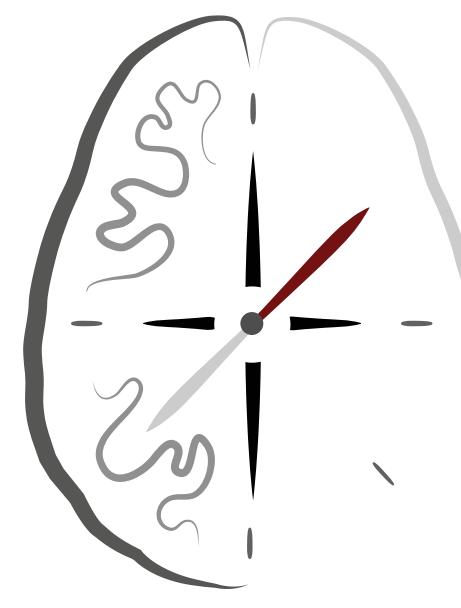
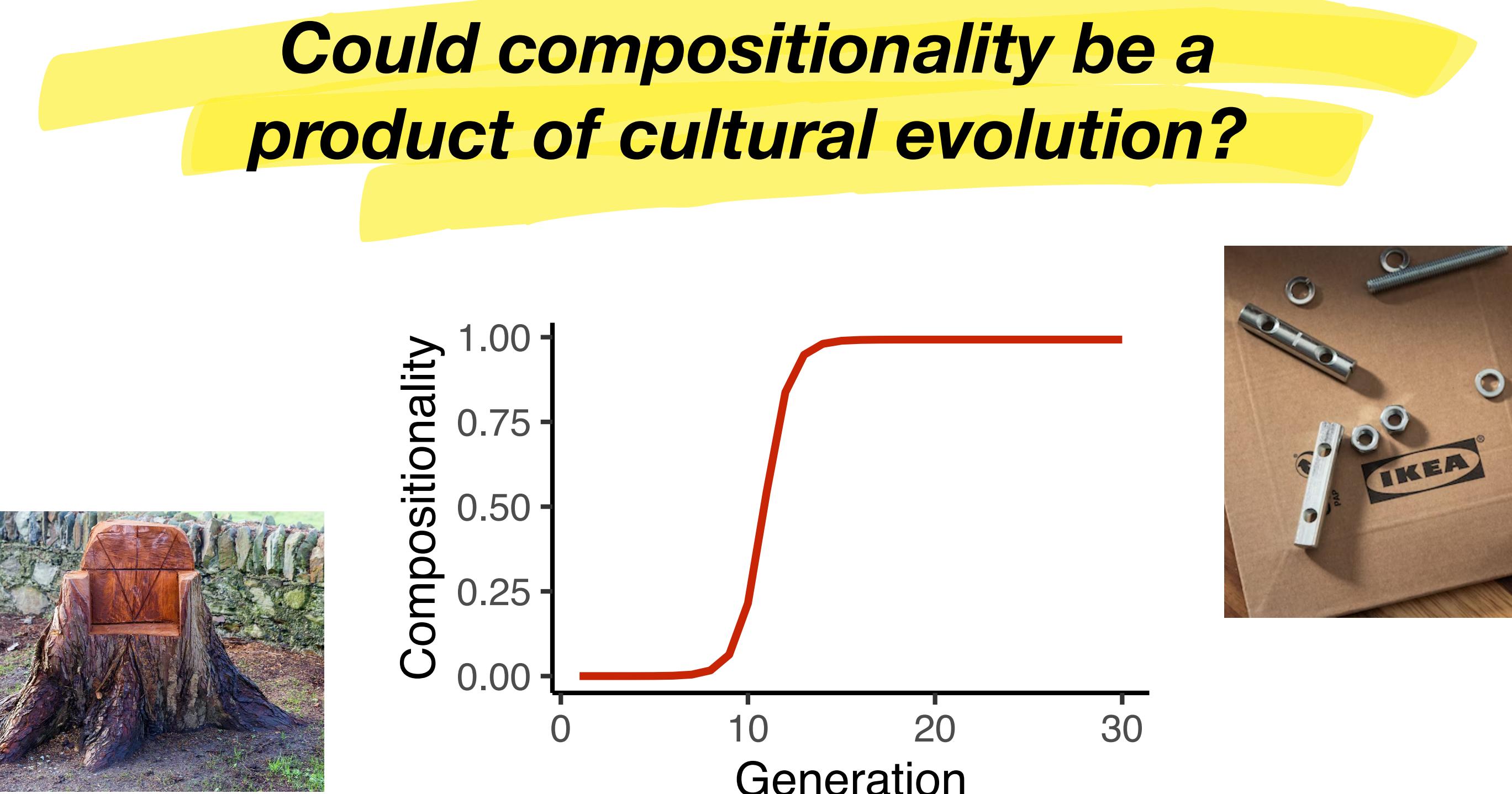
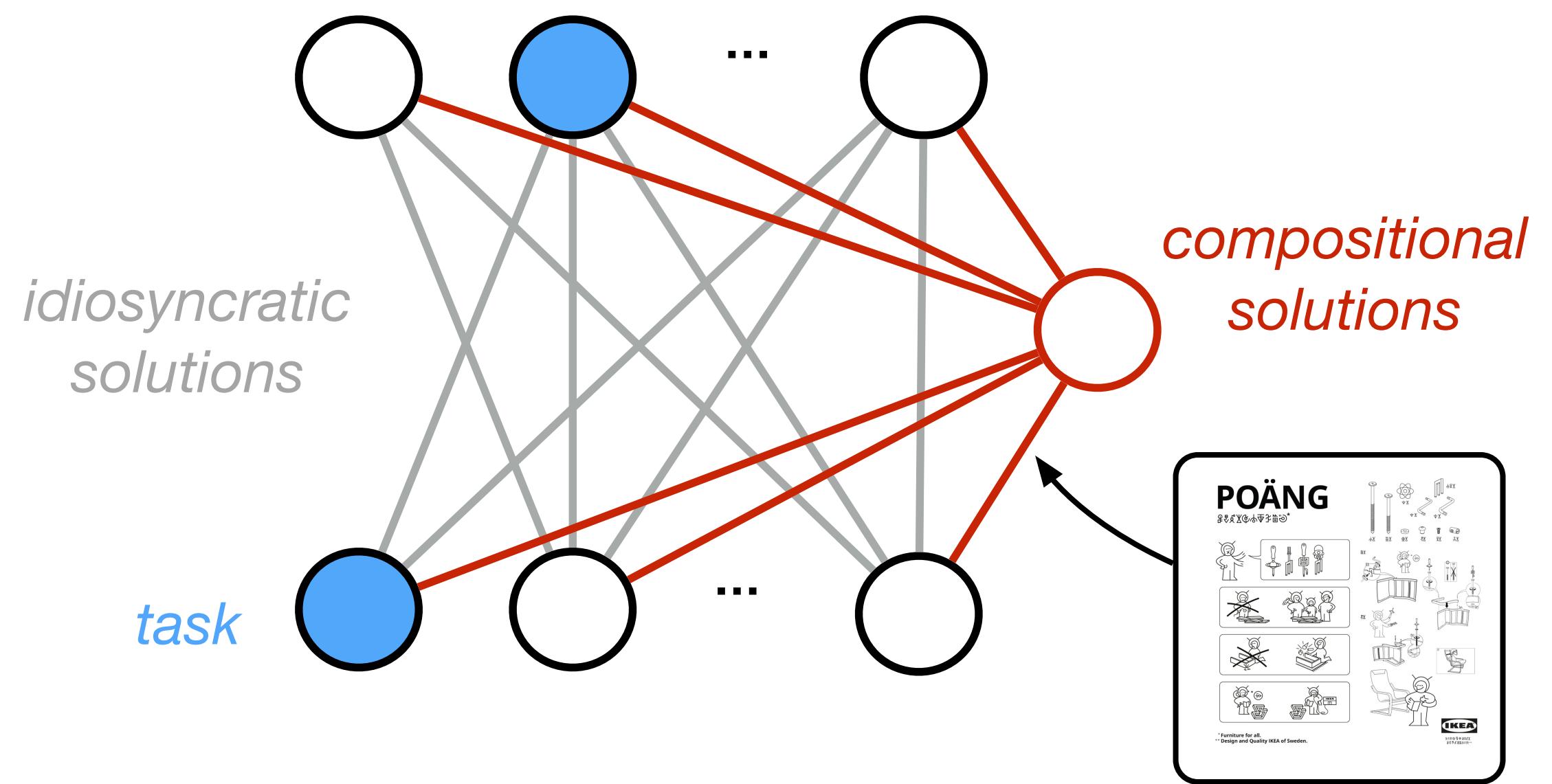


# Cultural evolution of compositional problem solving

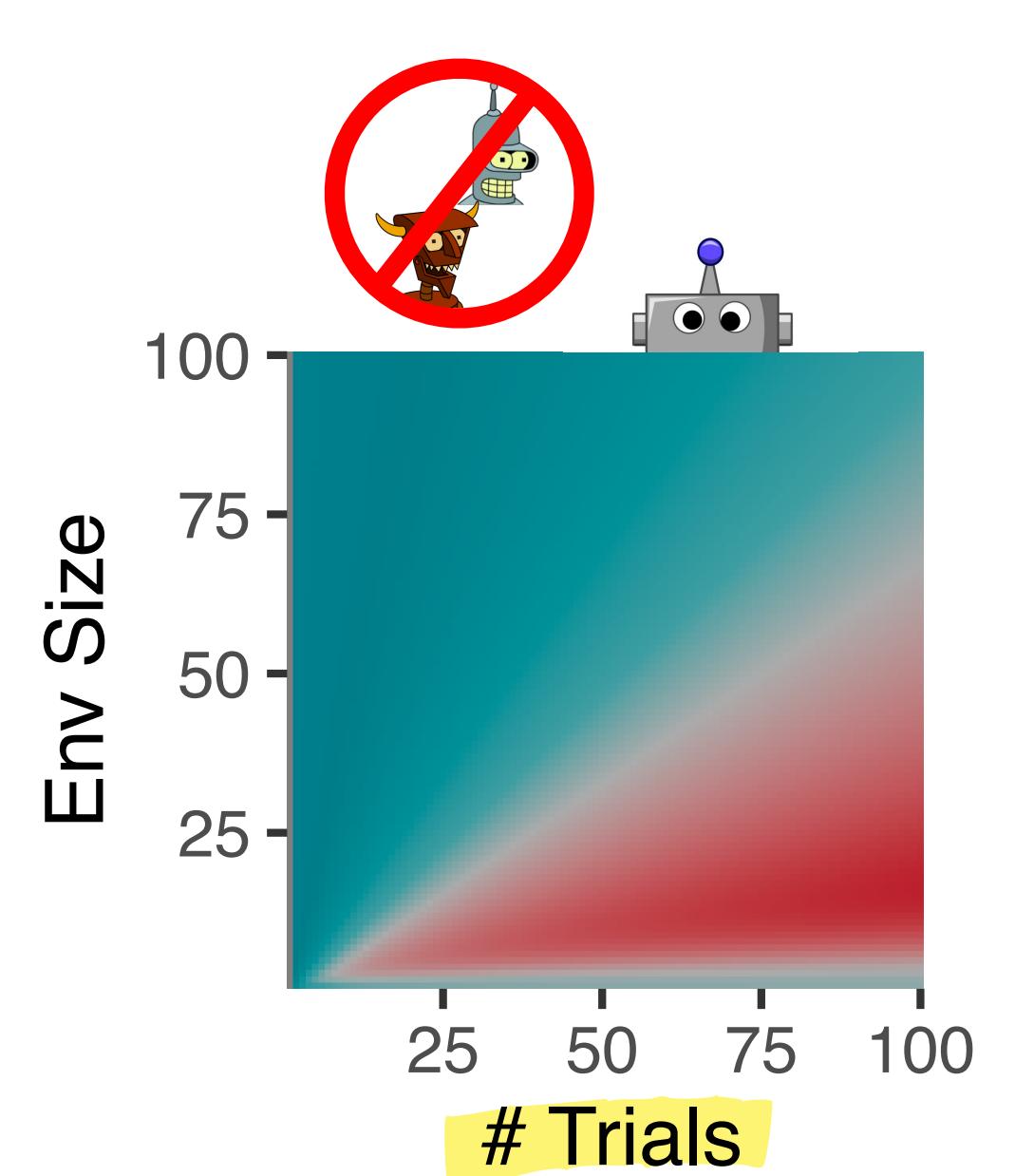
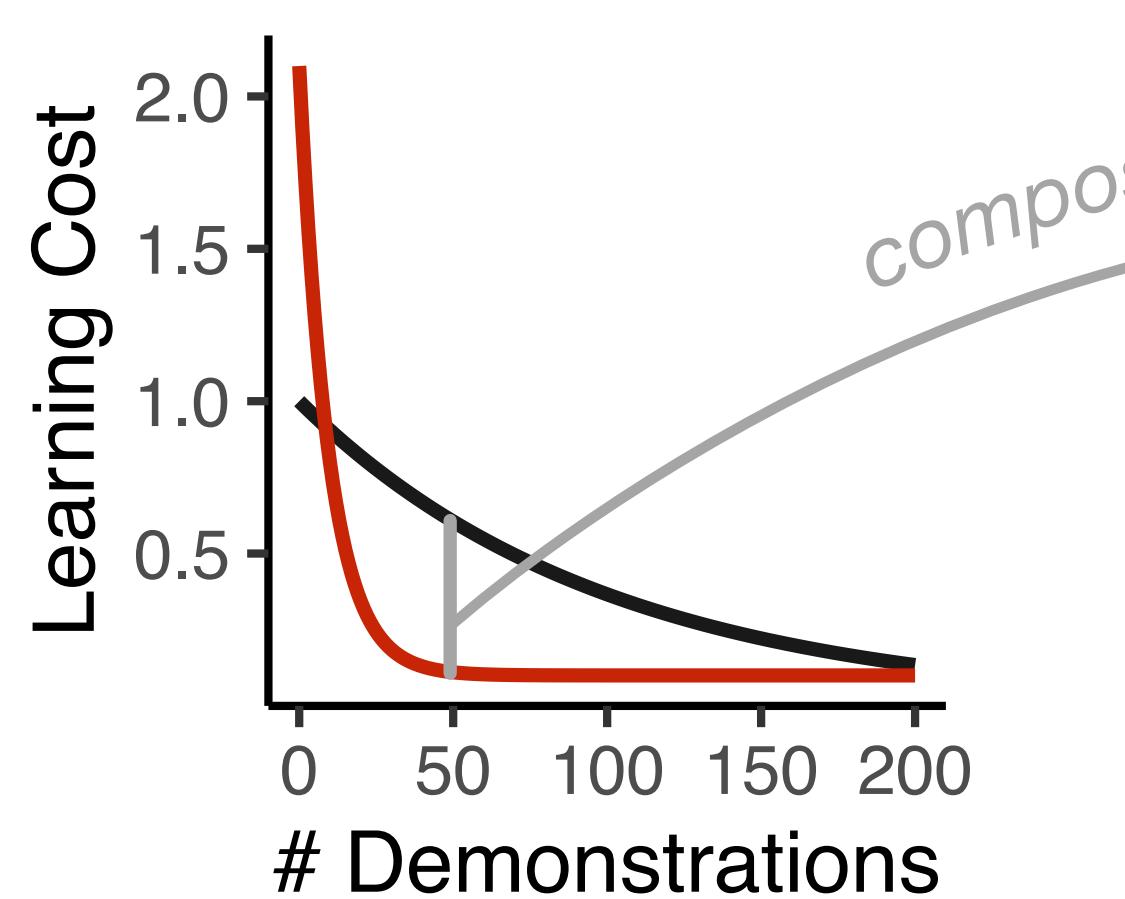
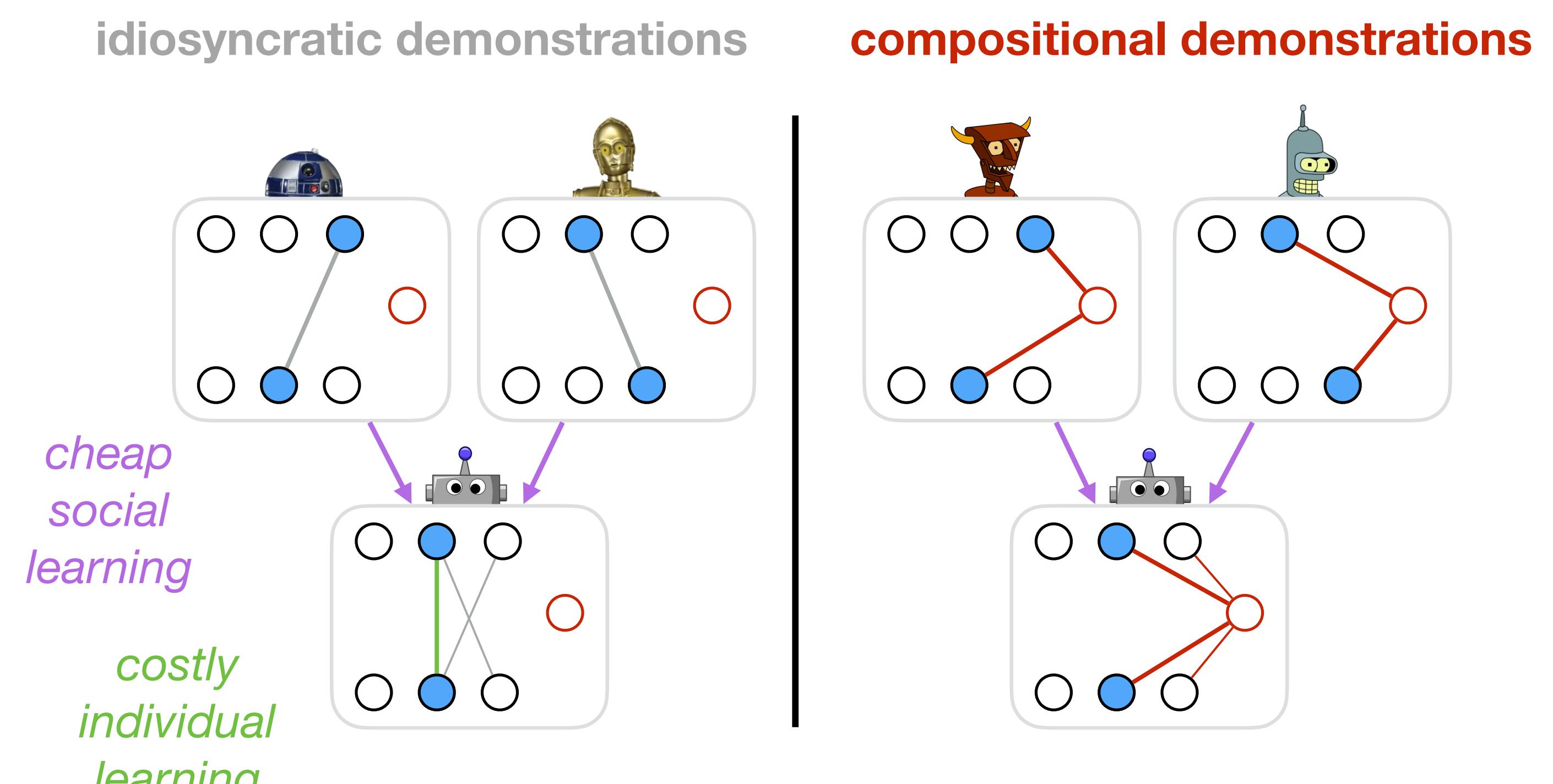
Frederick Callaway, Marcelo Mattar, Sam Gershman, Fiery Cushman  
Harvard, NYU



## A minimal model of composition

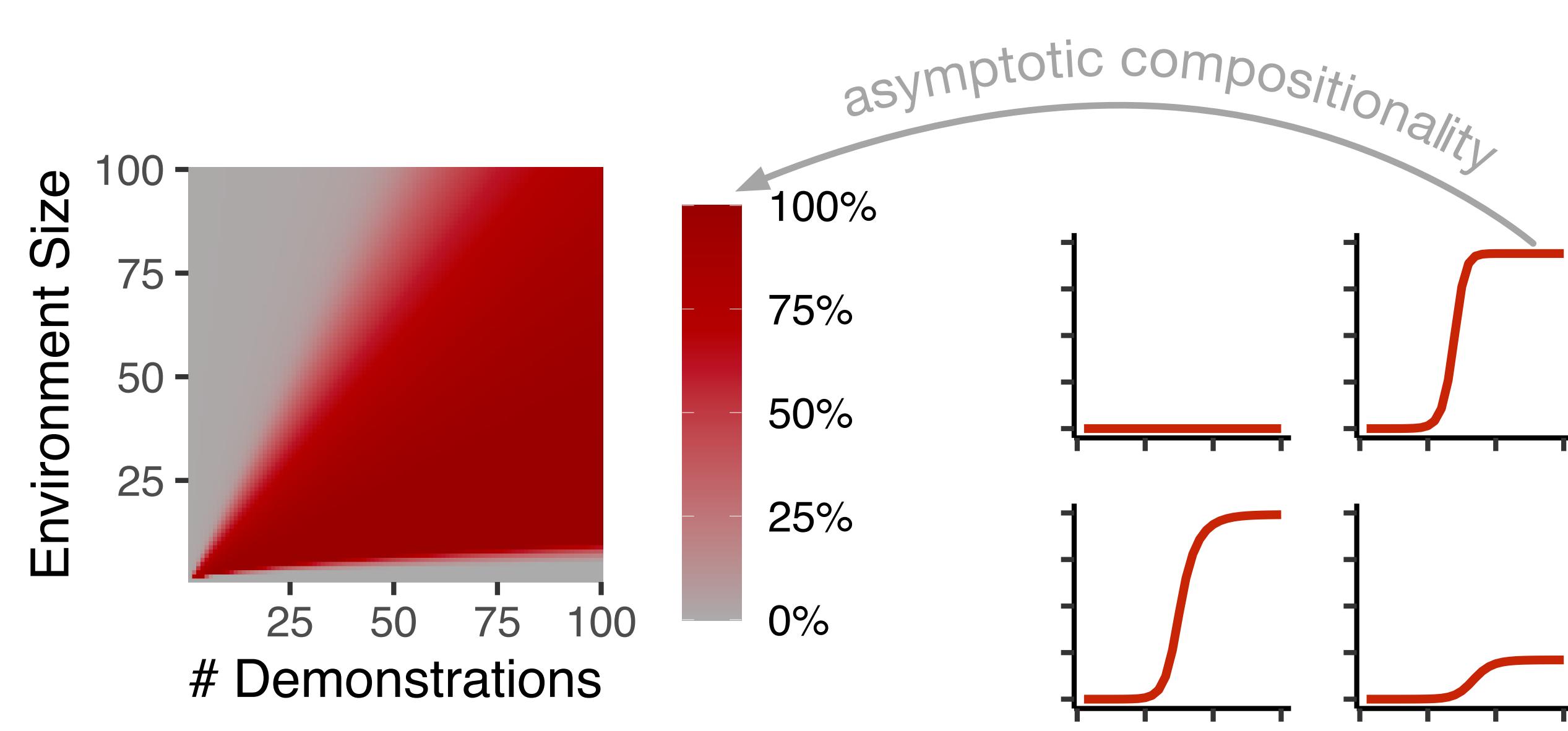


## Compositionality empowers social learning

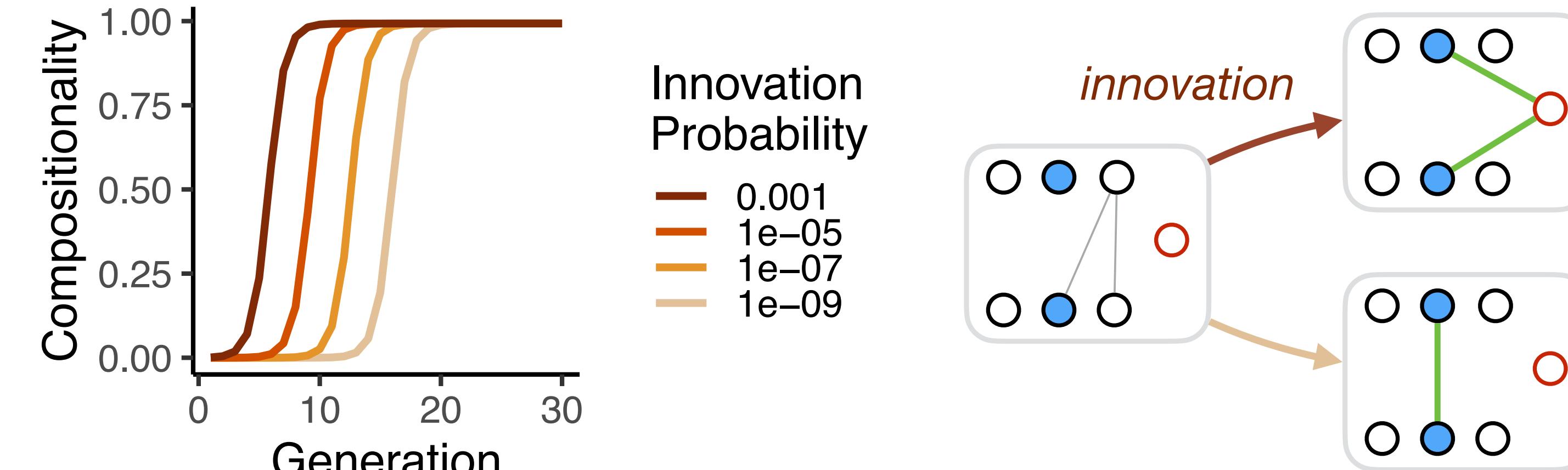


## When does compositionality evolve?

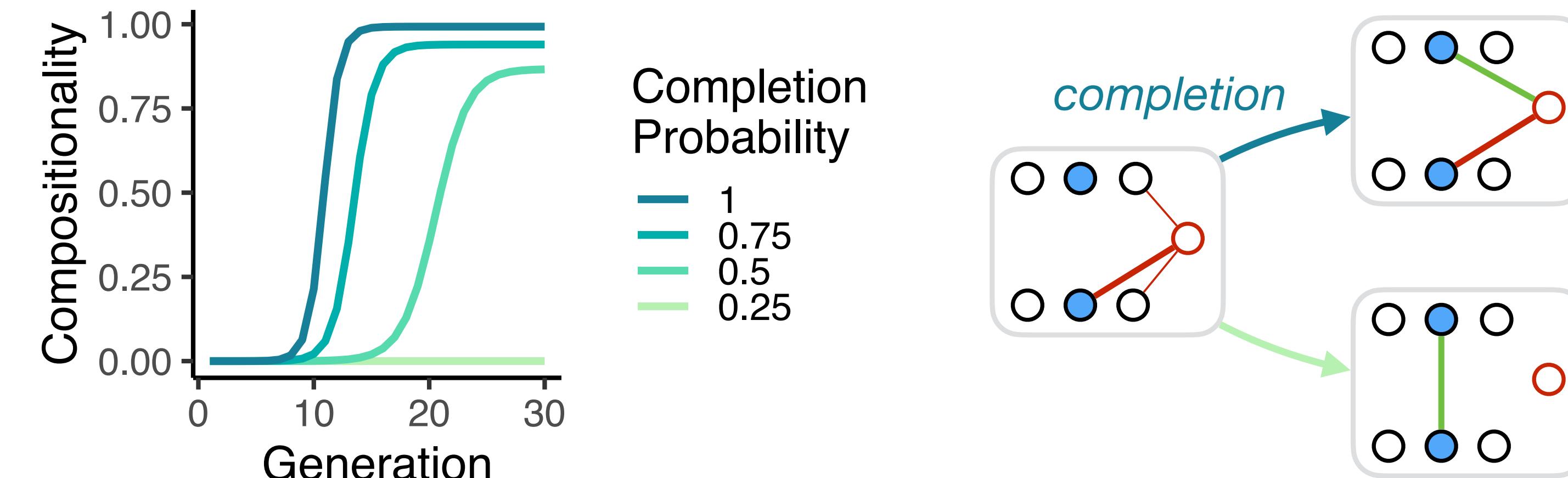
*There must be a social learning benefit*



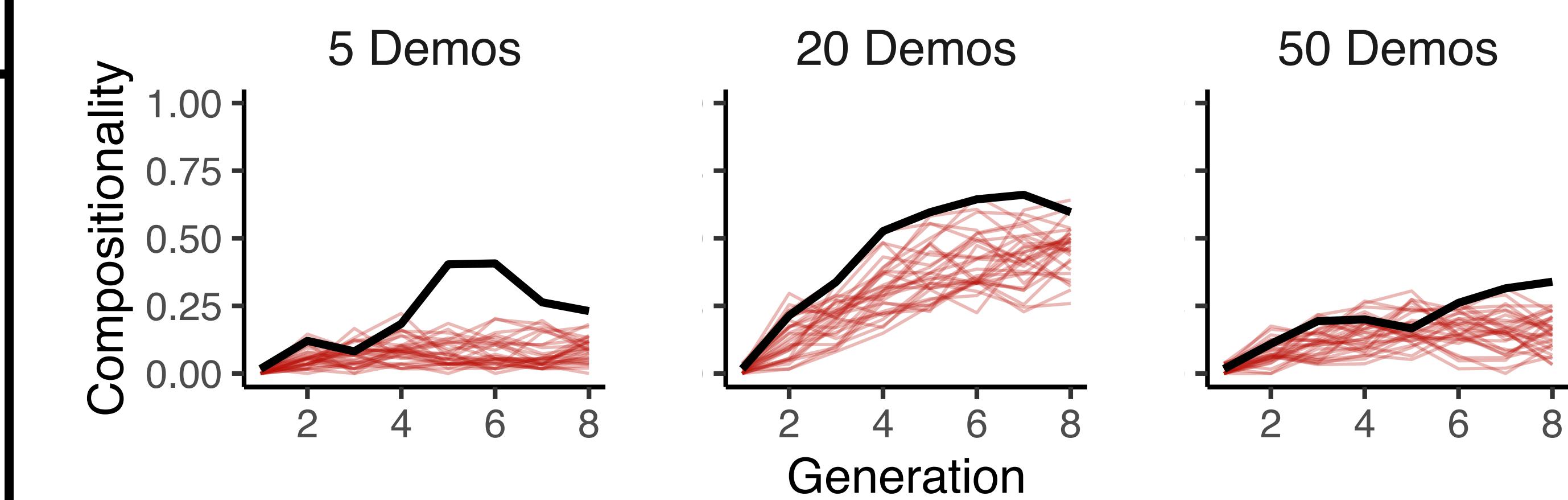
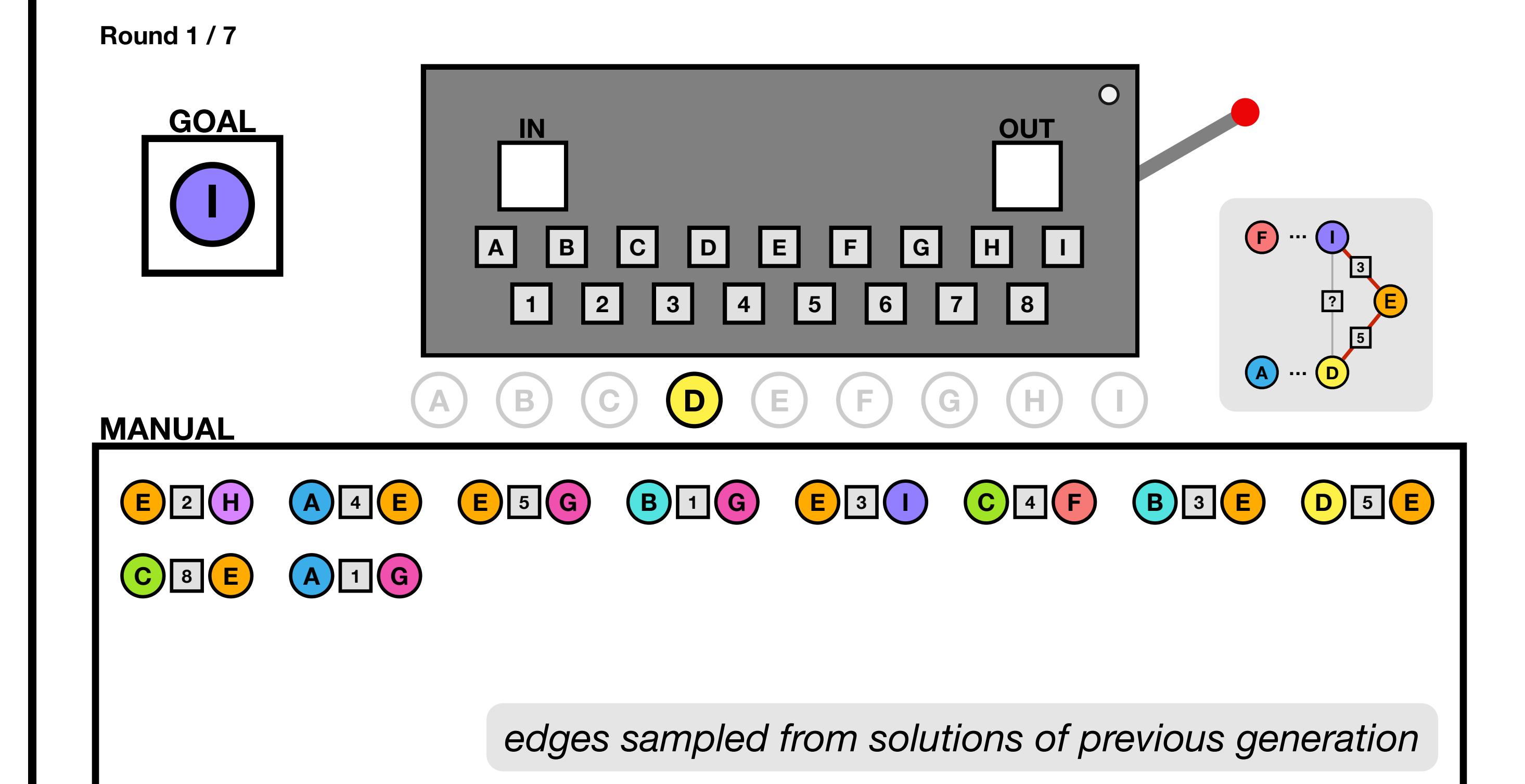
## Innovation of a compositional system can be vanishingly rare



## Individuals must be able to extend an existing system



## Iterated learning experiment



## Takeaways

- Compositional systems can emerge by cultural evolution even when a rational individual learner would not use them.
- This occurs because compositional information is more likely to be socially reused, giving it higher *memetic fitness*.
- The evolution of compositionality depends on a moderate complexity-information ratio and the ability of individuals to extend an existing compositional system.
- We can show this in the lab—but should we?

## Coming soon

