

The effects of cultural inheritance on problem solving ability

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github.com/pedmiston/team-structures

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Cumulative cultural evolution

Populations solve increasingly complex problems over generations that individuals struggle to solve on their own.

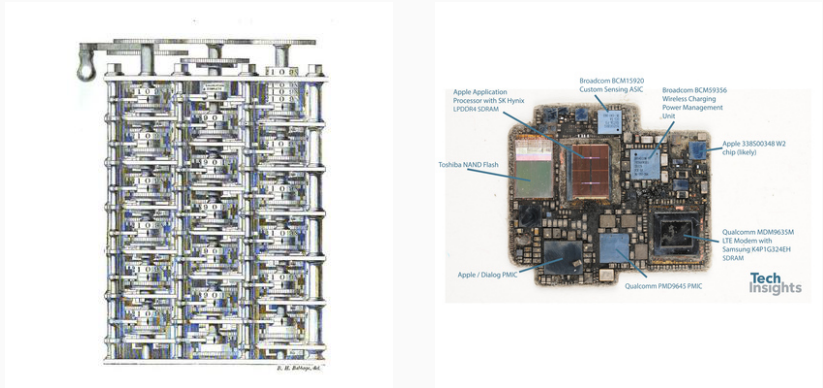


Figure 1: The Difference Engine and the Apple Watch S3.

Why are cultures better at solving problems than individuals?

Inheritance Problem solving extends beyond a single lifetime.

Group size Individuals can coordinate labor in large groups.

Does culture have an impact on problem solving ability?

When does working in a group improve problem solving?

Not very often!

Group benefits in search tasks:¹

- Wider search
- Avoid premature convergence
- Better exploitation

Groups as information processors.²

¹e.g., Hong & Page (2004); Mason & Watts (2012); Derex & Boyd (2016)

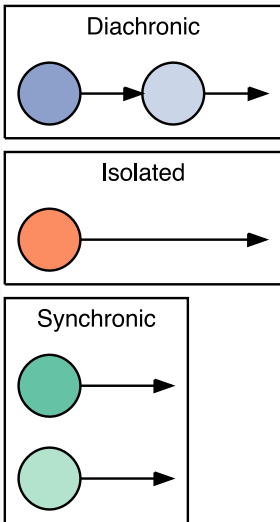
²Hinsz, Tindale, & Vollrath (1997); Woolley, Chabris, Pentland, Hashmi, & Malone (2010)

When does inheritance improve problem solving?

Hard to answer!

- Copying isn't always advantageous, but when it is, it's additive.
- Transmission experiments demonstrate *capacity*, not *effectiveness*.

Measuring the effects of cultural inheritance on problem solving



Types of time³

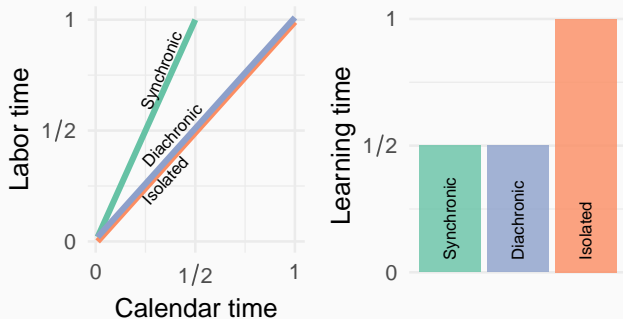
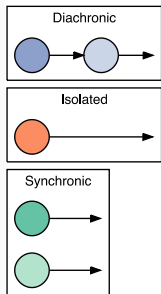
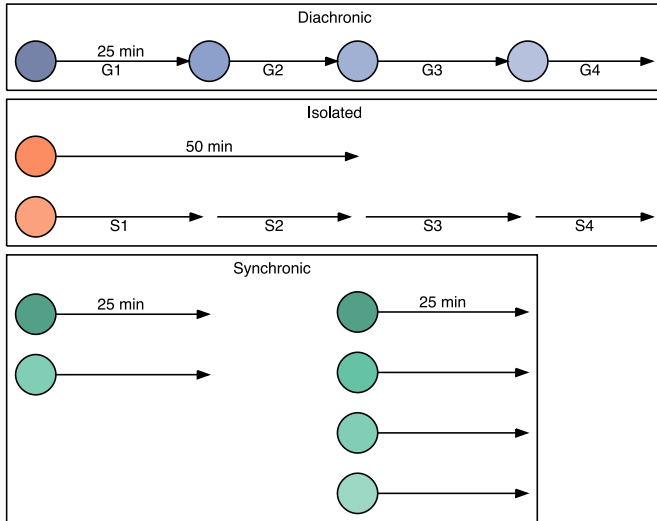









Figure 2: Team structures controlling for labor time.

³Miton & Charbonneau (2018)

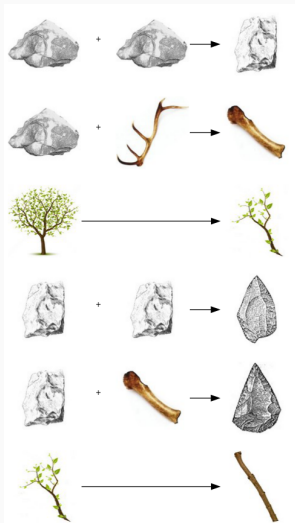
All team structure conditions



The Totem Game (Derex & Boyd, 2015)

Resources		Stock				Totem
						
						
						
Workshop						Bin
				Try		
						0

Recipes



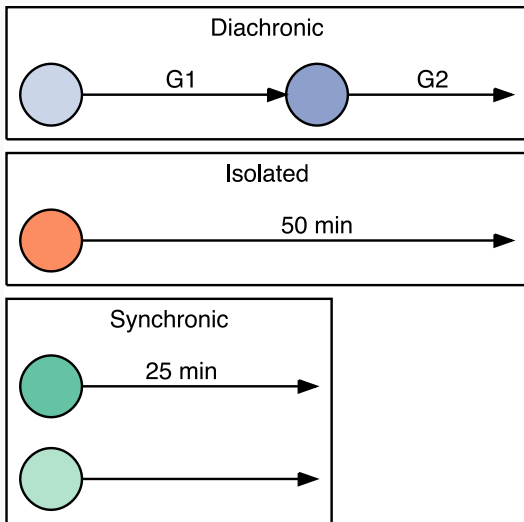
Solution landscape



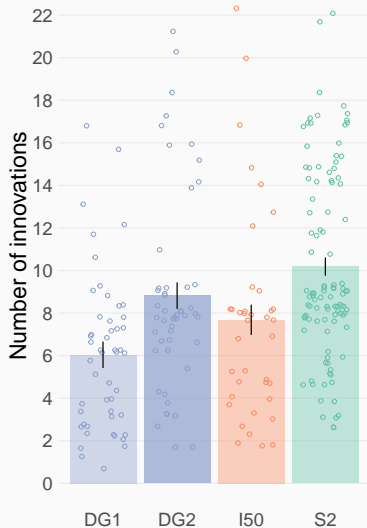
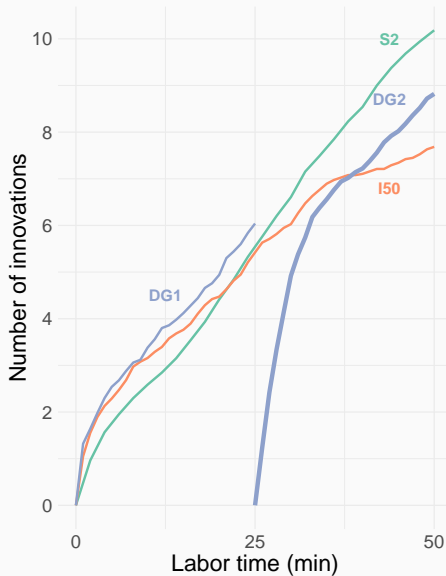
Overview of experiments

1. Simple diachronic inheritance
2. Diachronic versus isolated
3. Scalability of diachronic and synchronic

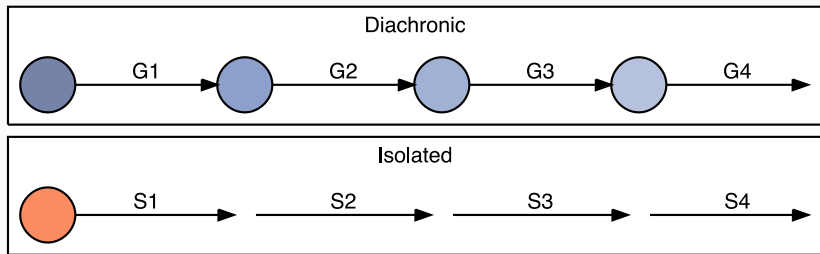
Simple diachronic inheritance



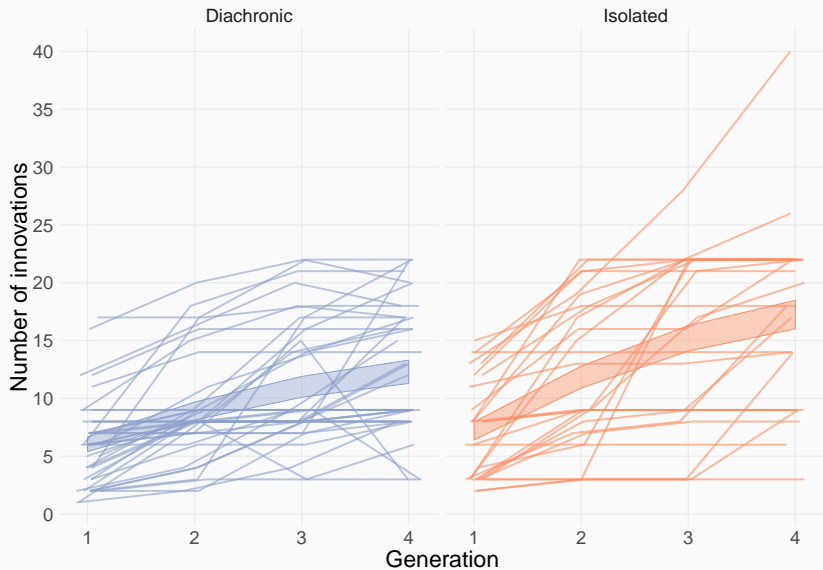
Simple diachronic inheritance



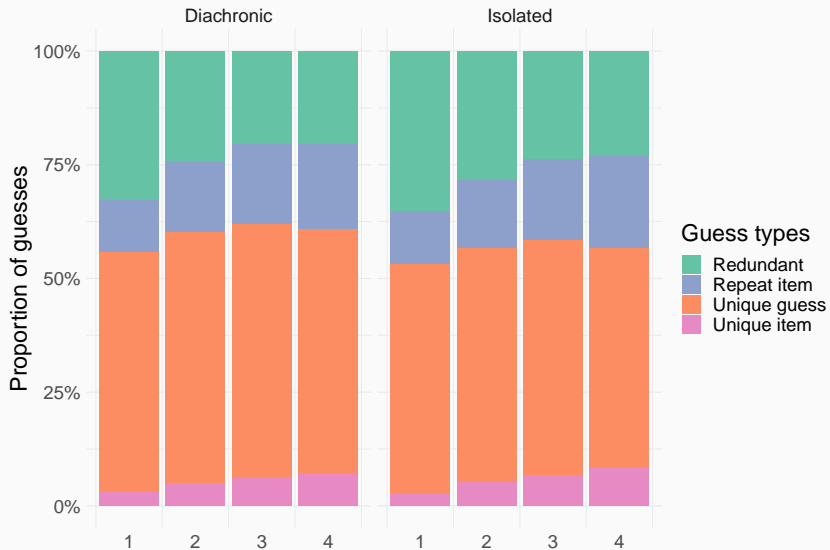
Diachronic versus individual inheritance



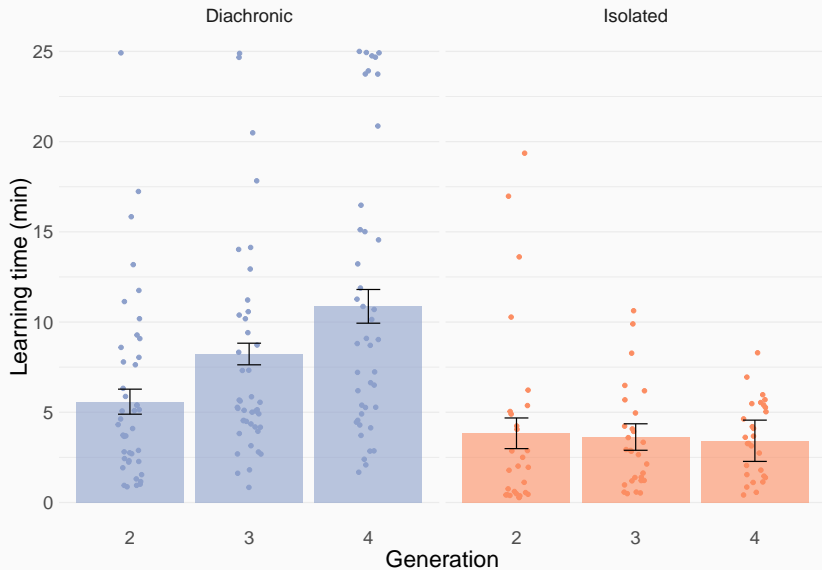
Diachronic versus individual inheritance



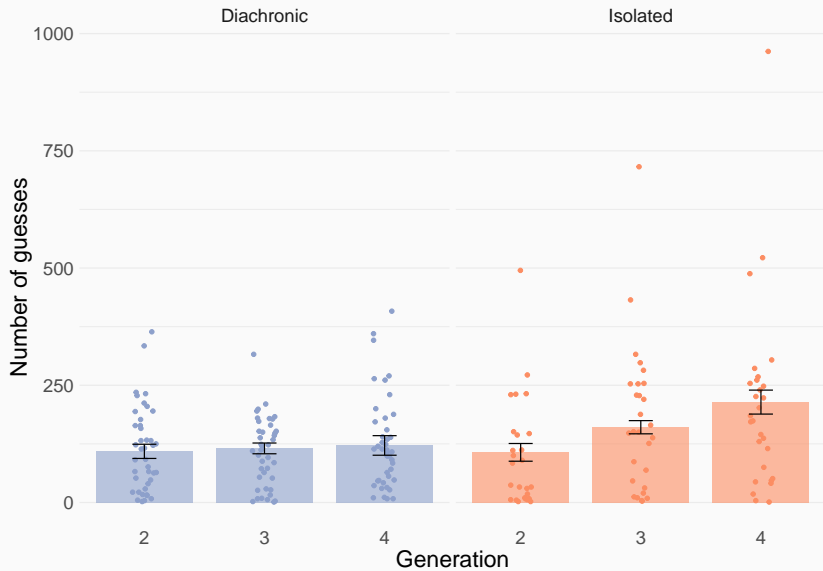
Guess types



Learning times



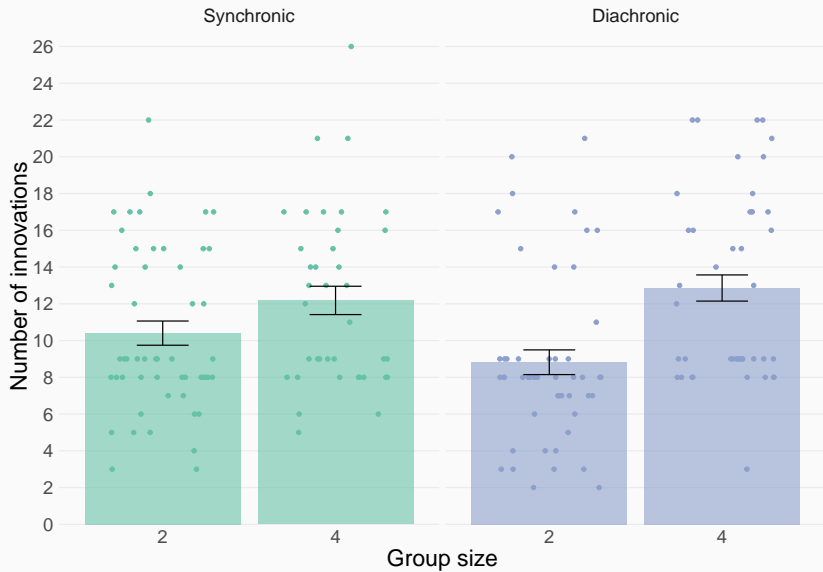
First discovery



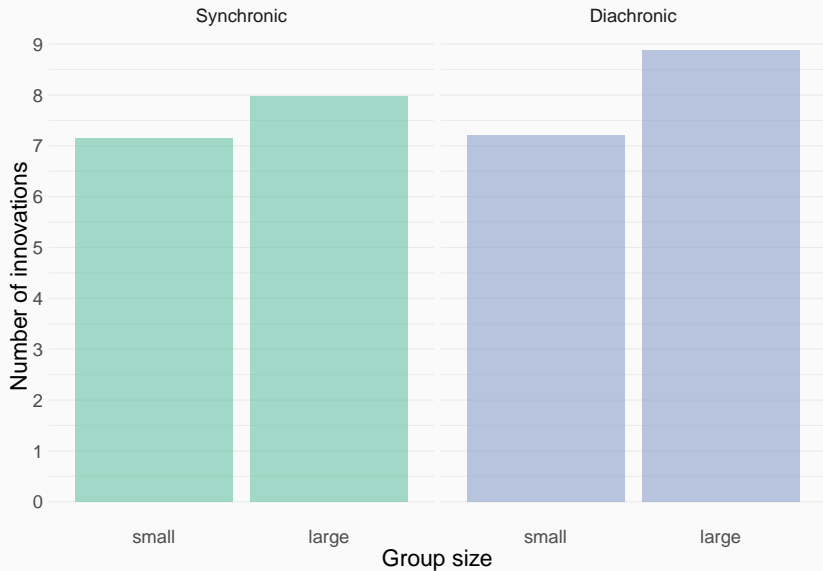
Scalability of diachronic and synchronic strategies

Do the diachronic and synchronic strategies diverge when more people are added to the group?

Innovations by team size



Simulations of team size



Can cultural inheritance improve the problem solving abilities of future generations?

- Answering this question requires proper control conditions.
- Cultural inheritance remediates the cost of fixation.
- Cultural inheritance scales better than group size.

github.com/pedmiston/team-structures

```
# install the "totems" package  
remotes::install_github("pedmiston/totems-data")  
# list the available datasets  
data(package = "totems")
```


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