



Death of Renaissance Scientists

Leonardo da Vinci
500 y

Isaac Newton
300 y

Albert Einstein
100 y

Human Genome Project
10 y

Lingfei Wu

Isaiah Berlin



The Hedgehog and the Fox



Trait



Is research style a personal trait or an evolving strategy?

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Increasing trend of scientists to switch between topics

[An Zeng](#), [Zhesi Shen](#), [Jianlin Zhou](#), [Ying Fan](#), [Zengru Di](#), [Yougui Wang](#) , [H. Eugene Stanley](#)  & [Shlomo Havlin](#) 

Administrative Science Quarterly



Restricted access

Research article

First published online July 30, 2018

Creativity at the Knowledge Frontier: The Impact of Specialization in Fast- and Slow-paced Domains

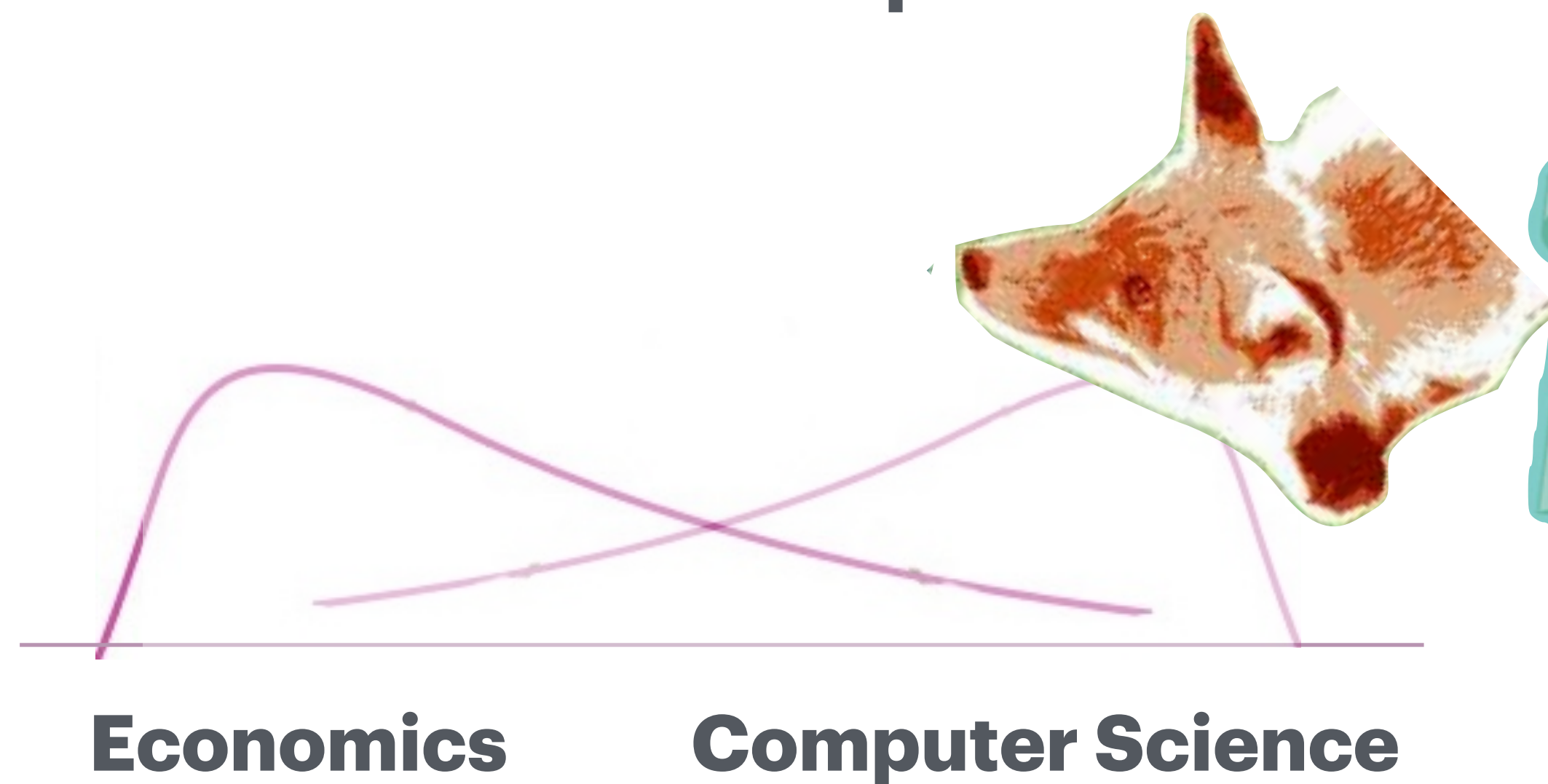
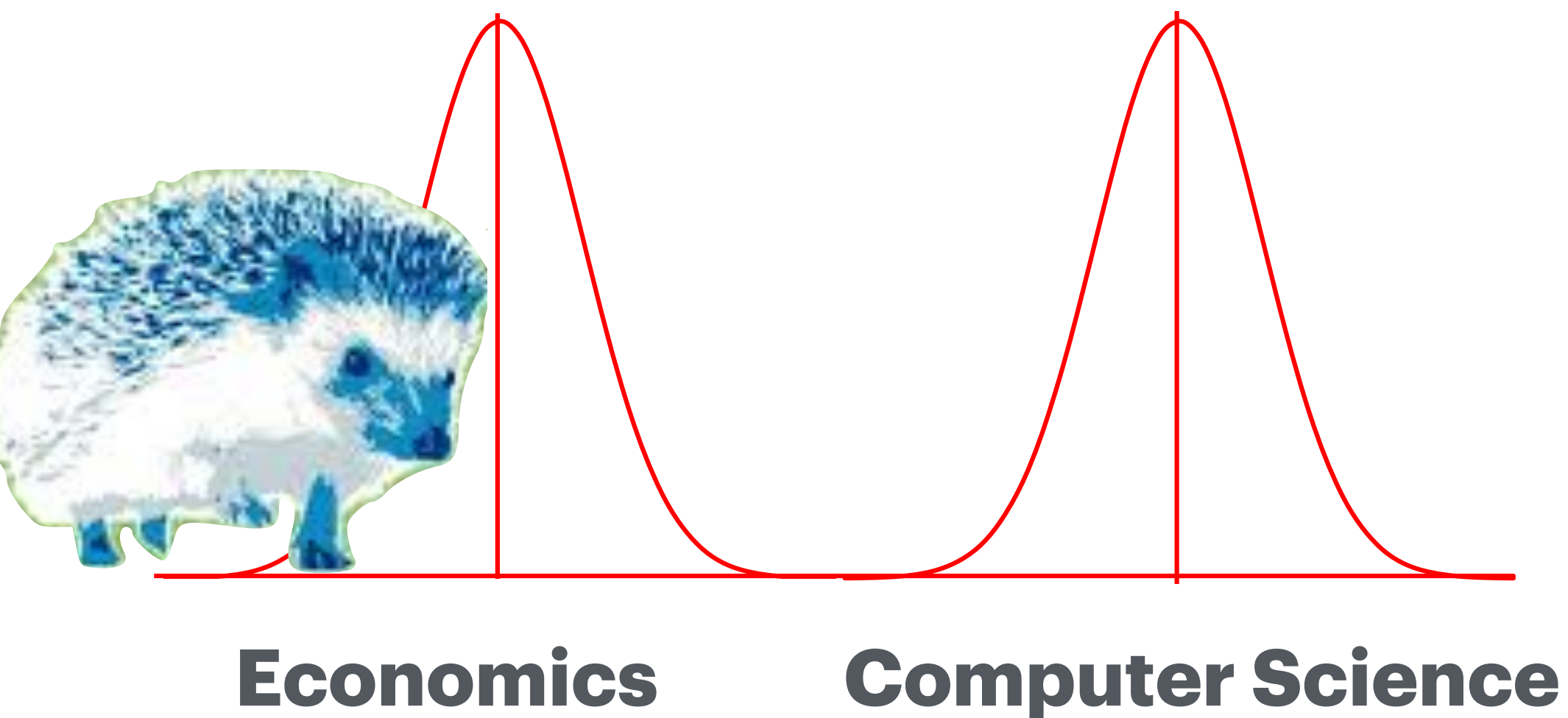
[Florenta Teodoridis](#) , [Michaël Bikard](#), and [Keyvan Vakili](#) [View all authors and affiliations](#)

[Volume 64, Issue 4](#)

<https://doi.org/10.1177/0001839218793384>

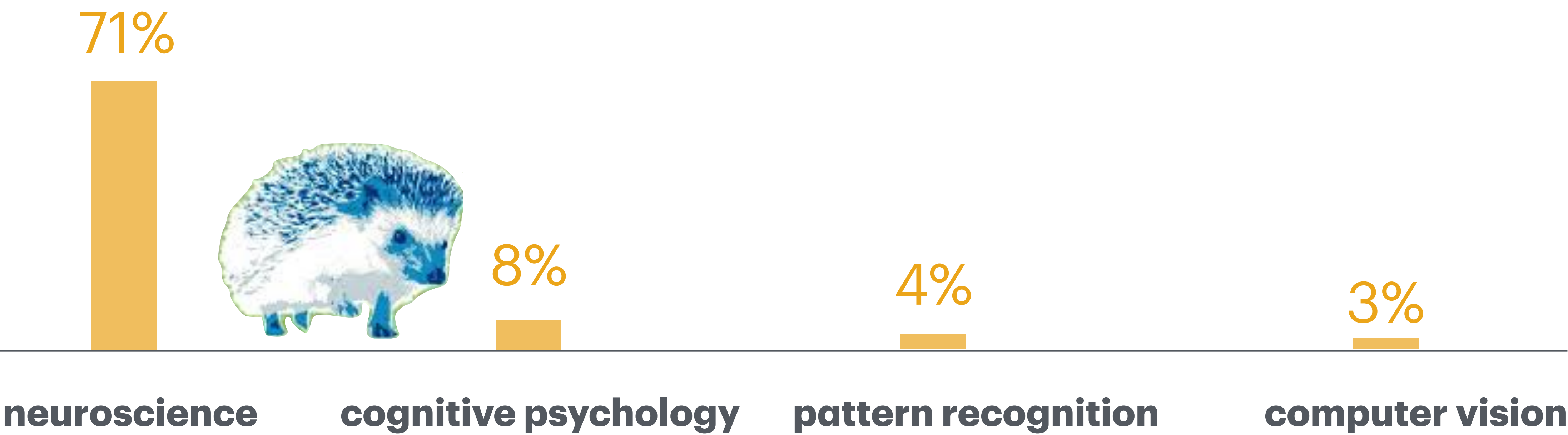
Strategy

Hiring foxes or hedgehogs in your interdisciplinary center?



Edmund Rolls

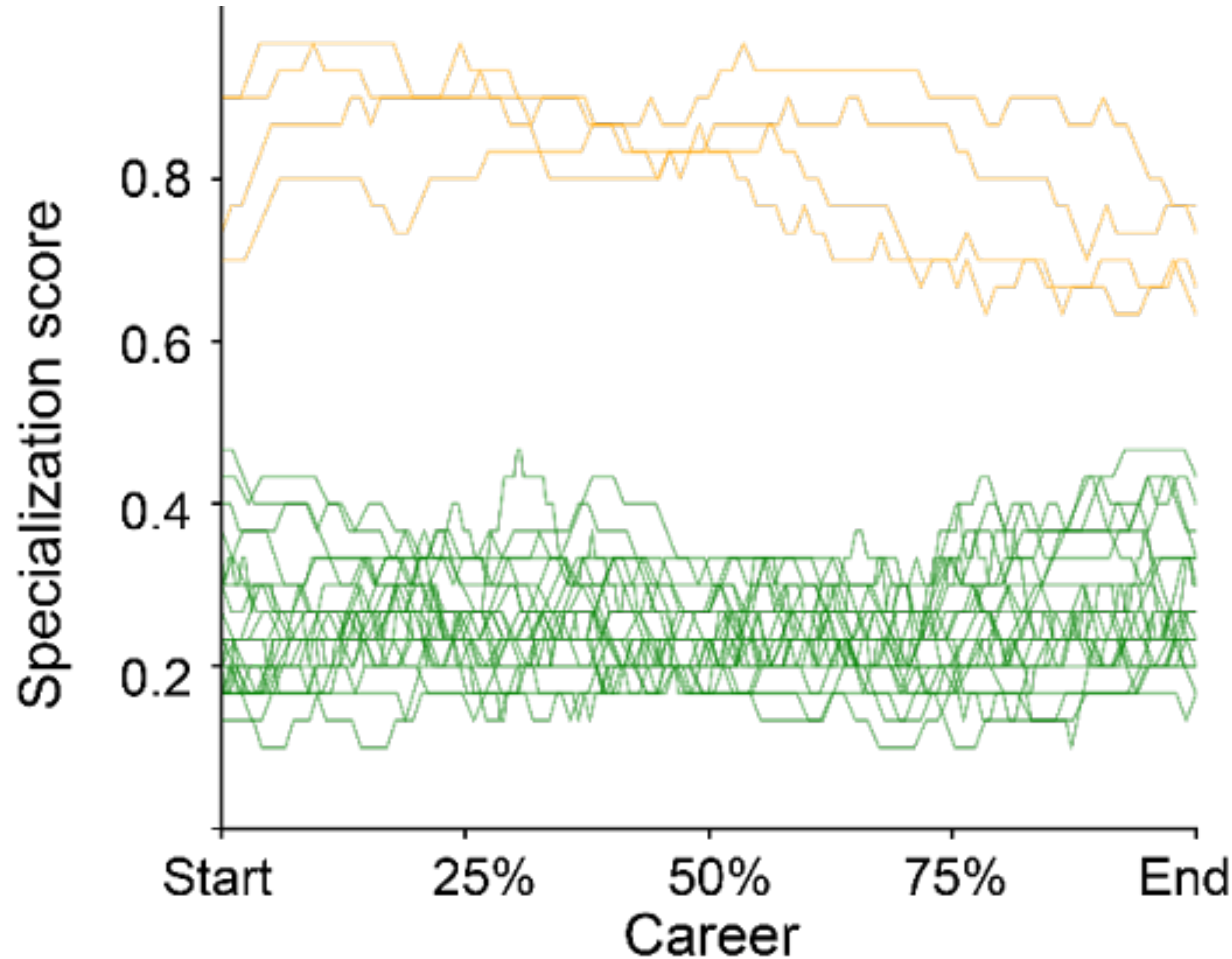
Specialization (S) score = 0.71



Herbert Simon

S-score = 0.12

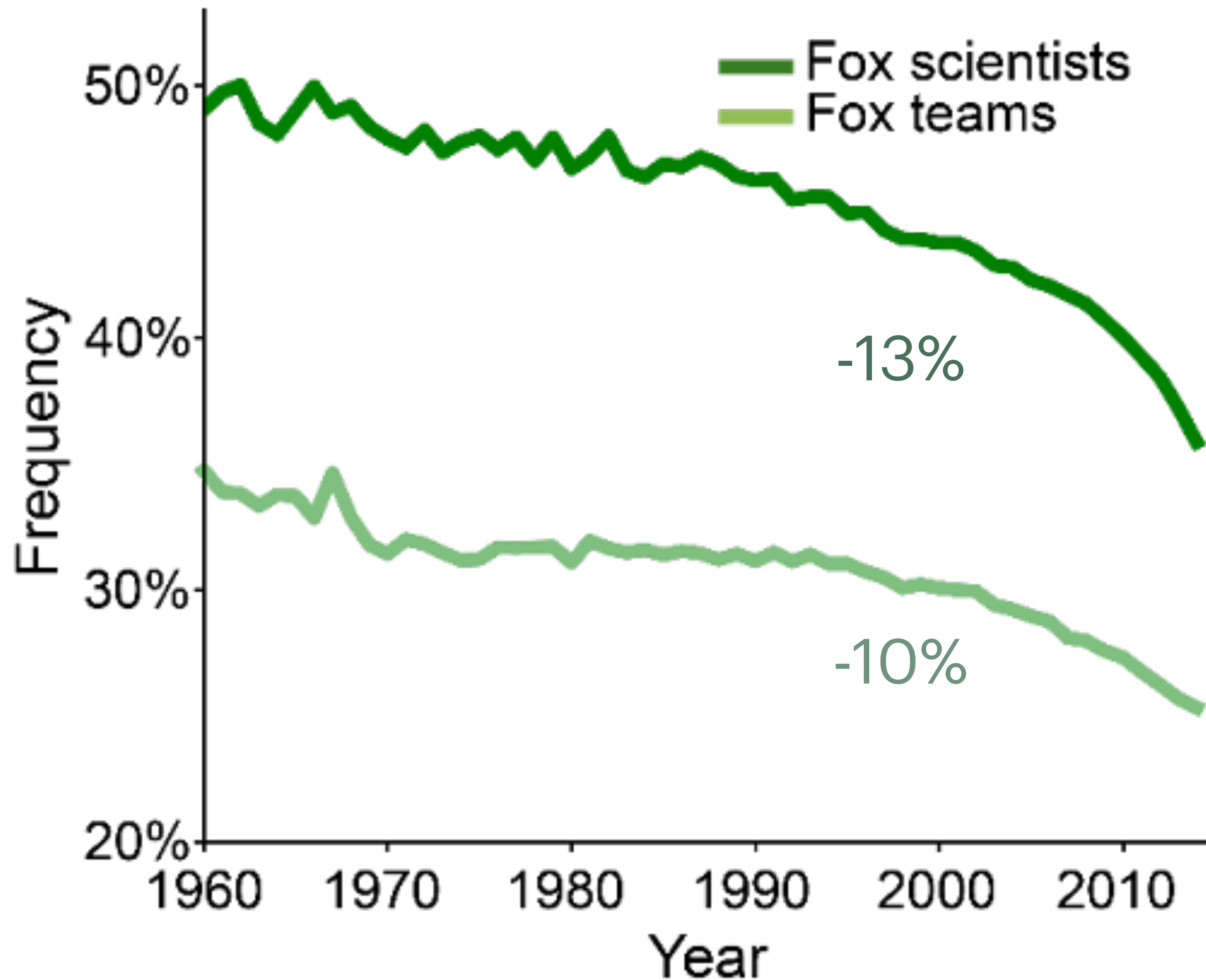




Research style is
more a personal
trait than an
evolving strategy

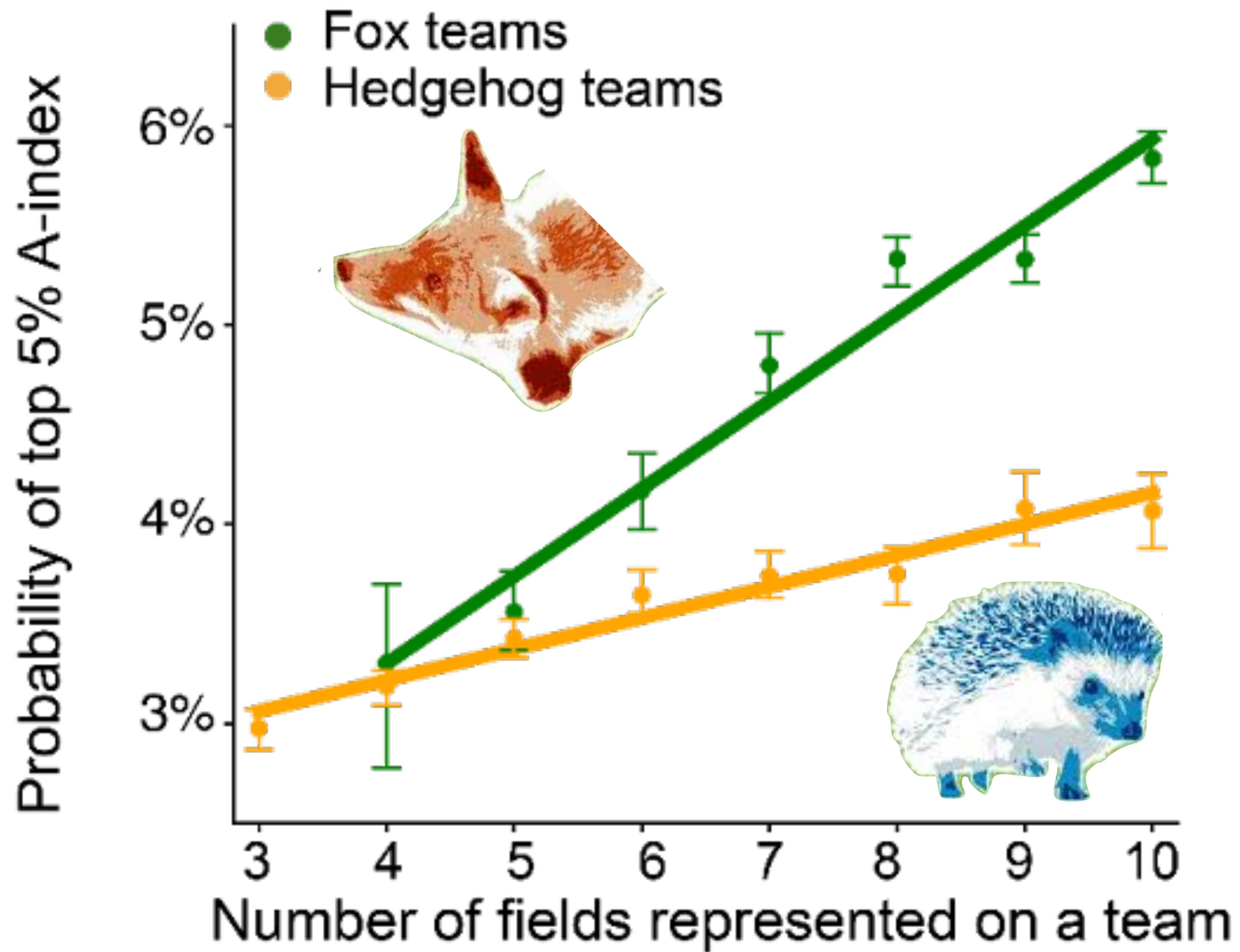
**APS data, 24,304 scientists,
84% unchanged**

**MAG data, 454,737 scientists,
77% unchanged**



Death of
Renaissance
Scientists?

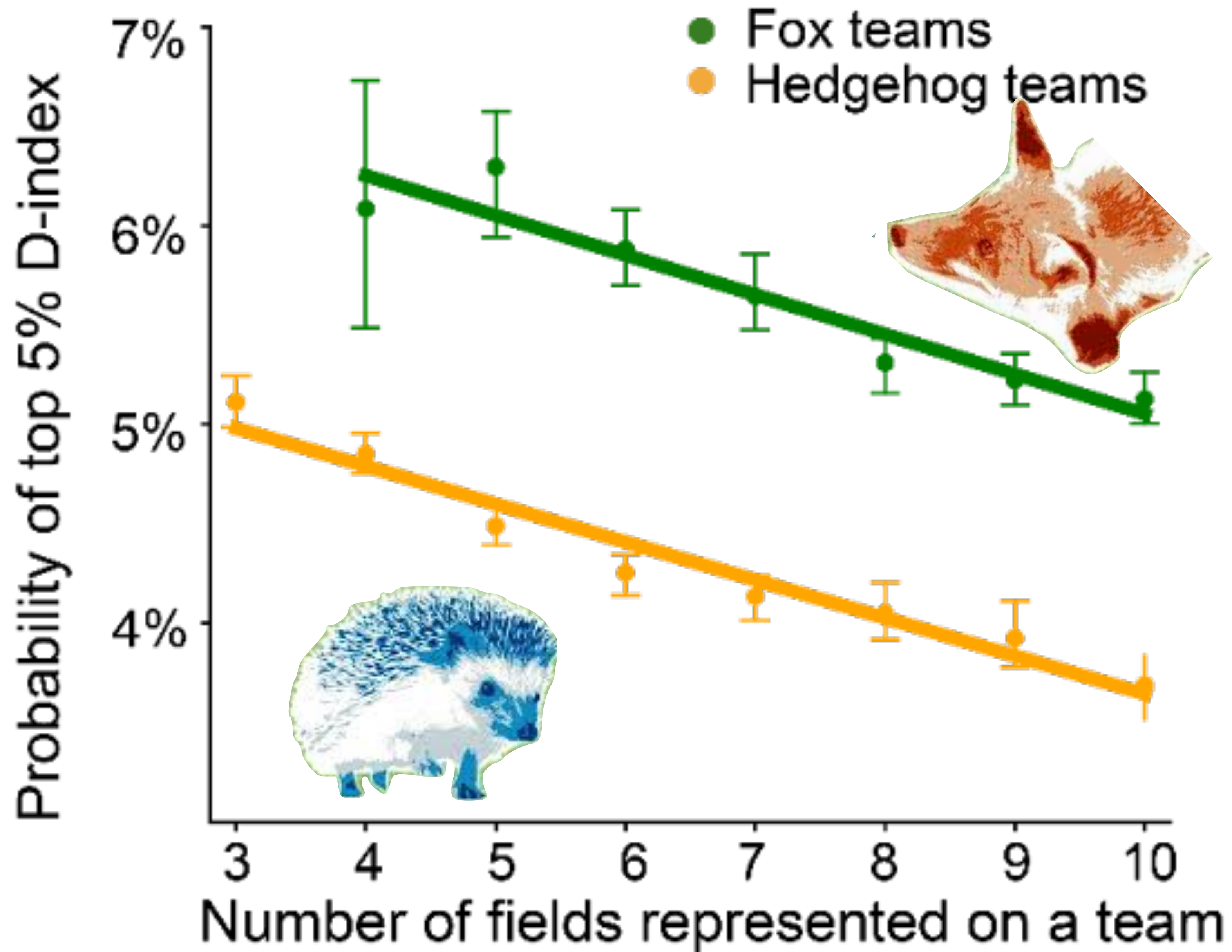
Fox-like scientists
are declining



Atypicality index (Uzzi et al., 2013) measures (surprising) idea complementary

e.g., GPS, microwave TV

Comparing the effect of research styles while accounting for knowledge diversity



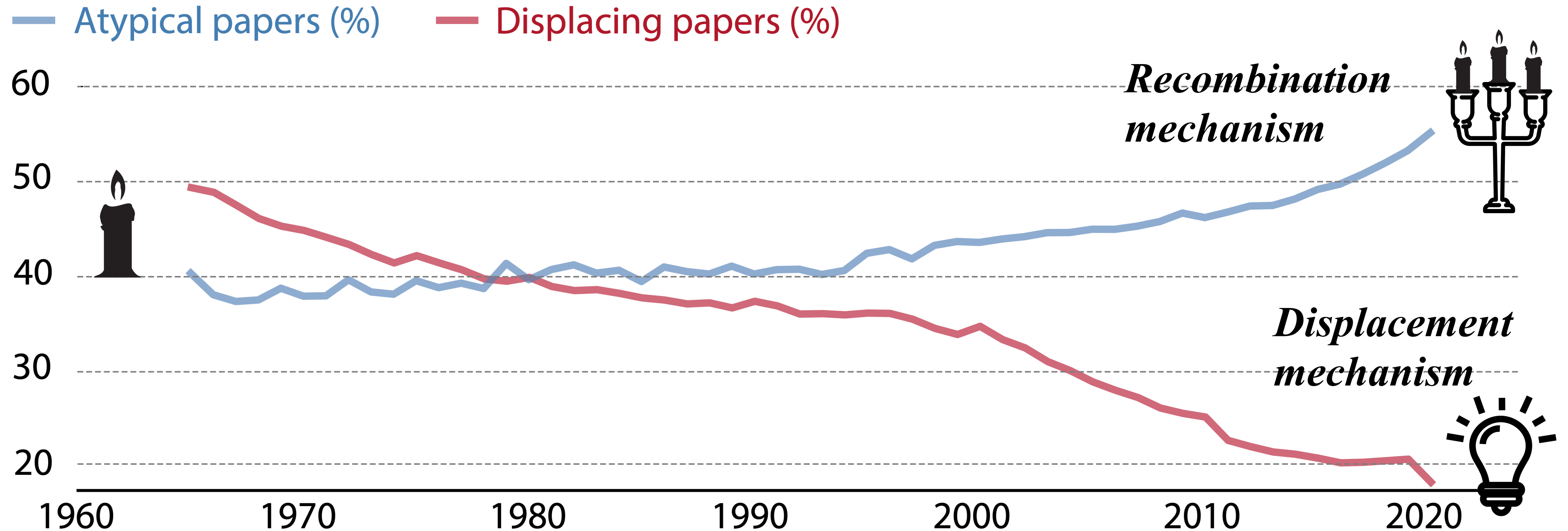
Disruption index (Wu et al., 2019) measures idea substitution

e.g., light bulb vs candle

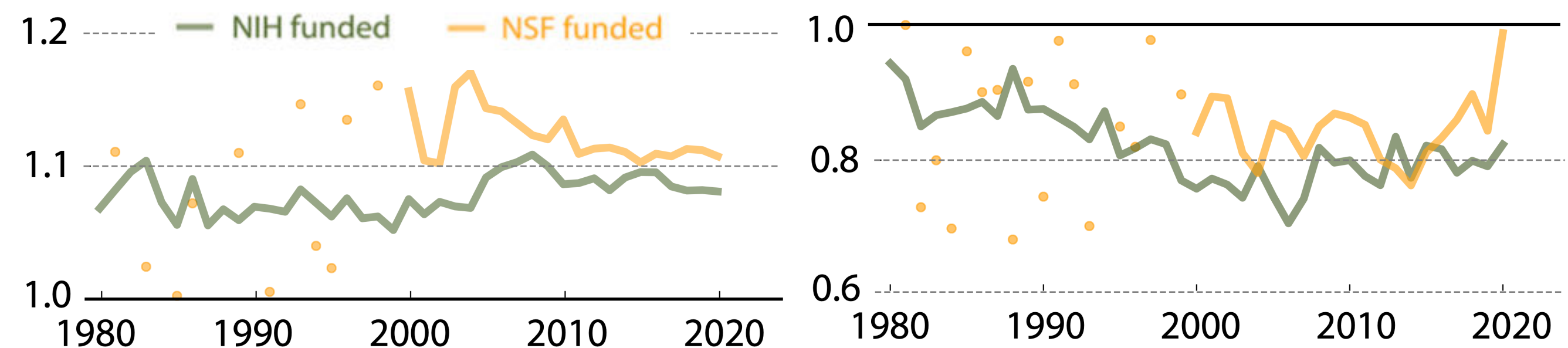
knowledge diversity becomes a burden, e.g., microwave TV

Ideas are getting harder to displace in science

Li et al., Displacing science, 2023



The principle of functional equivalence: ideas or technologies of the same function substitute for one another, while those with different functions may complement each other.



Isaiah Berlin

The Hedgehog and the Fox

With a foreword by
Michael Ignatieff



Death of Renaissance Scientists

1. Research style is more a personal trait (~80%) than an evolving strategy (~20%);
2. Fox-like scientists declined by 13% (49% to 36%) over the past six decades;
3. Fox teams consistently outperform hedgehog teams in scientific innovation.



***Zak Risha
Pitt***



***Yiling Lin
Pitt***



***Erin Leahey
U of Arizona***

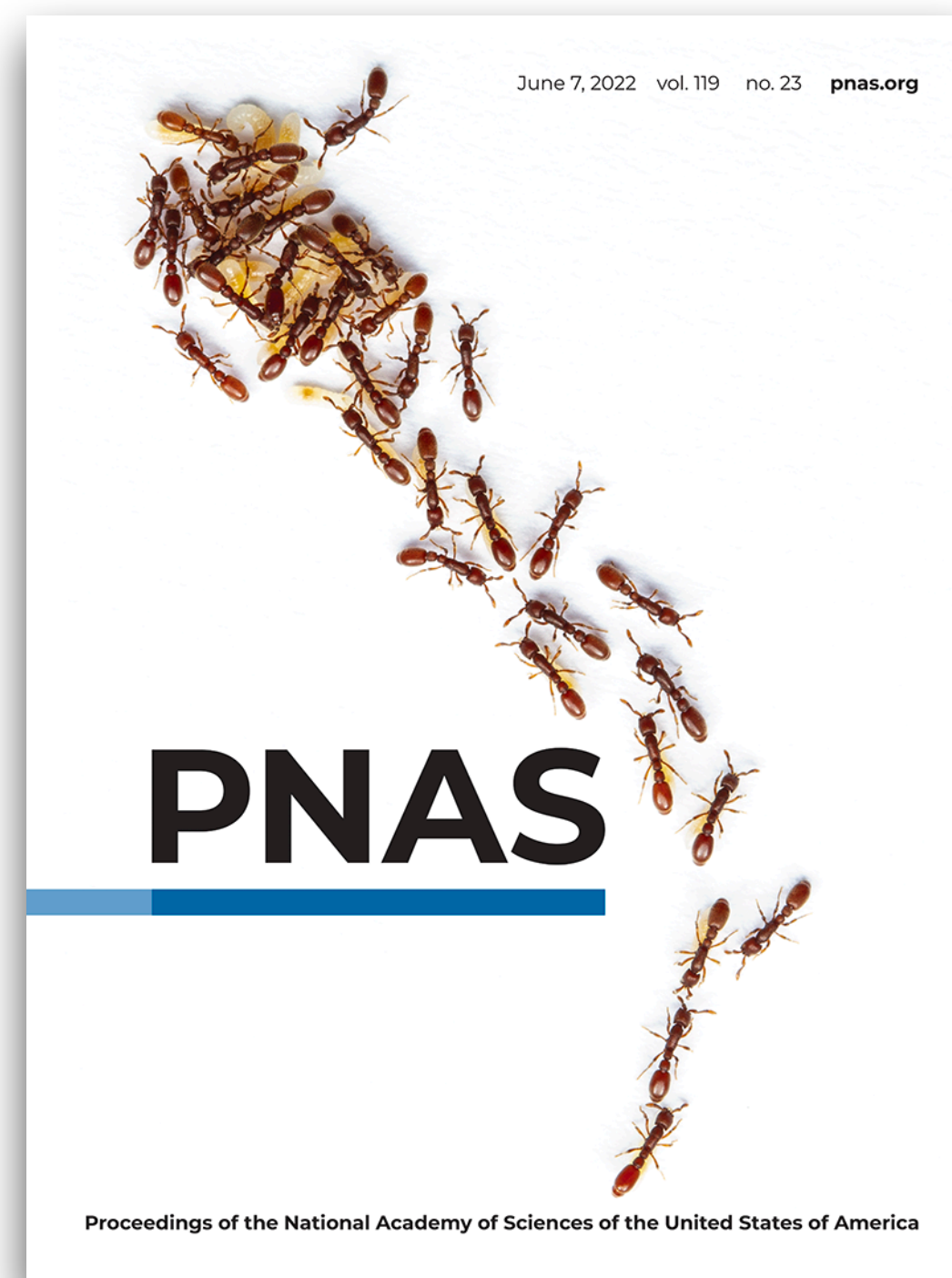
How can science and technology advance?

Measure innovation (metrics) and study its cognitive, organizational, and social foundations (mechanisms). Teams are the testbed for all three.

2019 size
Small teams disrupt



2022 shape
Flat teams innovate



2023 location
Onsite teams conceive



How scientists innovate in teams?



1. Author rank;
2. Author contribution disclosure;
3. Author Latex Macro

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"Team Science & Innovation"
NSF CAREER 2023-2028