

Cultural evolution

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

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Unifying theme

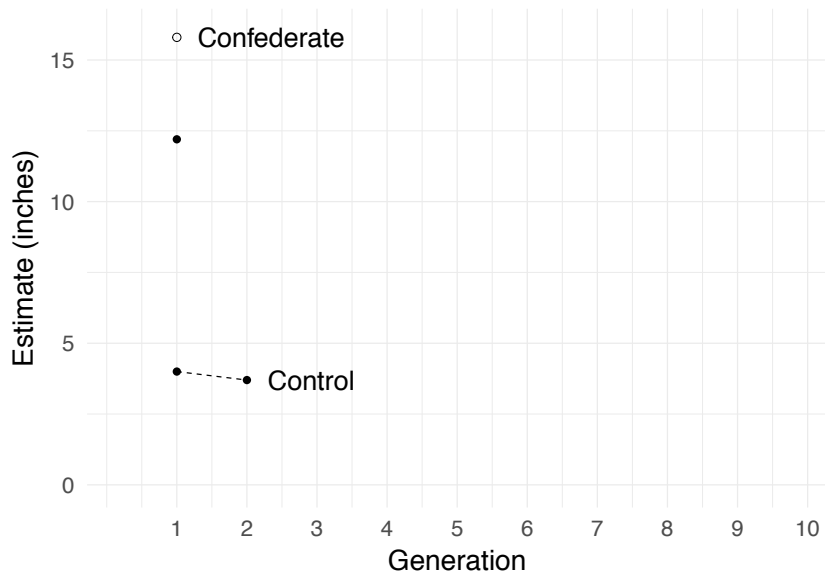
- ▶ **Iteration** is “the repetition of a process or utterance.”
- ▶ When can iteration be trusted?

Evolution in the psychology department

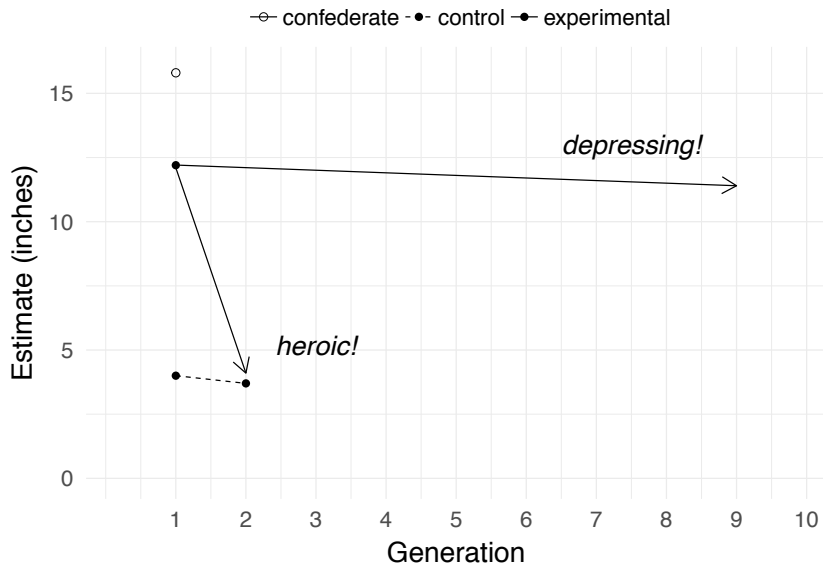
Jacobs & Campbell (1961) *J Abnorm Soc Psychol*.

The perpetuation of an arbitrary tradition through several generations of a laboratory microculture.

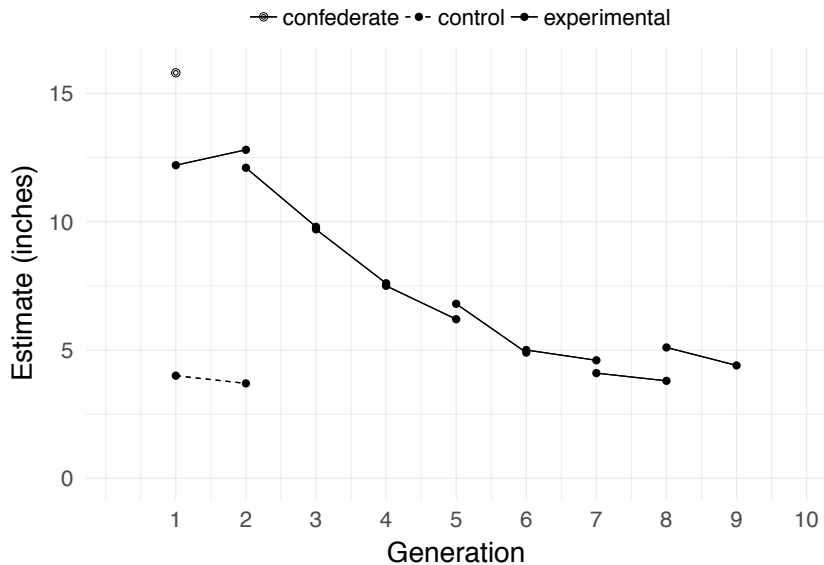
Iterated conformity (Jacobs & Campbell, 1961)



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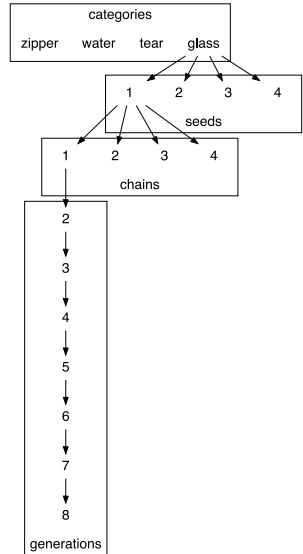


Word origins

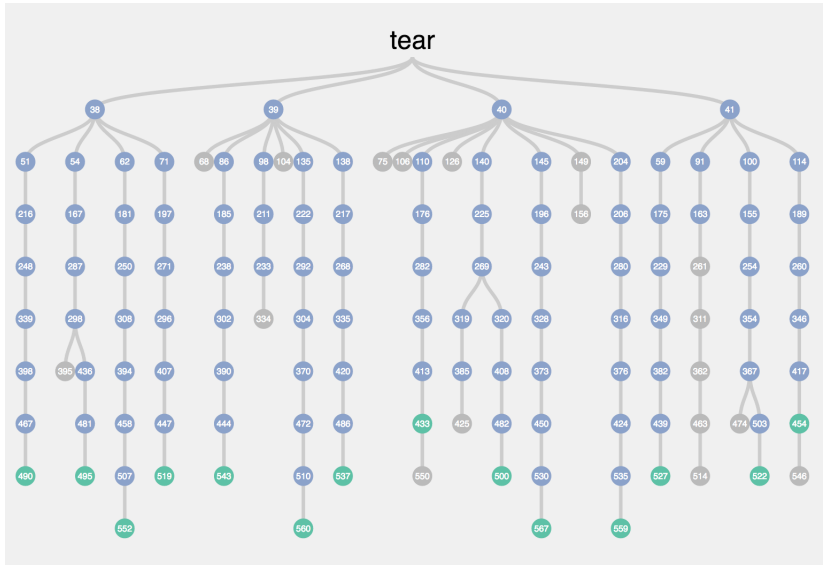
Edmiston, Perlman, & Lupyan. (in prep). Creating words from iterated vocal imitation.

Telephone game

Telephone Game

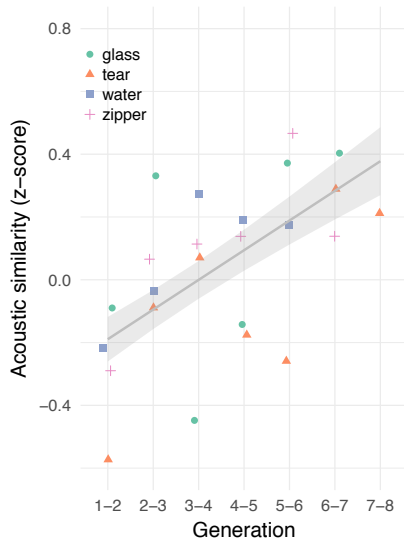


Telephone app

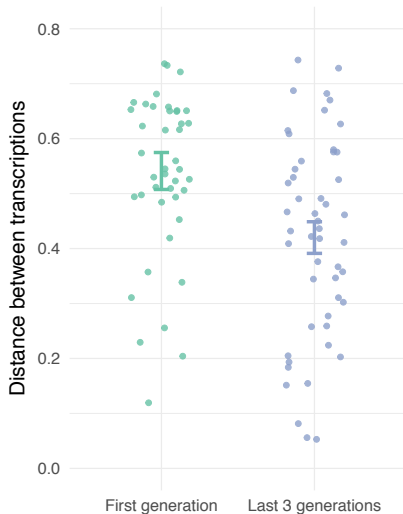


Imitations stabilize over generations

Acoustic similarity increases

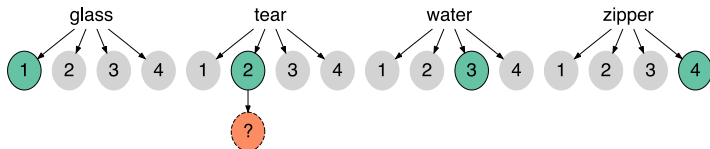


Spelling agreement increases

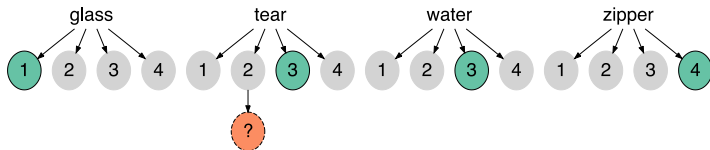


Question types

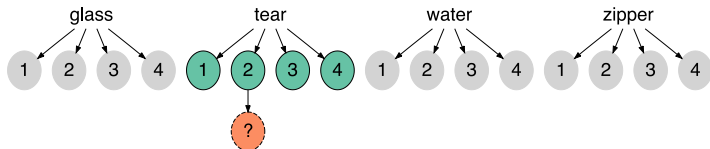
True seed



Category match

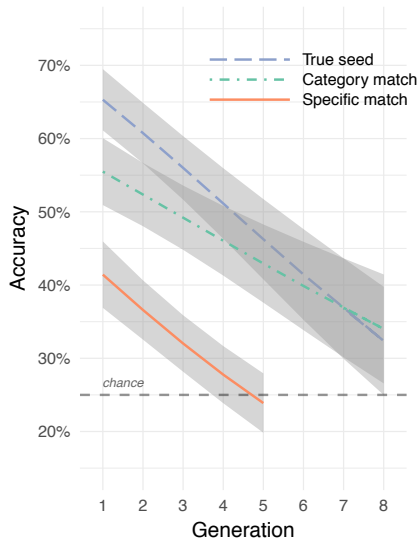


Specific match

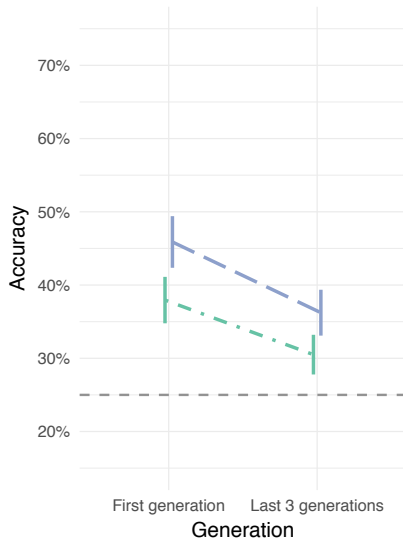


Guess the seed

Matching imitations



Matching transcriptions

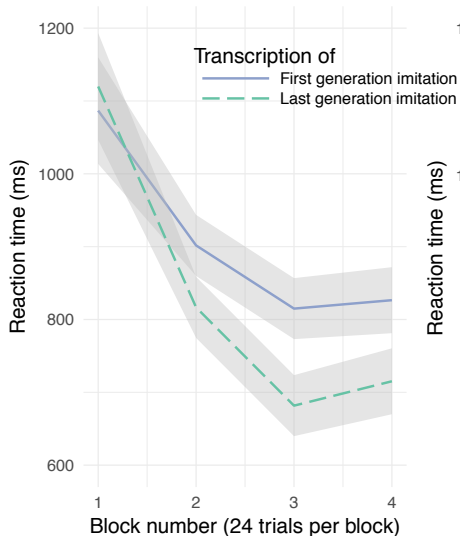


Invented words

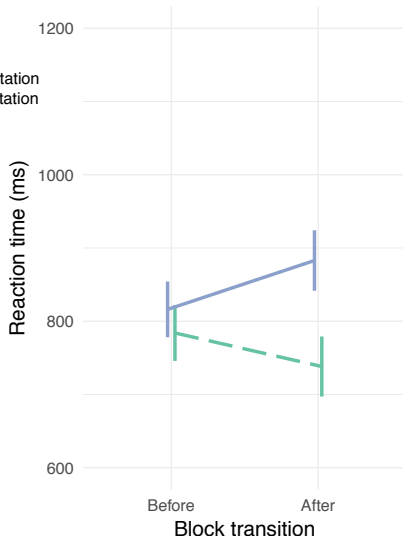
Category	Seed	First generation	Last generation
glass	1	tingtingting	dundunduh
glass	2	chirck	correcto
glass	3	dirrng	wayew
glass	4	boonk	baroke
tear	1	scheeept	cheecheea
tear	2	feeshefee	cheeoووو
tear	3	hhhweerrr	chhhhhhewwwwe
tear	4	ccccchhhhyeaahh	shhhhh
water	1	boococucuwich	eeverlusha
water	2	chwoochwooochwooo	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

Learning rates



Cost to generalization



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

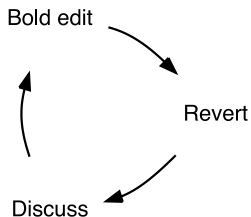
- ▶ 7th most popular website in the world.
- ▶ 6-10 edits per second.
- ▶ 700 new articles per day.

Wikipedians

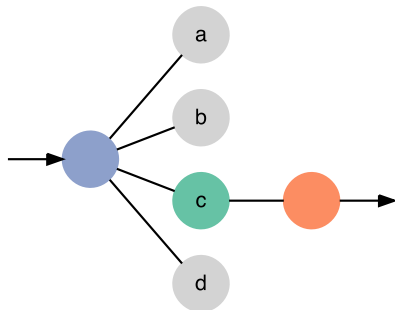
- ▶ 140,000 active users (< 30 days).
- ▶ Vandalism detection is highly automated.
- ▶ New editors do not like getting reverted.
- ▶ All editors are protective of their own edits.
- ▶ Chance of being reverted doesn't change.

Wikipedia article editing as an evolutionary strategy

The BRD cycle editing strategy

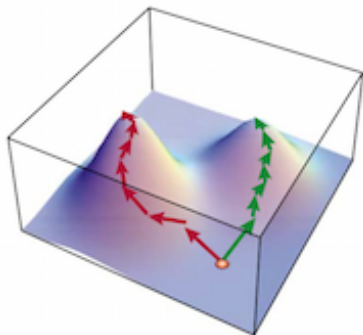


Results of BRD cycle editing

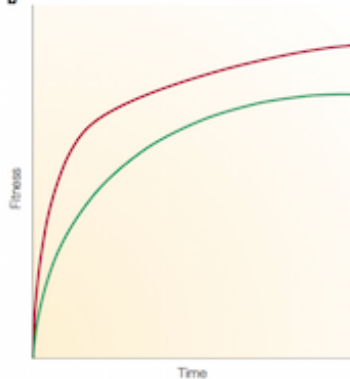


Experimental evolution (Elena & Lenski, 2003)

a

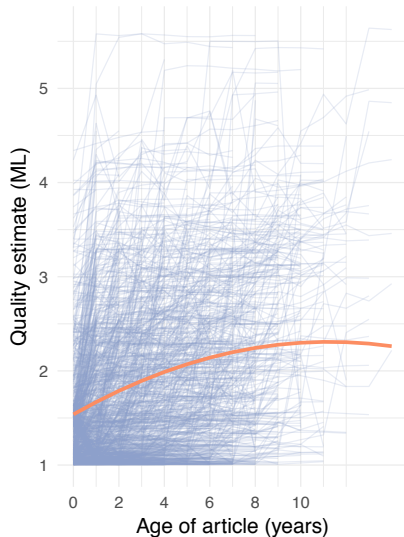


b

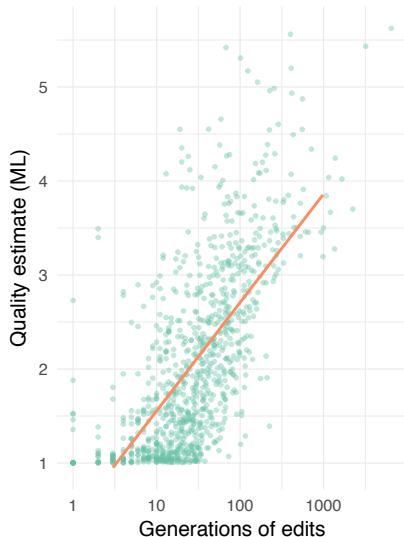


Wikipedia article quality

Quality by article age



Quality by generations of edits



Future directions

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

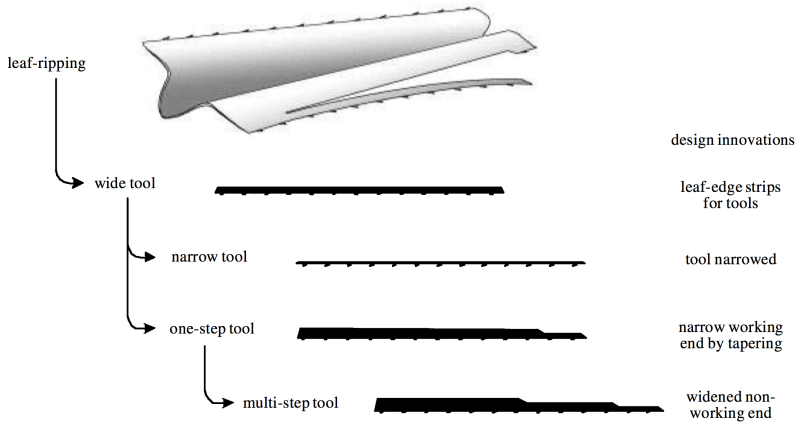
Discussion question

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

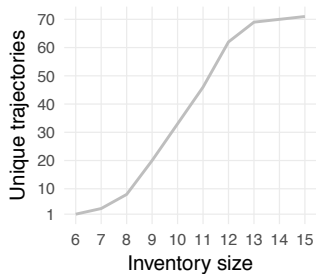
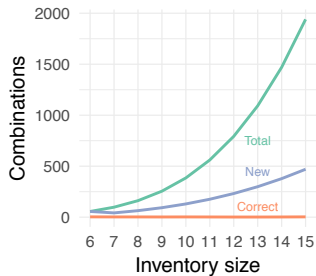
Problem solving

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

Technological evolution (Hunt & Gray, 2003)



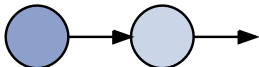
Innovation landscape



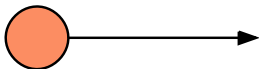
Team types

Strategies

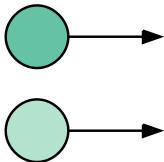
Diachronic



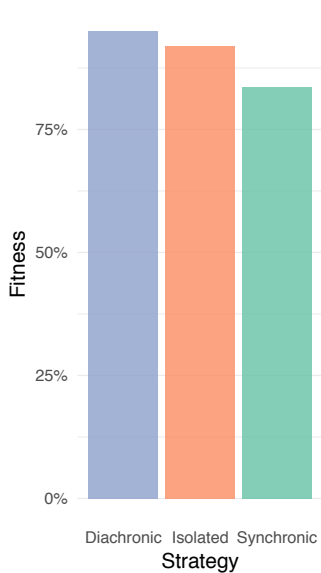
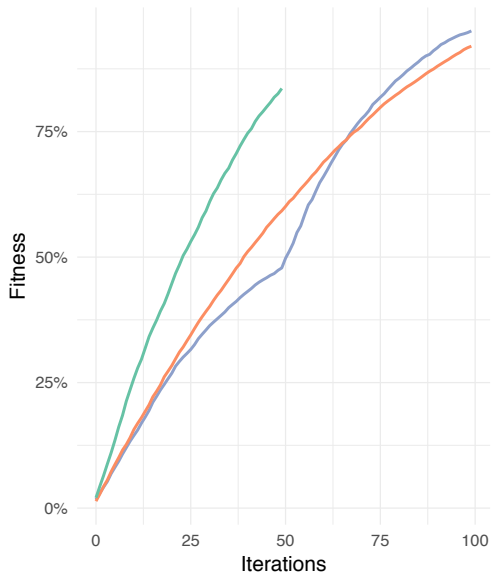
Isolated



Synchronic

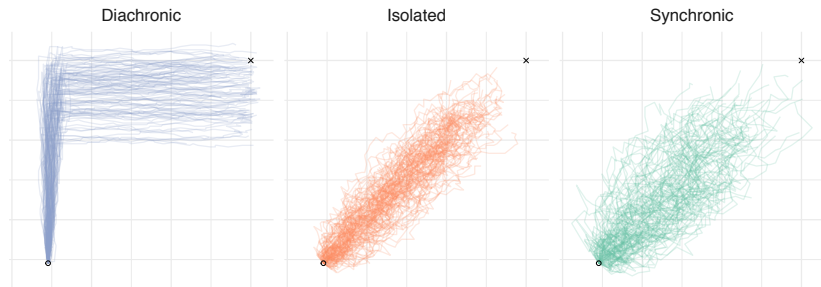


Proof of principle

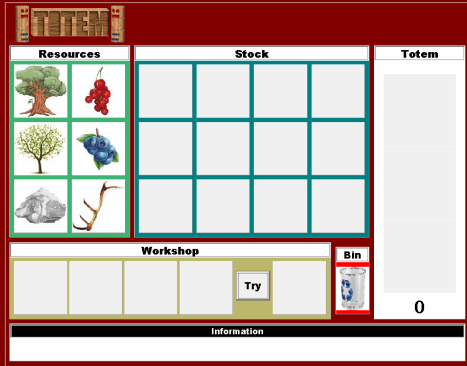
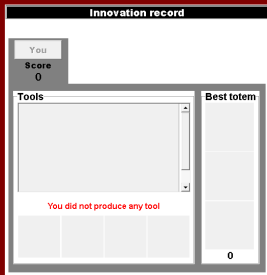


Problem solving as hill climbing

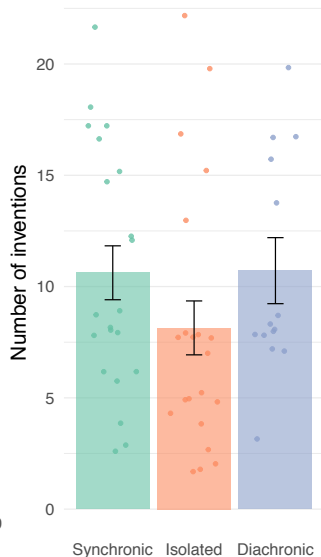
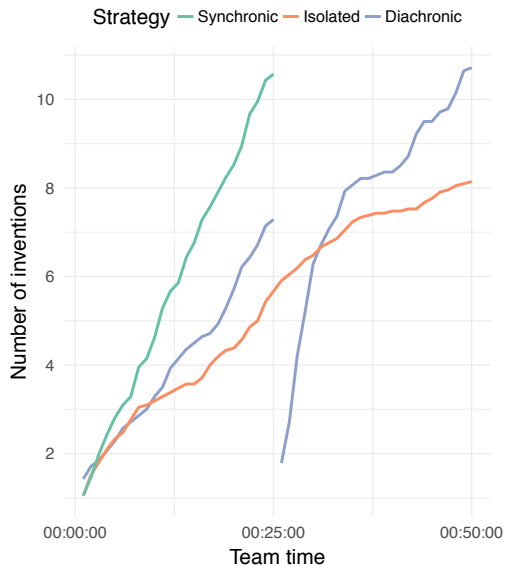
Diachronic collaboration puts problem solvers in a different part of the problem space than they would have been likely to reach on their own.



Totems game



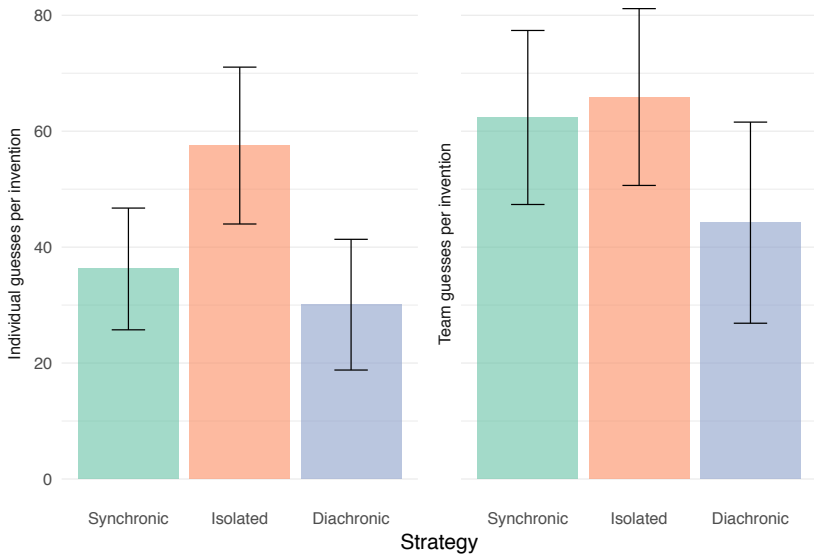
Number of inventions



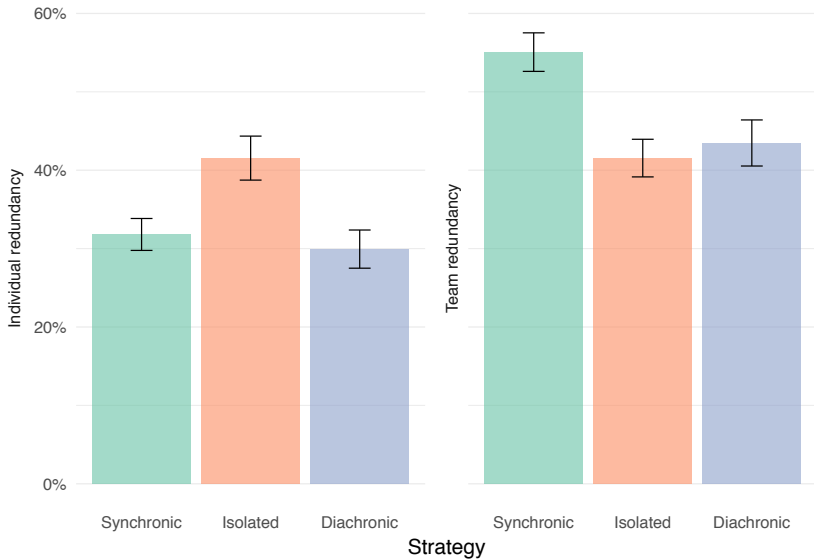
Measuring differences in problem solving

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

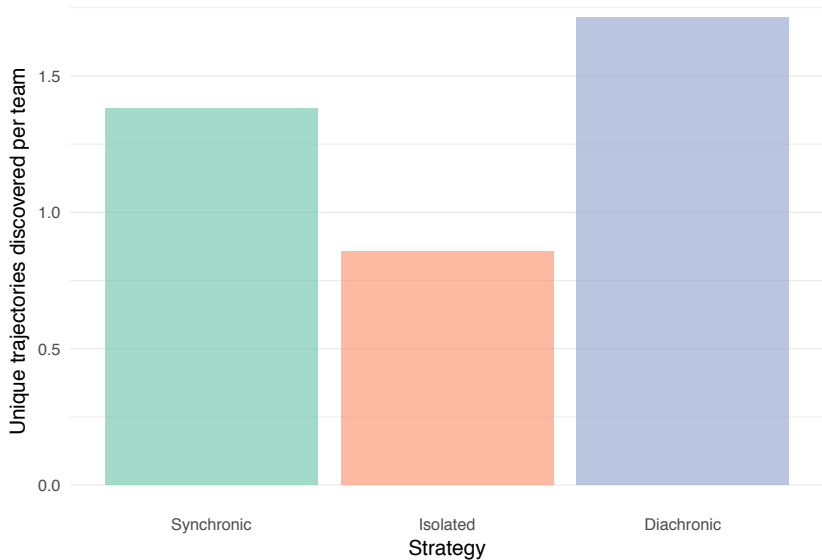
Effectiveness: Guesses per invention



Redundancy: Non-unique guesses

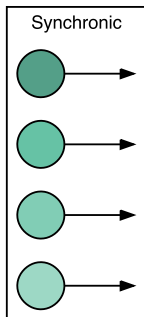
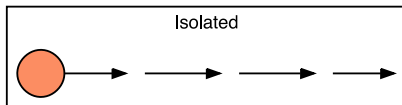
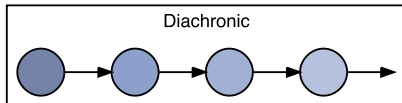


Trajectories: Exploration of landscape



Prediction

Experiment 2



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

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github.com/pedmiston/leaning-on-darwin