

Modeling the Interaction between  
Culture and Institutional Performance,  
with Implications for Institutional Sequencing and  
Robust Design

Jenna Bednar & Scott Page  
University of Michigan

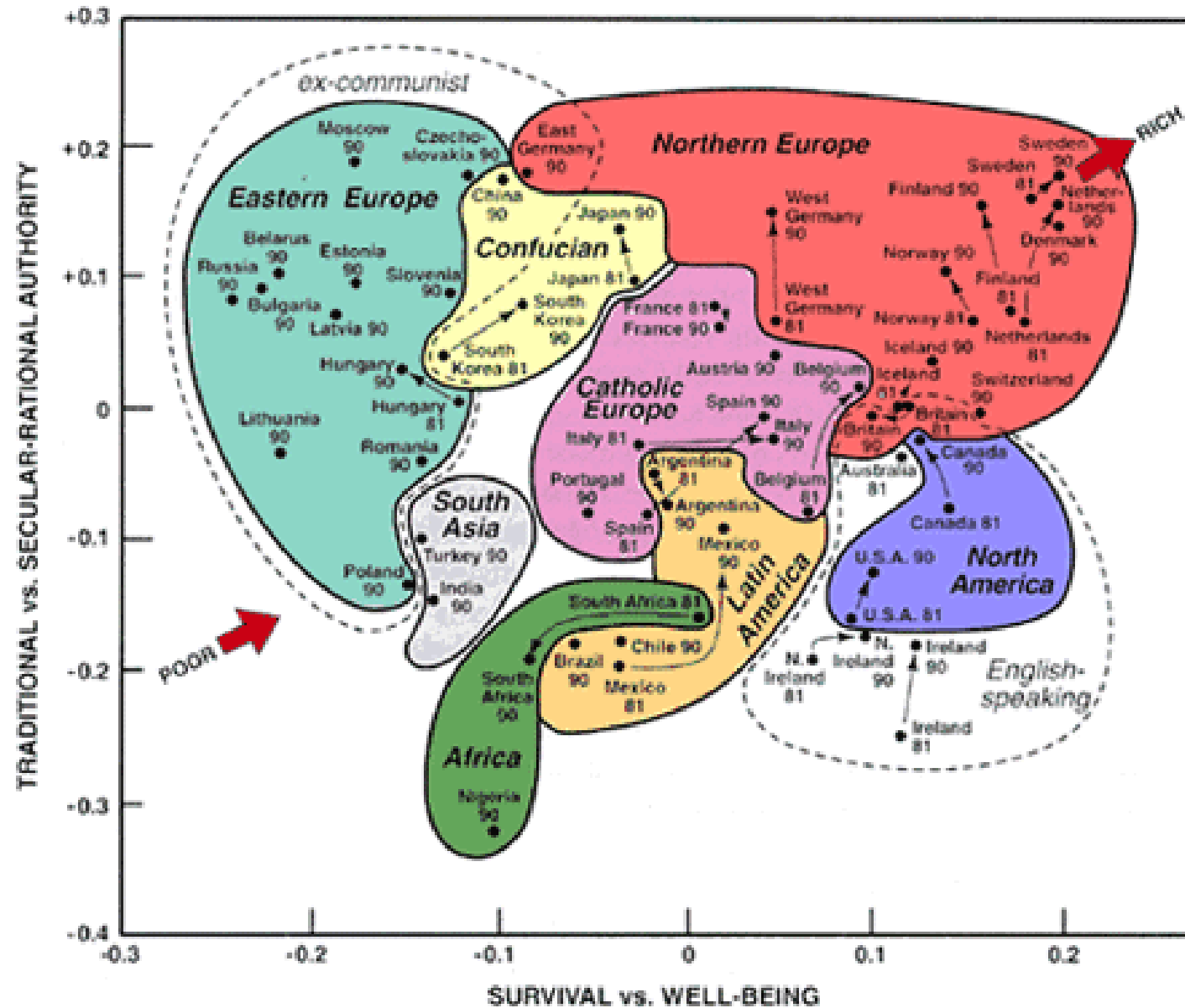
# Research Motivation

- **Laws are embedded in context.** They are subject to interpretation; that interpretation is influenced by other institutions as well as culture.

# Research Motivation

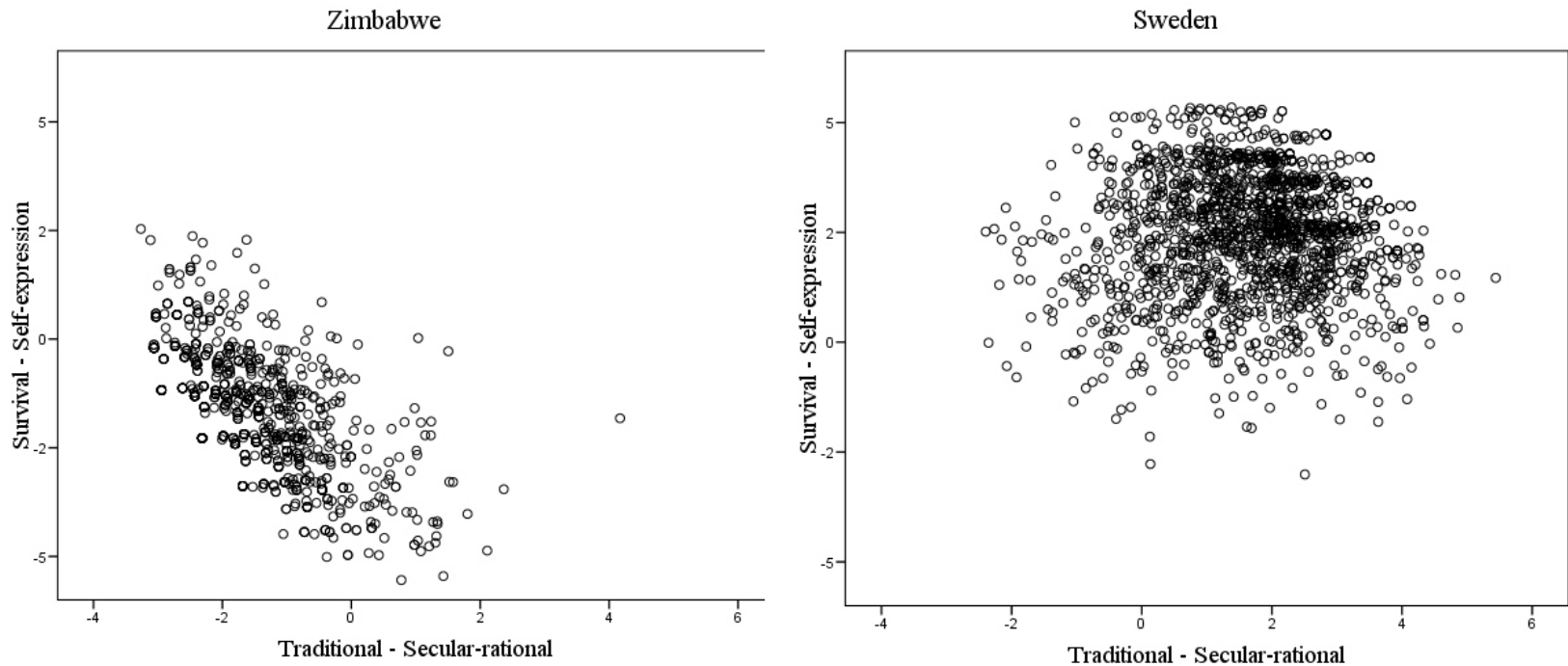
- **Laws are embedded in context.** They are subject to interpretation; that interpretation is influenced by other institutions as well as culture.
- Great, that's intuitive. But now what?

# We can measure cultural differences...



Source: R. Inglehart, 1997

# Measurable Cultural Differences Within and Between: Zimbabwe vs Sweden



Source: data courtesy Ron Inglehart.

# Cultural Differences have Meaningful Effects on Institutional Performance



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)



Journal of Comparative Economics 35 (2007) 659–688

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Journal of  
COMPARATIVE  
ECONOMICS

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[www.elsevier.com/locate/jce](http://www.elsevier.com/locate/jce)

## Culture rules: The foundations of the rule of law and other norms of governance

Amir N. Licht<sup>a,\*</sup>, Chanan Goldschmidt<sup>a</sup>, Shalom H. Schwartz<sup>b</sup>

<sup>a</sup> *Interdisciplinary Center Herzliya, Kanfe Nesharim Street, Herzliya 46150, Israel*

<sup>b</sup> *Department of Psychology, Hebrew University of Jerusalem, Jerusalem 91905, Israel*

# Cultural Differences Affect Cooperation

Journal of Economic Behavior & Organization 95 (2013) 90–110



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Journal of Economic Behavior & Organization

journal homepage: [www.elsevier.com/locate/jebo](http://www.elsevier.com/locate/jebo)



Institutions, culture, and open source<sup>☆</sup>

Sebastian v. Engelhardt<sup>a,\*</sup>, Andreas Freytag<sup>a,b</sup>

<sup>a</sup> Friedrich-Schiller-University Jena, Department of Economics and Business Administration, Carl-Zeiss-Str. 3, 07743 Jena, Germany

<sup>b</sup> Stellenbosch University, Department of Economics, Private Bag x1 Matieland, 7602 Stellenbosch, South Africa



Evidence of lingering effects of culture and pre-existing institutions, but no means to disentangle the two.

An Empirical Investigation of the Legacies of  
Non-Democratic Regimes:  
The Case of Soeharto's Mayors in Indonesia\*

Monica Martinez-Bravo  
CEMFI

Priya Mukherjee  
College of William & Mary

Andreas Stegmann  
CEMFI

January 25<sup>th</sup>, 2016

Legacy: “A new democracy can inherit a constitution, a number of laws and regulations, a large army, or an inefficient bureaucracy from the previous regime”



# Disagreement about policy prescriptions

DAVID LIPTON

*Economic Adviser to Solidarity*

JEFFREY SACHS

*Harvard University and Economic Adviser to Solidarity*

## *Creating a Market Economy in Eastern Europe: The Case of Poland*

*The Economic Journal*, **102** (March 1992), 291–300

*Printed in Great Britain*

### THE VIRTUES OF GRADUALISM AND LEGITIMACY IN THE TRANSITION TO A MARKET ECONOMY\*

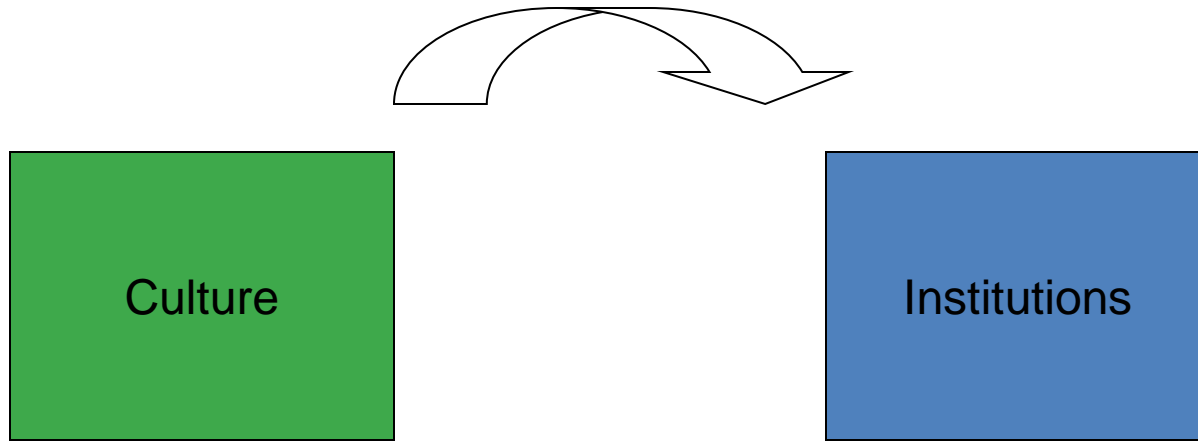
*M. Dewatripont and G. Roland*

This paper addresses two policy issues relevant to the transition from plan to market in Central and Eastern Europe. First, are there any virtues to 'gradualist' strategies as opposed to 'big bang' strategies, in the transition process? Second, to what extent is the introduction of democratic regimes prior to radical economic reform an obstacle to the latter, when transition measures may hurt a majority of the population in the short run? These questions are

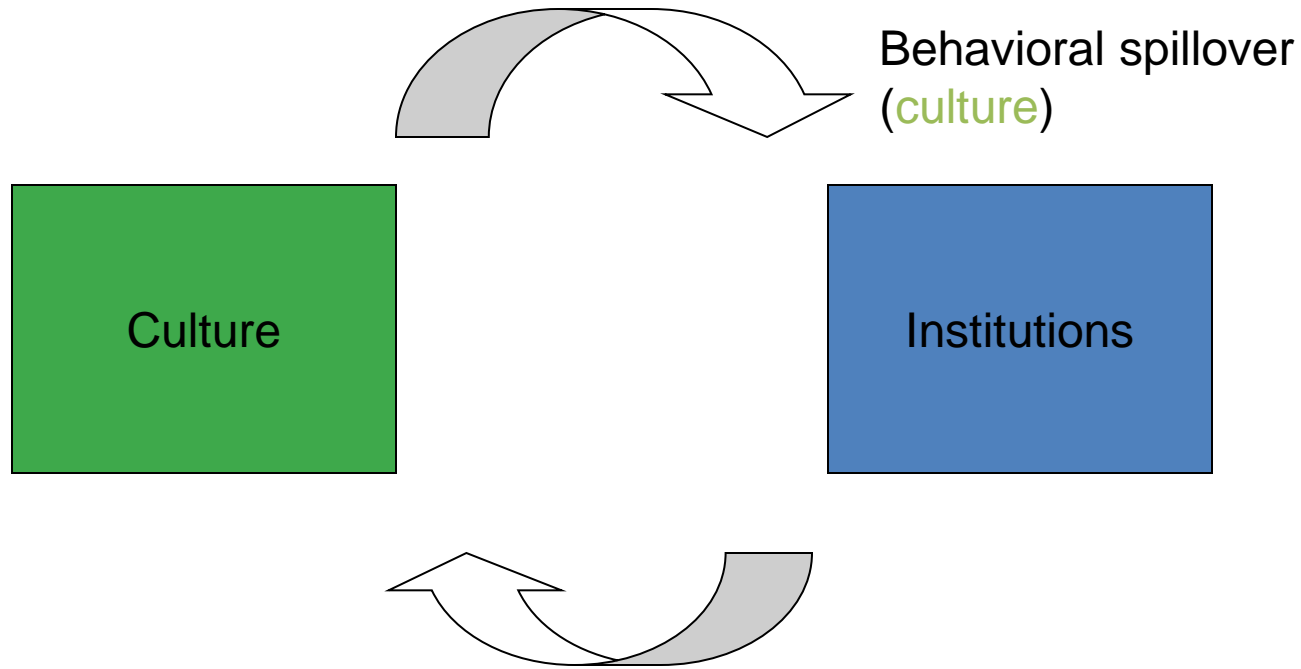
# Research Motivation

- **Laws are embedded in context.** They are subject to interpretation; that interpretation is influenced by other institutions as well as culture.
- Great, that's intuitive.
- We need a model of **how culture and institutions affect one another.**

# Larger Project



# Larger Project



Bednar and Page (2007) "Can Game(s) Theory Explain Culture? The Emergence of Cultural Behavior Within Multiple Game" *Rationality and Society*

Bednar, Chen, Liu, and Page (2012) "Behavioral Spillovers and Cognitive Load in Multiple Games: An Experimental Study." *Games and Economic Behavior*.

# Game(s) Theory

People interact in multiple strategic settings and their behavior in one setting can spill over into other settings.

These patterns of behavior shape culture.

# 3 Sets of Results

- Spillovers (using experiments)
- Sequencing (using mathematical model)
- Diversity (using ABM)

## Results 1:

Behavioral spillovers affect  
Institutional Performance

# Our Games

## Self Interest

7,7	2,9
9,2	10,10

## Prisoner's Dilemma

7,7	2,10
10,2	4,4

## Strong Alternation

7,7	4,14
14,4	5,5

## Weak Alternation

7,7	4,11
11,4	5,5



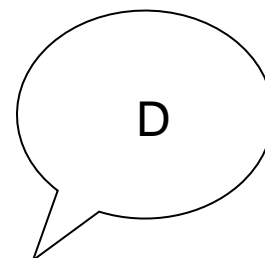
# Variation in Experiments

	<b>Control</b>	<b>Trtmt 1</b>	<b>Trtmt 2</b>	<b>Trtmt 3</b>
PD: % CC	56	42	41	40
SA: % ALT	71	48	48	38
WA: % ALT	36	21	18	37

Why?

# Standard Experiment

7,7	2,10
10,2	4,4



# Our Experiments

7,7	4,14
14,4	5,5

7,7	2,10
10,2	4,4



# Variation in Experiments

	<b>Control</b>	<b>w/ Self Interest</b>	<b>w/ SA* or PD</b>	<b>w/ WA or SA*</b>
PD: % CC	56	42	41*	40
SA: % ALT	71	48	48	38
WA: % ALT	36	21	18	37*

# Two Theories for Observed Variation

- Cognitive Overload
- Behavioral Spillovers

# Two Theories

- Cognitive Overload
  - Rationale: Multitasking leads to confusion and suboptimal decision-making



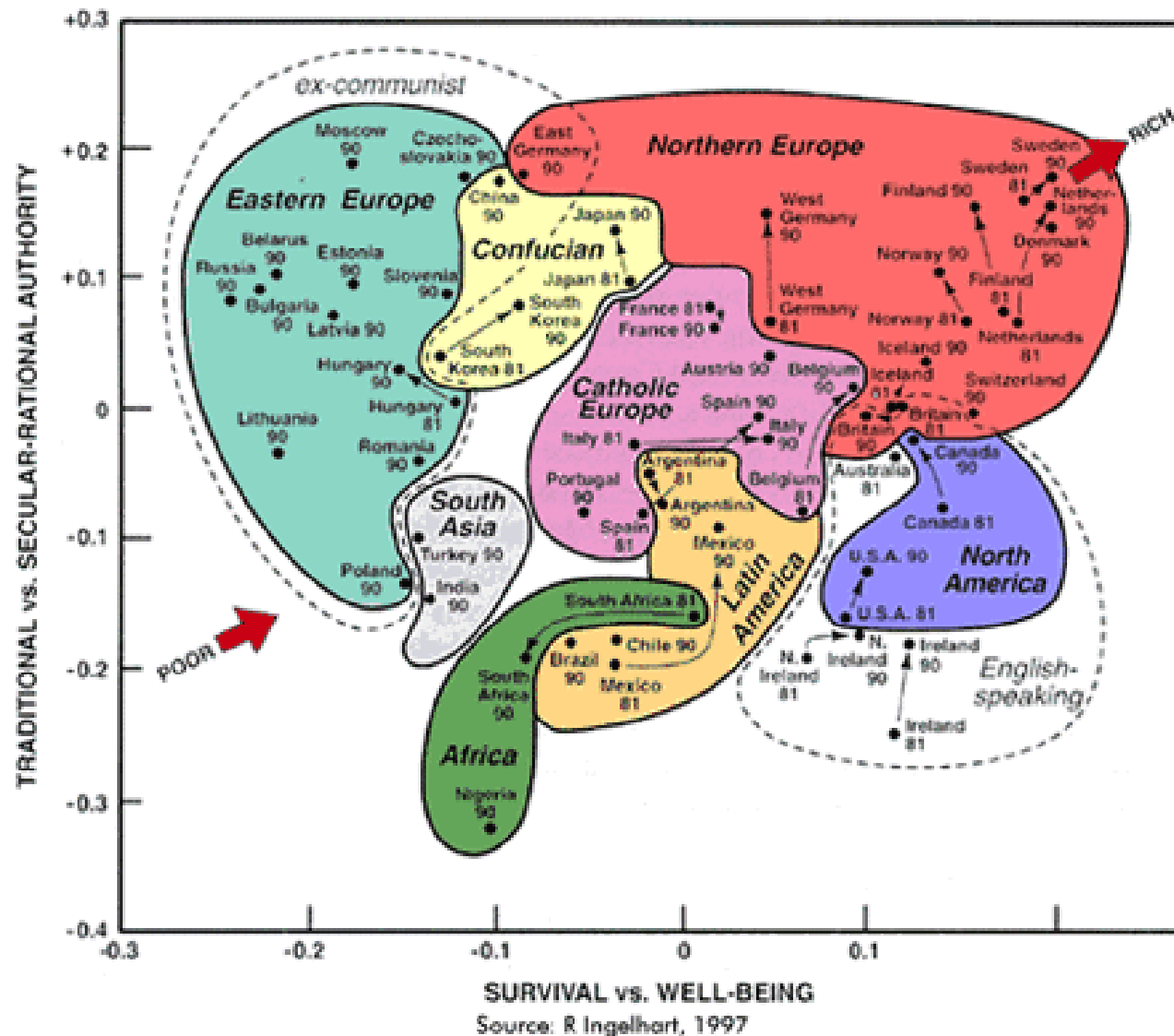
# Two Theories

- Cognitive Overload
- Behavioral Spillovers
  - Rationale: in solving new problem, apply behavior from existing repertoire (ie Agents apply same strategies in different contexts)





Cultures are coherent; we have behavioral expectations based on culture



# Research questions

- When will behavioral spillovers exist?
- Can we predict their direction?
- We need a measure of game difficulty to allow us to compare games

# ENTROPY

- Measure of amount of info needed to describe the distribution of outcomes
- Measure variation in control responses
- Correlated with cognitive load
- In 2X2, bounded between [0,2], where  $H = 0$  is all observations in one cell and  $H=2$  uniform across all four cells

$$H(x) = -\sum_x p(x) \log_2 p(x)$$

# ENTROPY

- aka, **Measure of surprise**
- Low entropy: you know what people will do
- High entropy: their reactions may surprise you

**Table 2**  
 Distribution of outcomes and entropy in control sessions.

	SI		PD		SA		WA	
	C	S	C	S	C	S	C	S
C	0.00	0.14	55.68	11.67	5.02	39.81	33.18	21.57
S	0.00	99.86	14.82	17.82	40.37	14.81	22.74	22.51
Entropy	0.02		1.68		1.68		1.98	

# Hypotheses

- Low entropy games will not be subject to influence
- Behavioral spillovers will run from low entropy to high or between highs
- Cognitive Load highest in high entropy games, so least behavioral pull

# Ensemble Effect on SI play

- Easiest game: NO EFFECT.
  - Behavior across rounds > 99% selfish in controls and ensembles.



# SI Effect on other Games

- Predicted: More SS in PD, WA, and SA when each is paired with SI than in control

# SI's Effect on Behavior in other Games

- Predicted: More SS in PD, WA, and SA when each is paired with SI than in control
- Significant Differences for PD and SA:
  - PD vs PD+SI: 0.0780 / 0.1049
  - SA vs SA+SI: 0.1220 / 0.0800
  - WA vs WA + SI: 0.3966 / 0.5787

(p-values, whole series / last 100 rounds)

# Behavioral Spillovers: PD Games

- (PD+SA) : (PD+SI)
  - More ALT w/SA : 0.0455 / 0.0452
  - More SS w/SI : 0.0736 / 0.1049
- (PD+SA) : (PD+WA)
  - More ALT w/SA : 0.0910 / 0.0727
  - More SS w/WA : 0.1063 / 0.0754

(p-values, whole series/last 100 rounds)

What our work means for  
culture and institutional  
performance

Will personal exchange scale, and if not, why not?





+



+





+



+





# Spillovers: Key Insights

- Institutions may not perform as expected due to the presence of behavioral spillovers.
- Institutions with multiple “reasonable” reactions are most susceptible.
- Response to susceptible institutions is driven by behavior in easier games (w dominant strategy)



## Results 2:

Sequencing of Institutions affects  
Institutional Performance

# The Model

- Games arrive in sequence
- Initial Behavior:
  - Efficient equilibrium strategy ( $1-\gamma$ )
  - Equilibrium strategy of nearest game ( $\gamma$ )
- Best response dynamics (Nash 1951)

Tradition

Innovate

Tradition

$16-\Theta, 16-\Theta$

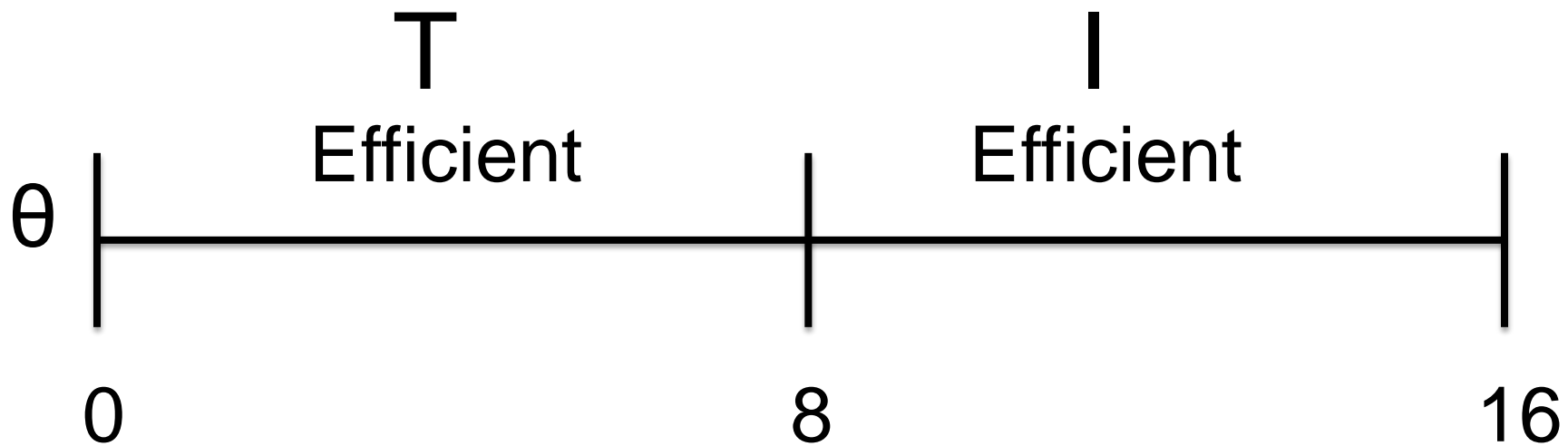
$4, 4$

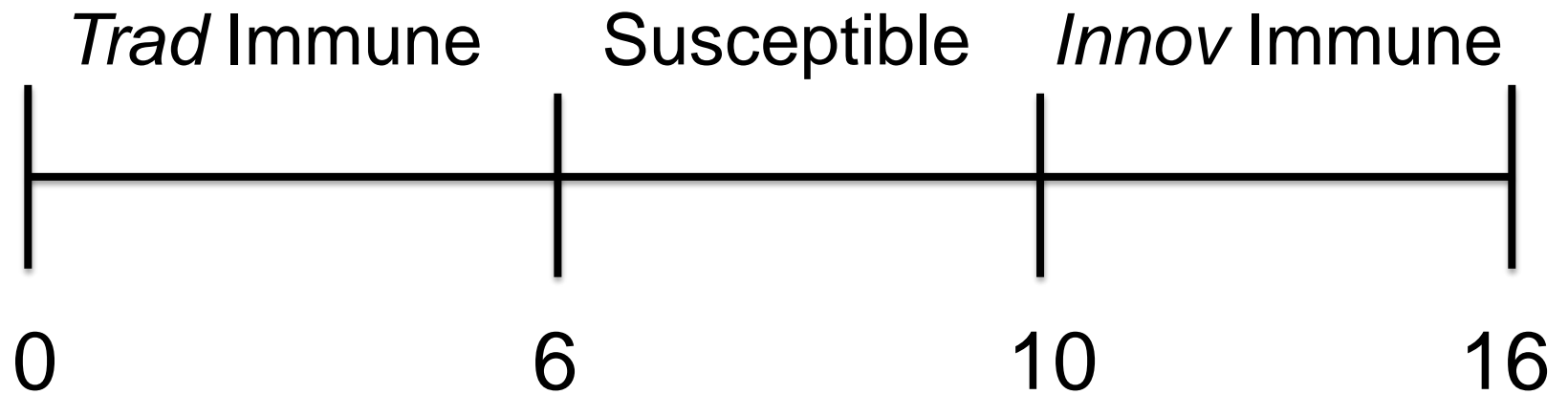
Innovate

$4, 4$

$\Theta, \Theta$

	Tradition	Innovate
Tradition	$16-\Theta, 16-\Theta$	$4, 4$
Innovate	$4, 4$	$\Theta, \Theta$

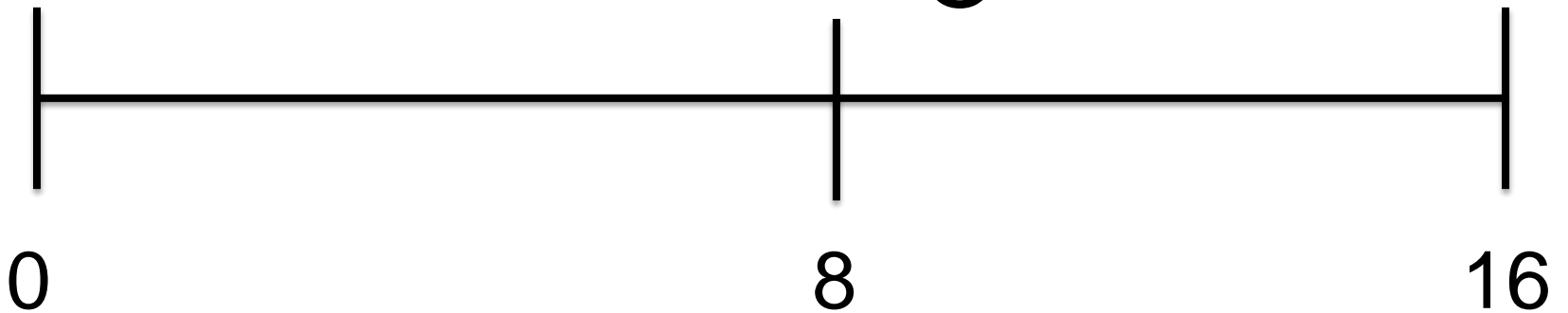


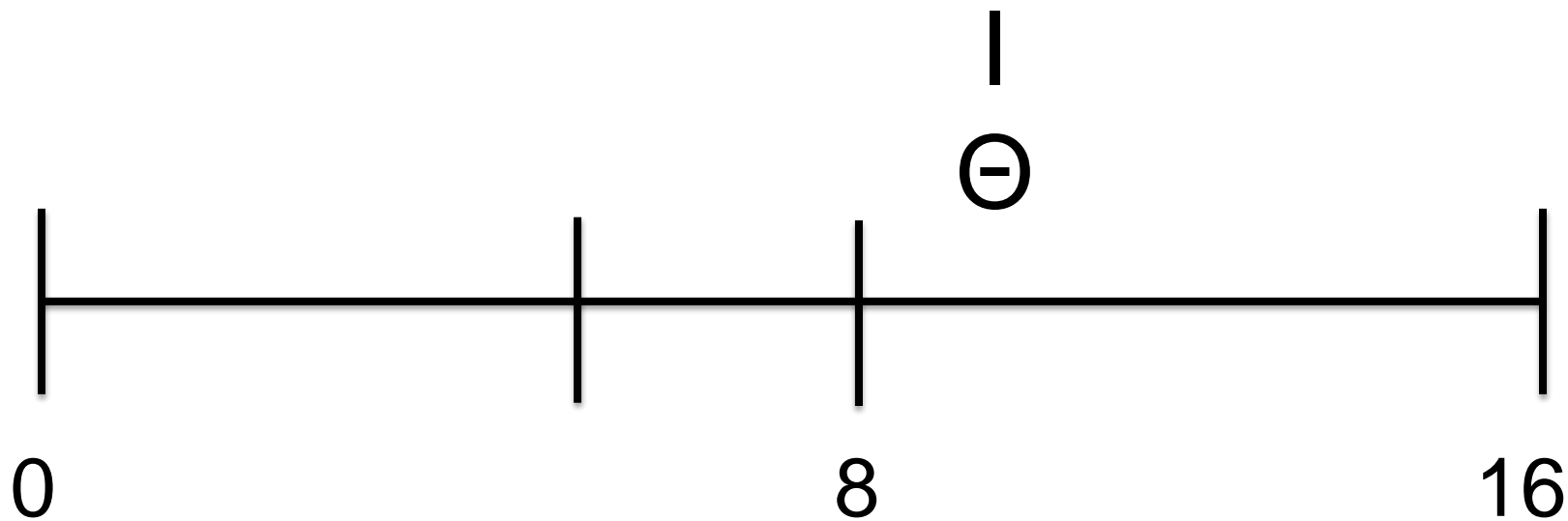


Game 1:  $\Theta = 9$

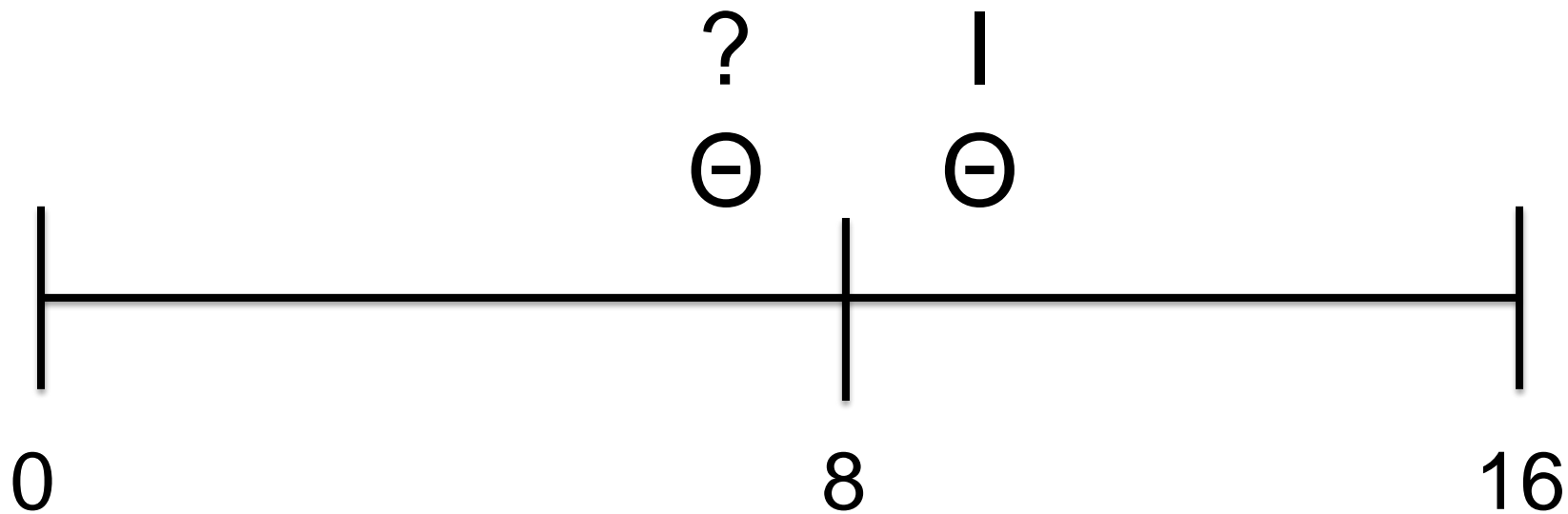
?

$\Theta$

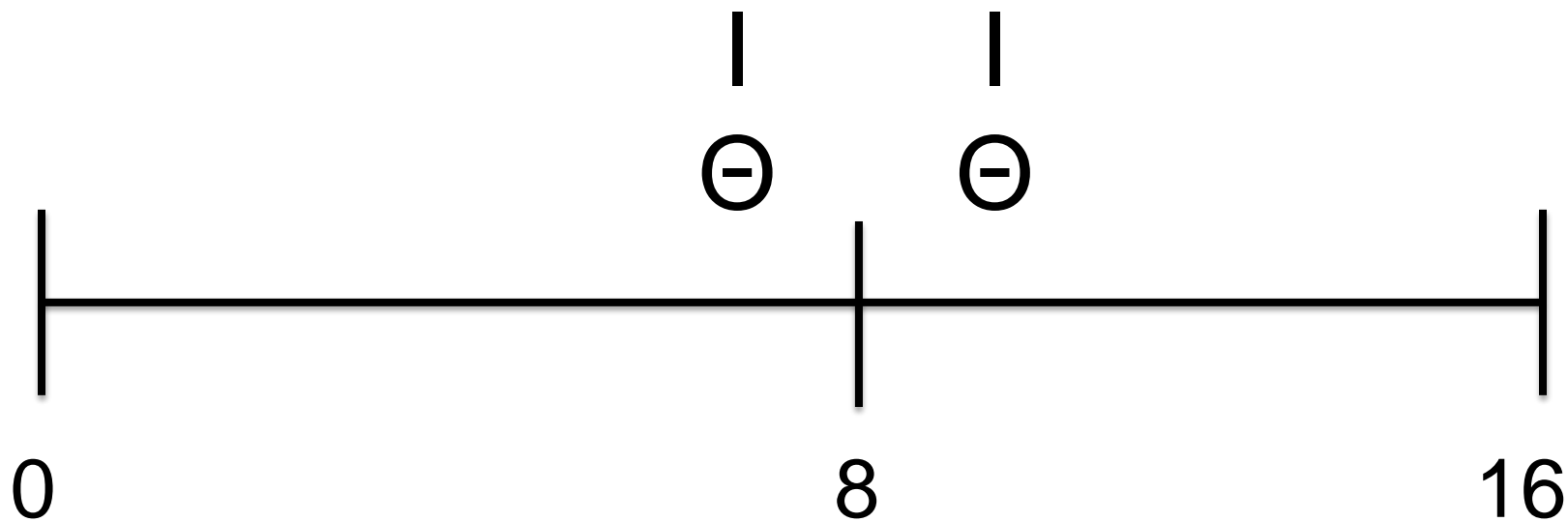




Innovate.







# Sequencing: Key Insights

- Path dependence widespread with moderate spillovers
- Larger behavioral spillover increases susceptible region and path dependence.
- Efficient paths require **clearer incentives early** (1-dim)
- Efficient paths maintain path dependence
- **Endogenous Institutional change occurs too late**
- Efficient paths require **weak punishment** (General)

## Results 3:

Behavioral Diversity affects  
Institutional Performance

# Bottom Left

Effective Number of Behaviors: 2.3

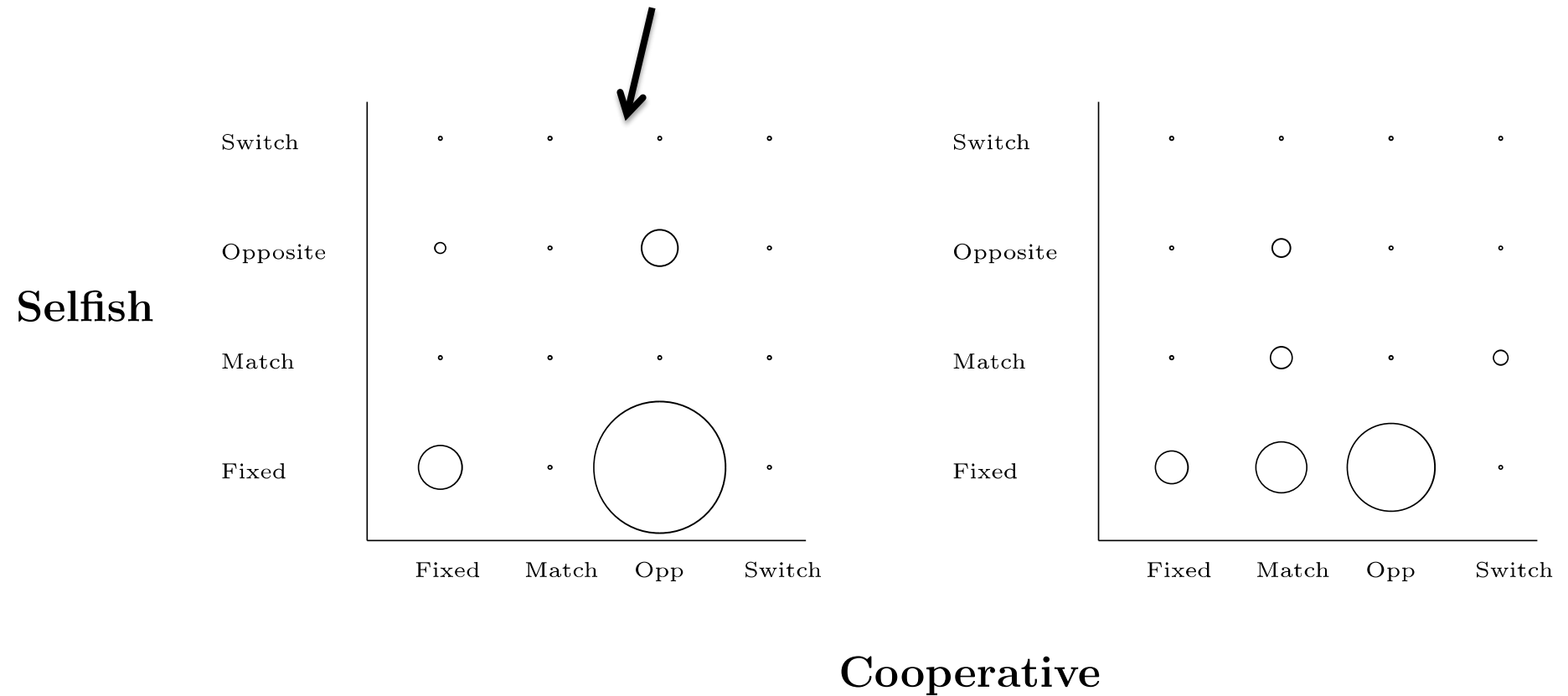


Figure 6: Behavior: Bottom Left and Knife Edge Following Bottom Left

# PD

**Effective Number of Behaviors: 4.58**

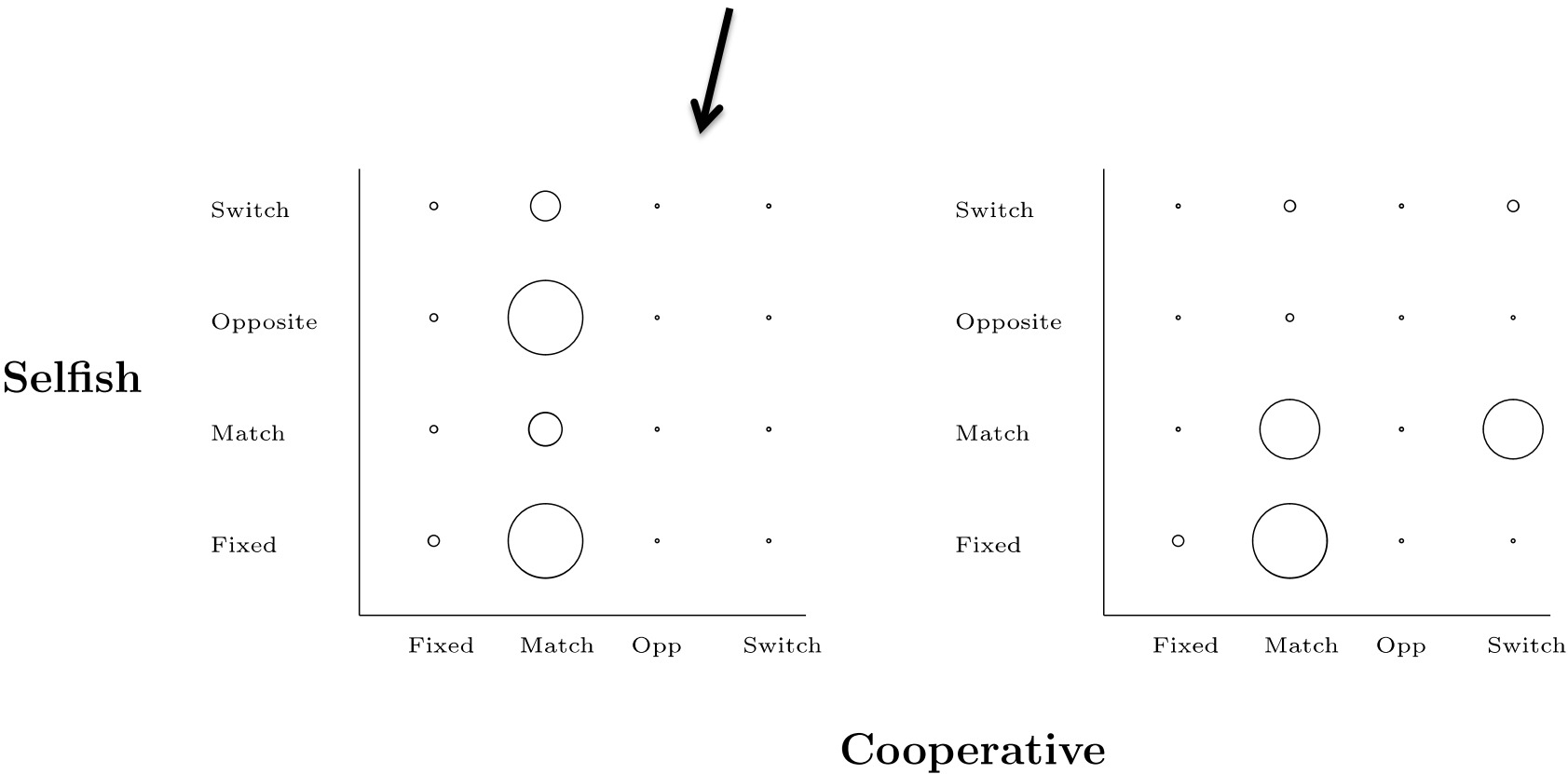
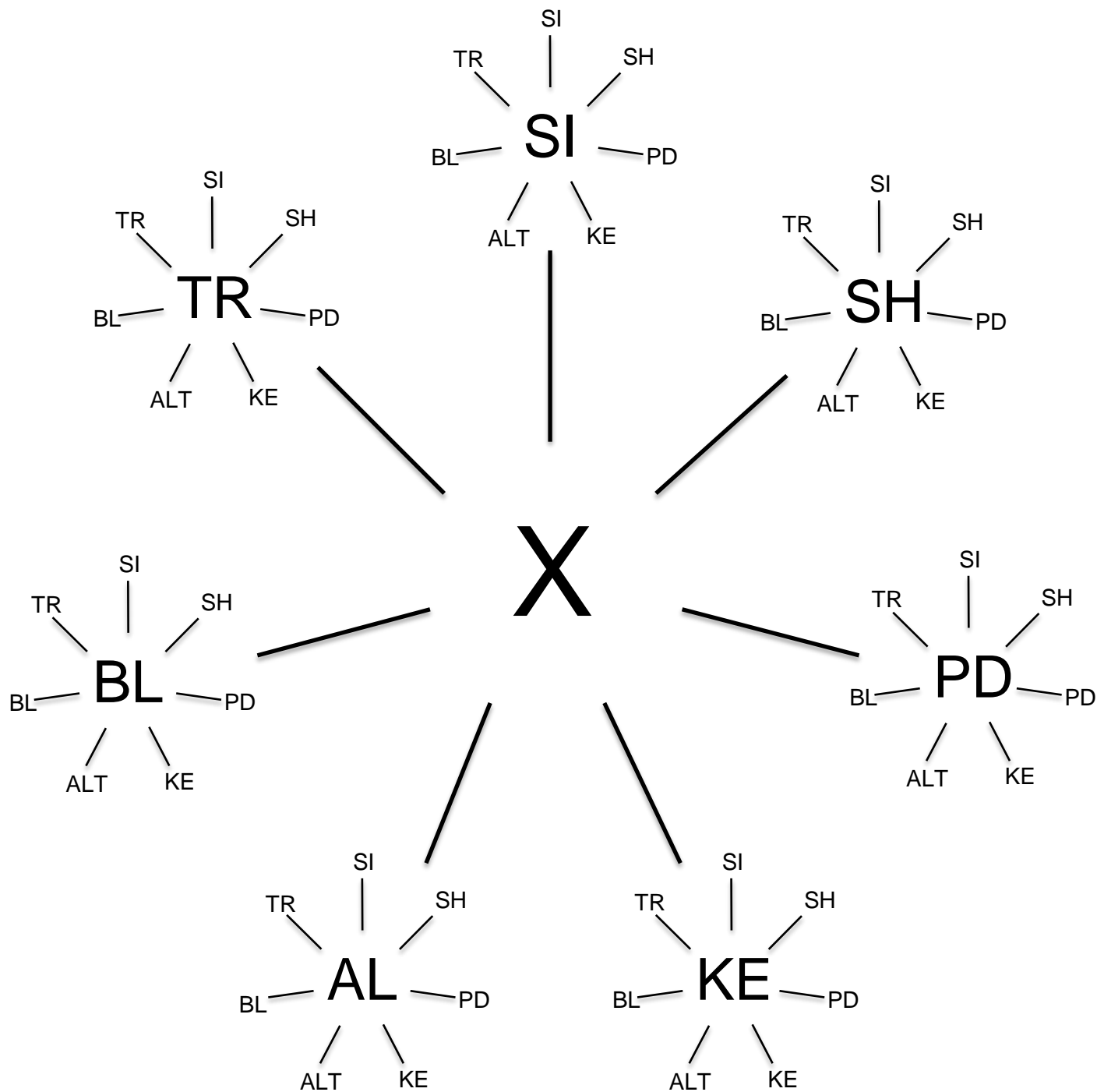


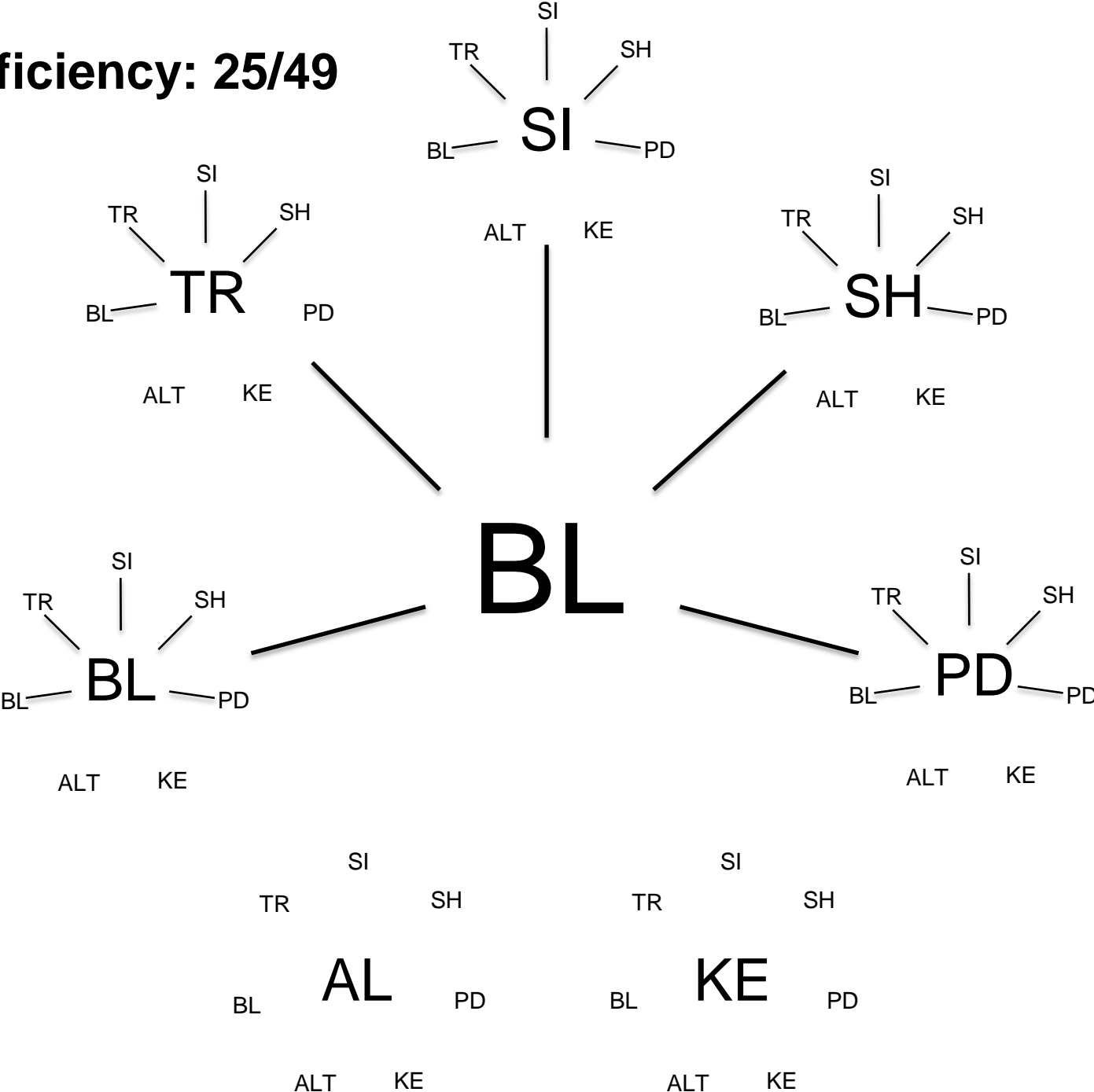
Figure 7: Behavior: Prisoners' Dilemma and Knife Edge Following Prisoners' Dilemma

# Diversity: Key Insights

- Diverse behaviors increase adaptability, resilience

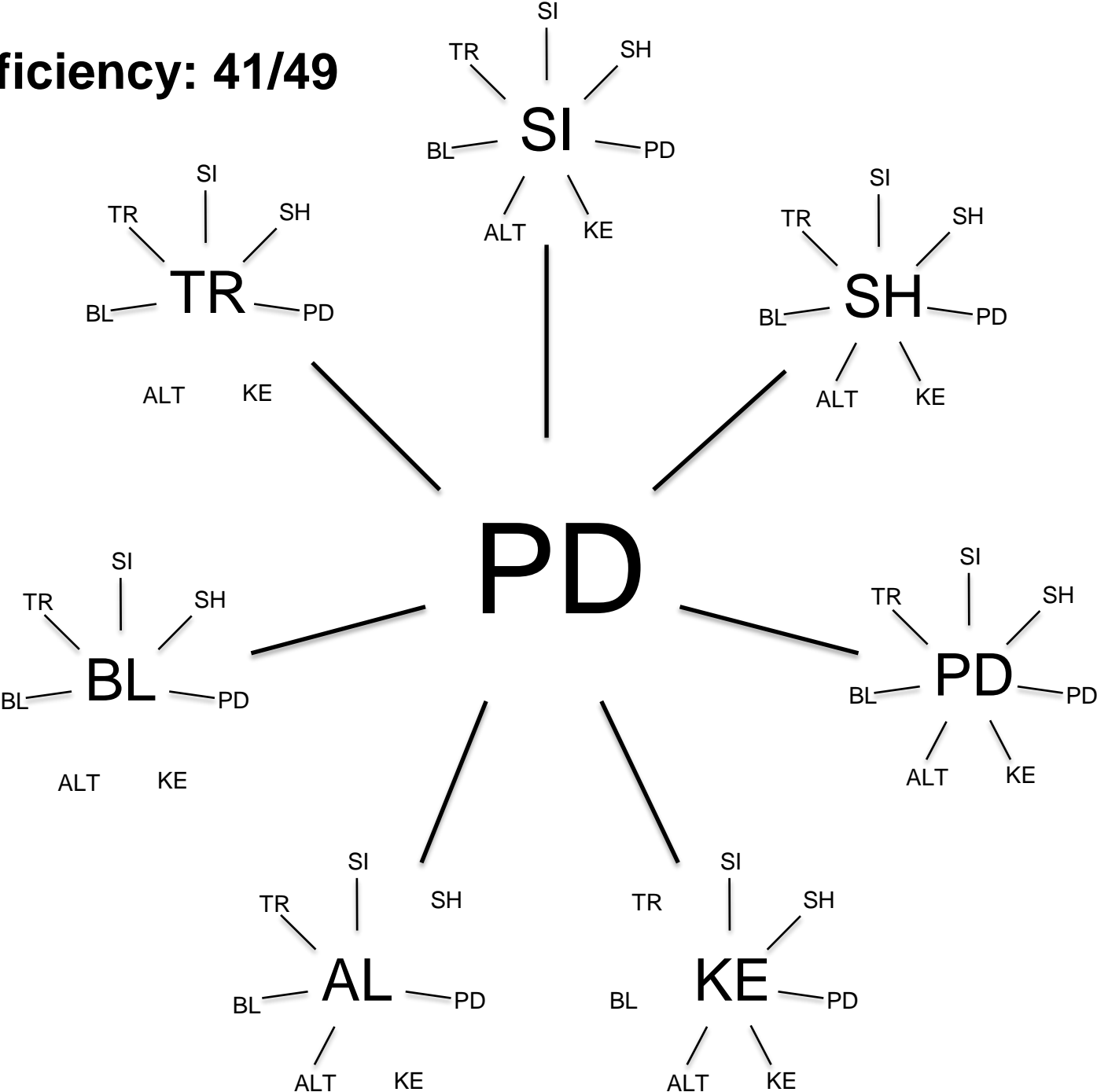


Path Efficiency: 25/49

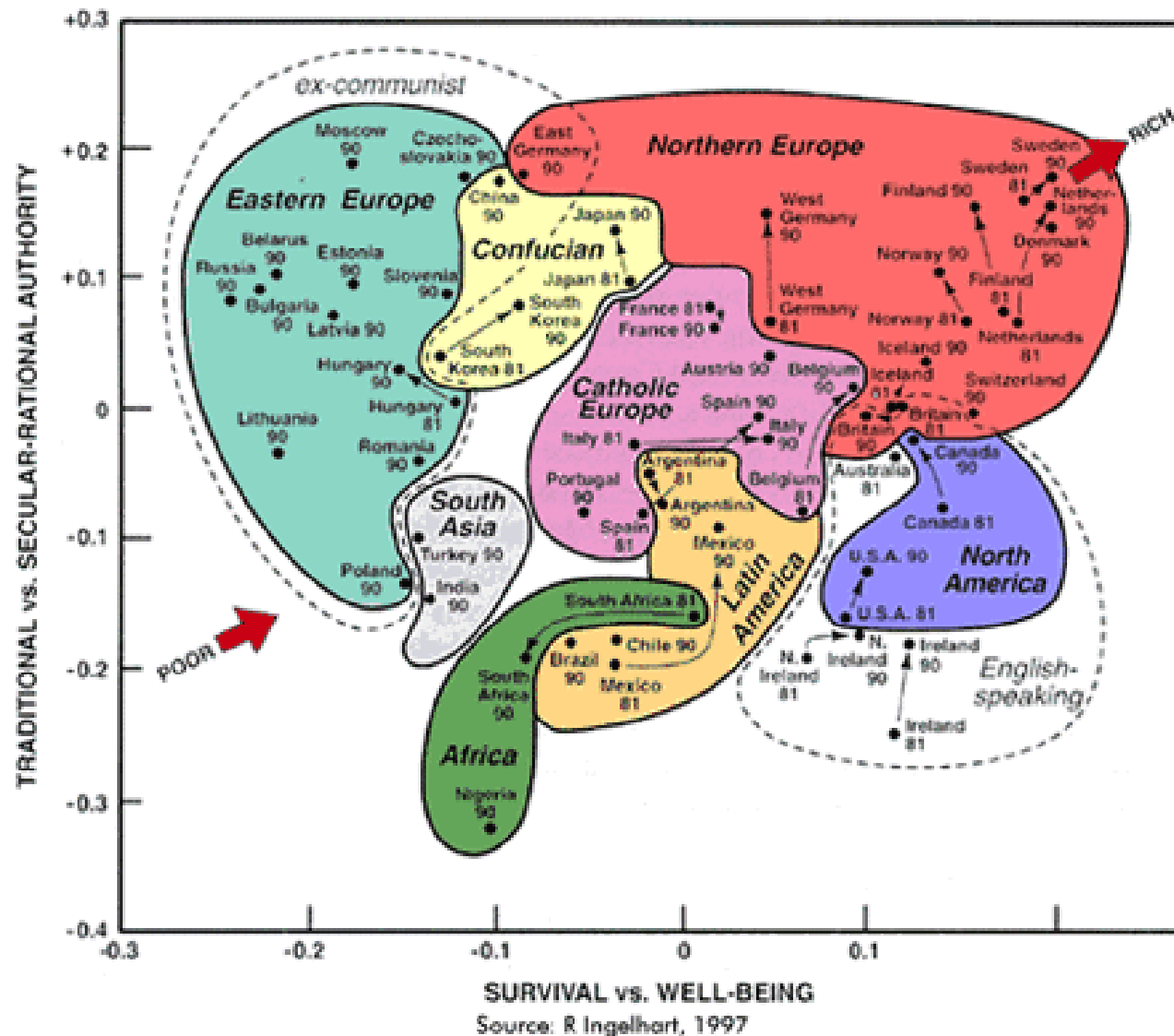




Path Efficiency: 41/49



Cultures are coherent; we have behavioral expectations based on culture



# Institutional Design



## Behavioral spillovers and cognitive load in multiple games: An experimental study<sup>☆</sup>

Jenna Bednar<sup>a,b,\*</sup>, Yan Chen<sup>c</sup>, Tracy Xiao Liu<sup>c</sup>, Scott Page<sup>d,b</sup>

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European Journal of Political Economy

Volume 40, Part B, December 2015, Pages 312–332

Behavioral Political Economy



Ann Arbor, MI 48109, United States

## Choosing a future based on the past: Institutions, behavior, and path dependence

Jenna Bednar<sup>a</sup>,  , Andrea Jones-Rooy<sup>b</sup>, Scott E. Page<sup>c</sup>,  

When Order Affects Performance:

Institutional Sequencing,

Cultural Sway, and Behavioral Path Dependence

Jenna Bednar and Scott E Page\*

September 20, 2015