Cultural evolution

Using evolutionary principles to make sense of
word origins,
problem solving, and
the growth of Wikipedia articles.

Pierce Edmiston
pedmiston@wisc.edu

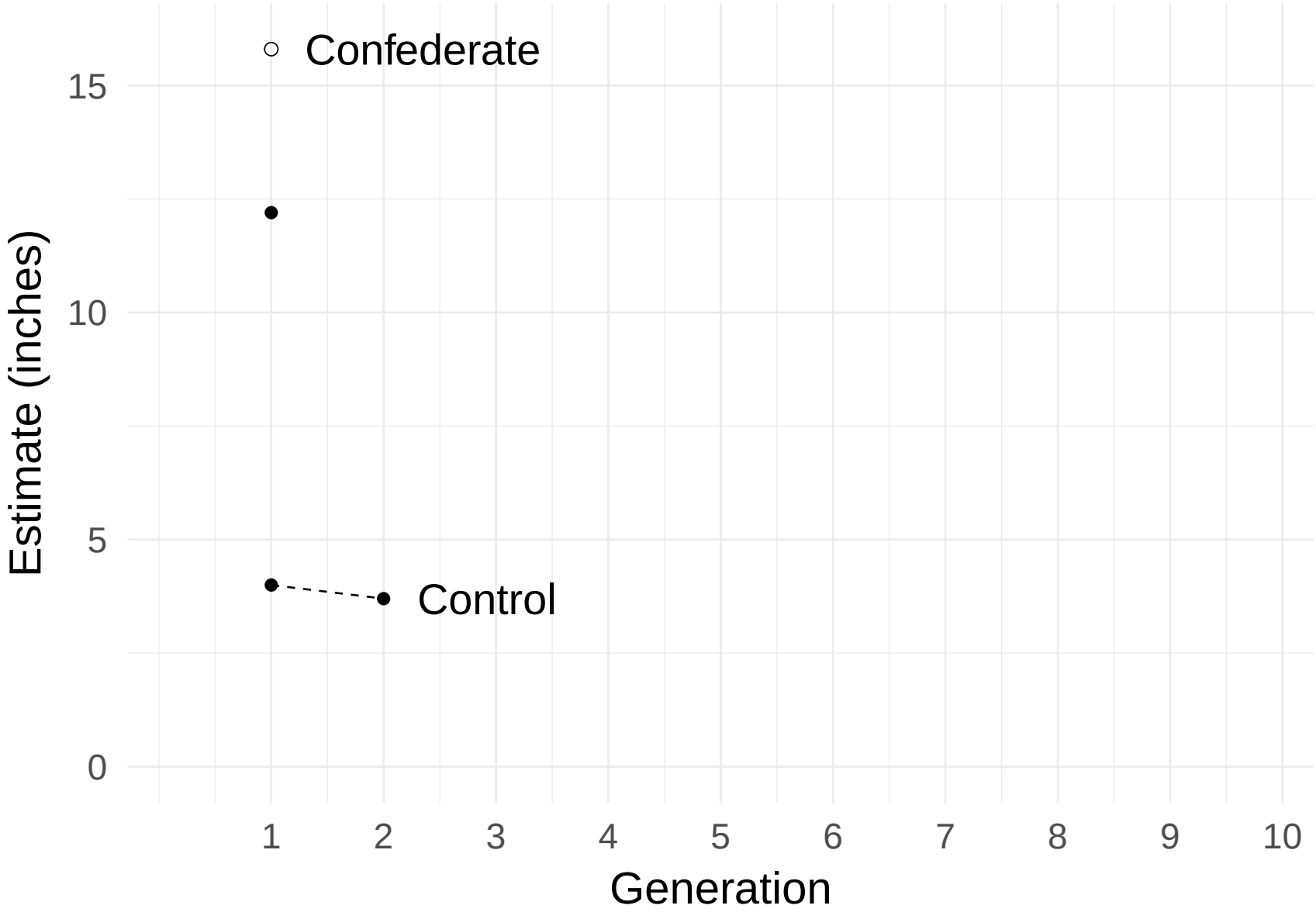
Unifying theme

- **Iteration** is "the repetition of a process or utterance."
- When can iteration be trusted?

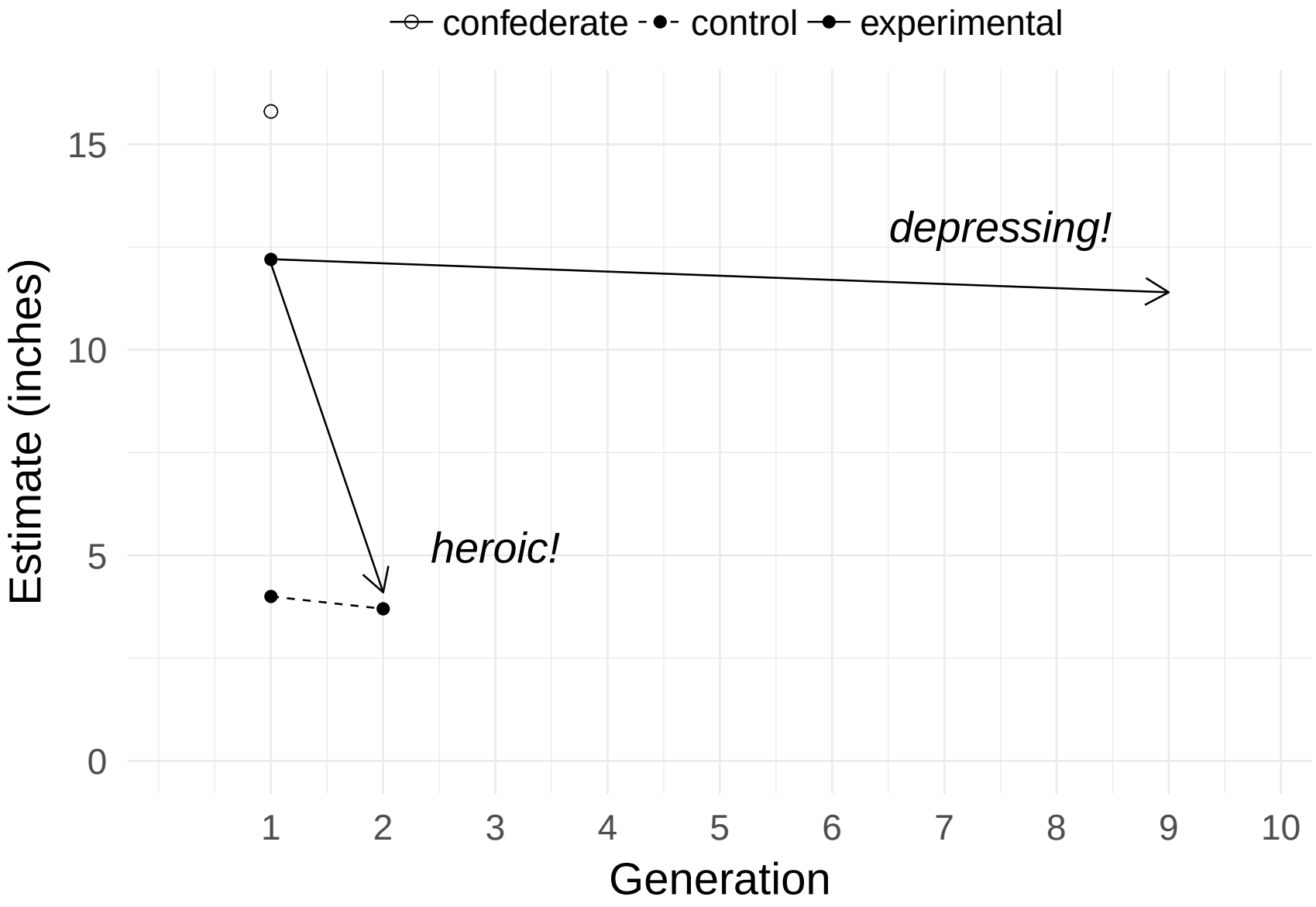
Evolution in the psychology department

Jacobs & Campbell (1961) *J Abnorm Soc Psychol*.
The perpetuation of an arbitrary tradition through several generations of a laboratory microculture.

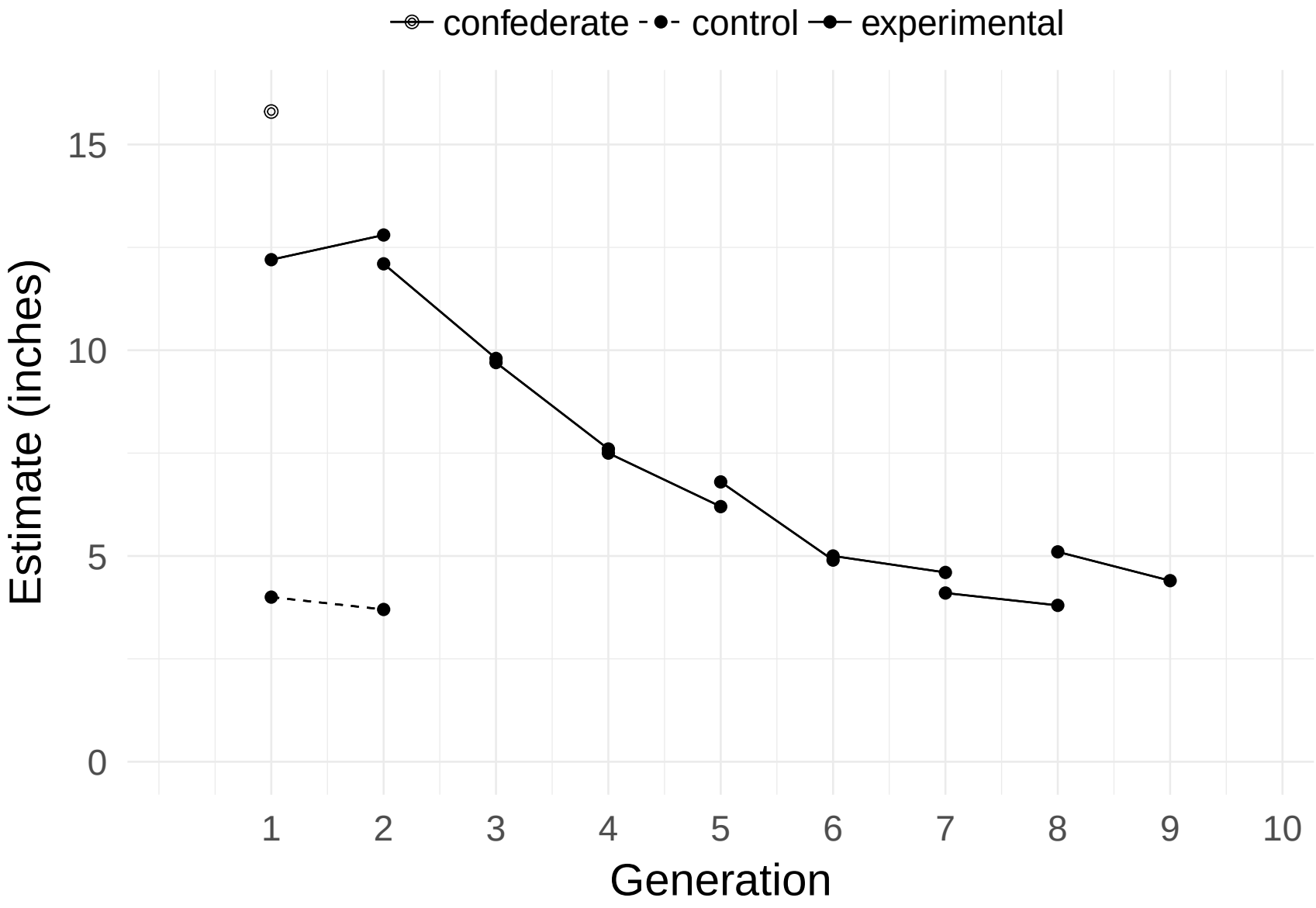
Iterated conformity (Jacobs & Campbell, 1961)



Iterated conformity (Jacobs & Campbell, 1961)



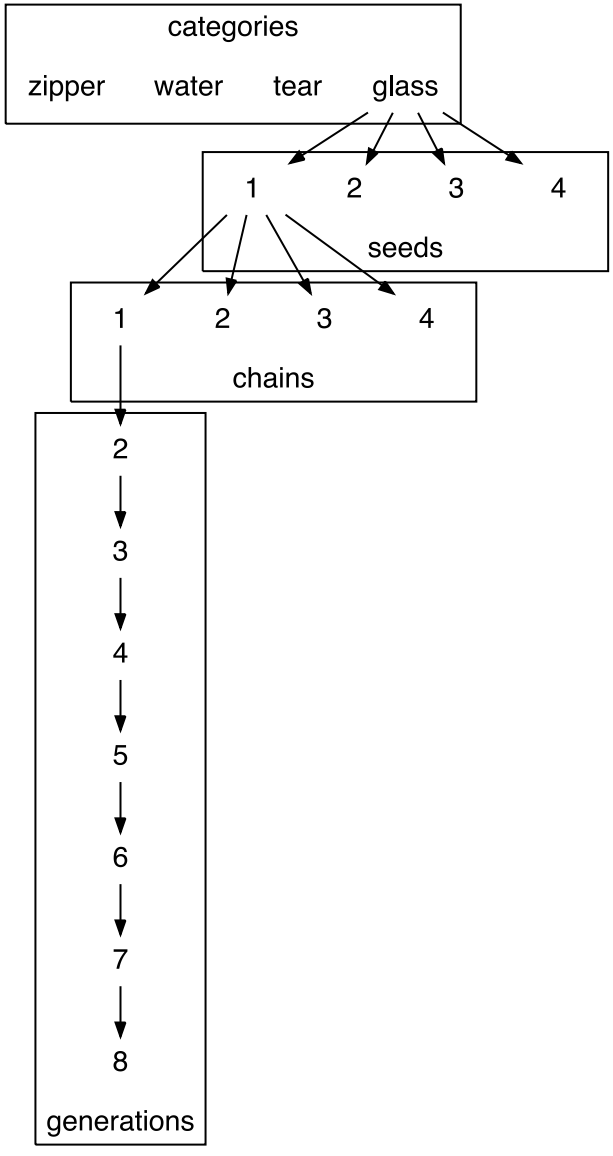
Iterated conformity (Jacobs & Campbell, 1961)



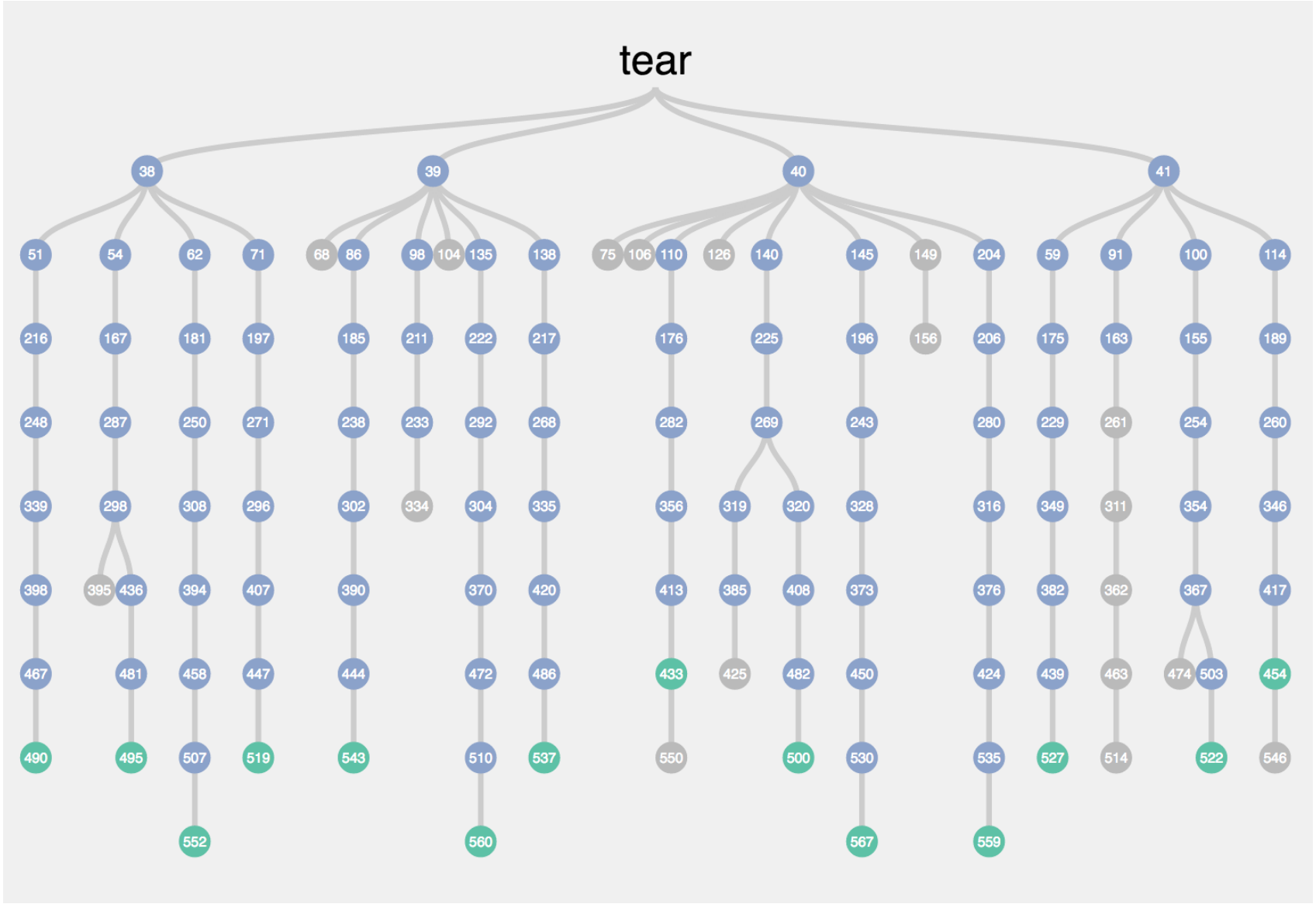
Word origins

Edmiston, Perlman, & Lupyan. (in prep). Creating words from iterated vocal imitation.

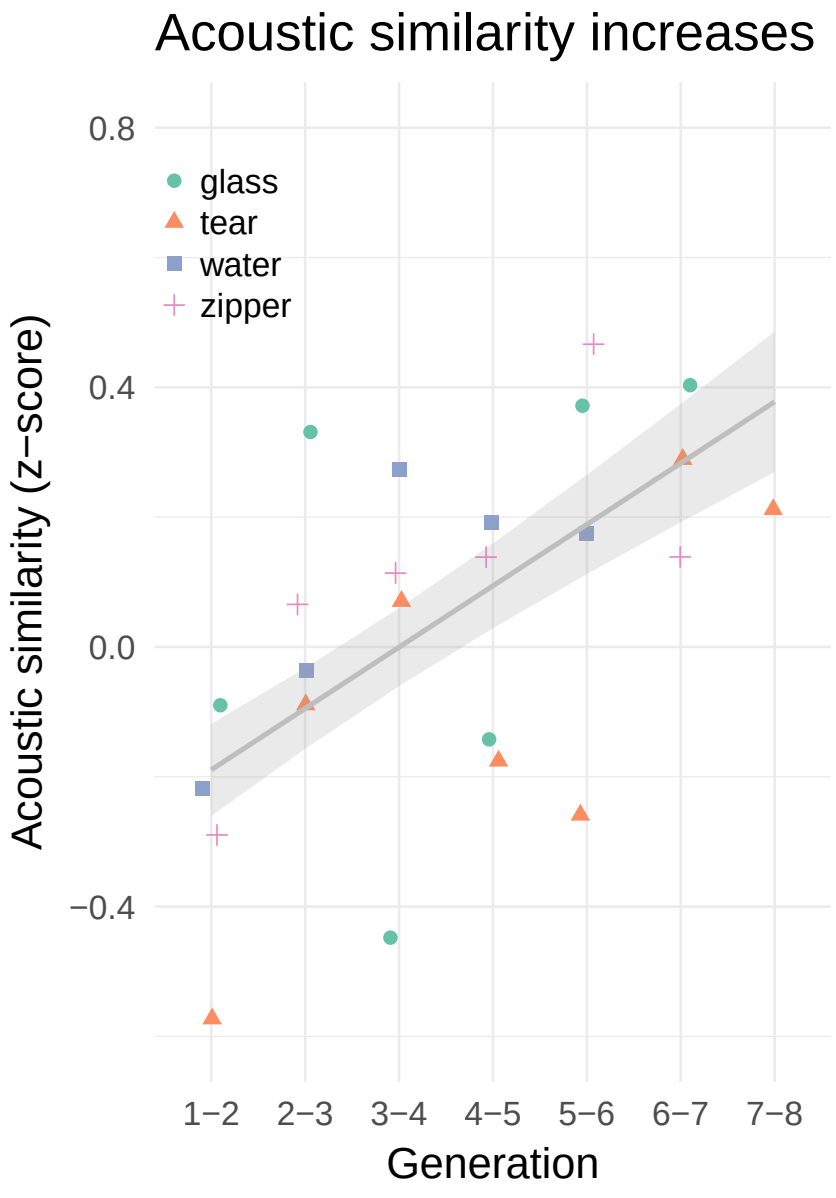
Telephone game

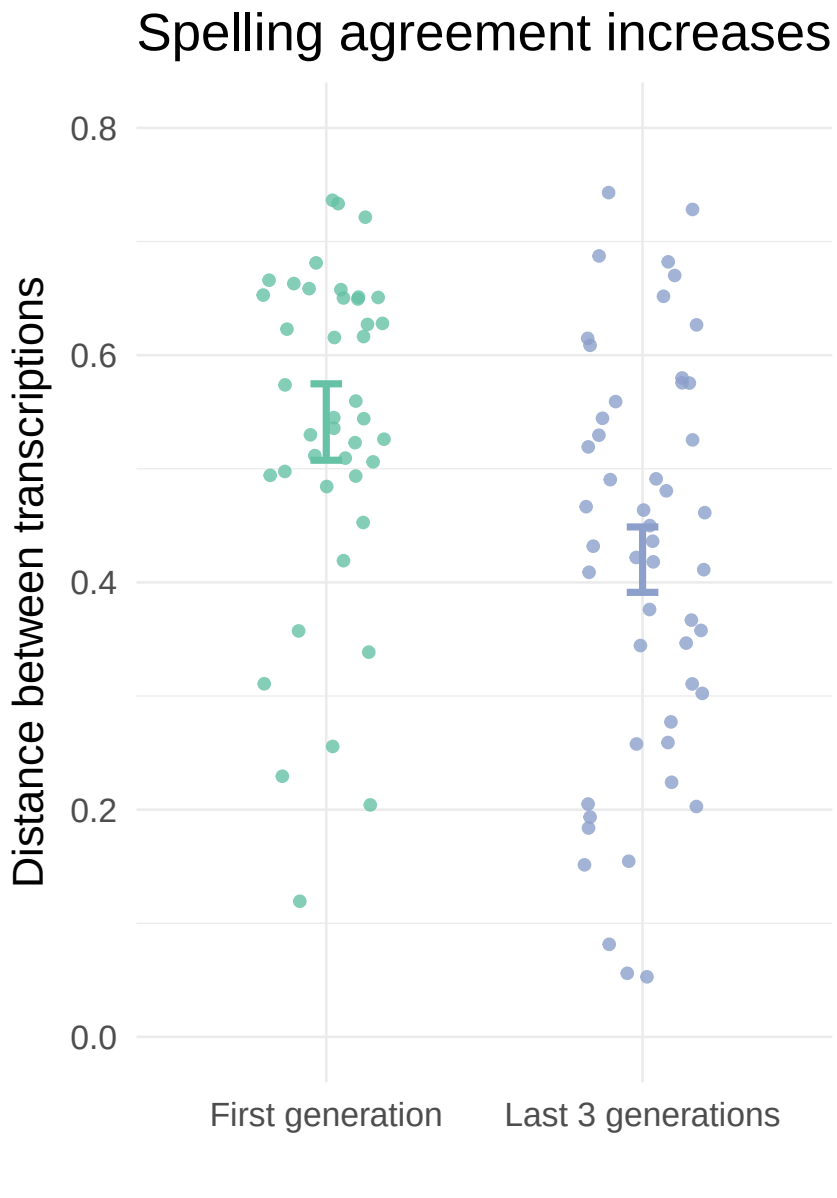


Telephone app

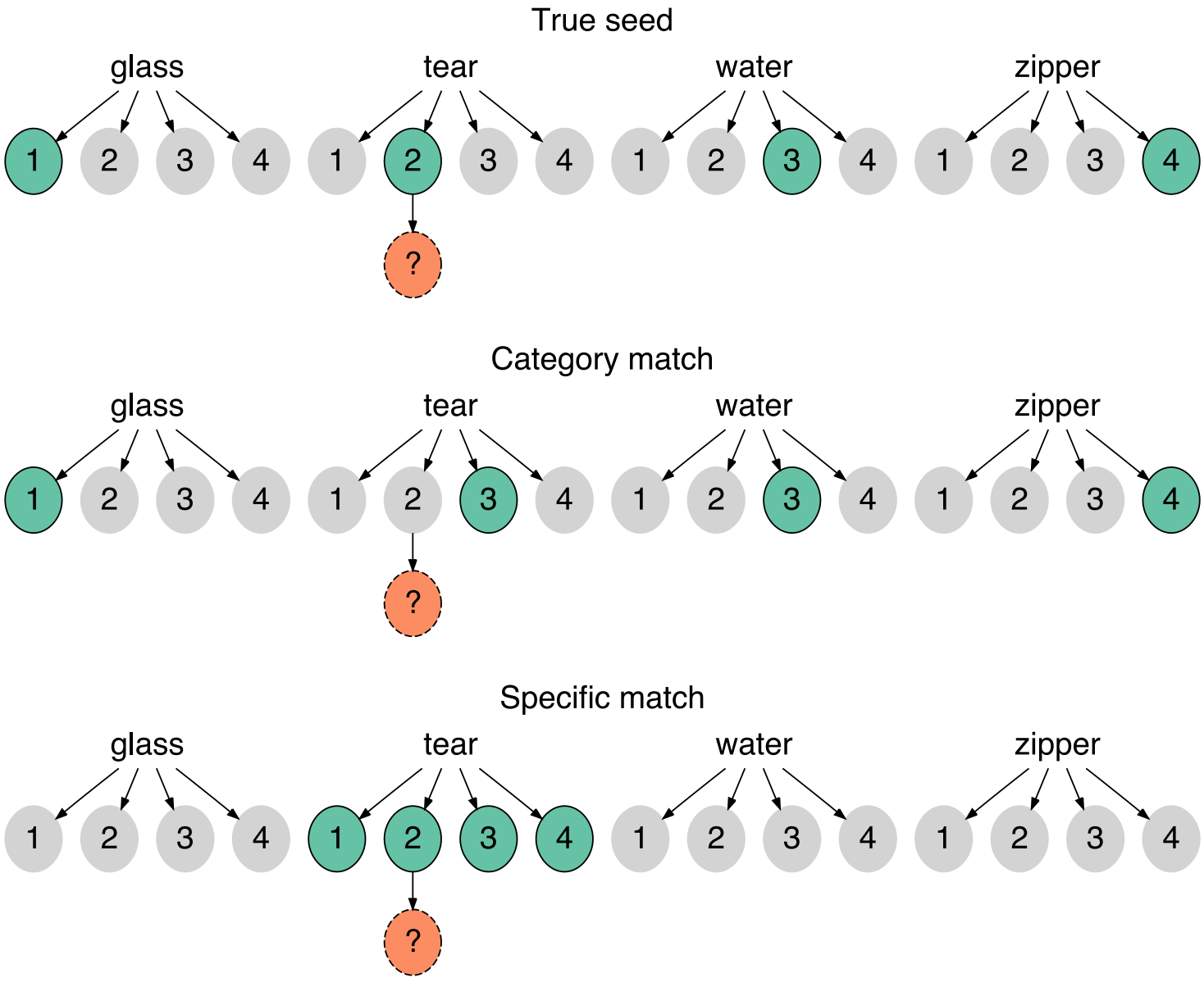


Imitations stabilize over generations

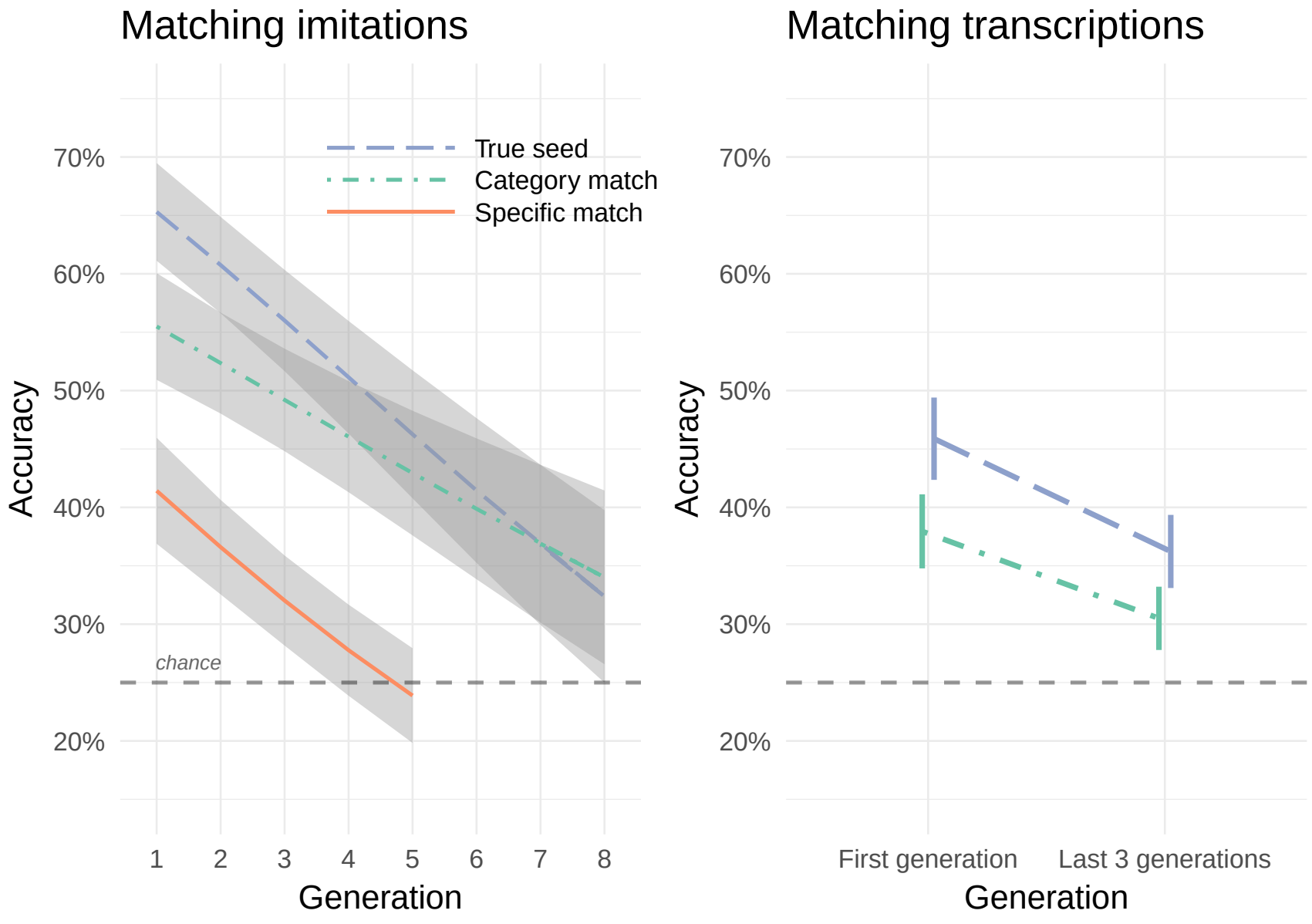




Question types



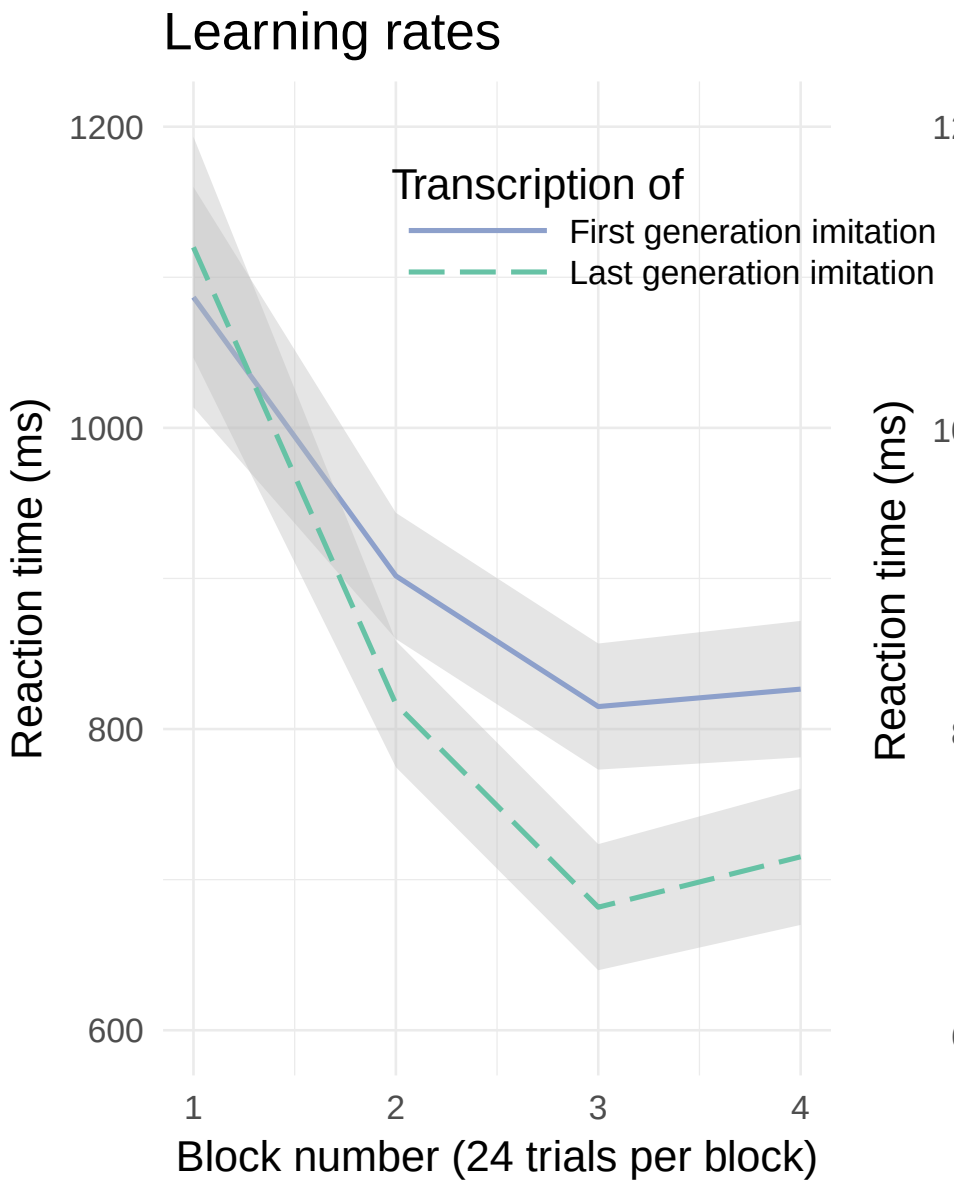
Guess the seed

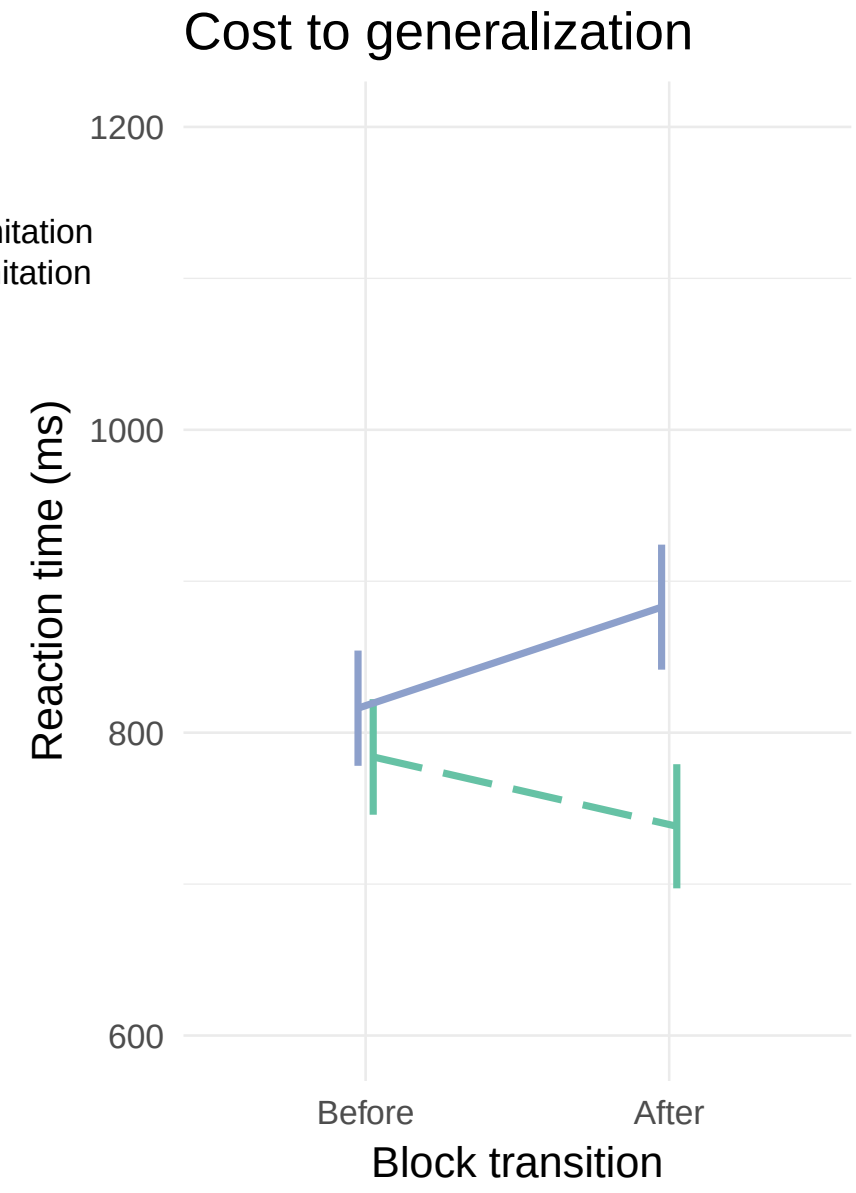


Invented words

Category	Seed	First generation	Last generation
glass	1	tingtingting	dundunduh
glass	2	chirck	correcto
glass	3	dirrng	wayew
glass	4	boonk	baroke
tear	1	scheeept	cheecheea
tear	2	feeshefee	cheeoooo
tear	3	hhhweerrr	chhhhhhewwwe
tear	4	ccccchhhhyeaahh	shhhhh
water	1	boococucuwich	eeverlusha
water	2	chwoochwooochwooo	cheiopshpshcheiopsh
water	3	atoadelchoo	mowah
water	4	awakawush	galonggalong
zipper	1	euah	izoo
zipper	2	zoop	veeeep
zipper	3	arrgt	owww
zipper	4	bzzzzup	izzip

Category learning





Summary

Unguided repetition of nonverbal imitations makes them more word-like.

- Acoustic form becomes more repeatable and easier to spell.
- Imitations and transcriptions gradually lose resemblance to source.
- As imitations transition into words they become more categorical.

Supports theories of language evolution that value human imitative abilities.

Wikipedia

Edmiston. (unpublished). Article quality as a selection pressure in the evolution of Wikipedia articles.

Is Wikipedia getting better?

WIKIPEDIA
The Free Encyclopedia

My favorite way of checking this is to "click random article" on 10 articles, and go back and look at them a year ago, 5 years ago, 10 years ago. Every time I have tried, it's unambiguous: Wikipedia is getting better by this test. – Jimbo Wales

Wikipedia is hard to measure

- **Size.** Over 5 million articles in English.
- **Expertise.** e.g., Hurricane Claudette.
- **Always changing.** Articles are never considered complete.

Wikipedia is alive

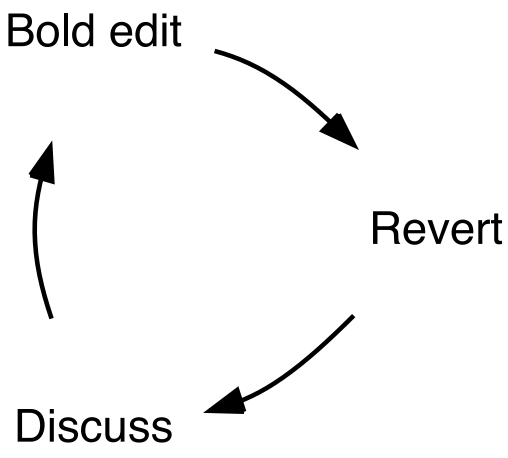
- 7th most popular website in the world.
- 6-10 edits per second.
- 700 new articles per day.

Wikipedians

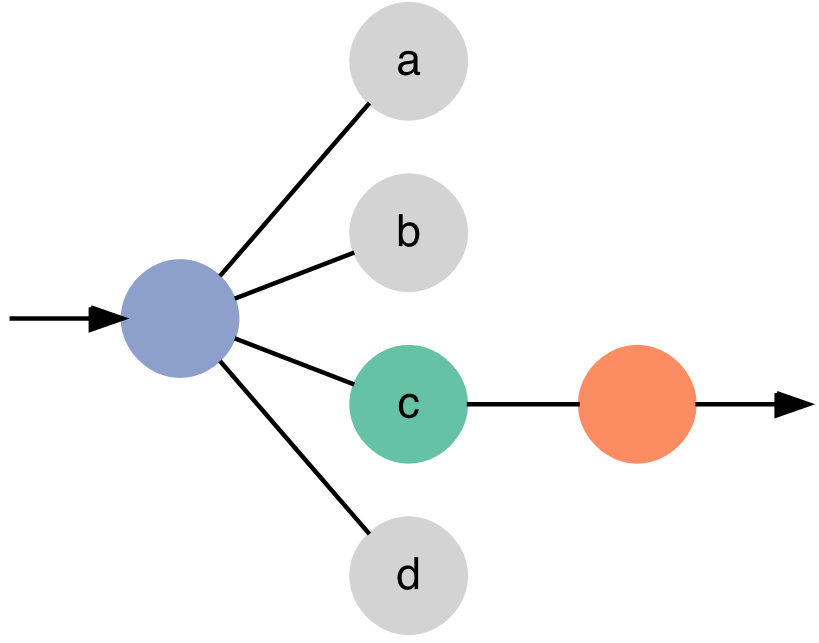
- 140,000 active users ($<$ 30 days).
- Vandalism detection is highly automated.
- New editors do not like getting reverted.
- All editors are protective of their own edits.
- Chance of being reverted doesn't change.

Wikipedia article editing as an evolutionary strategy

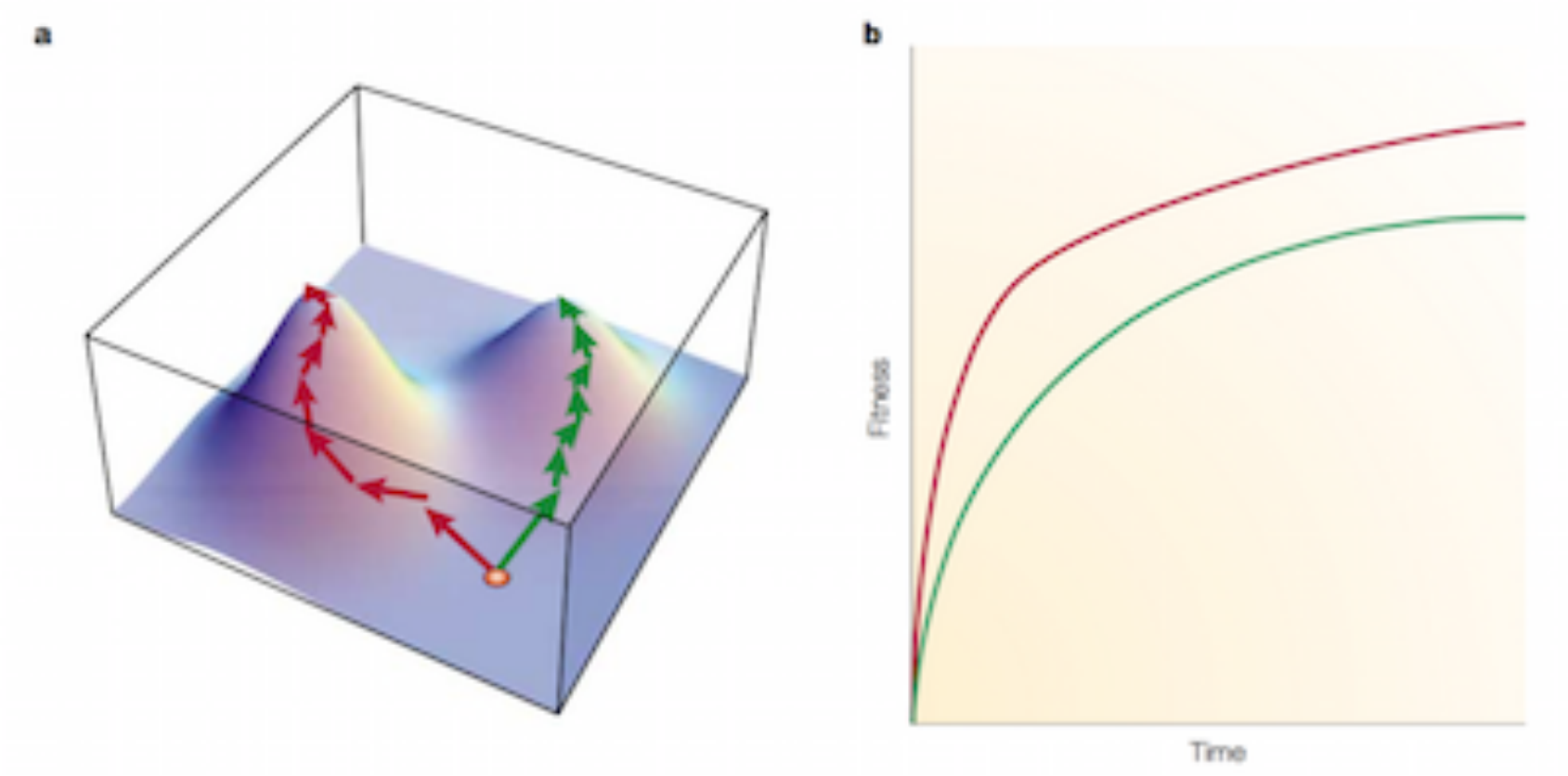
The BRD cycle editing strategy



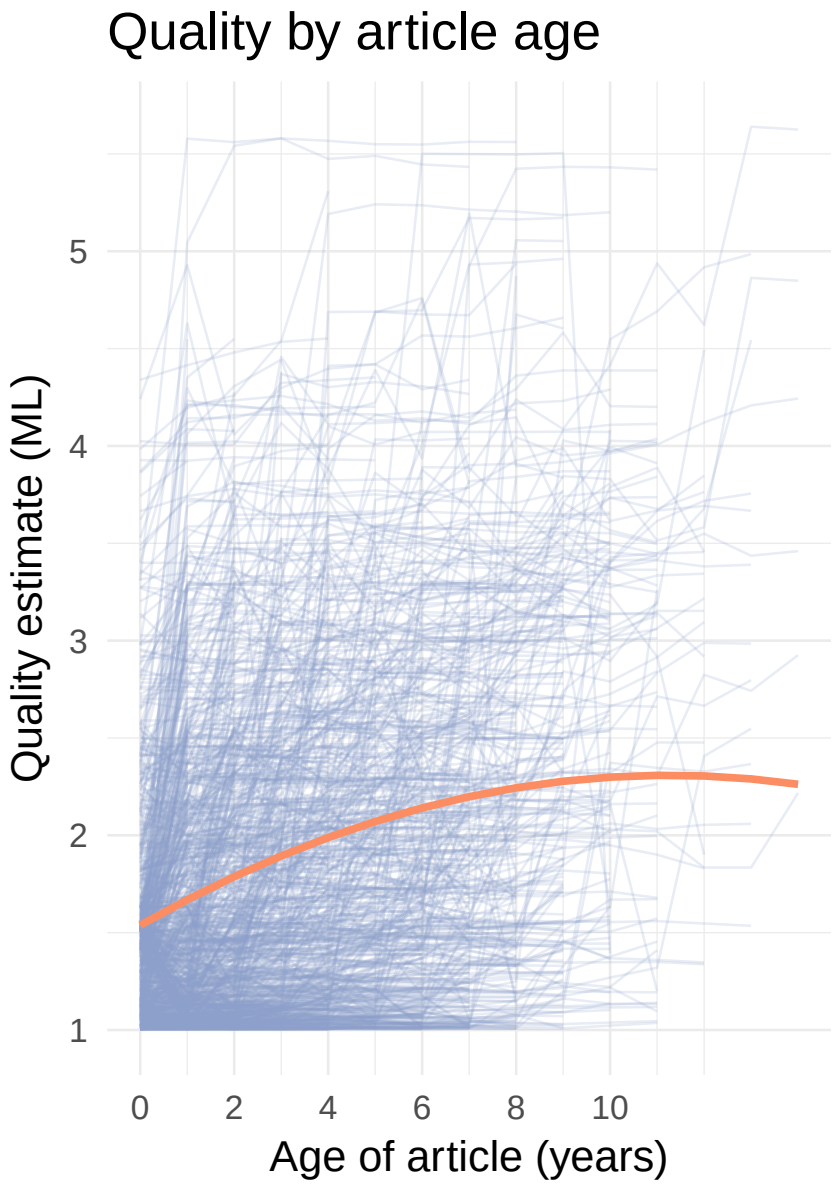
Results of BRD cycle editing

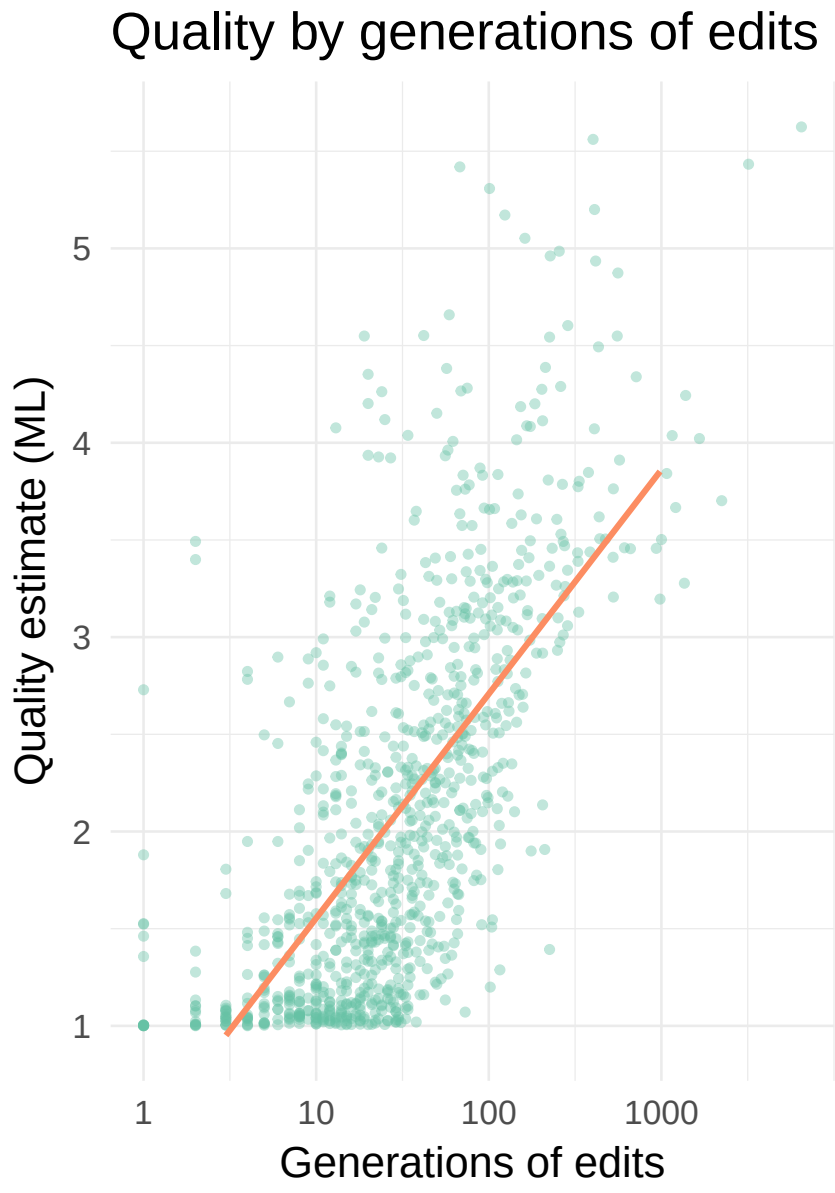


Experimental evolution (Elena & Lenski, 2003)



Wikipedia article quality





Future directions

- Edit quality models (big data!).
- Separate purifying from positive selection.
- Expand to open source software projects.

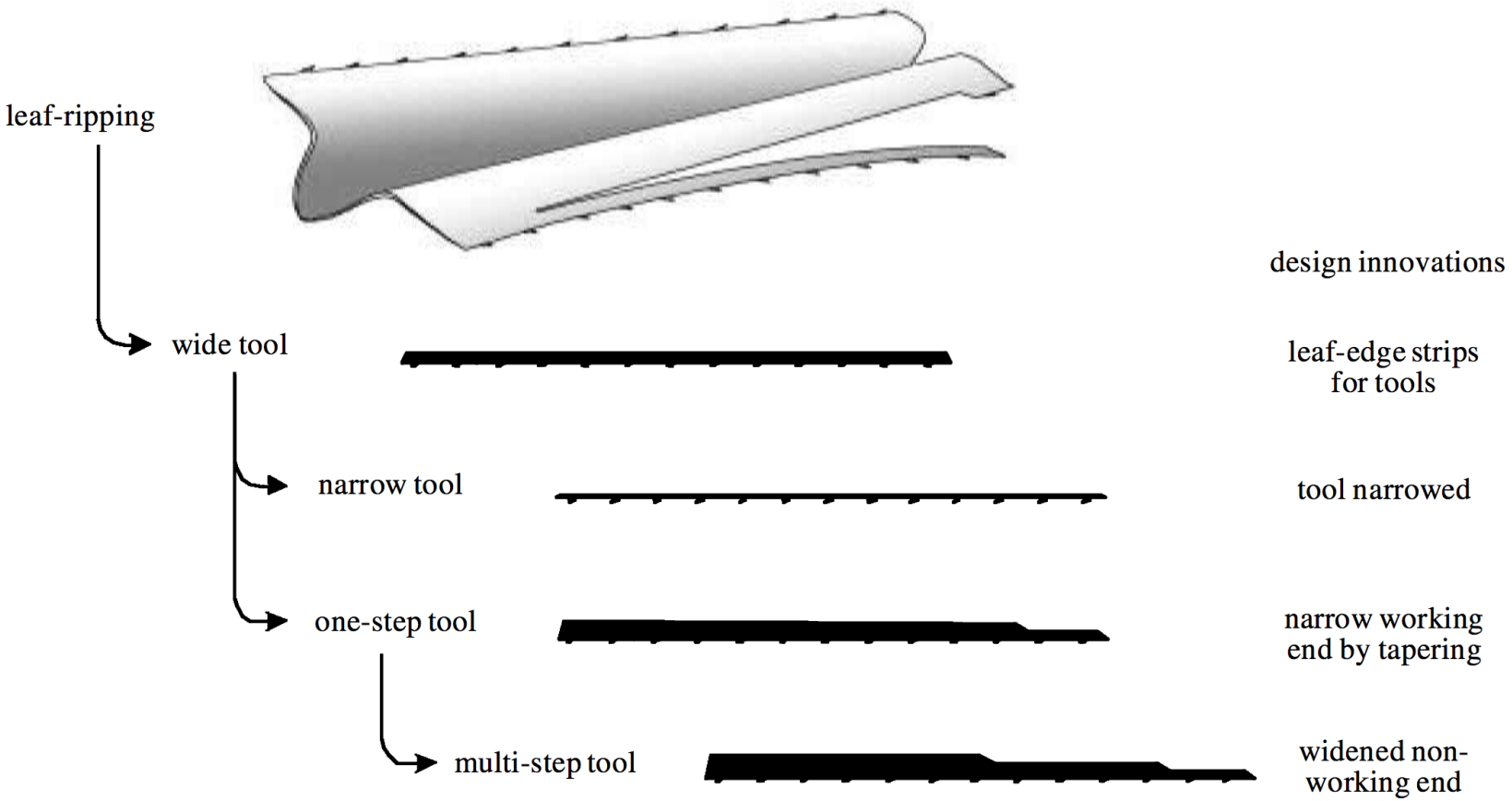
Discussion question

What do you like/dislike about the Wikipedia/evolution comparison?

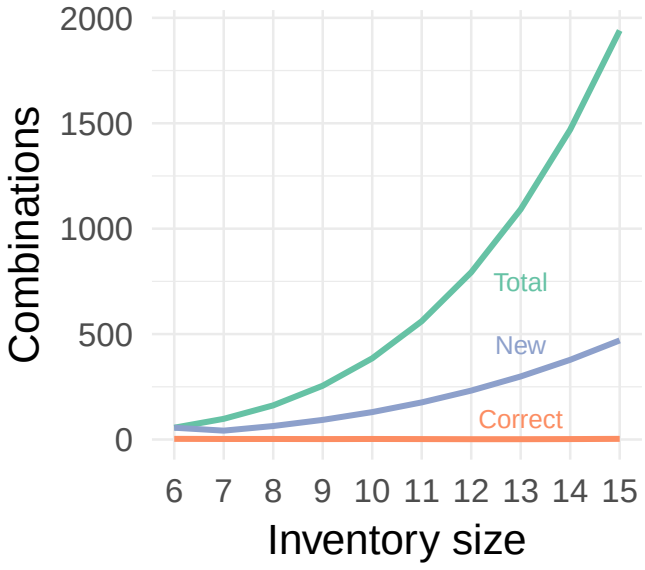
Problem solving

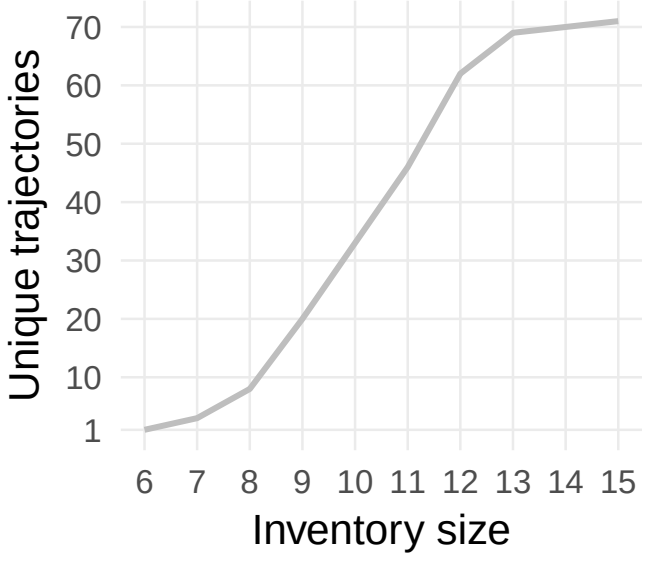
Edmiston, Derex, & Lupyan. (in prep). The impact of inheritance on problem solving ability.

Technological evolution (Hunt & Gray, 2003)

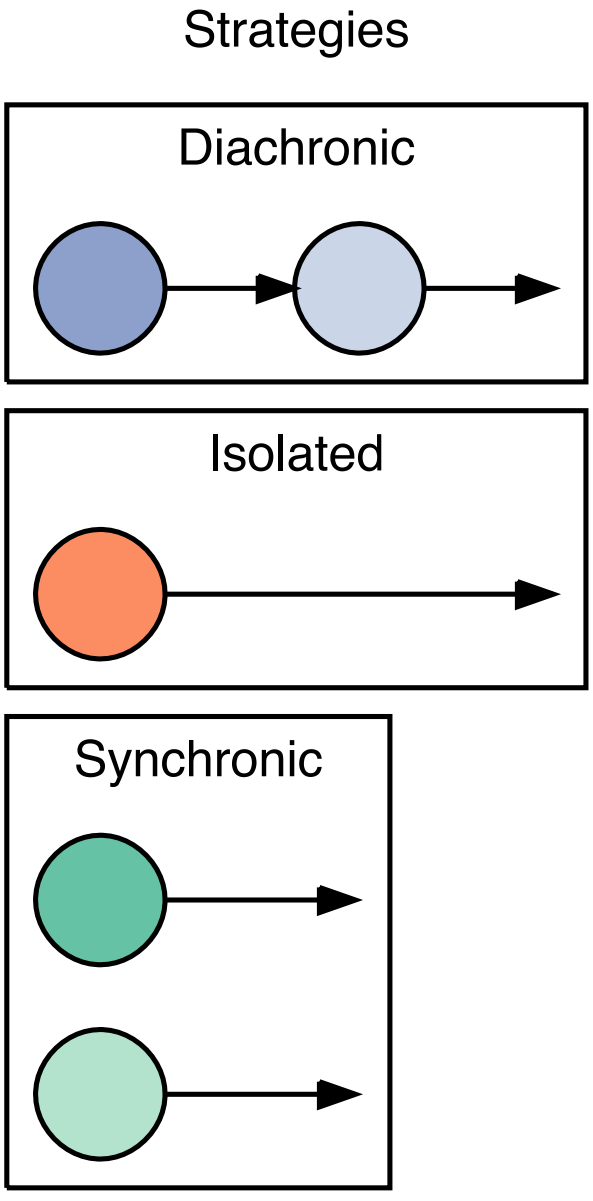


Innovation landscape

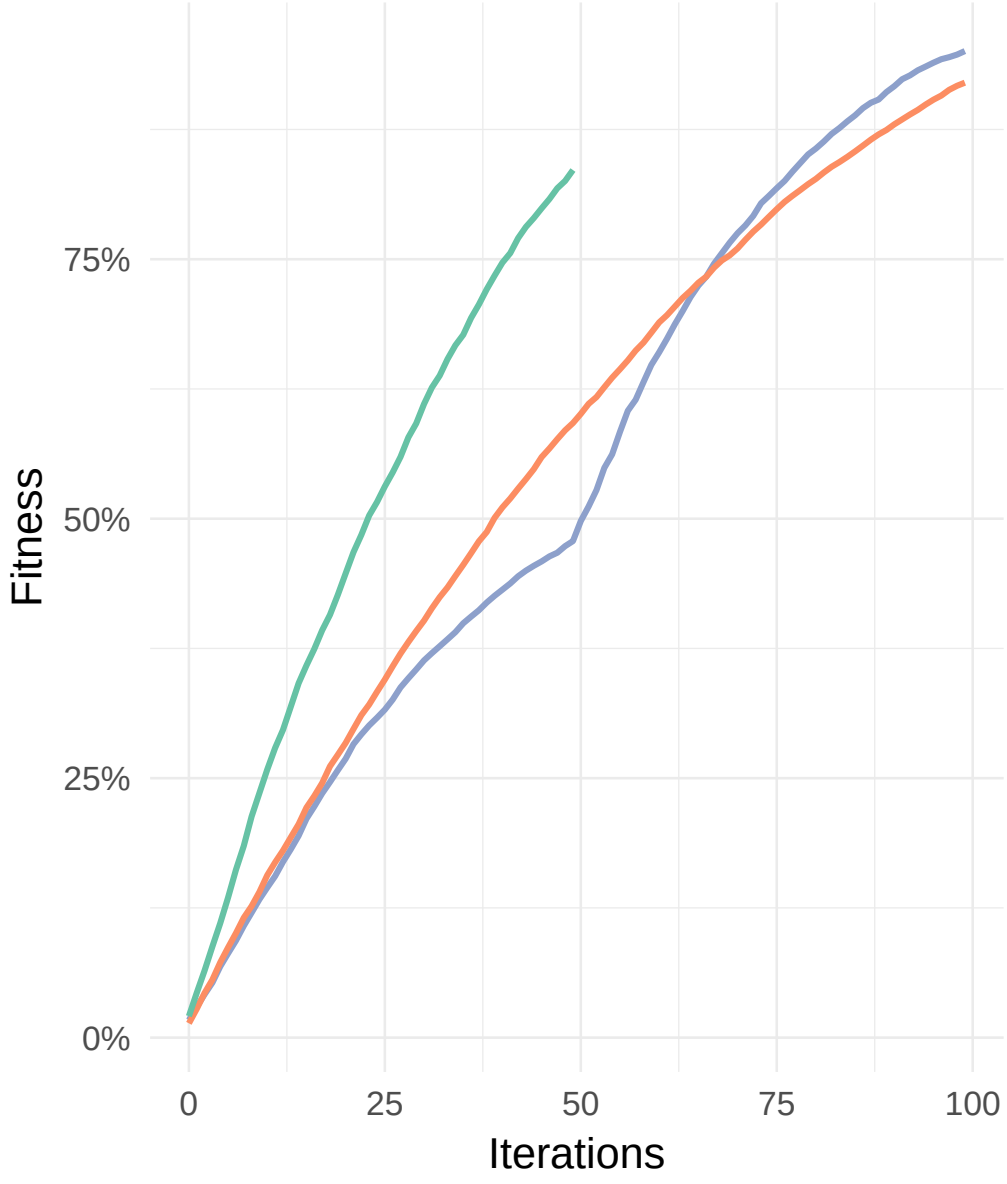


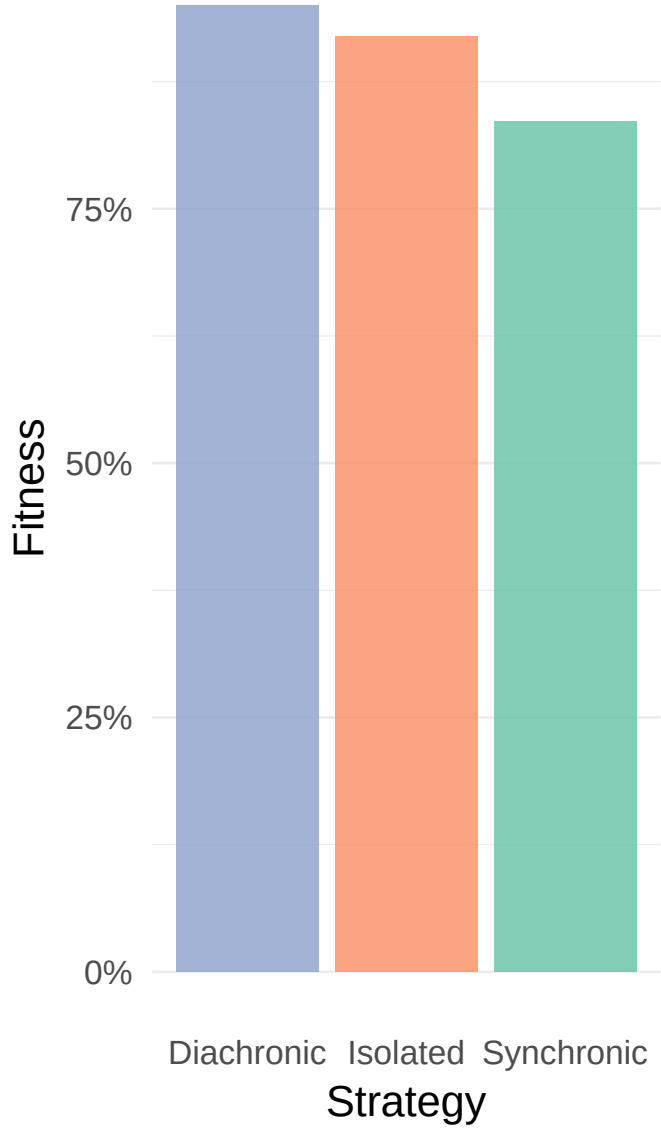


Team types



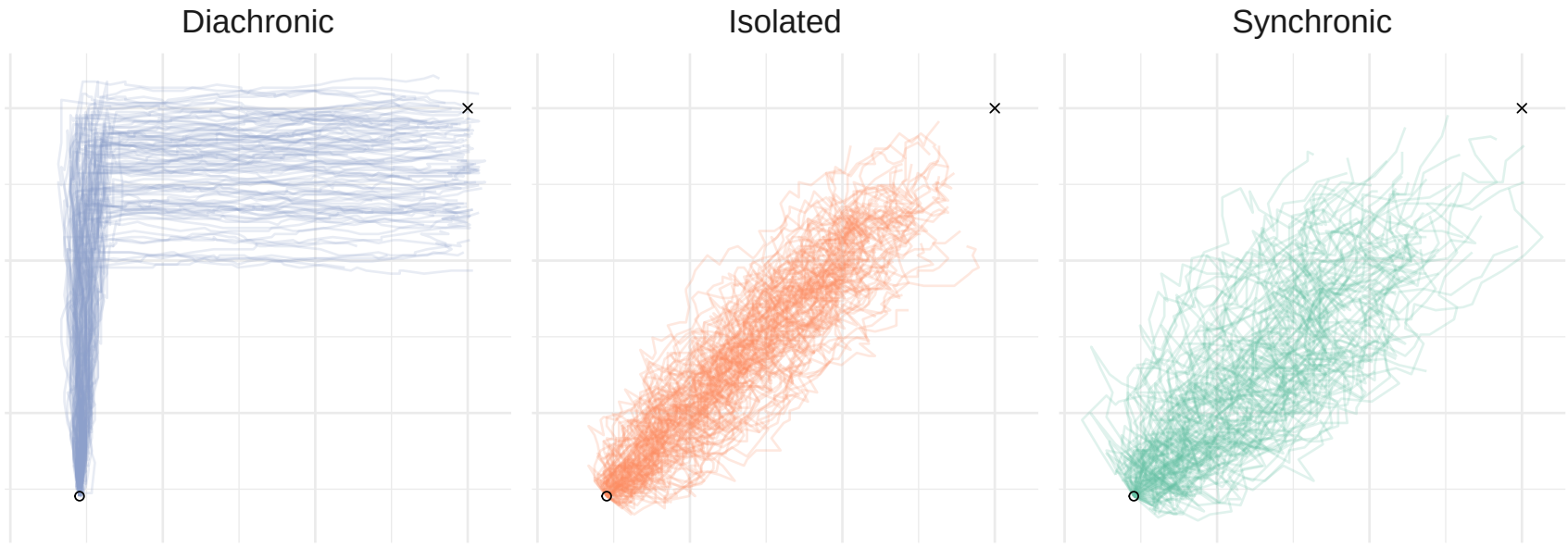
Proof of principle



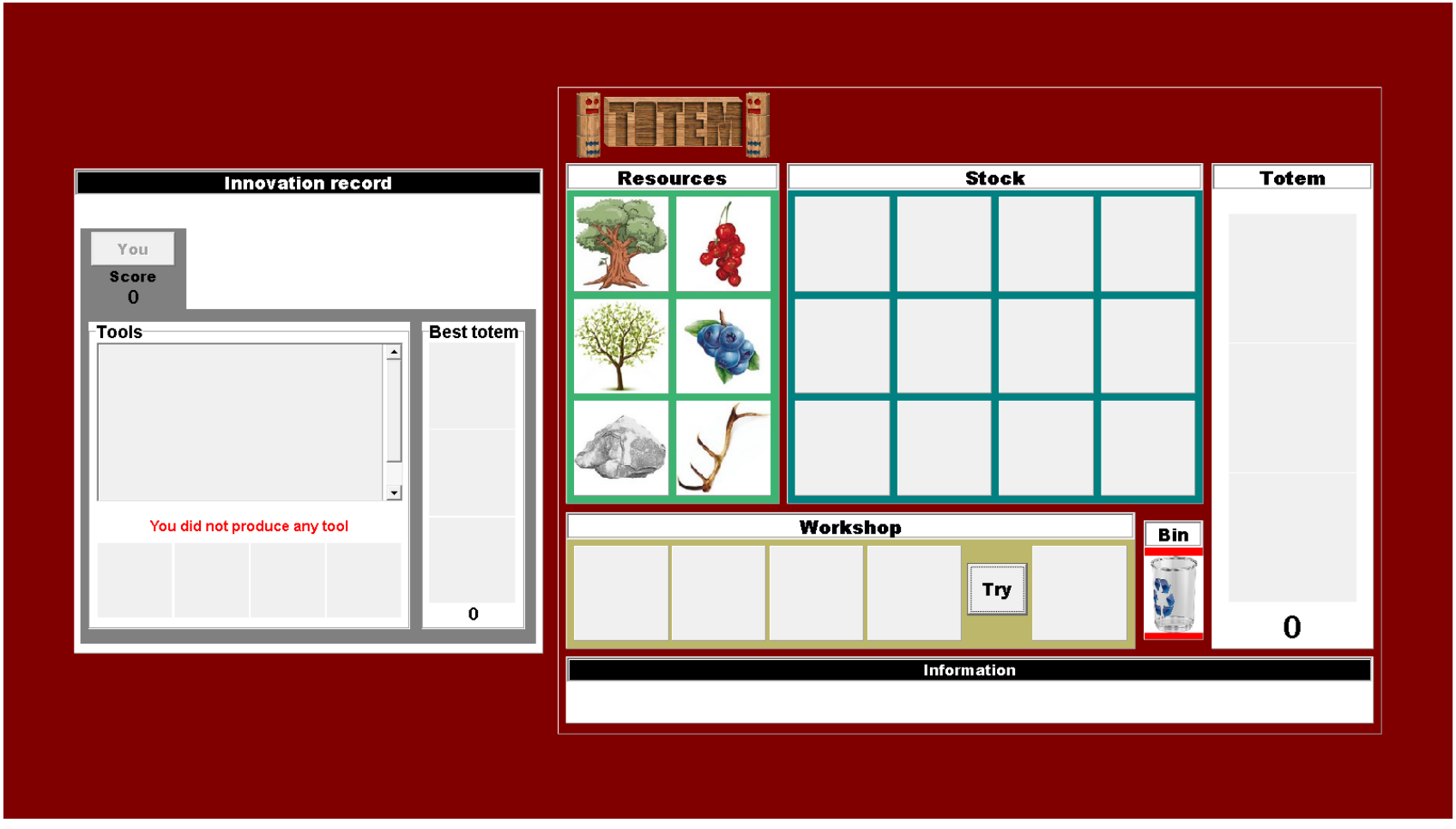


Problem solving as hill climbing

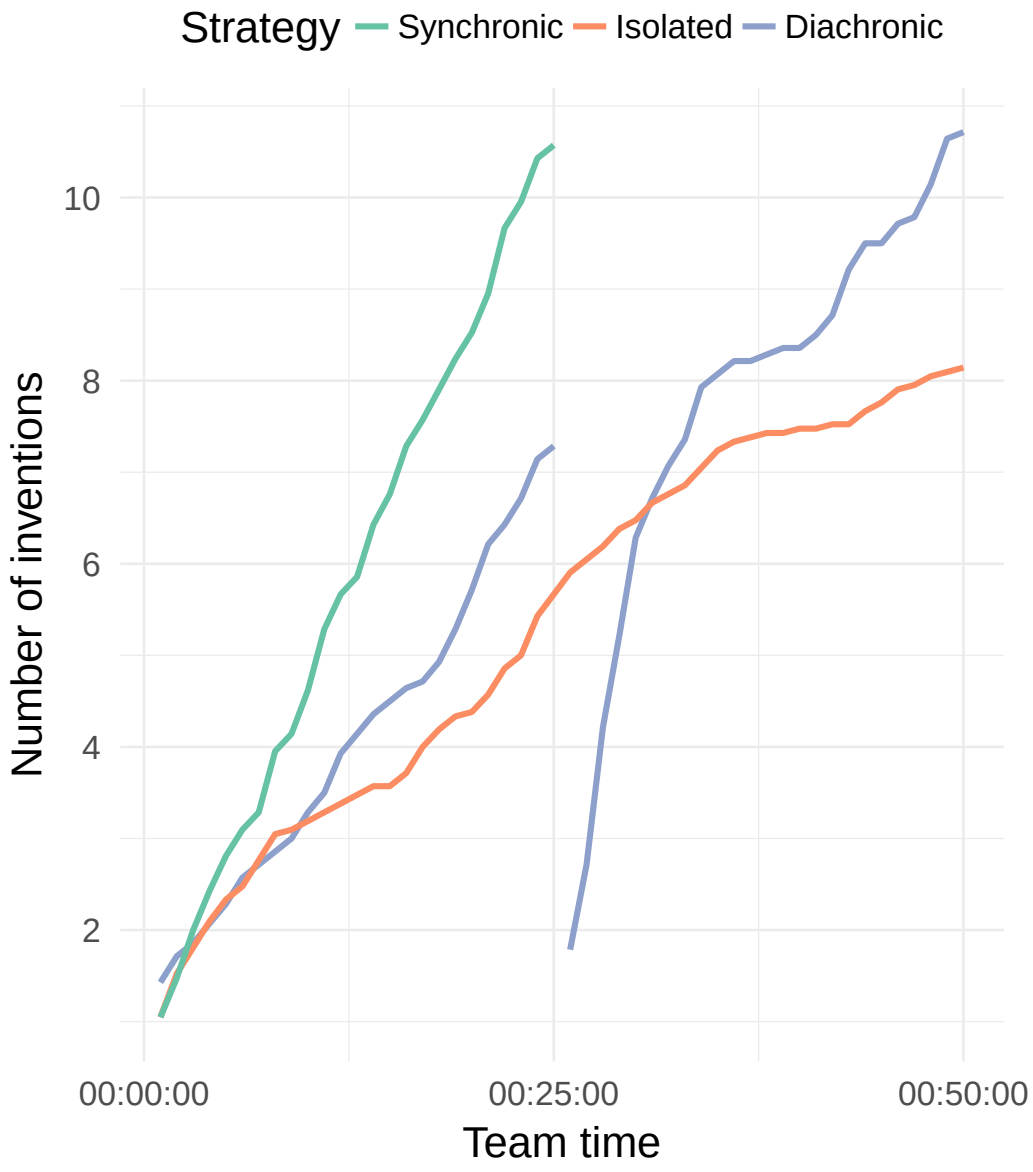
Diachronic collaboration puts problem solvers in a different part of the problem space than they would have been likely to reach on their own.

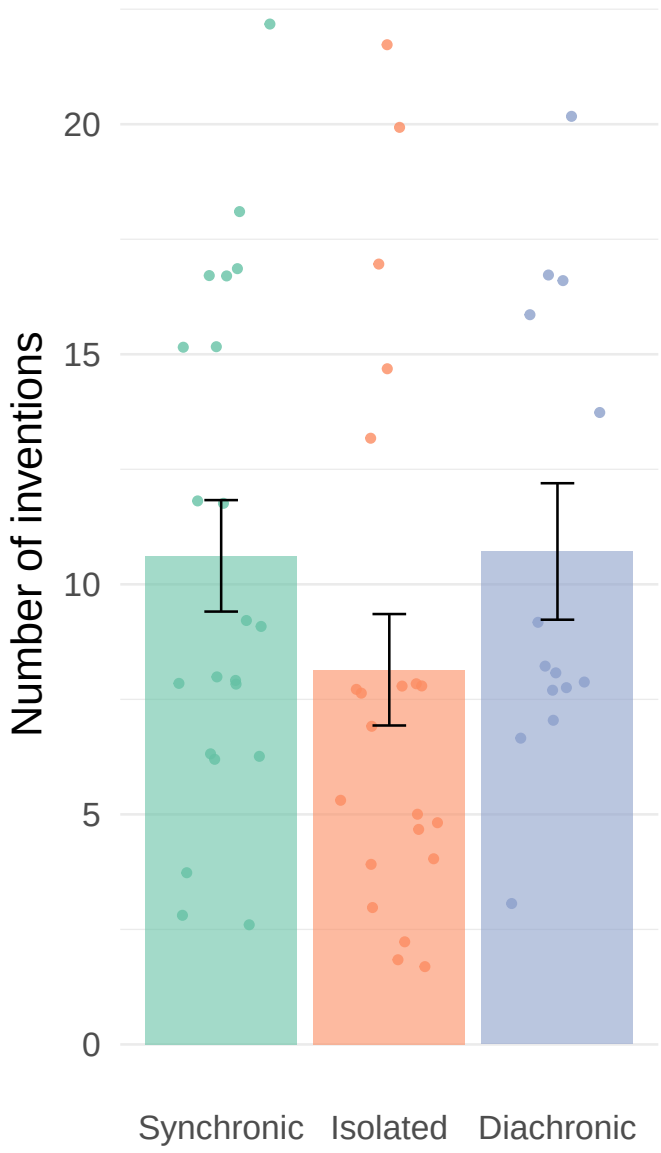


Totems game


Innovation record
You
Score
0
Tools
You did not produce any tool
Best totem
0
TOTEM
Resources
Stock
Totem
Workshop
Try
Bin
0
Information

Number of inventions

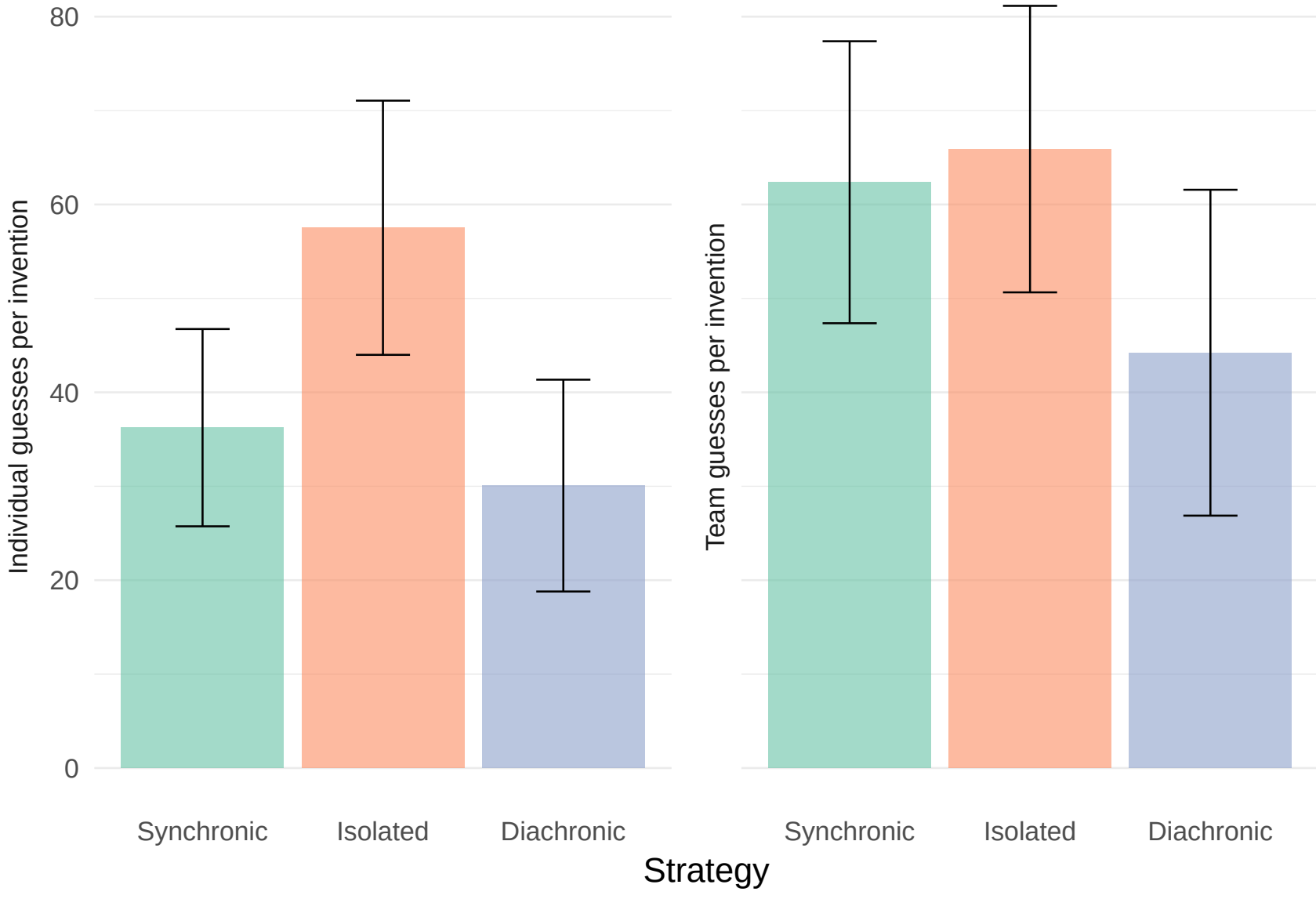




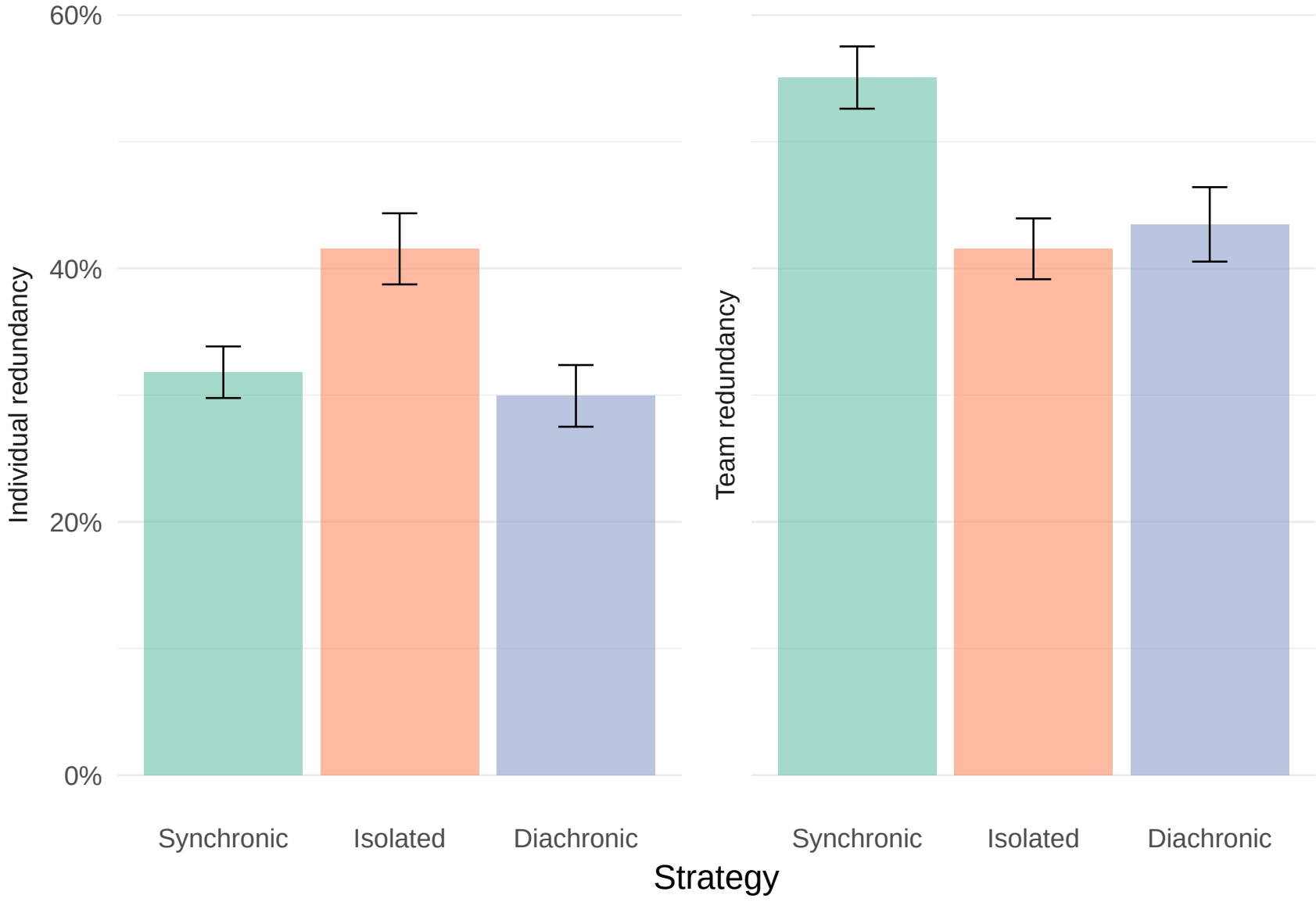
Measuring differences in problem solving

- Effectiveness (guesses per invention)
- Redundancy (non-unique guesses)
- Trajectories (unique paths)

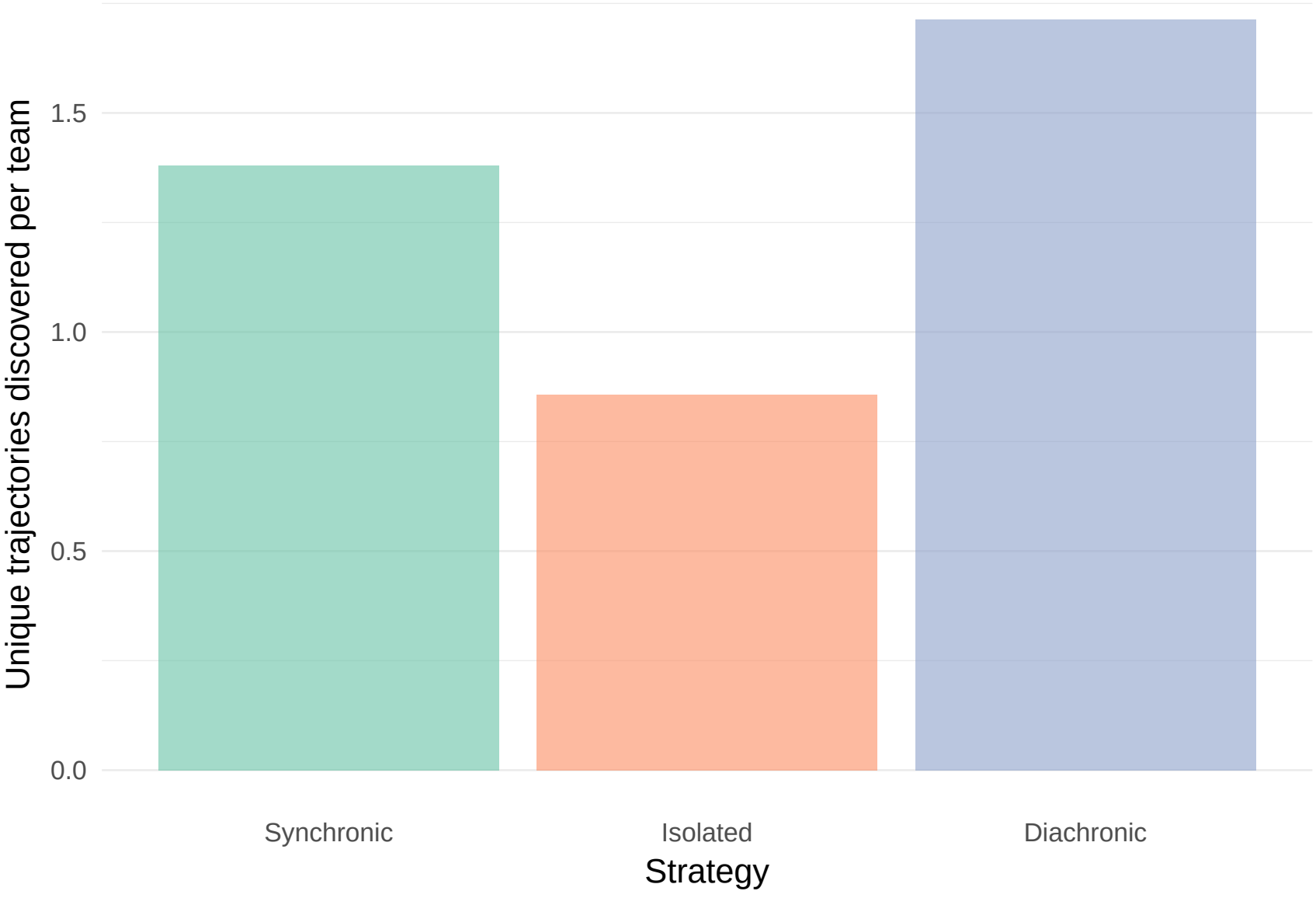
Effectiveness: Guesses per invention



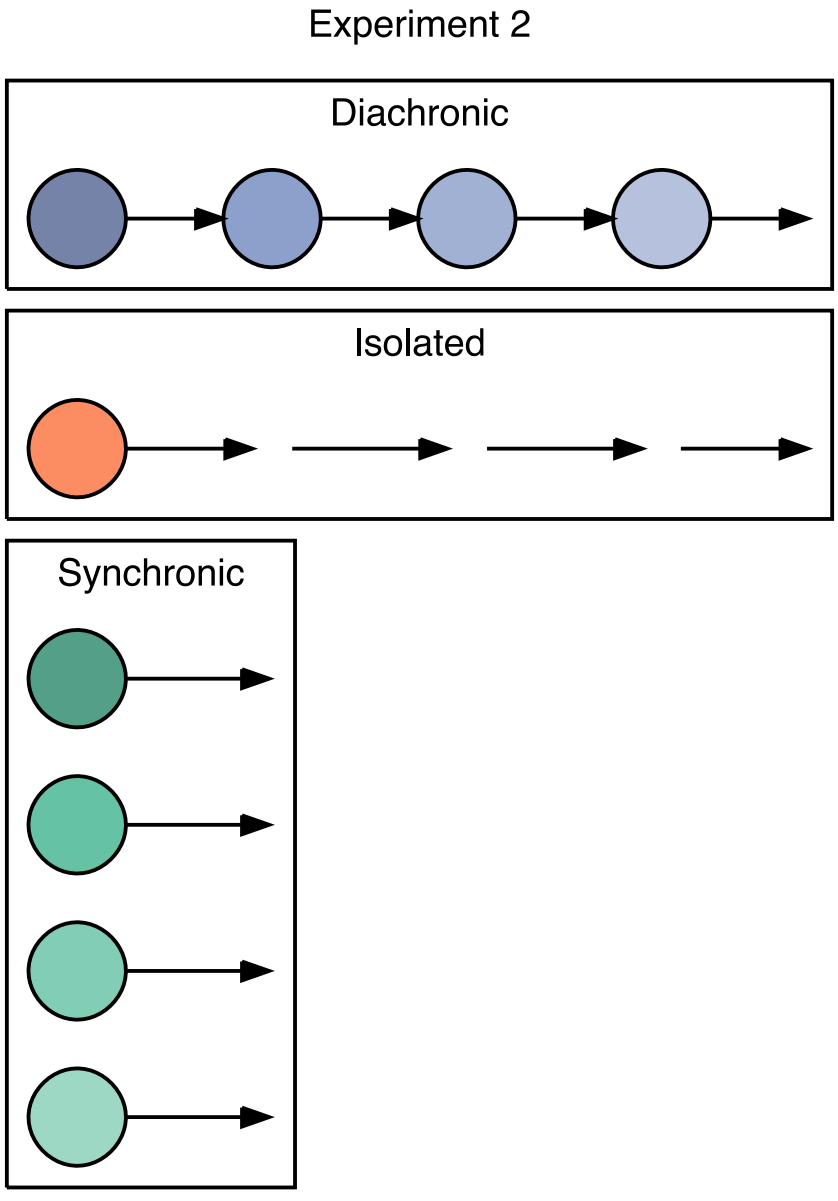
Redundancy: Non-unique guesses



Trajectories: Exploration of landscape



Prediction



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Pierce Edmiston
pedmiston@wisc.edu
github.com/pedmiston/leaning-on-darwin