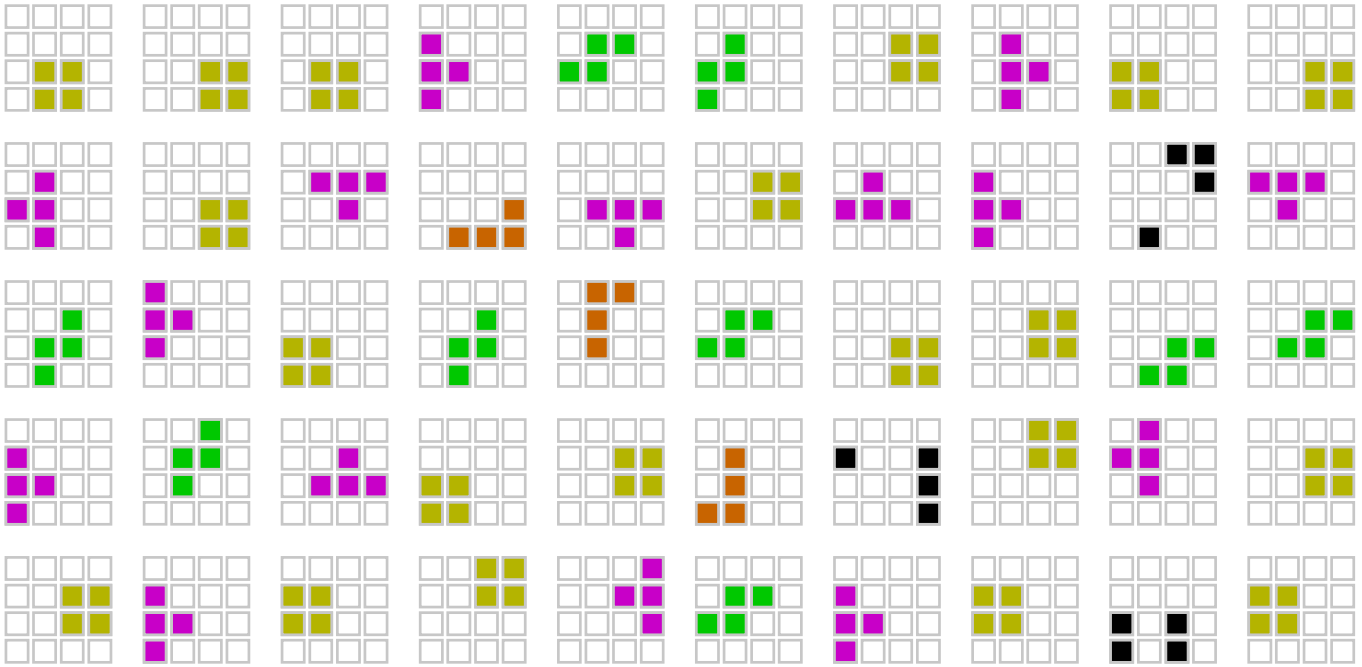
Generation 8



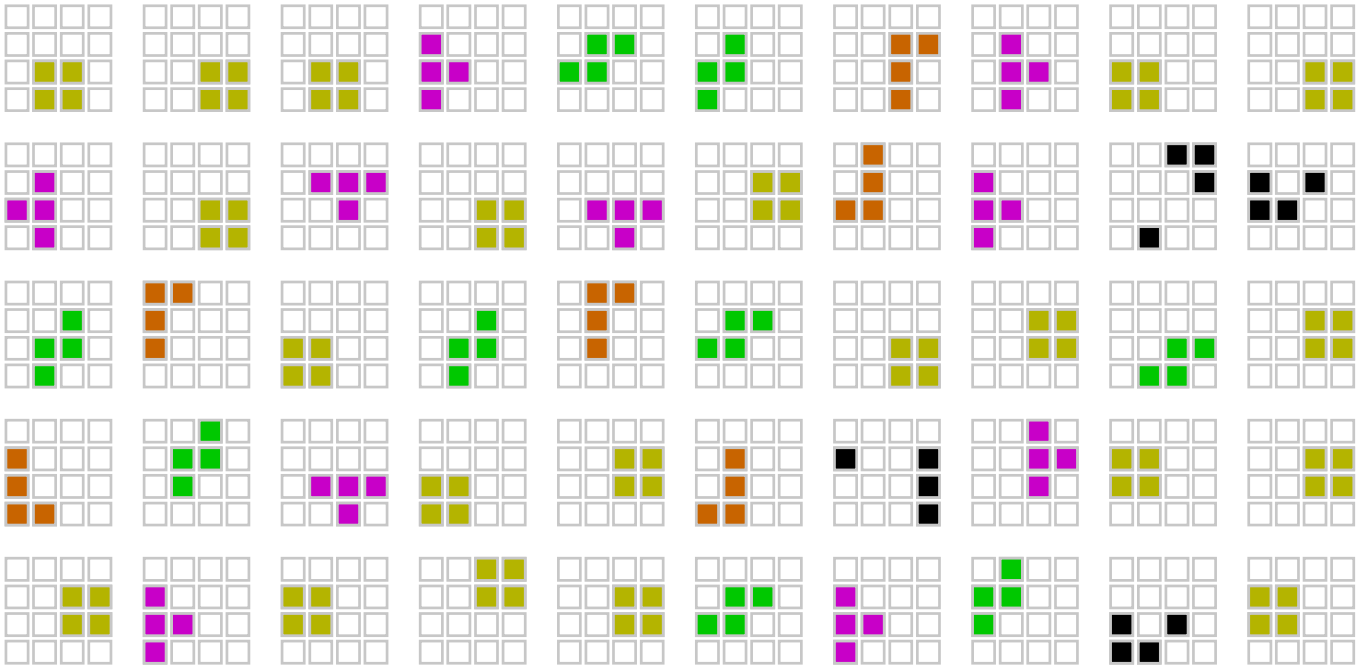
Generation 9



Generation 10

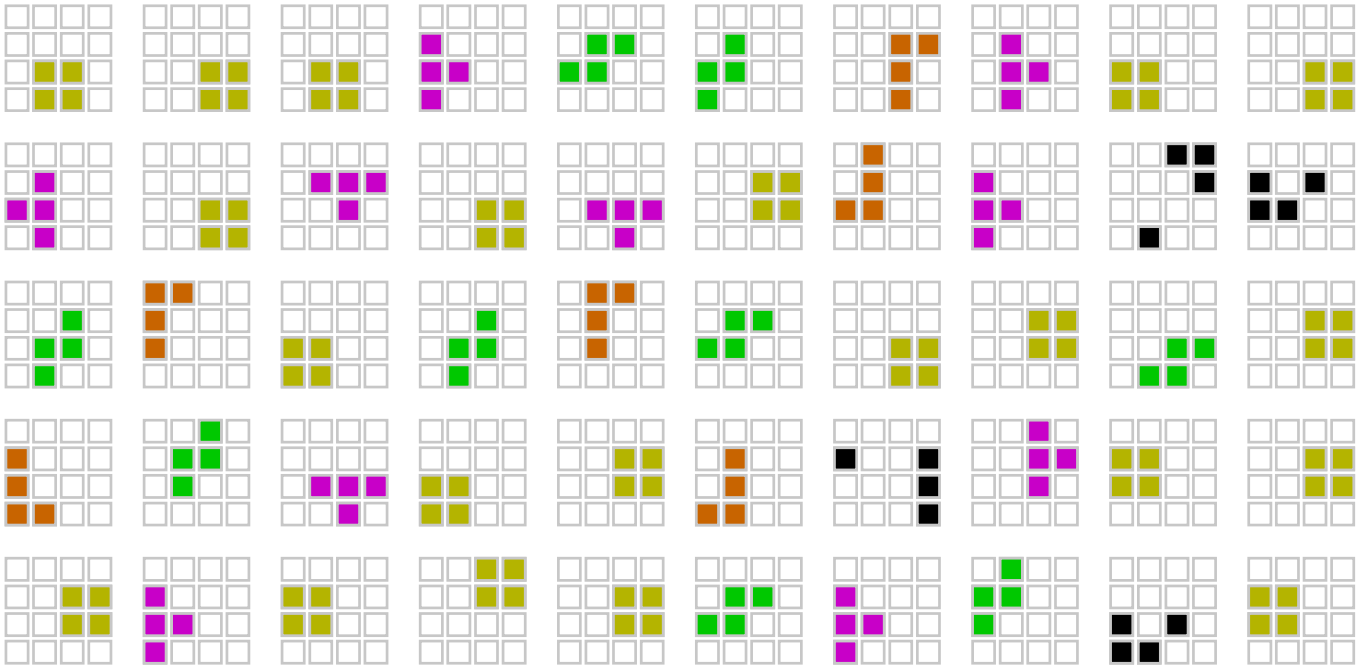


Generation 11



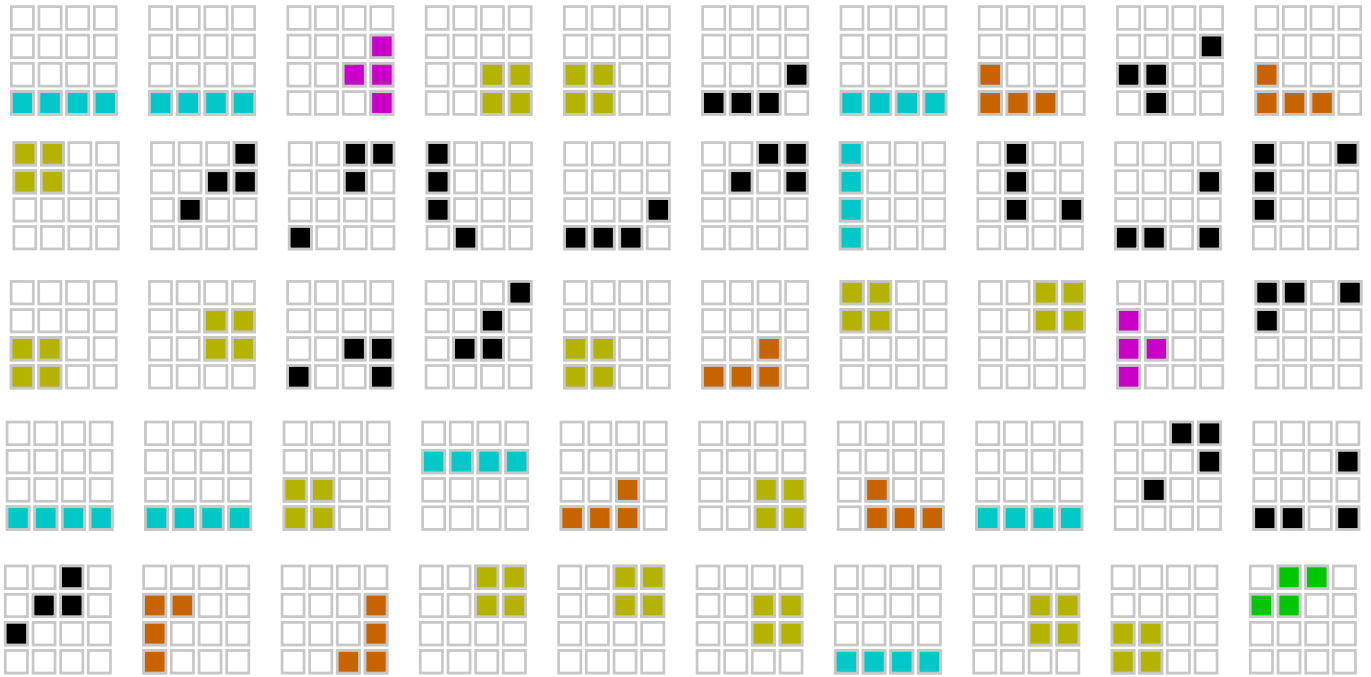
Generation 12

Emergence of a **system**



Chain 4, Generation 12

Emergence of a **system**



Chain 1, Generation 12

Systematic structure develops even in baboons (if you scaffold their environment in the right way)

The idea

- Humans ended up with an unusual combination of traits: ubiquitous social learning (including of vocal signalling) and mental interpenetration
- This set in place a cultural evolutionary process that shaped how language works

Schedule

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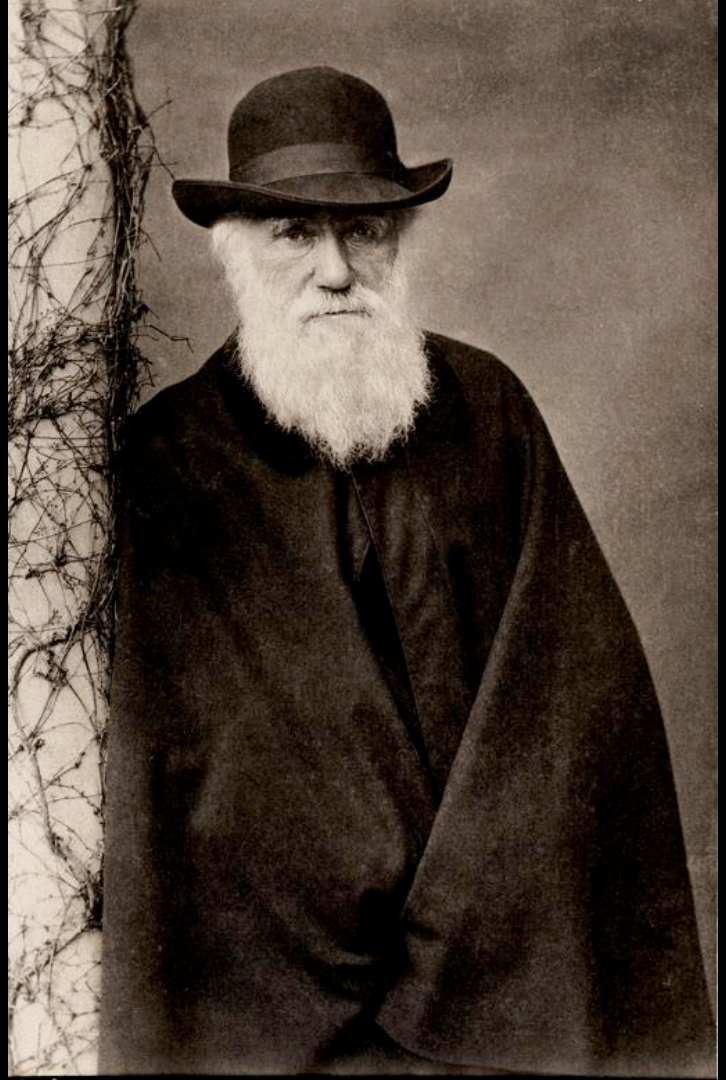
Readings and next lecture

- What is evolution? What is adaptation? How can we learn about humans by studying other animals?
- Language as a biological adaptation, evolved through natural selection under pressure for communication