Cumulative improvements in iterated problem solving

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The cultural inheritance of problem solving knowledge

Why are humans effective problem solvers?

– We evolved specialized intelligences (Pinker, 2010).
– We developed systems of cultural inheritance (Boyd et al., 2011).



Figure 1: Human settlements in the Moroccan desert, the Brazilian rainforest, and the Canadian arctic.

Lost European explorer experiments[1]

"Starvation on nardoo is by no means unpleasant, but for the weakness one feels, and the utter inability to move oneself, for as the appetite is concerned, it gives me the greatest satisfaction."

Figure 2: The nardoo acquatic fern, native to Australia.

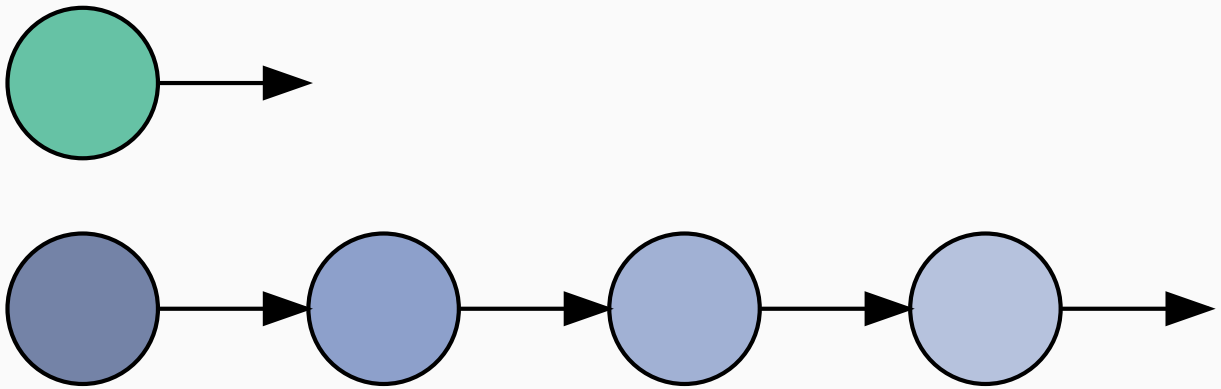
[1](Boyd, 2018; Boyd, Richerson, & Henrich, 2011; Henrich, 2015)

The adaptiveness of cultural inheritance[2]

Cultural inheritance is adaptive because **even smart people die.**

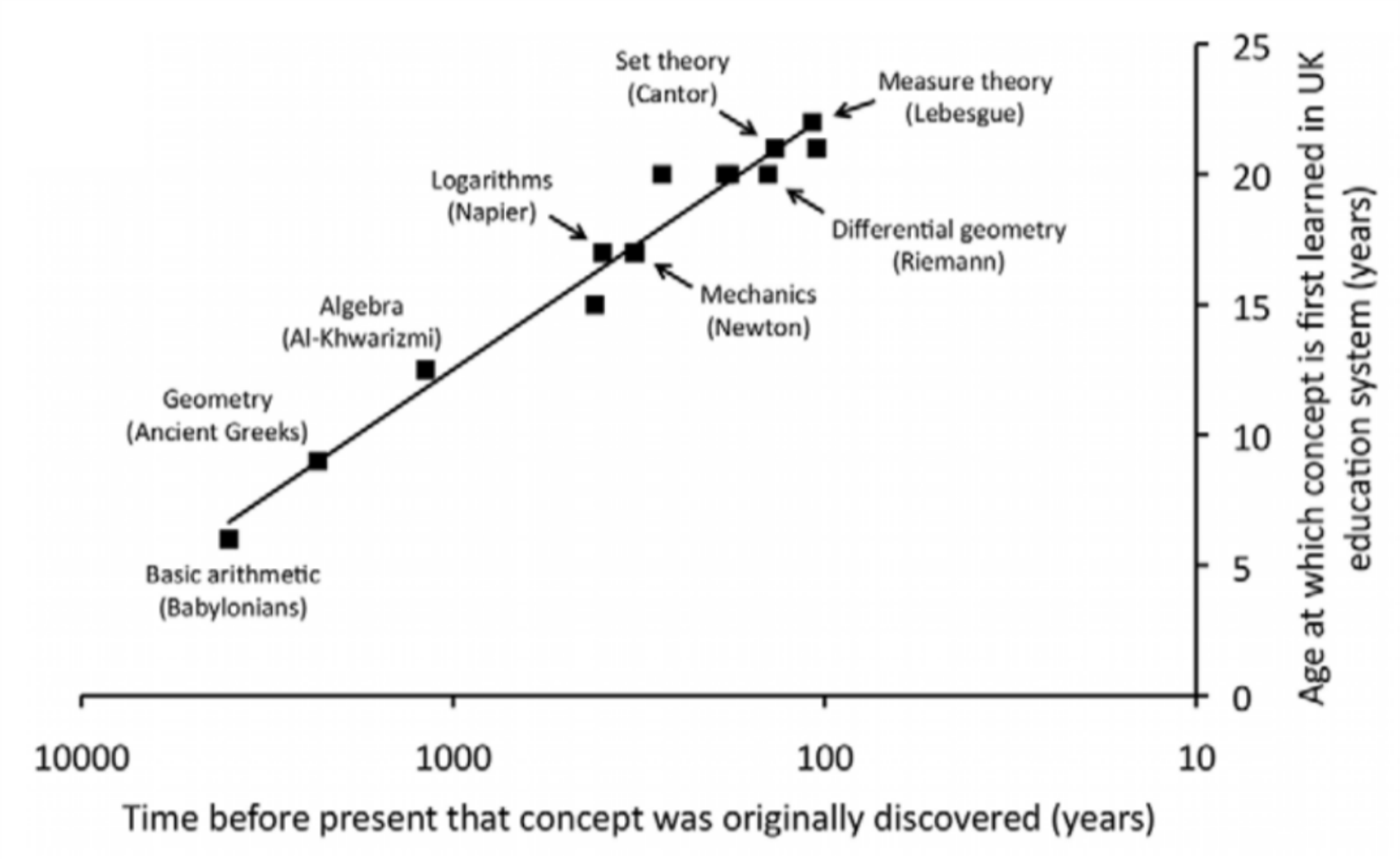
Cultural inheritance enables problem solving to extend far longer than any lifetime.

How effectively does problem solving accumulate over generations?



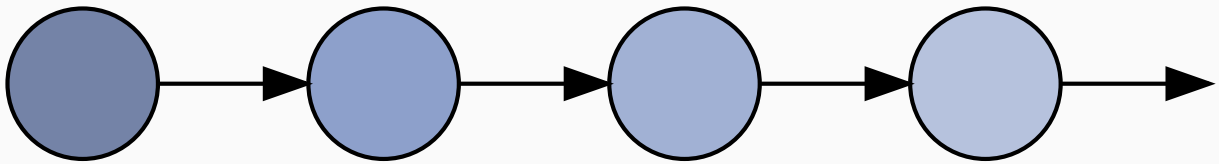
[2](Boyd & Richerson, 1985; Richerson & Boyd, 2005)

Increasing acquisition costs[3]



[3](Fig. 2A, Mesoudi, 2011)

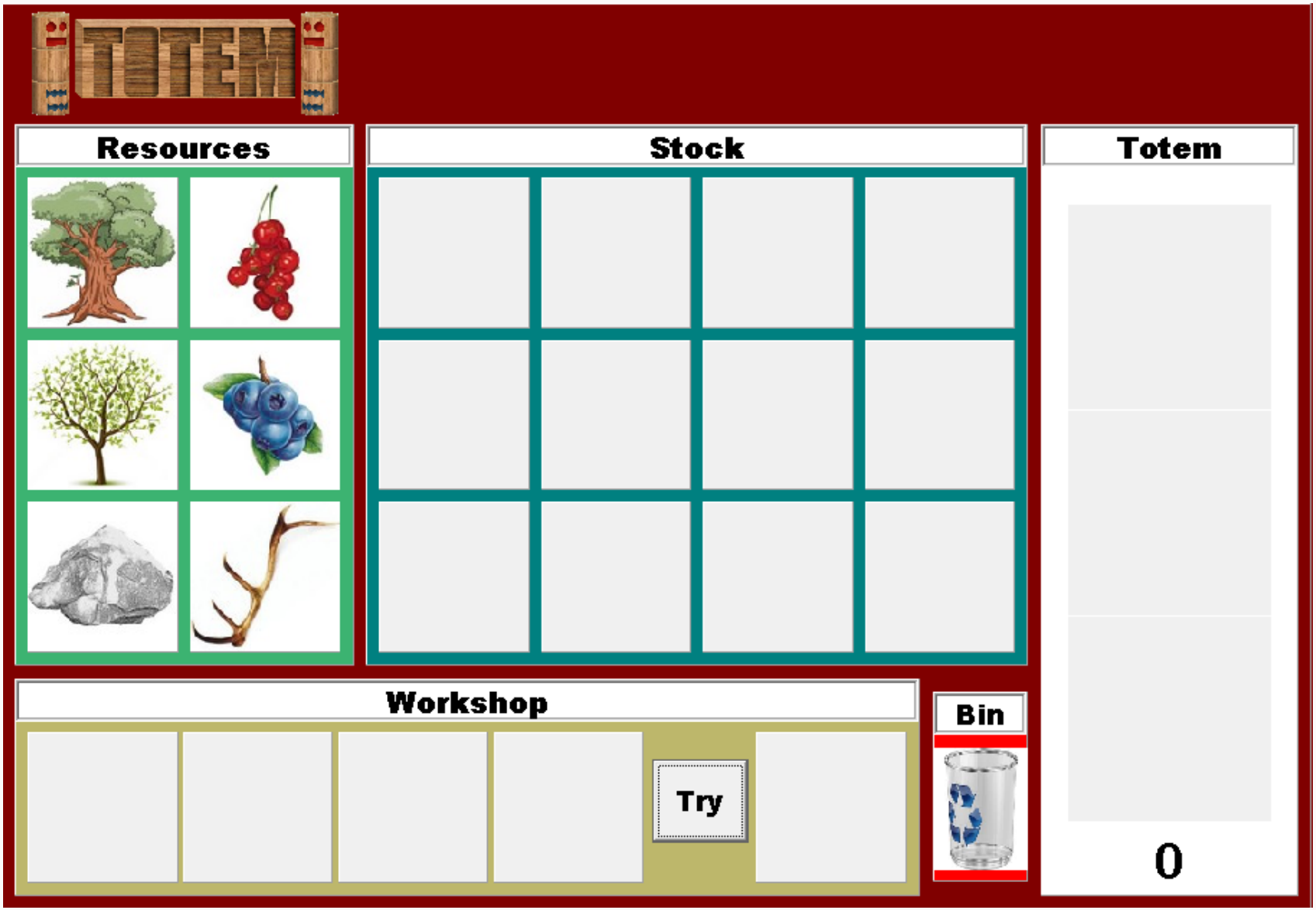
How does problem solving performance accumulate?



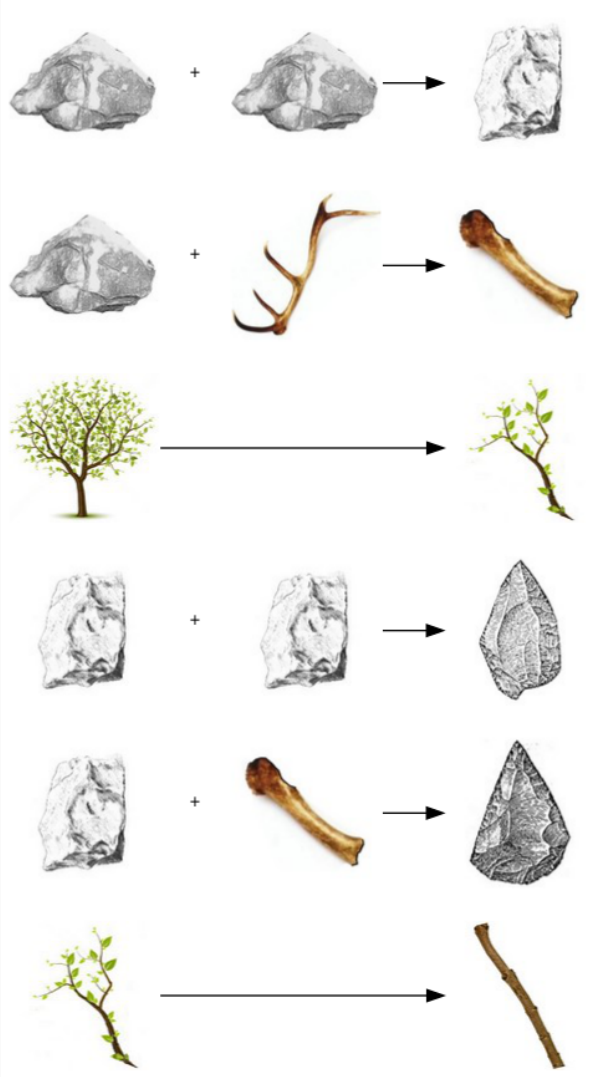
Experimental models of cumulative culture:

- building paper airplanes
- knapping stone tools
- constructing baskets
- solving puzzles on a computer

The Totem Game (Derex & Boyd, 2015)

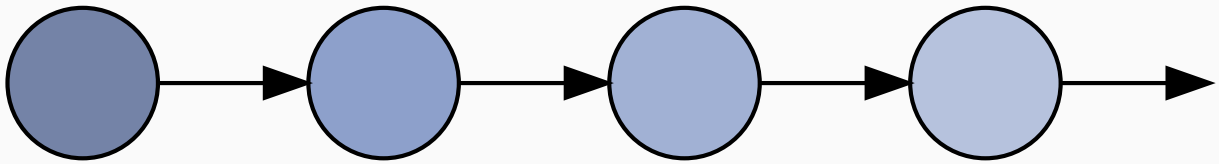


Recipes



Solution landscape

Methods

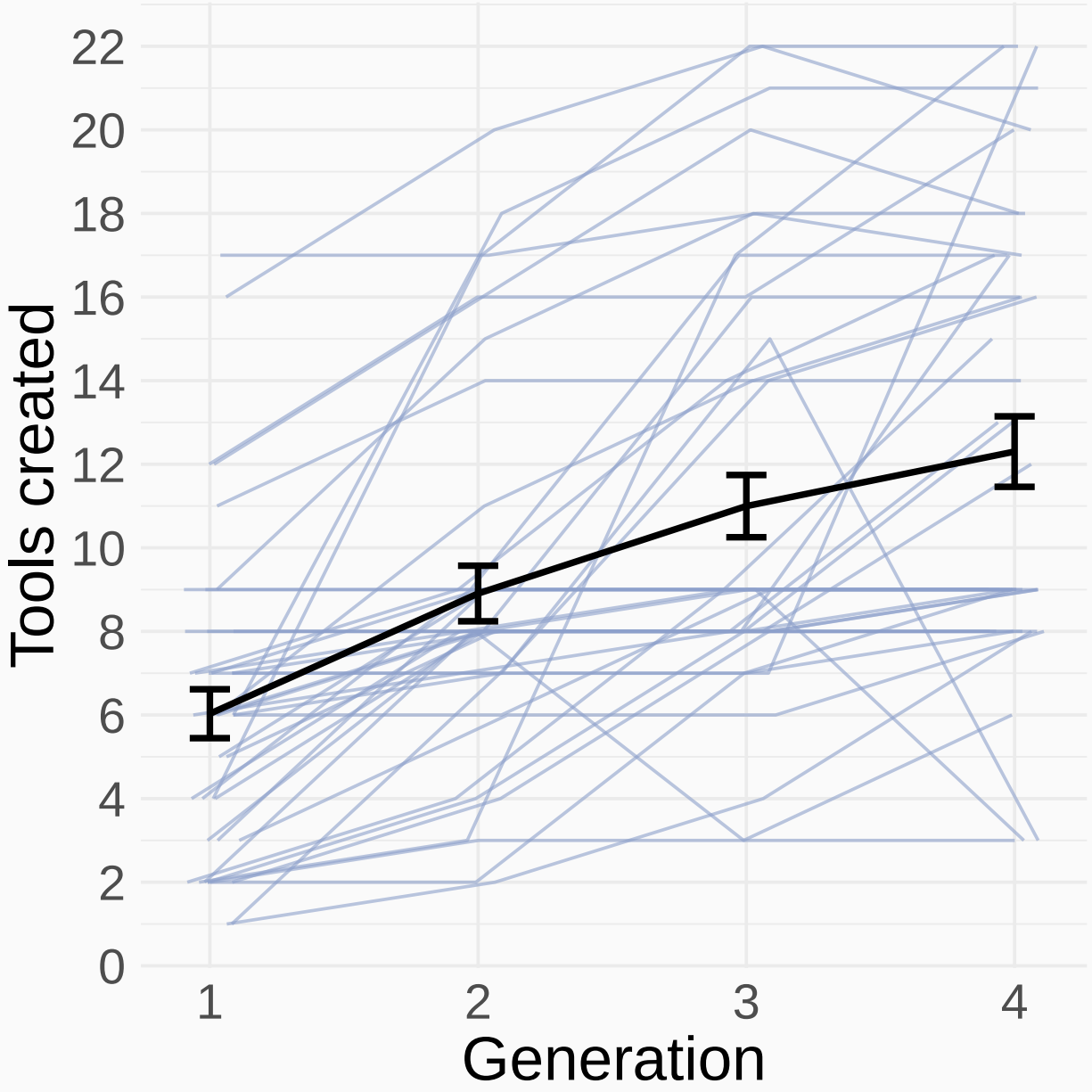


- 42 complete chains (N=168 participants).
- Each participant played the Totem game for 25 minutes.
- Participants in Gen. 2-4 inherited **recipes** from their ancestor.

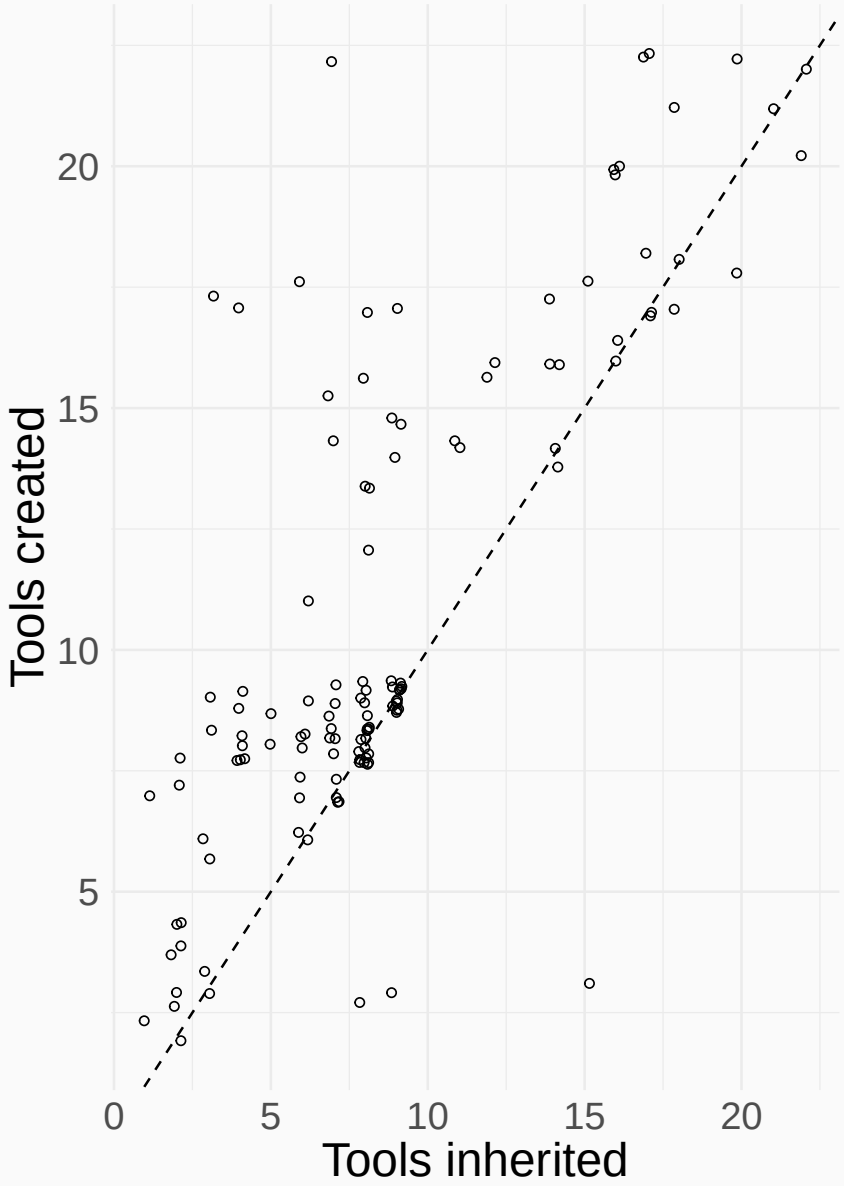
Research questions

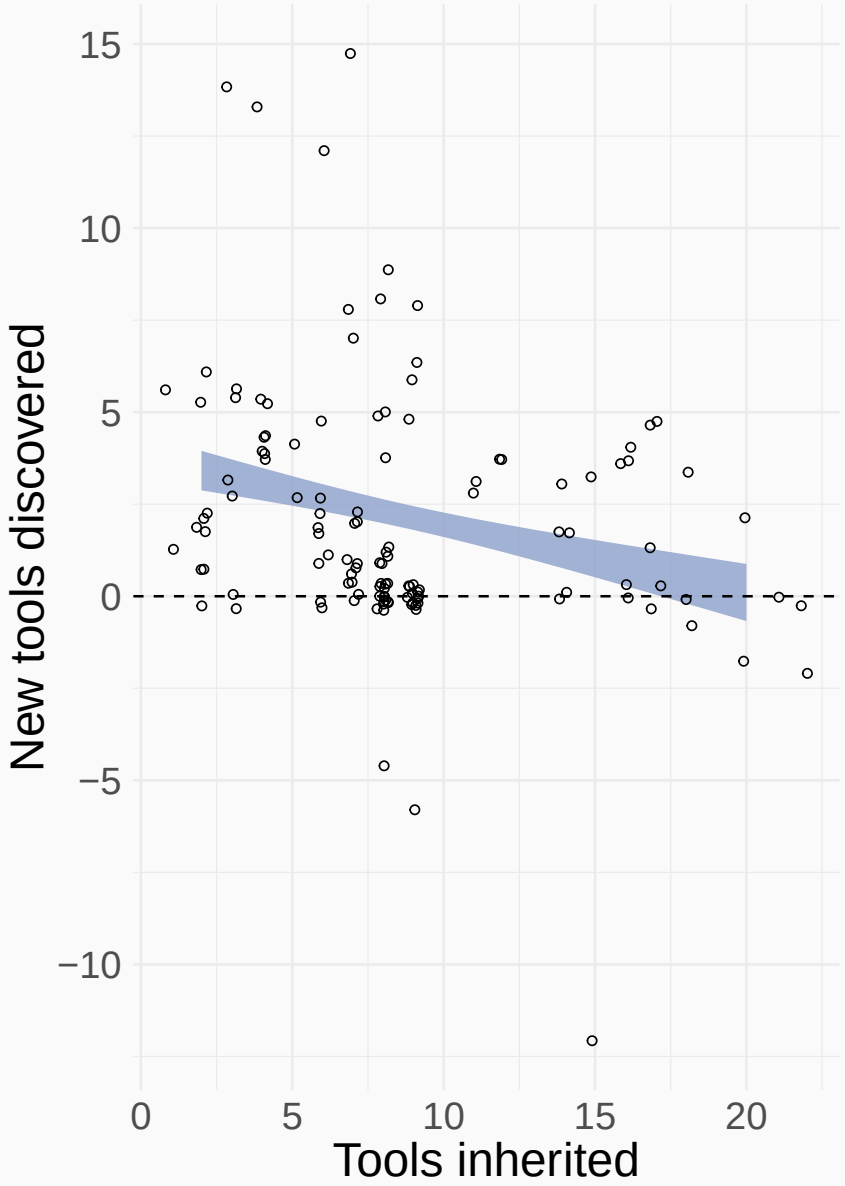
1. How likely are future generations to exceed their ancestors?
2. Does inheritance have an impact on new tool discovery?

Tools by generation

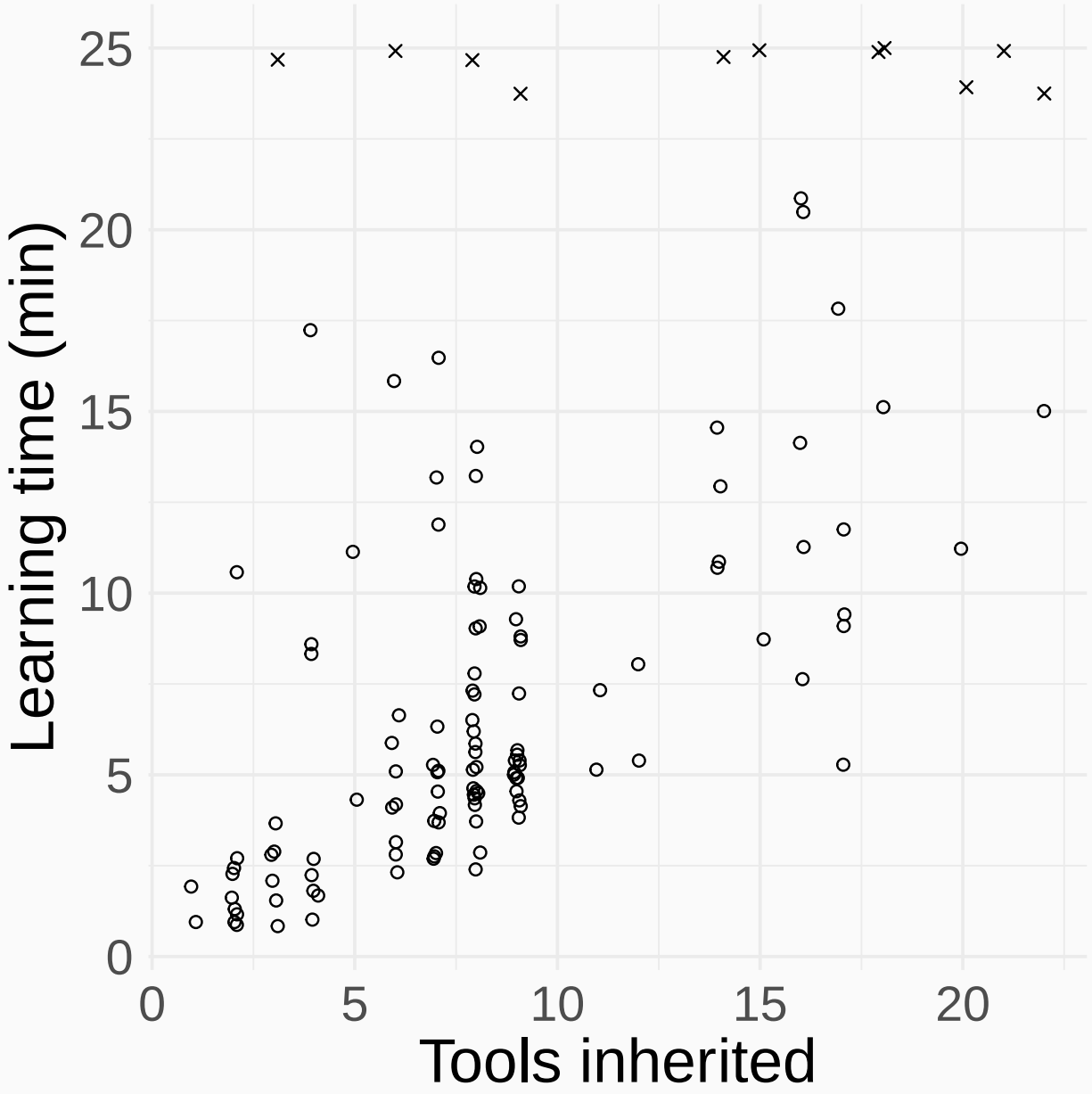


Tools by inheritance size

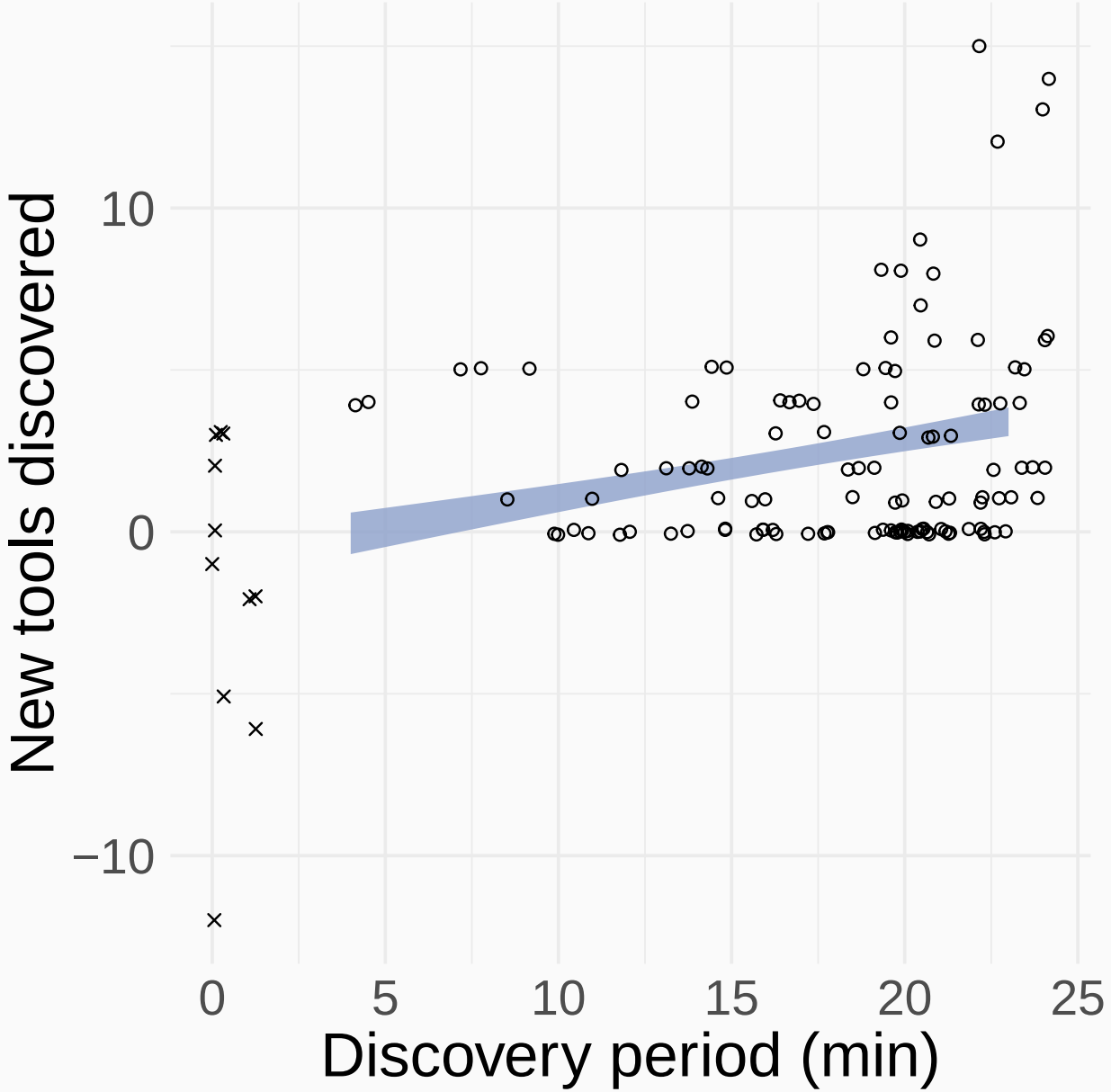




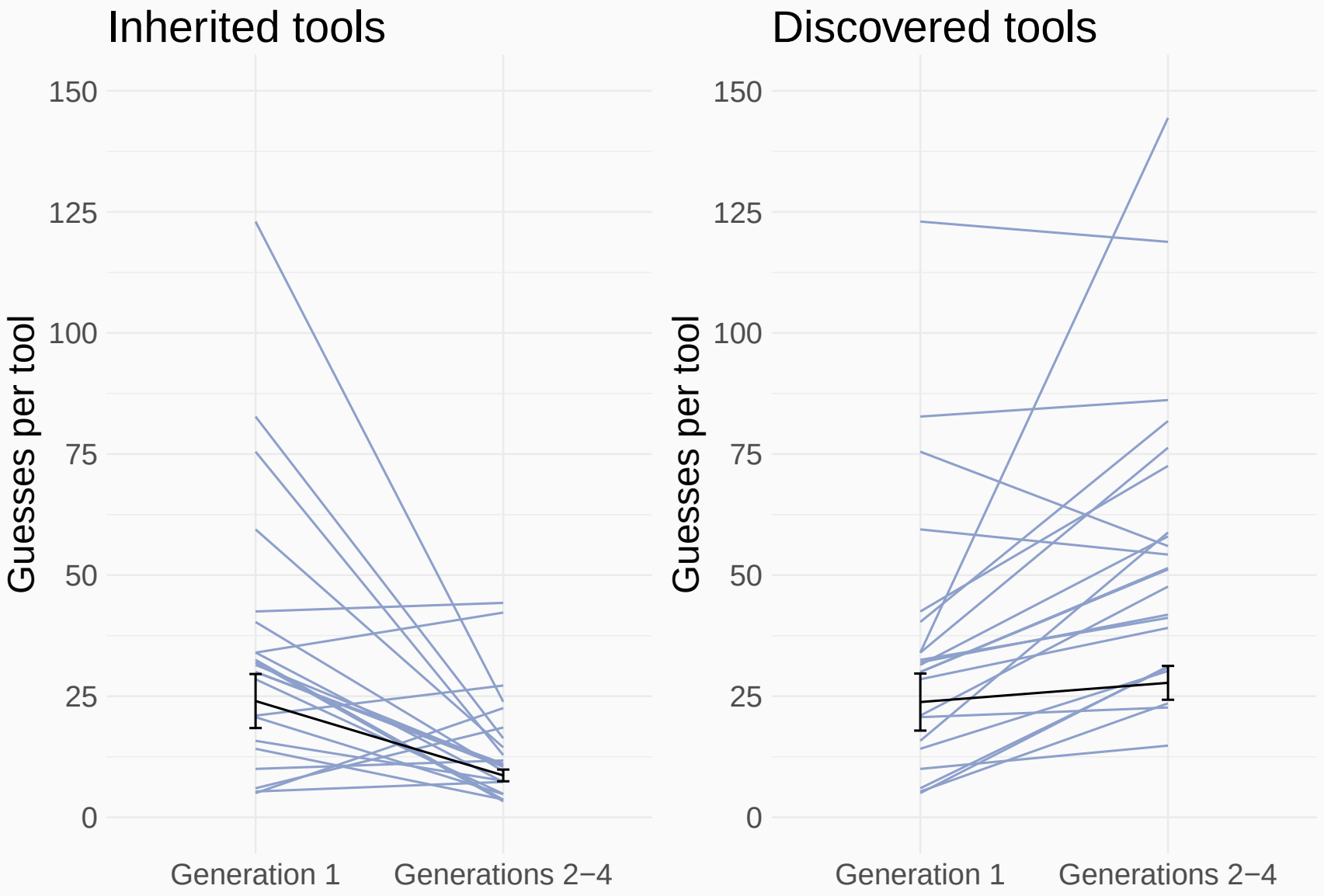
Learning times



Discovery rates



Guesses per tool



Results

1. How likely were participants able to exceed their ancestors?

– Participants were able to solve more problems in 25 minutes than their ancestors.

2. Does inheritance have an impact on new tool discovery?

– No effect on the rate of new tool discovery.
– No effect on the number of guesses required for new tools.

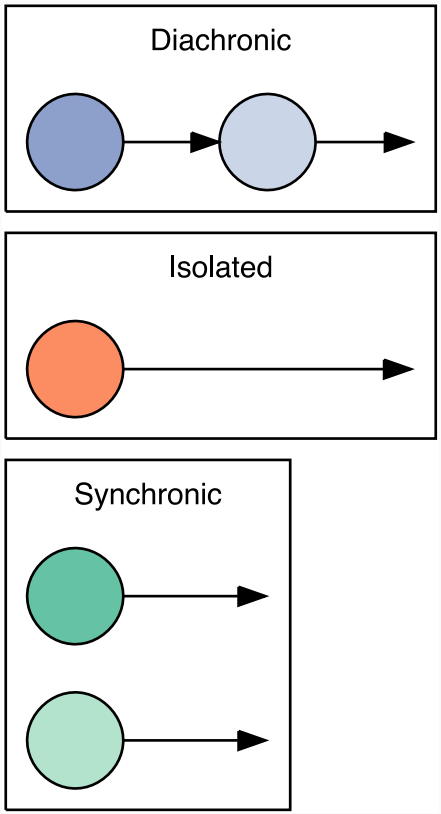
Summary

– Experimental evidence for increasing acquisition costs constraining cumulative culture.
– Constraints on information acquisition do not extend to future problem solving.

Why isn't this the complete story?

How does iterated problem solving compare to alternative strategies?

- Is it better to pass on to the next generation or continue on individually?
- Is it better to work in sequence or in parallel?



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