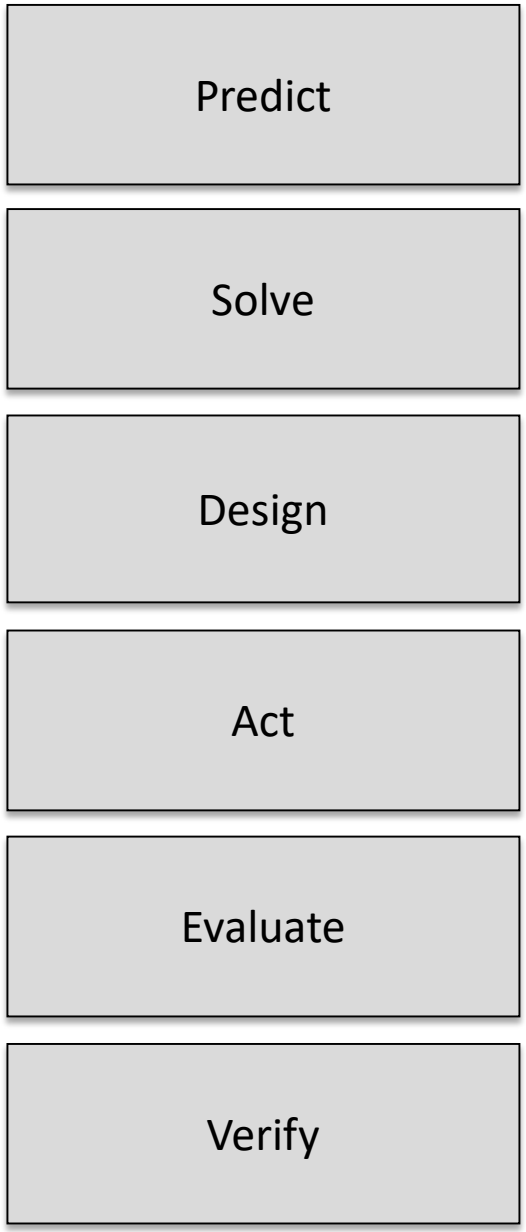
Scott E Page
University of Michigan
Santa Fe Institute

Diverse Teams

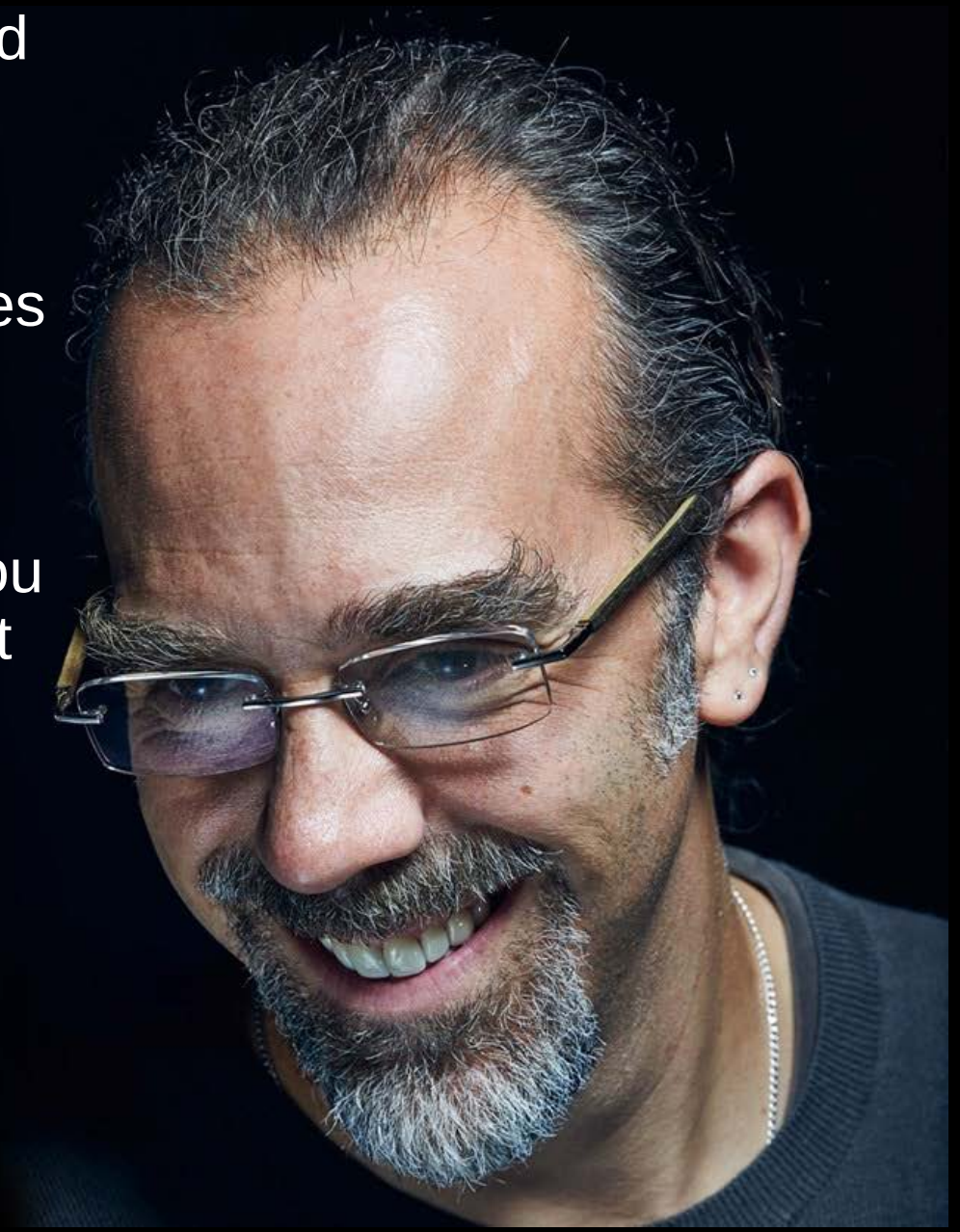
Intelligence community’s success depends on its ability to predict, evaluate, solve, act, create, and verify

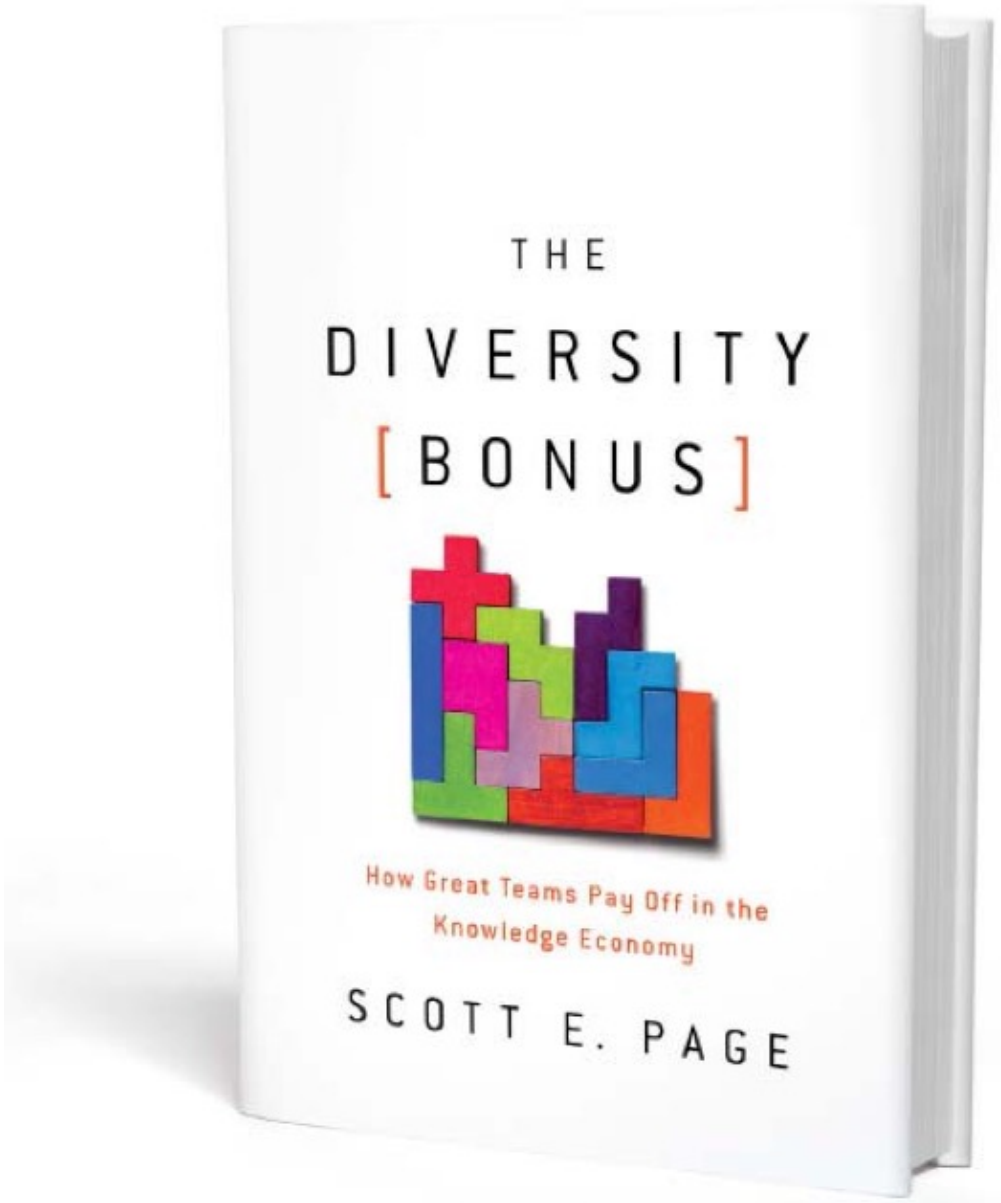

Predict
Solve
Design
Act
Evaluate
Verify

People throw around the word 'diversity' like it's a tip at a restaurant. But really, having people who have different mental perspectives is what's important. If you want to explore things you haven't explored, having people who look just like you and think just like you is not the best way

-Astro Teller

Google X

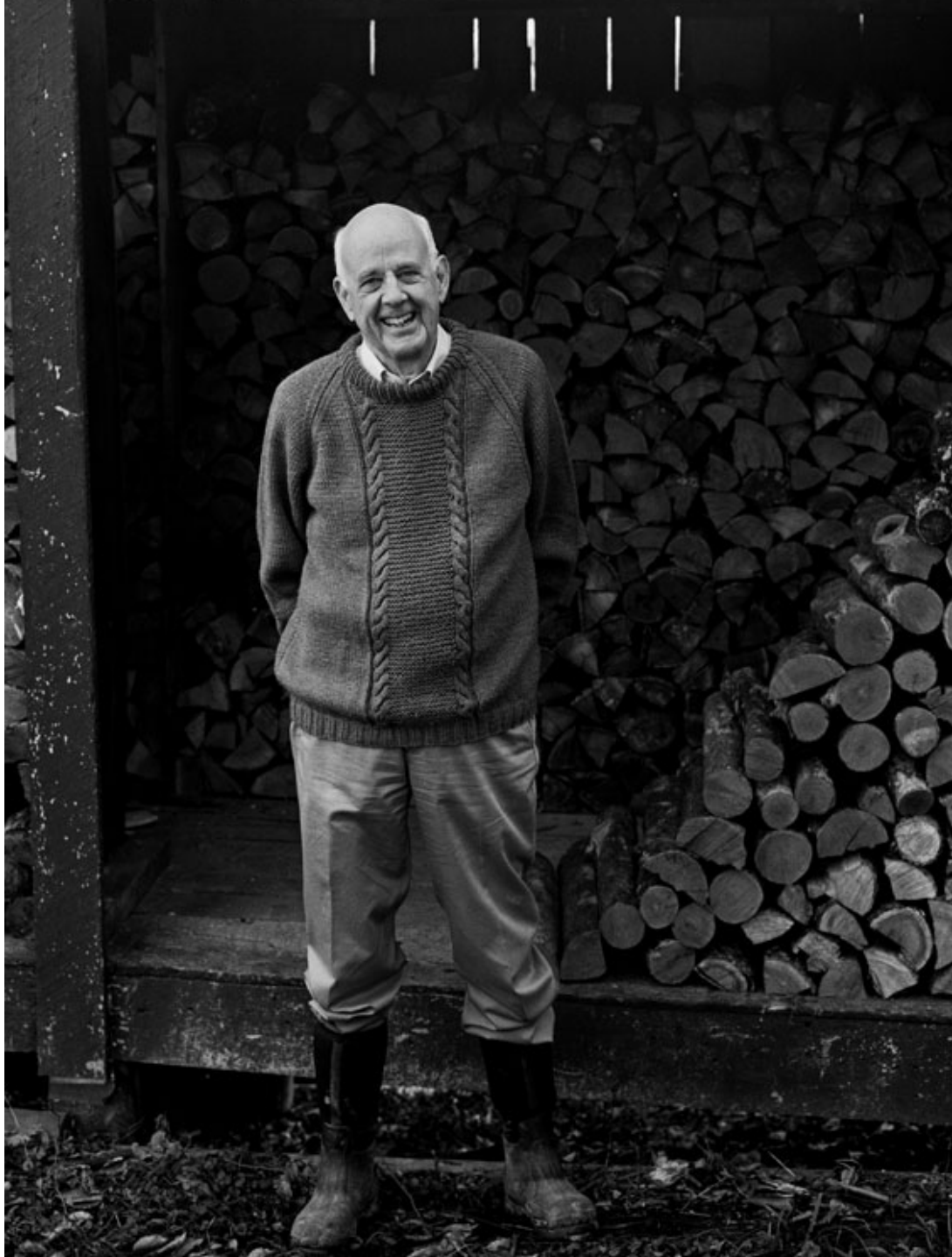




Available Now!

We have been wrong. We must change our lives, so that it will be possible to live by the contrary assumption that what is good for the world will be good for us.

-Wendell Berry

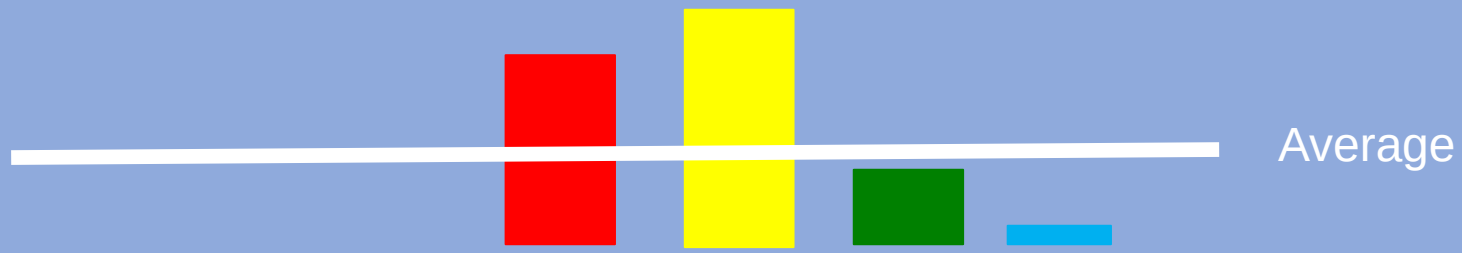


(Cognitive) Diversity Bonuses

The Wrong Metaphor

Portfolio Of Assets

Portfolio: Average



Predictions

A *NEW YORK TIMES* BUSINESS BESTSELLER

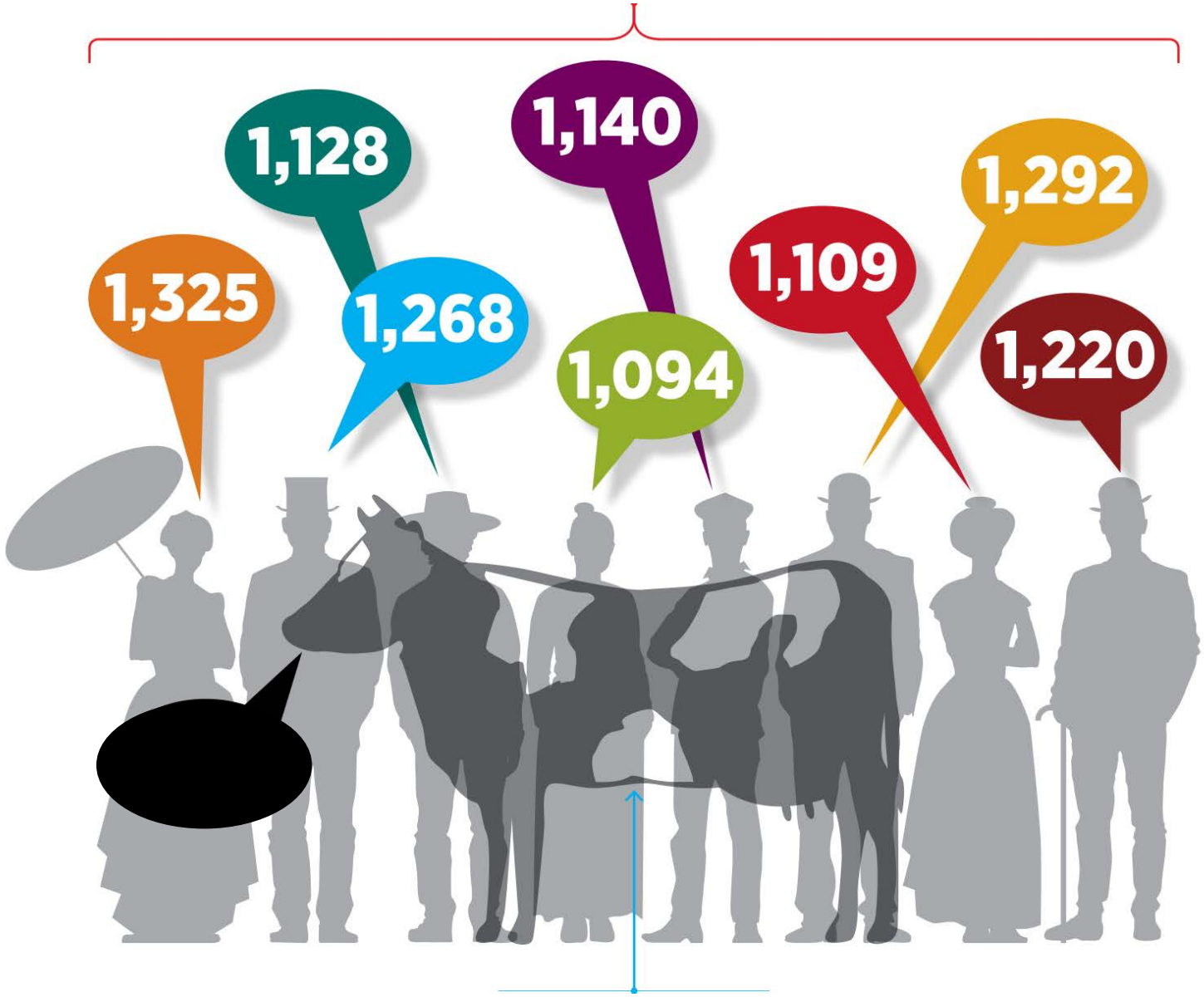
"As entertaining and thought-provoking as *The Tipping Point* by Malcolm Gladwell. . . . *The Wisdom of Crowds* ranges far and wide."
—*The Boston Globe*

THE WISDOM OF CROWDS

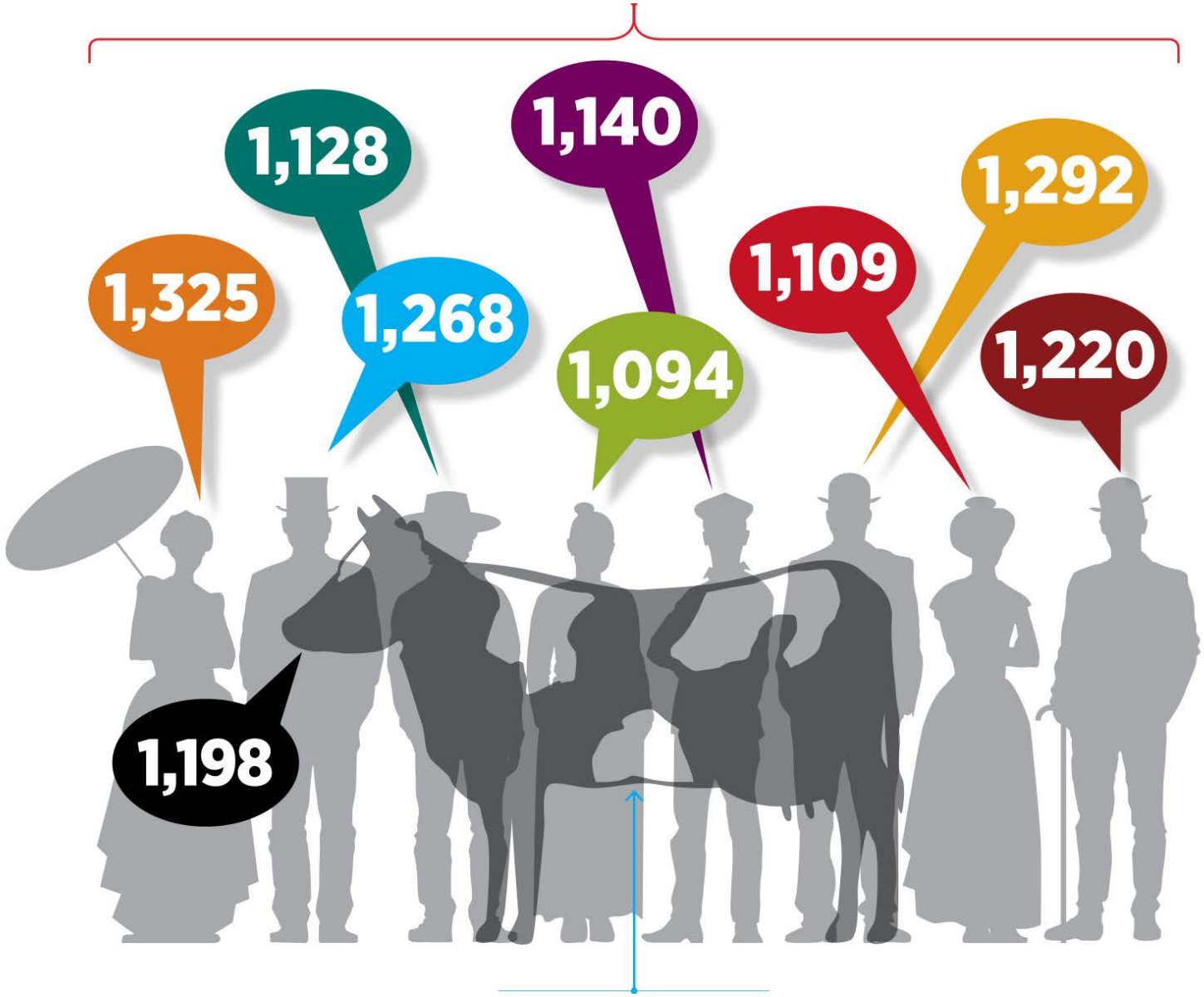
JAMES SUROWIECKI

WITH A NEW AFTERWORD BY THE AUTHOR

Average = 1,197



Average = 1,197



Diversity Prediction Theorem

Crowd Error = Average Error - Diversity

Diversity Prediction Theorem

Crowd Error = Average Error - Diversity

$$(c-\theta)^2 = \frac{1}{n}\sum_{i=1}^{n}(s_i-\theta)^2 - \frac{1}{n}\sum_{i=1}^{n}(s_i-c)^2$$

Galton’s Steer

Crowd Error = Average Error – Diversity

$$2 = 5410 - 5408$$

Economic Forecasts

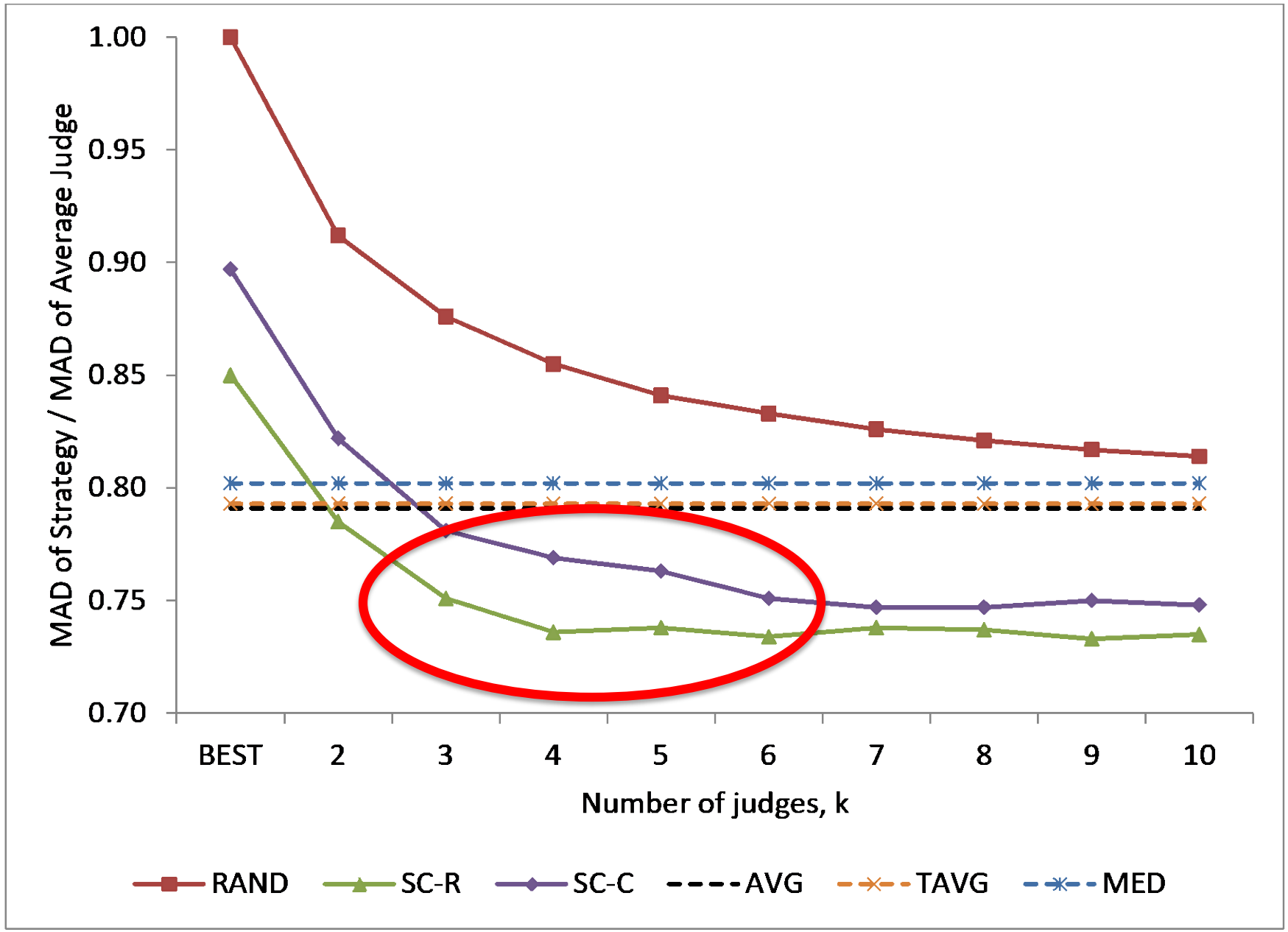
1969-2009

28,000 forecasts by professional economists

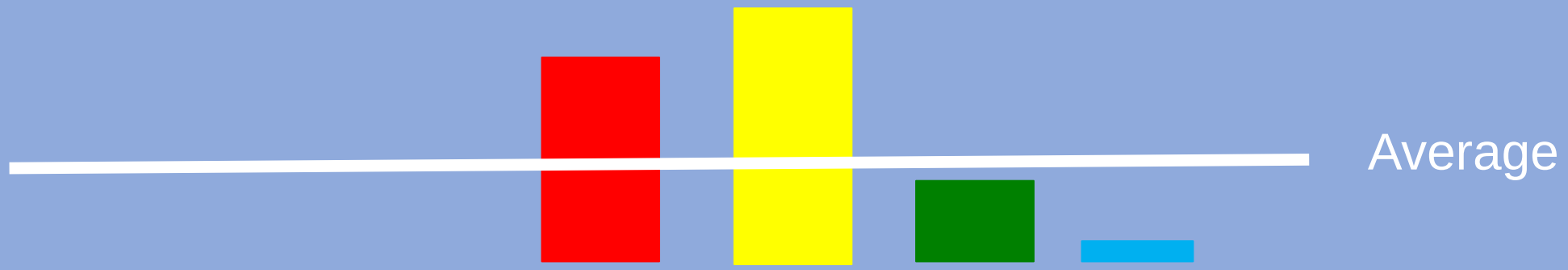
6 economic indicators

Crowd mean 21% better than average person

Mannes, A. E., Soll, J. B., & Larrick, R. P. (2014). The wisdom of select crowds. Journal of Personality and Social Psychology, 107, 276-299.


1.00
0.95
0.90
0.85
0.80
0.75
0.70
MAD of Strategy / MAD of Average Judge
BEST
2
3
4
5
6
7
8
9
10
Number of judges, k
RAND
SC-R
SC-C
AVG
TAVG
MED

Portfolio: You Get Average



Group of Predictors

Better Than the Average

Solving Difficult Problems

Hong and Page (2001)

A1: Difficult problem
A2: Capable, diverse problem solvers
A3: Moderately Large Team

Result: Randomly selected team better than team of the best individuals.

Marcolino, Jiang, and Tambe (2013)

A1: Game of GO
A2: Teams of algorithms vote on best move

Result: Team of diverse, less able algorithms outperforms team of variants of the best algorithm.

Kleinberg and Ragu (2015)

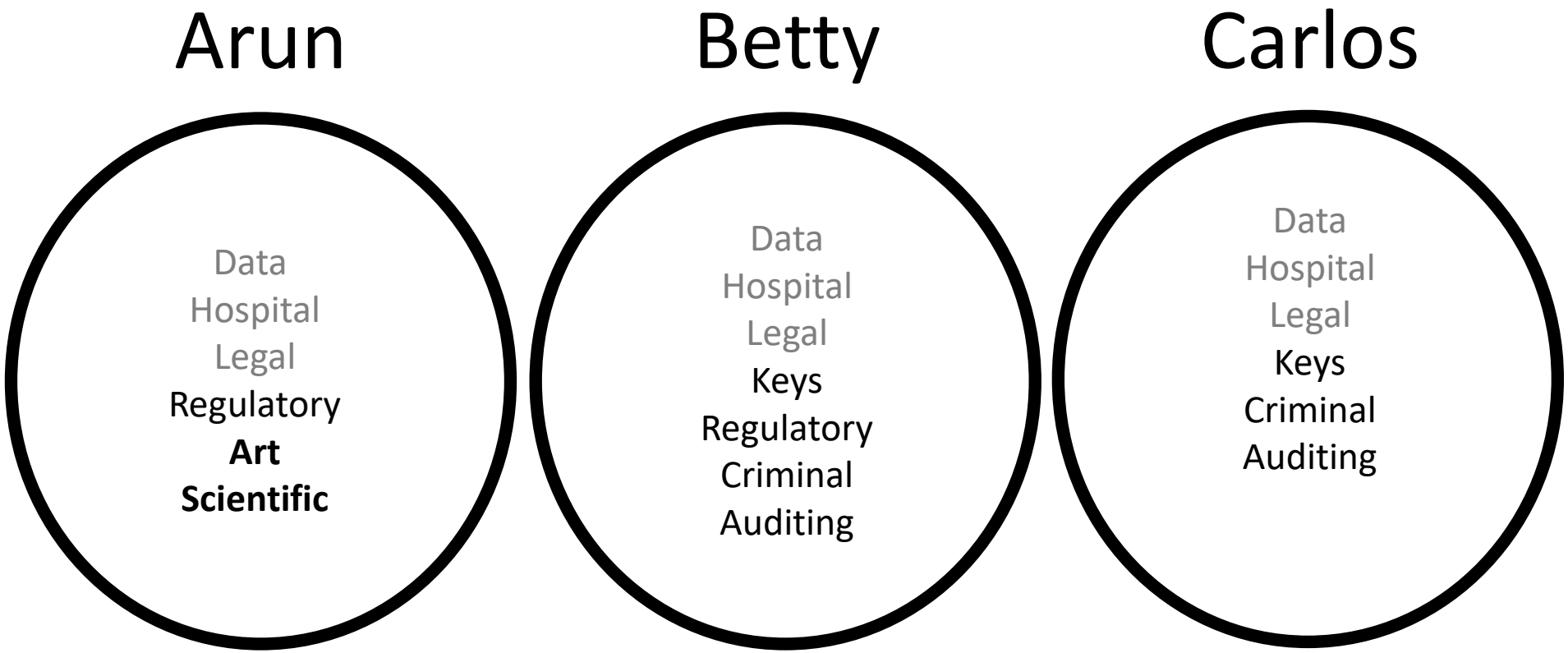
A1: Problem solvers = distribution of outcomes.

Result: For many nonlinear functions no test applied to individuals can determine the best team.

Creative Solutions

Task

Give categories of uses for Blockchain other than cryptocurrencies.

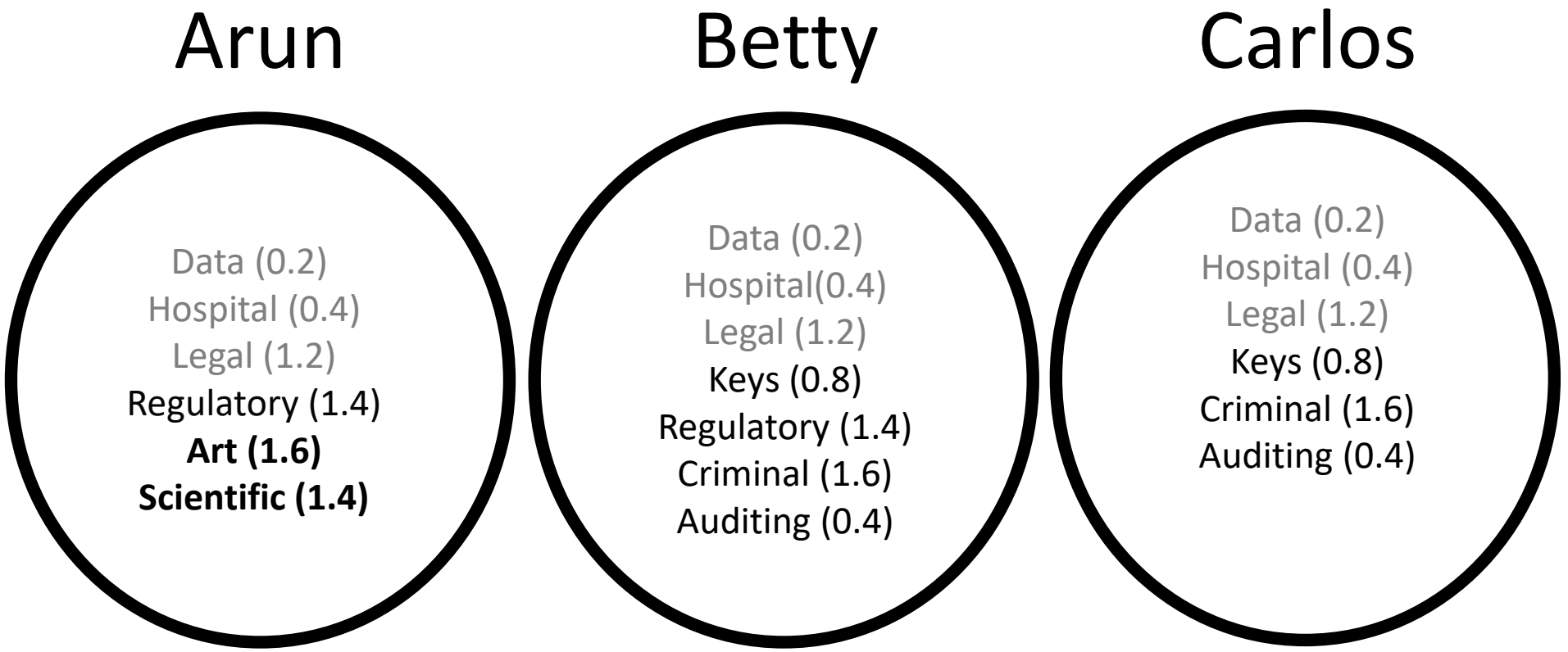


Creativity = 6
Shapley Value = 3.5

Creativity = 7
Shapley Value = 3

Creativity = 6
Shapley Value = 2.5

Group Creativity = 9



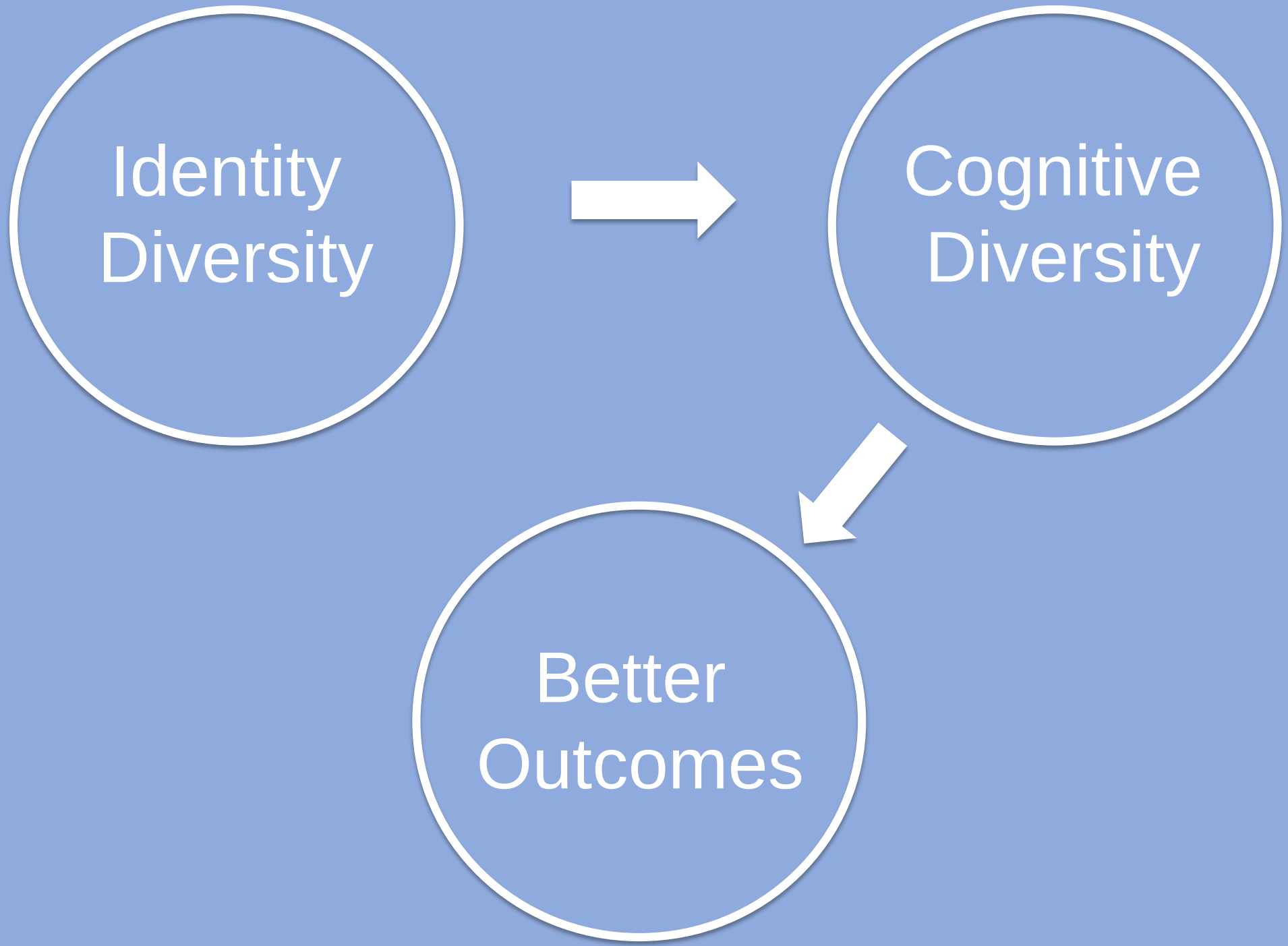
W-Creativity = 6.2
W-Shapley Value = 4.3
(0.2+0.4+1.2)/3 + 1.4/2 + 1.4 + 1.6

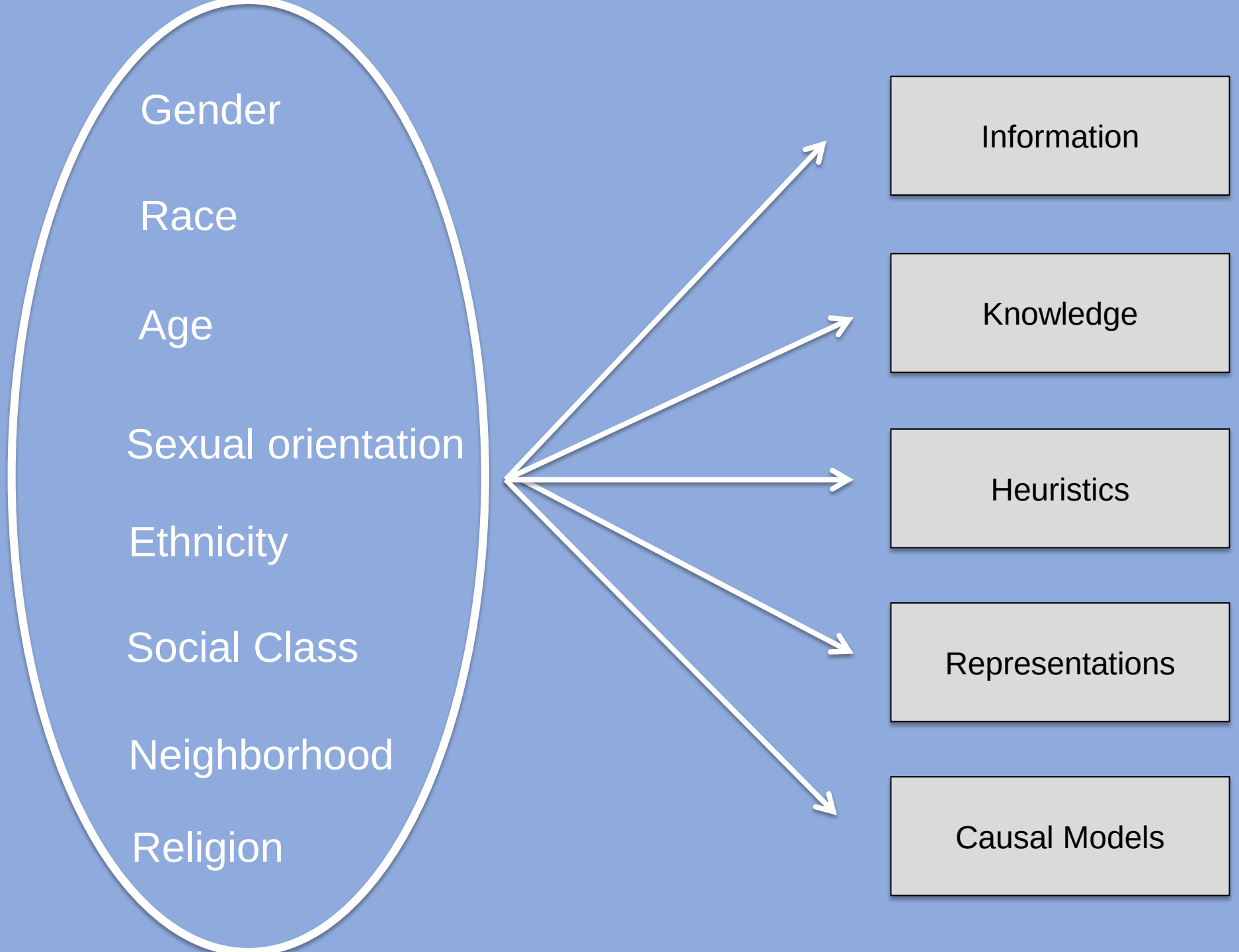
W-Creativity = 6
W-Shapley Value = 2.7
(0.2+0.4+1.2)/3 + (0.8+1.4+1.6+0.4)/2

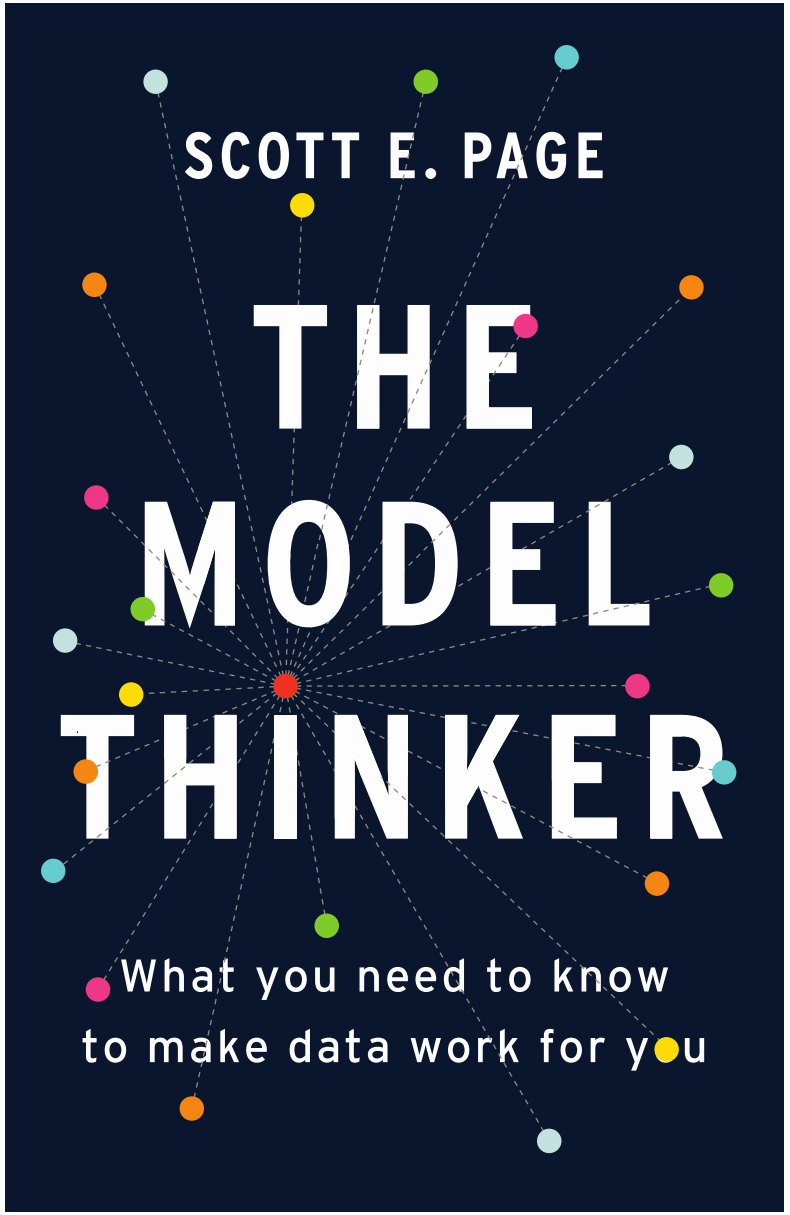
W-Creativity = 4.6
W-Shapley Value = 2
(0.2+0.4+1.2)/3 + (0.8+1.6+ 0.4)/2

Group Creativity = 9

Identity Diversity


Identity Diversity
Cognitive Diversity
Better Outcomes


Gender
Race
Age
Sexual orientation
Ethnicity
Social Class
Neighborhood
Religion
Information
Knowledge
Heuristics
Representations
Causal Models



Available 2019

Why Model?

R E D C A P E

Reason/Logic
Explain
Design
Communicate
Act
Predict
Explore

Many Model Thinking

Application:
Inequality

Mathematical Inequality Models

Captial - Piketty

$R > G$

Higher return on capital than economic growth

Econophysics

Random trade produces a long tailed distribution

Economic Inequality Models

Captial - Piketty

R > G

Higher return on capital than economic growth

Econophysics

Random trade produces a long tailed distribution

Technology

Technology. Replacing low skilled labor

Superstar Effect

Weightless
Information
Social influeences

Sociological Inequality Models

Captial - Piketty

R > G

Higher return on capital than economic growth

Econophysics

Random trade produces a long tailed distribution

Technology

Technology. Replacing low skilled labor

Superstar Effect

Weightless
Information
Social influeences

Poverty Traps

Poor people live in neighborhoods with bad schools and few opportunities

Assortative Mating

People marry later and choose partners with similar academic and economic standing

Parental Investment

Parents pass on the skills and resources to enable success

Political Inequality Models

Captial - Piketty

R > G

Higher return on capital than economic growth

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Parental Investment

Parents pass on the skills and resources to enable success

Plutocracy

CEO pay
Legacy programs
Social Networks

What is to be done?

Selecting

Avoid the Siren Call of Sameness
“He who looks like me is smart”

Sheen Levine

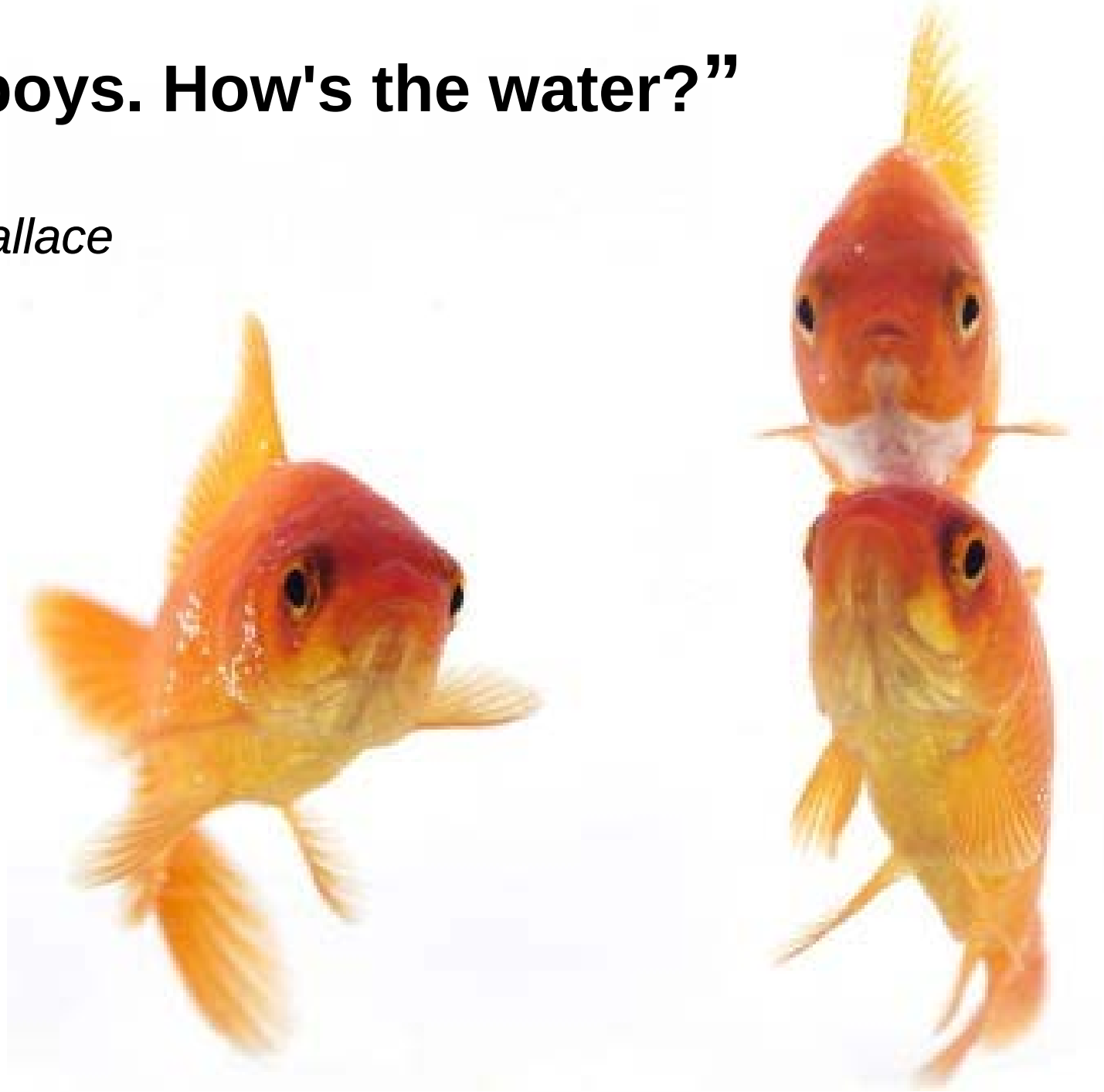
Select Based On Toolboxes

Person	T1	T2	T3	T4	T5	T6
Luiz	1	0	1	0	0	1
Martha	0	1	0	1	1	1
Waleed	0	1	0	1	1	0

Including

"Morning, boys. How's the water?”

David Foster Wallace



"What the hell is water?”

David Foster Wallace

Disrupting

Genentech

A Member of the Roche Group