

# Strategic Thinking In a Complex Environment

NASM

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# Music Education

Encouraging Creativity

Teaching Technique

Evaluating Performance

Humanistic Education

Cultural Pluralism

Public Outreach

Helpful  
to achieving the objective

Harmful  
to achieving the objective

Internal Origin  
(attributes of the organisation)

S

STRENGTHS

W

WEAKNESSES

External Origin  
(attributes of the environment)

O

OPPORTUNITIES

T

THREATS



# A Moment

Known Outcomes

Known Distribution of Outcomes

Alternative Scenarios Each With Different Distributions

Partially Known Scenarios, Distributions Uncertain


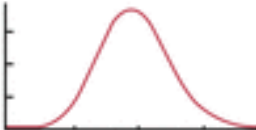
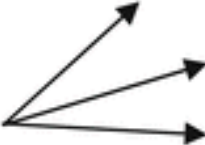
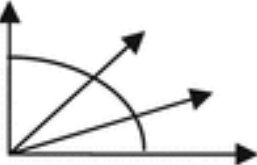
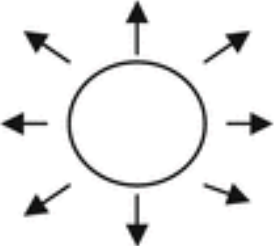
# A Moment

Known Outcomes

Known Distribution of Outcomes

Alternative Scenarios Each With Different Distributions

**Partially Known Scenarios, Distributions Uncertain: Complex**

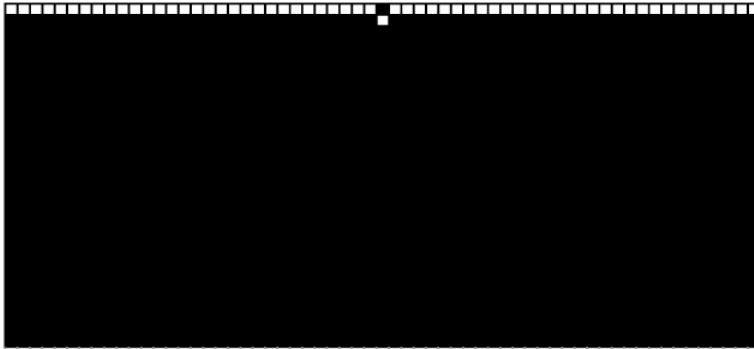
		LEVEL					
		Level 1	Level 2	Level 3	Level 4	Level 5	
LOCATION	Context	<div>A clear enough future</div> <div></div>	<div>Alternate futures (with probabilities)</div> <div></div>	<div>Alternate futures with ranking</div> <div></div>	<div>A multiplicity of plausible futures</div> <div></div>	<div>An unknown future</div> <div></div>	
	System model	<div>A single (deterministic) system model</div>	<div>A single (stochastic) system model</div>	<div>Several system models, one of which is most likely</div>	<div>Several system models, with different structures</div>	<div>Unknown system model; know we don't know</div>	
	System outcomes	<div>A point estimate for each outcome</div>	<div>A confidence interval for each outcome</div>	<div>Several sets of point estimates, ranked according to their perceived likelihood</div>	<div>A known range of outcomes</div>	<div>Unknown outcomes; know we don't know</div>	
	Weights on outcomes	<div>A single set of weights</div>	<div>Several sets of weights, with a probability attached to each set</div>	<div>Several sets of weights, ranked according to their perceived likelihood</div>	<div>A known range of weights</div>	<div>Unknown weights; know we don't know</div>	
		Complete Certainty				Total Ignorance	

# Complexity: BOAR

Between Ordered and Random

# Four Classes of Behavior

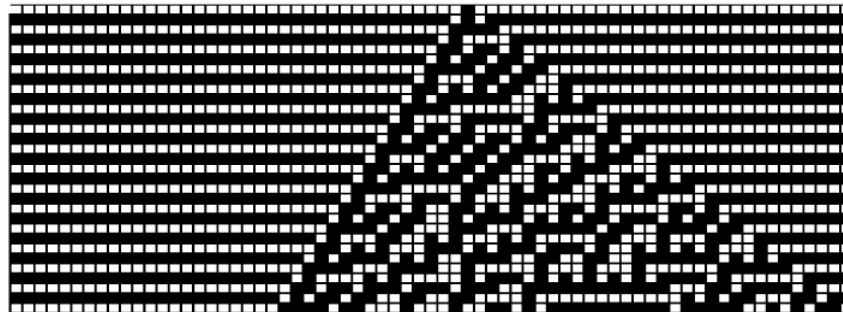
**Class I: Rule 251**



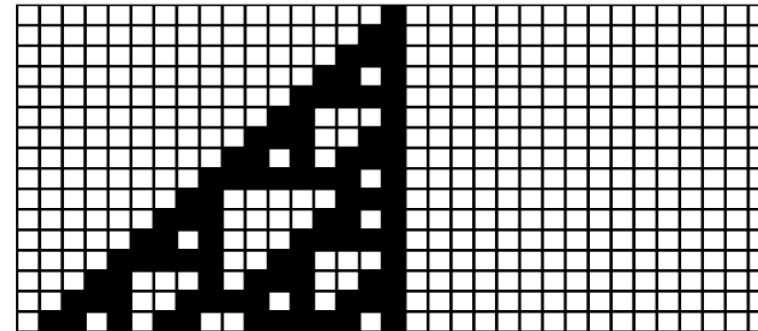
**Class II: Rule 119**



**Class III: Rule 45**

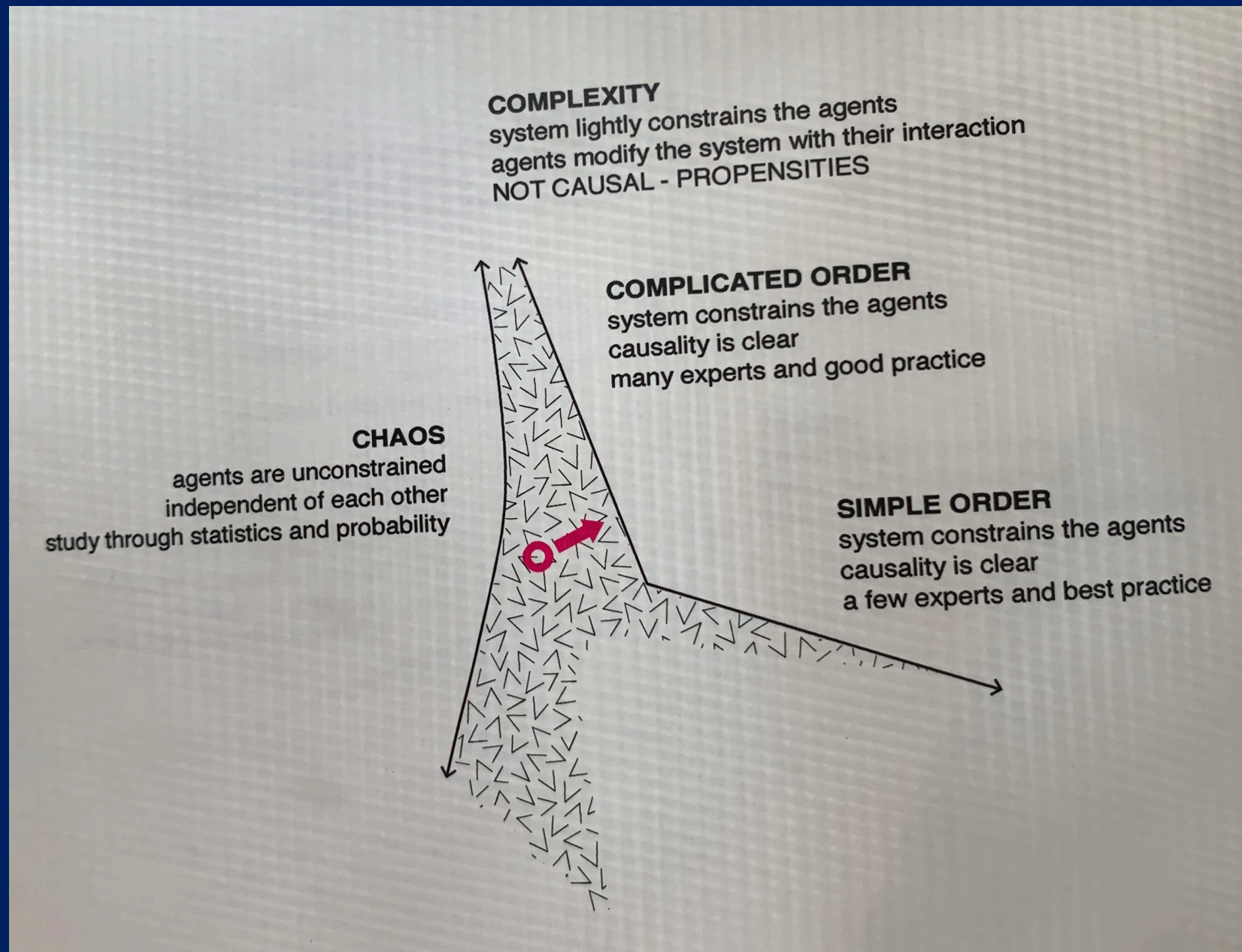


**Class IV: Rule 110**



**Source:** From Wolfram (2002, pp. 55-56)





# Strategic Thinking During High Complexity



fx						
	A	B	C	D	E	F
1	P	R	I	D	E	
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

Hundreds of Studies: Algorithms (Simple Rules) vs “Gut”

Algorithms Win Big: 50%

Kahneman, Rosenfield, Gandhi, Blaser, “How to Overcome the High Hidden Cost of Biased Decision Making,”  
*Harvard Business Review*, 2016

Hundreds of Studies: Algorithms (Simple Rules) vs “Gut”

Algorithms Win Big: 50%

Approximately the Same: 50%

# Human Biases

Escalation of Commitment

Anchoring

Framing

Availability

Overconfidence

# Gut vs Analytics

## Gut

Experience

Track Record

Common Situation

Fast Moving

## Analytics

Few Distinct Options

Lots of Data

Novel

Voice and Consensus Matter

# Goals

Better Decisions During Complex Period

Risk & Opportunity Awareness

Collective Intelligence



# Goals

Better Decisions During Complex Period

Risk & Opportunity Awareness

Collective Intelligence

**Bonus: Sense of Community & Richer Self Understanding**

# Part 1: Strategic Tools With Your Community

Qualitative Decision Theory

Multi-Criterion Decision Making

# Part 2: Conceptual Models

Dancing Landscapes

Multi-Armed Bandit: Value of Information

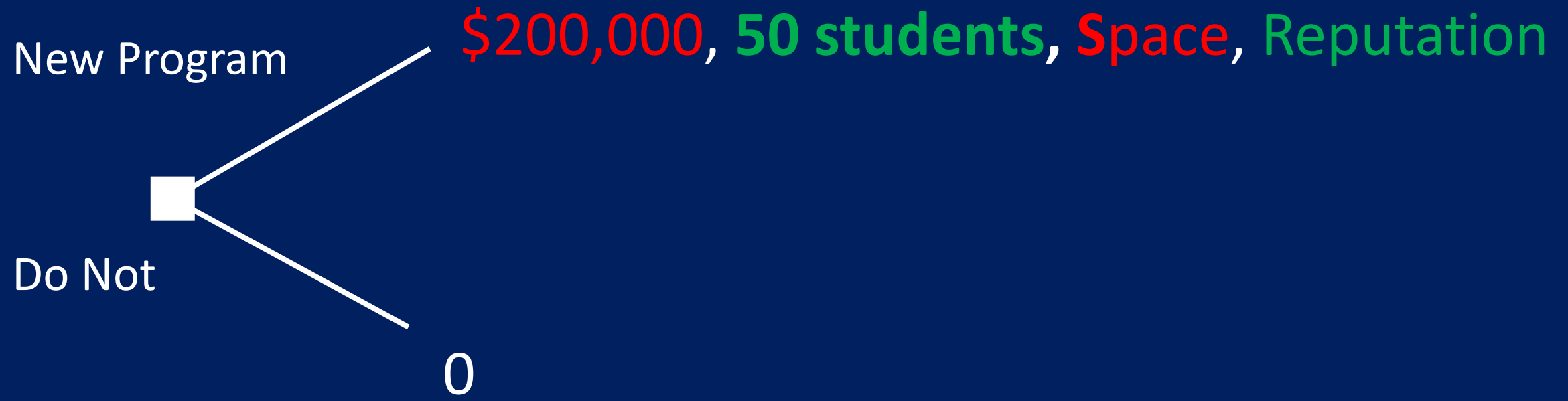
# Decision Theory

New Program



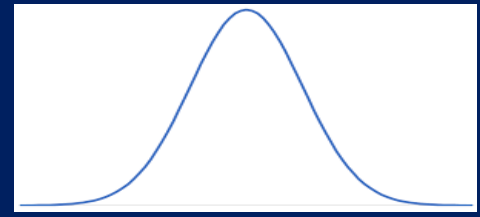
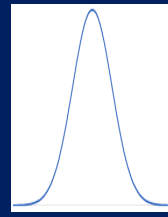
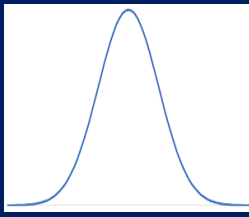
Do Not

# Decision Theory: Certainty



# Decision Theory: Uncertainty





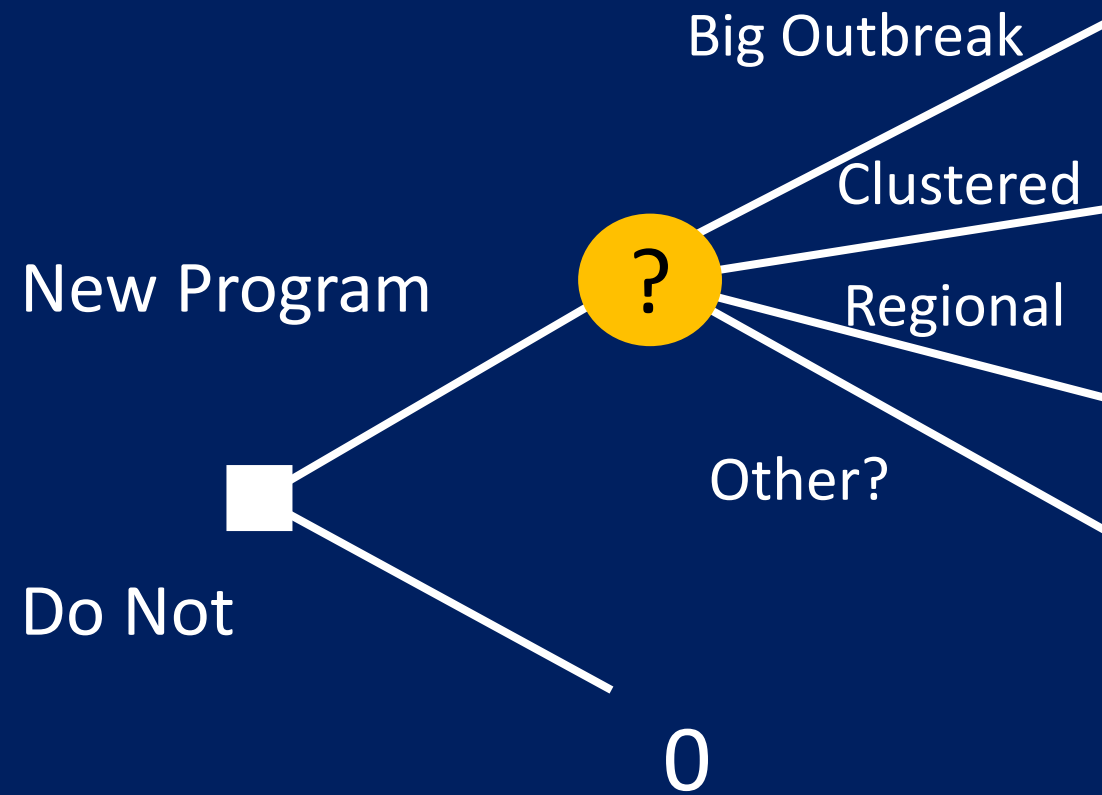
New Program

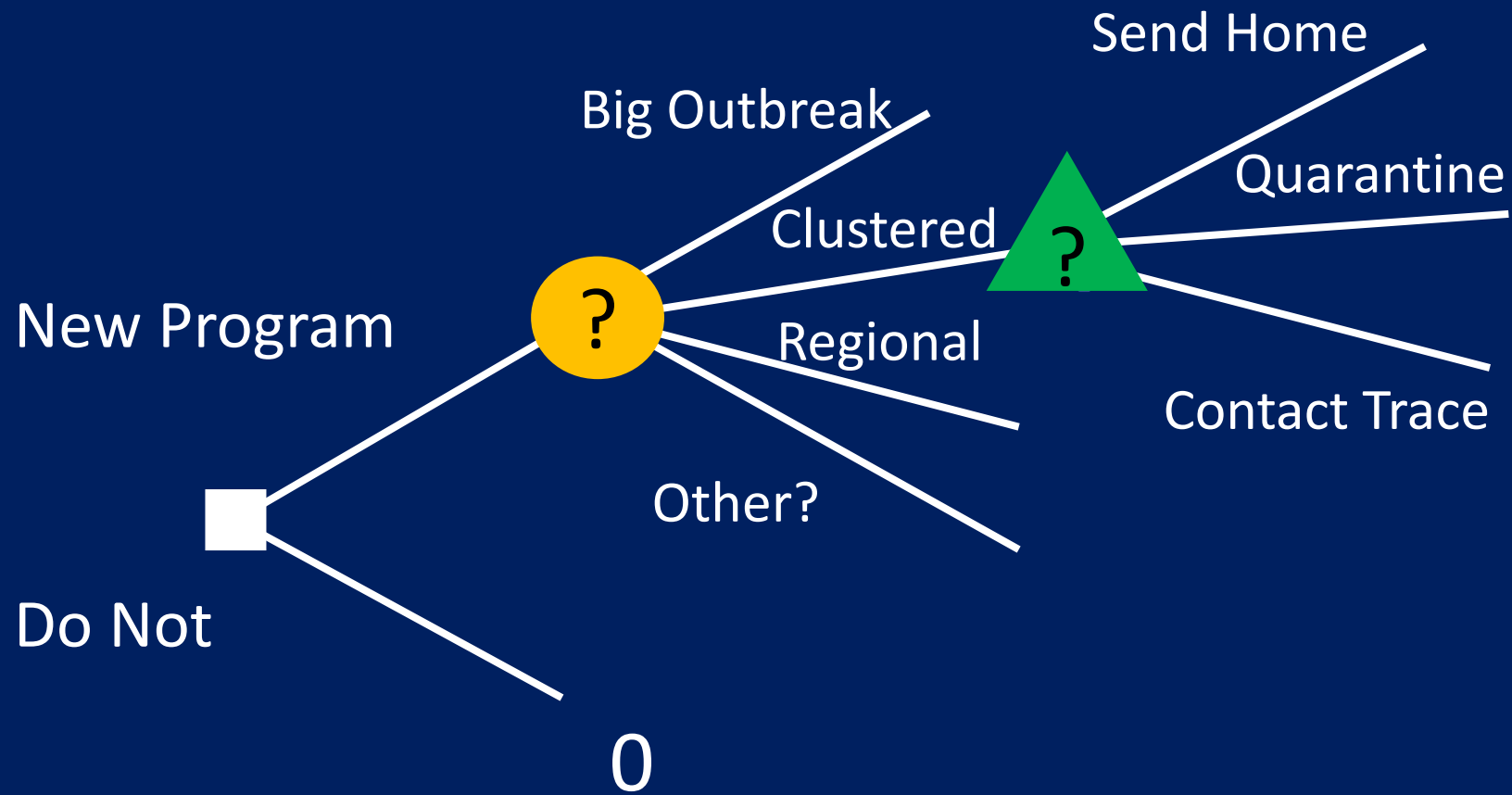
\$200,000, 50 students, Space, Reputation

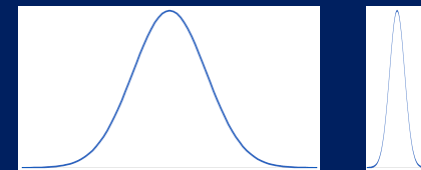
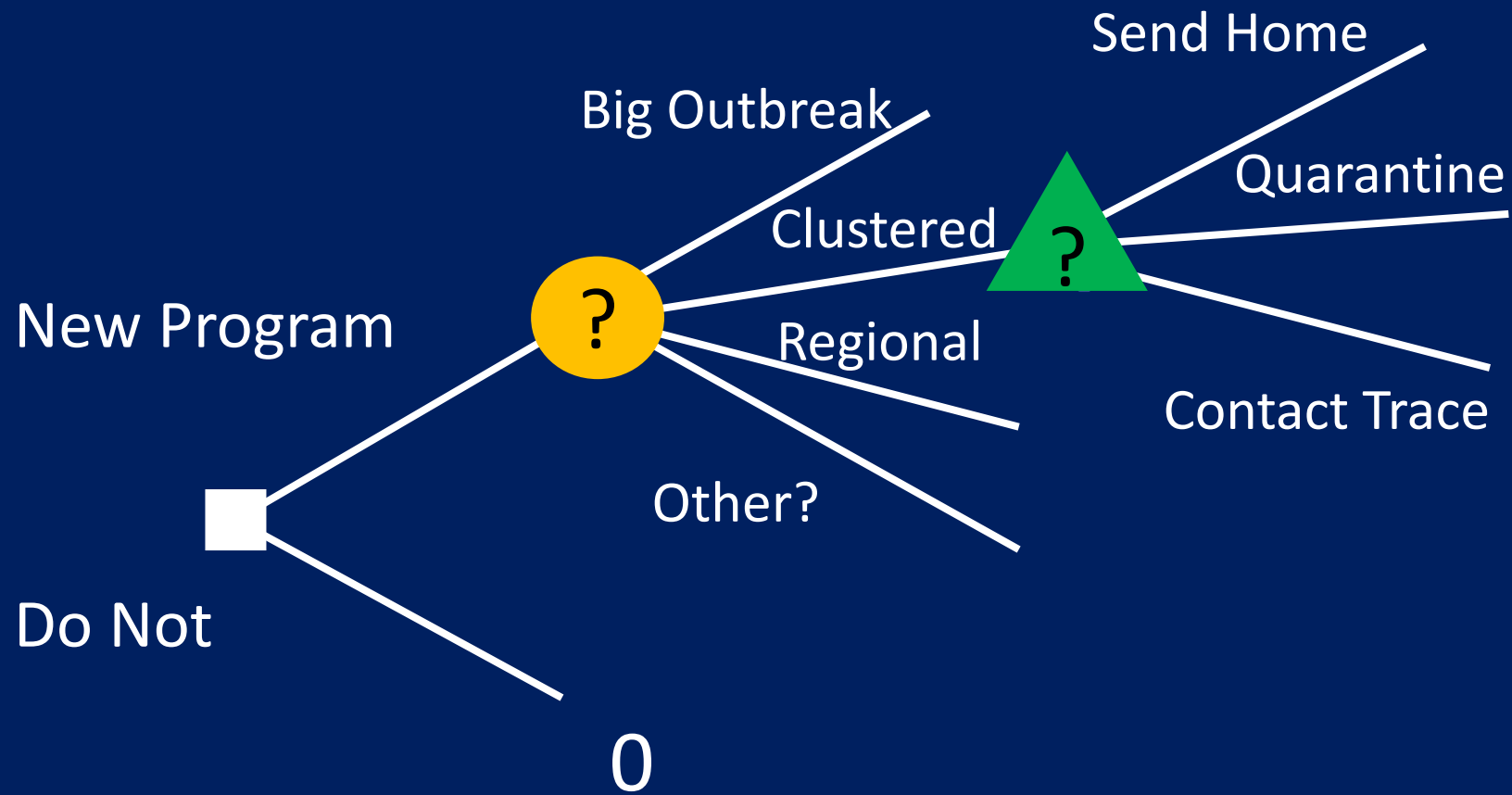
Do Not

0

# Qualitative Decision Theory: Complexity





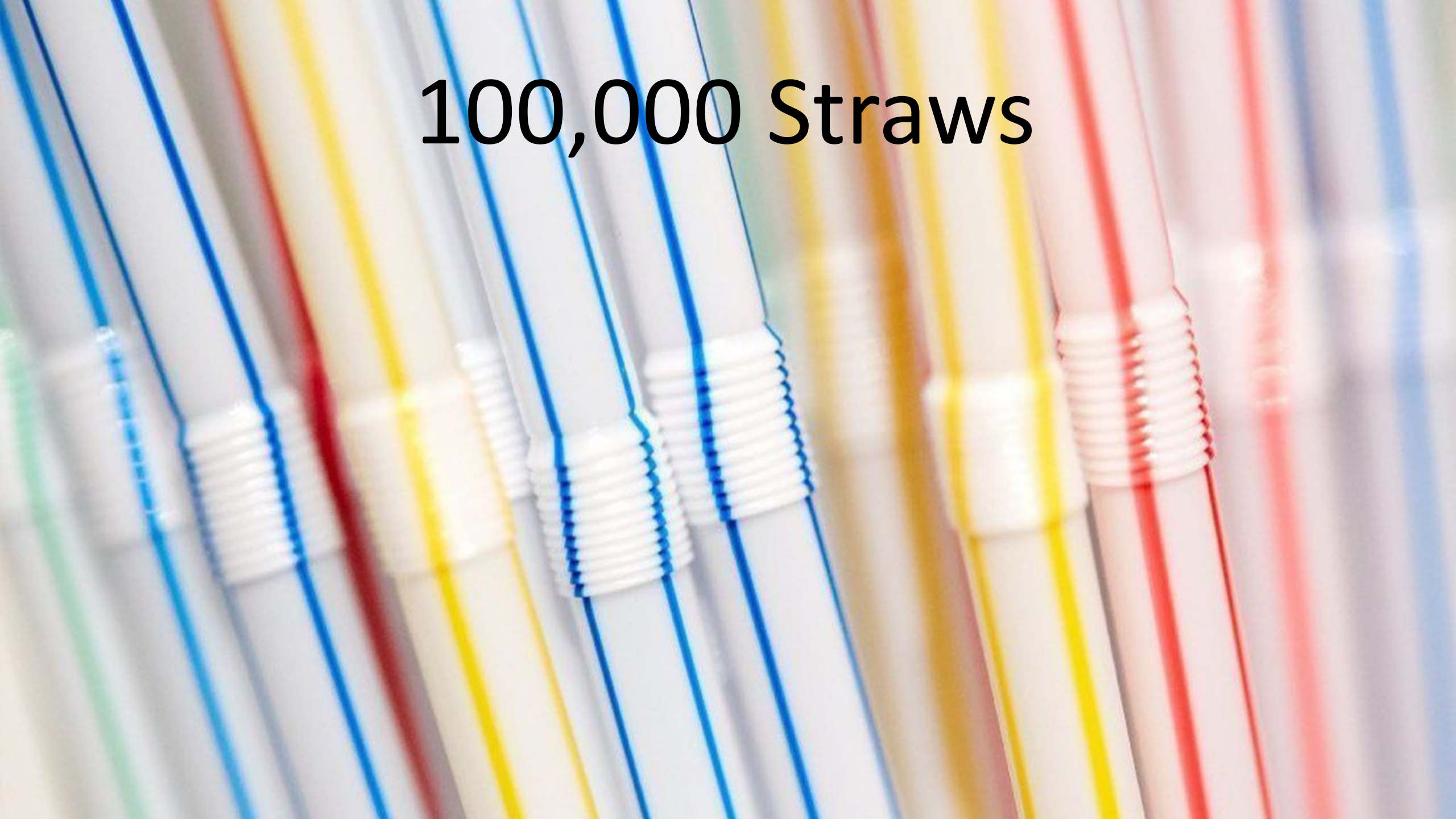


Look to Your Community for Scenarios

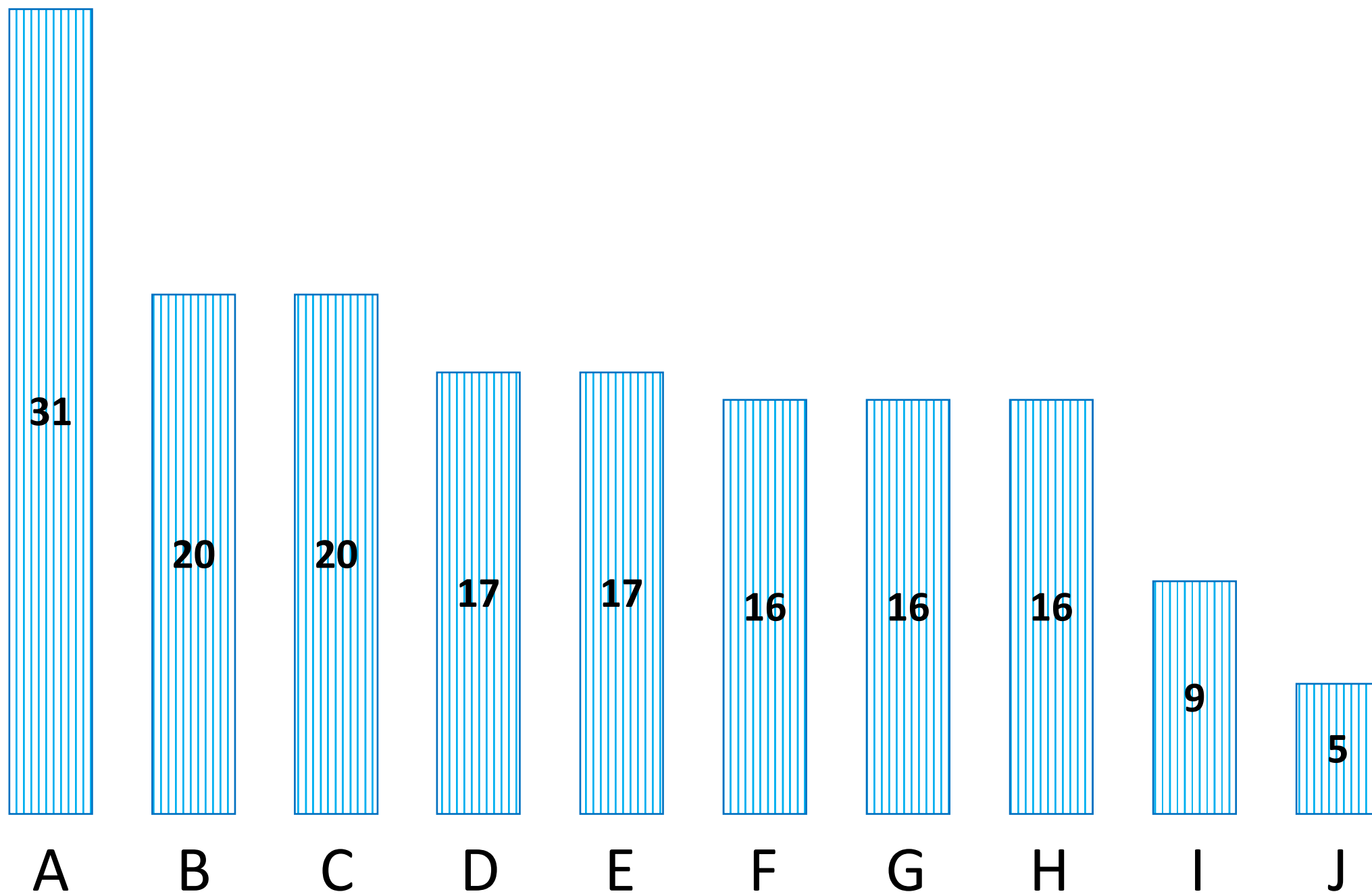
# Possible Scenarios: Alternative Uses Test



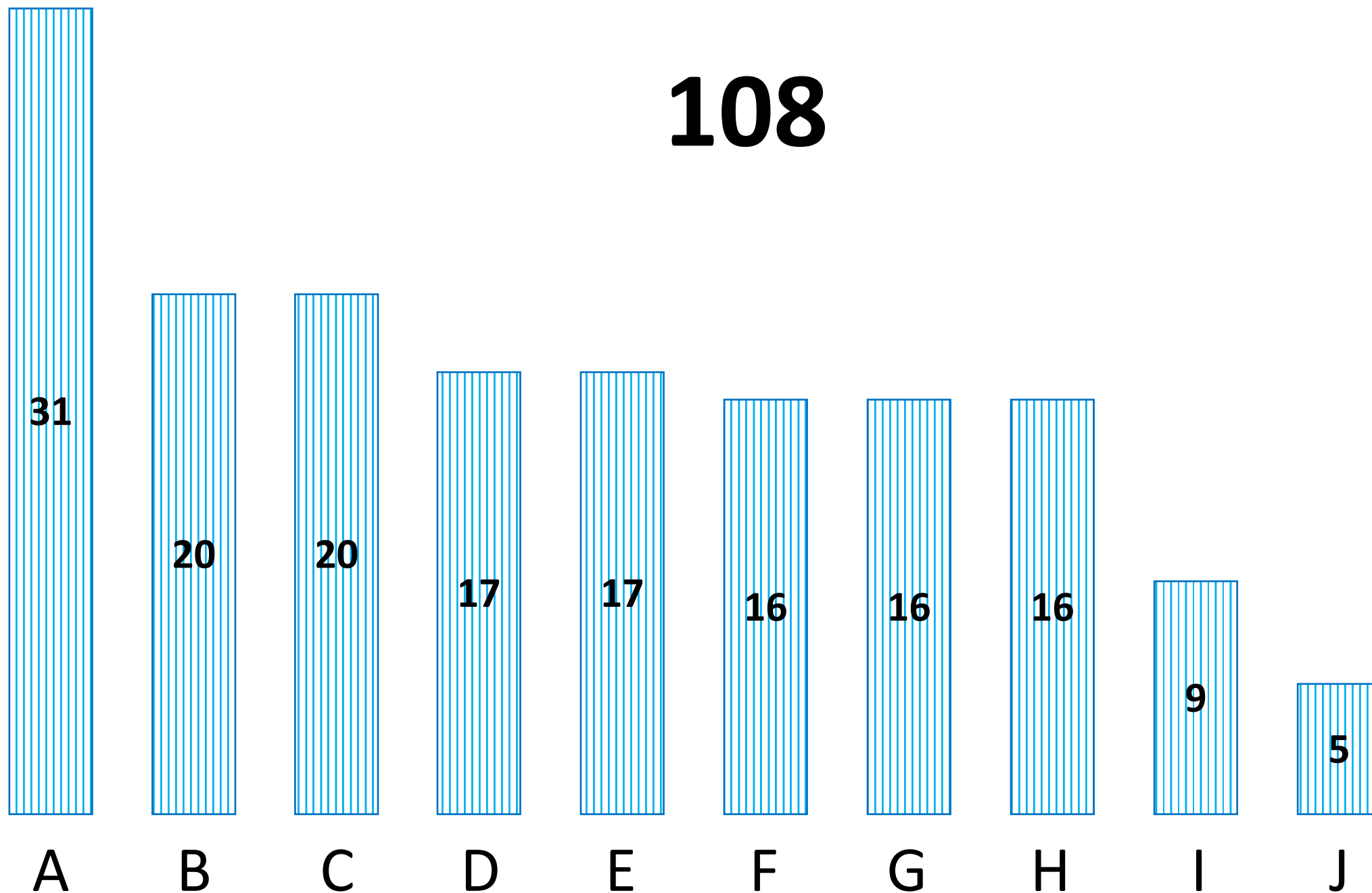
100,000 Straws







**108**



# Community Generated Scenarios

Quarantine All

Essential Workers

Gatherings of Fewer than X people

Tests at Cost  $\$C$

Contact Tracing Protocols

# Generate then Evaluate

Give everyone an opportunity to think of scenarios

Anonymously rank (vote up or down)

Discuss relative likelihood

# Determine Outcomes: Delphi Method

## DELPHI FORECASTING METHOD



## BRAINWRITING



© MARGREET DE HEER  
CPS 11-11-2007

# Four Step Process

Step 1: Describe what you think could happen under each scenario

Step 2: Have someone synthesize, collect reasons

Step 3: Have people rewrite or rank reasons

Step 4: Create new synthesis

# Best, Most Likely, Worst

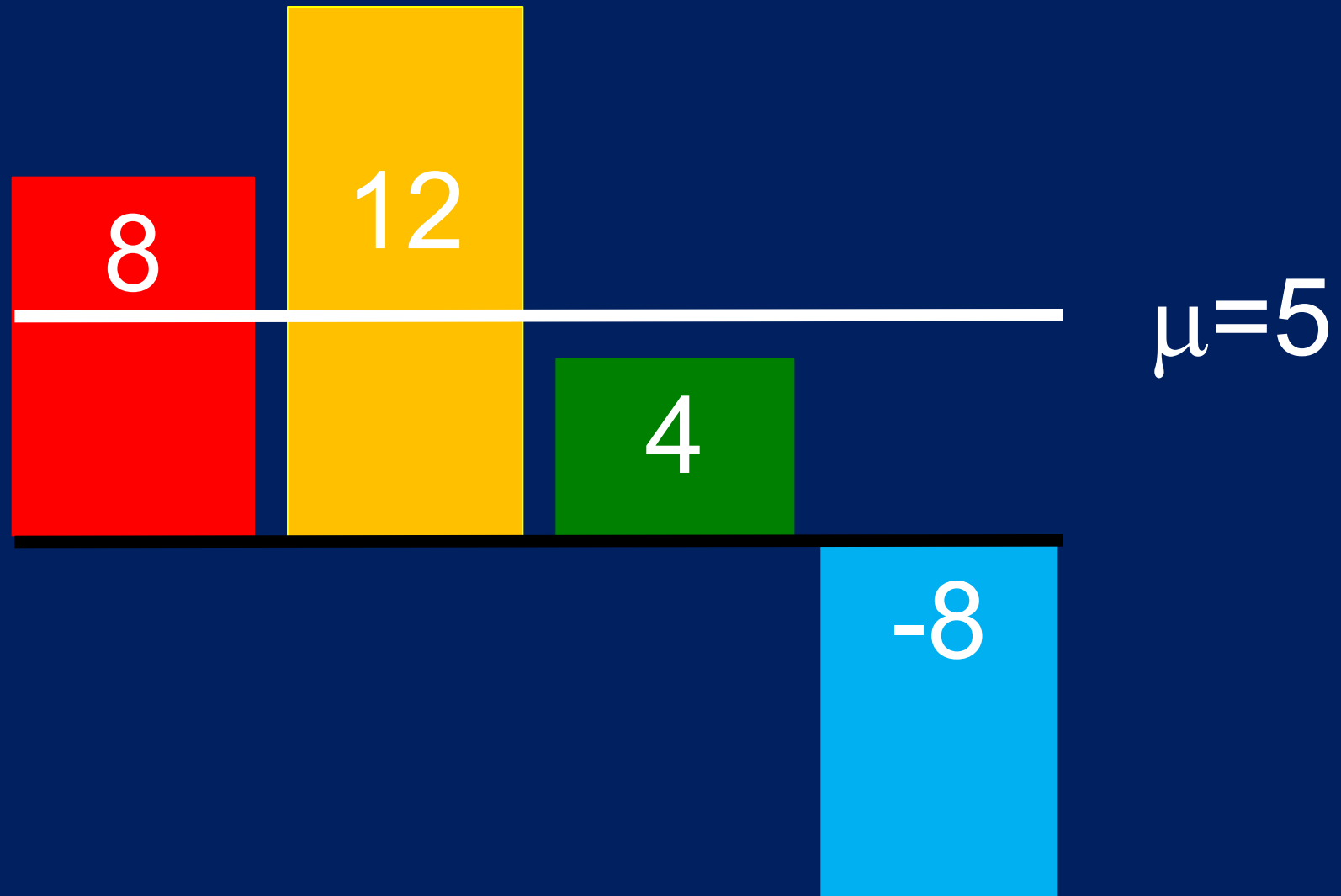
For each decision, consider the best case, most likely case, and the worst case.

May care more about minimizing regret than expected value

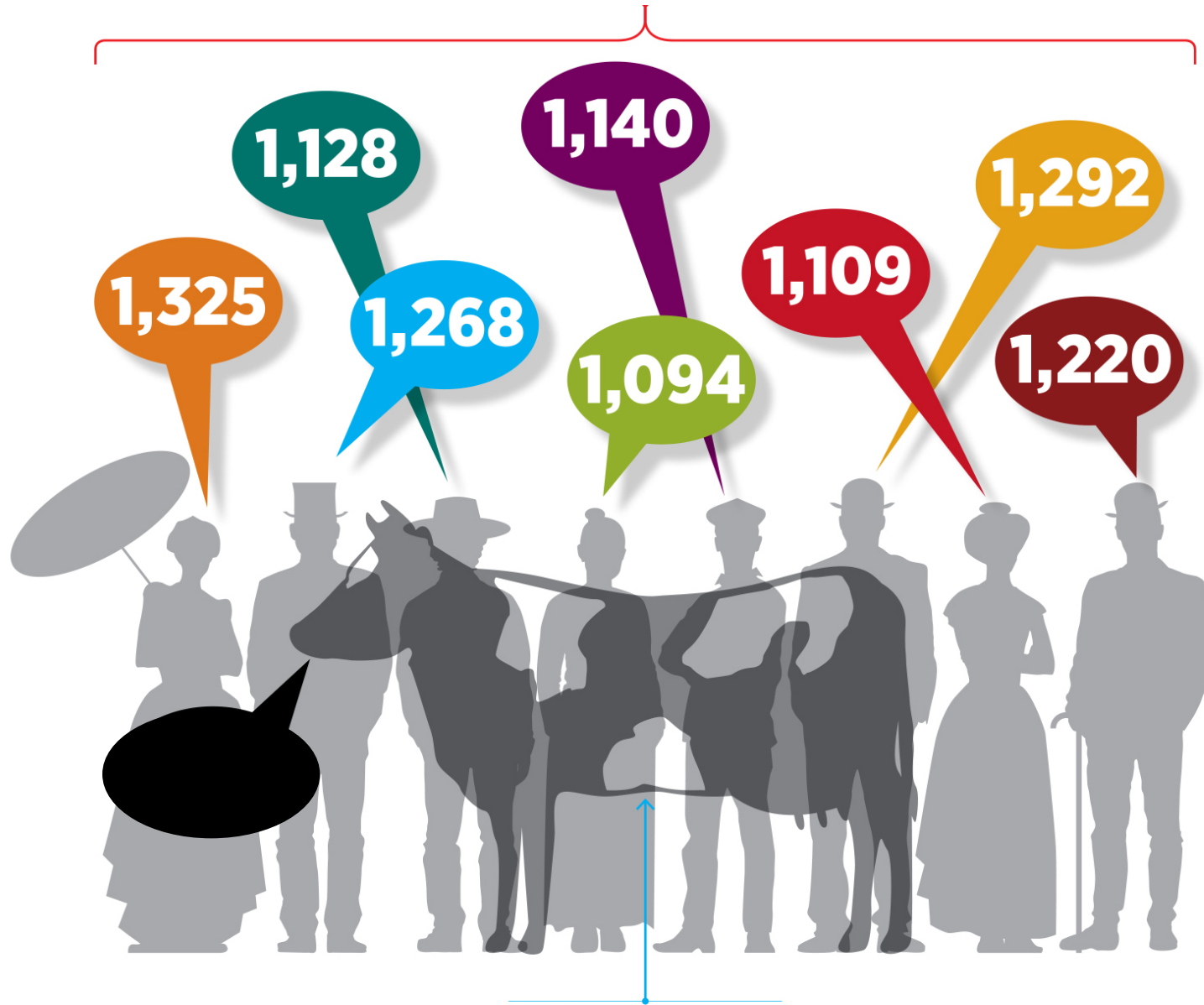
# Logic/Power of Diversity



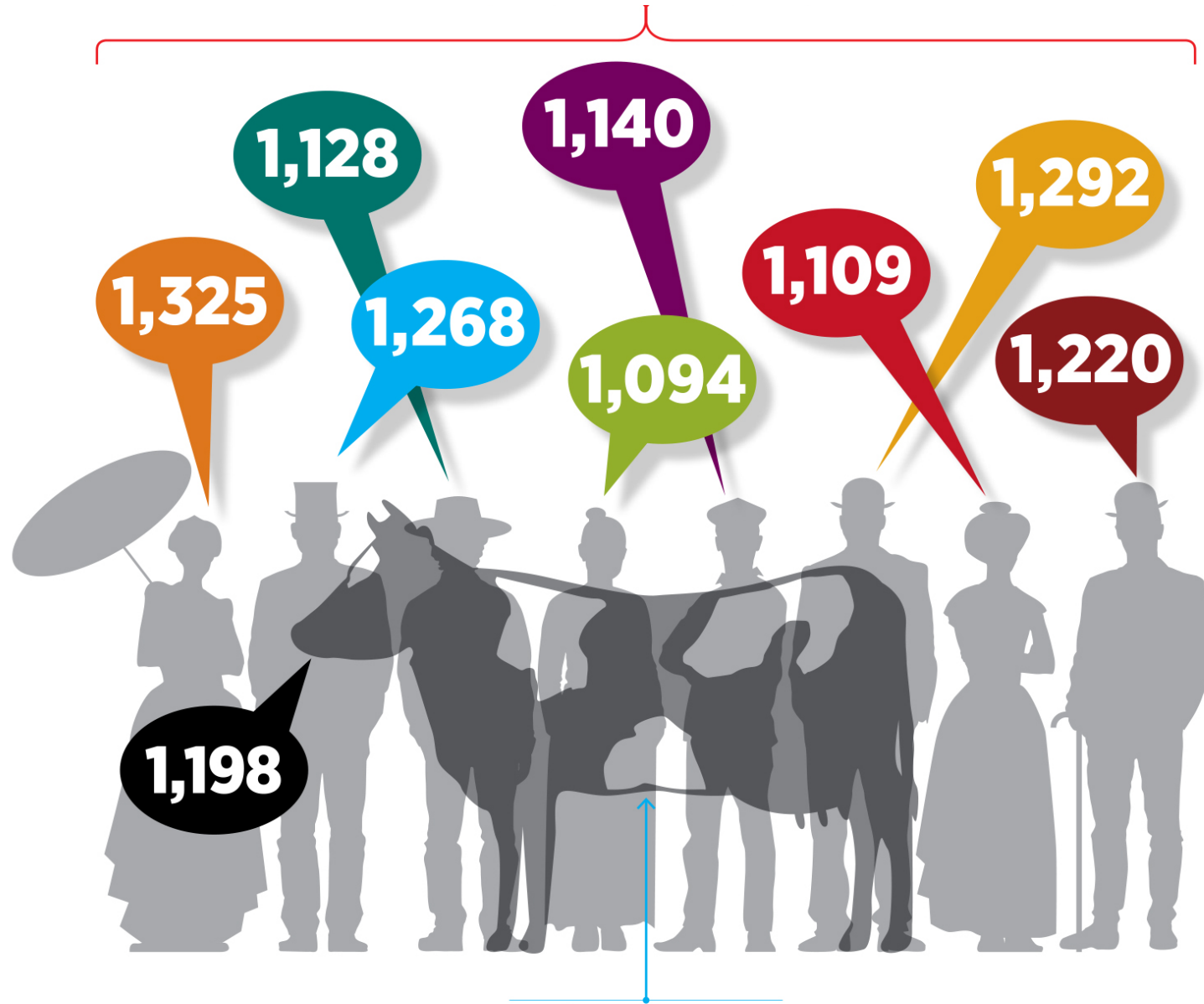
# Portfolio: Average



Average = 1,197



Average = 1,197



# Diversity Prediction Theorem

$$\text{Crowd Error} = \text{Average Error} - \text{Diversity}$$

# Diversity Prediction Theorem

Crowd Error = Average Error - Diversity

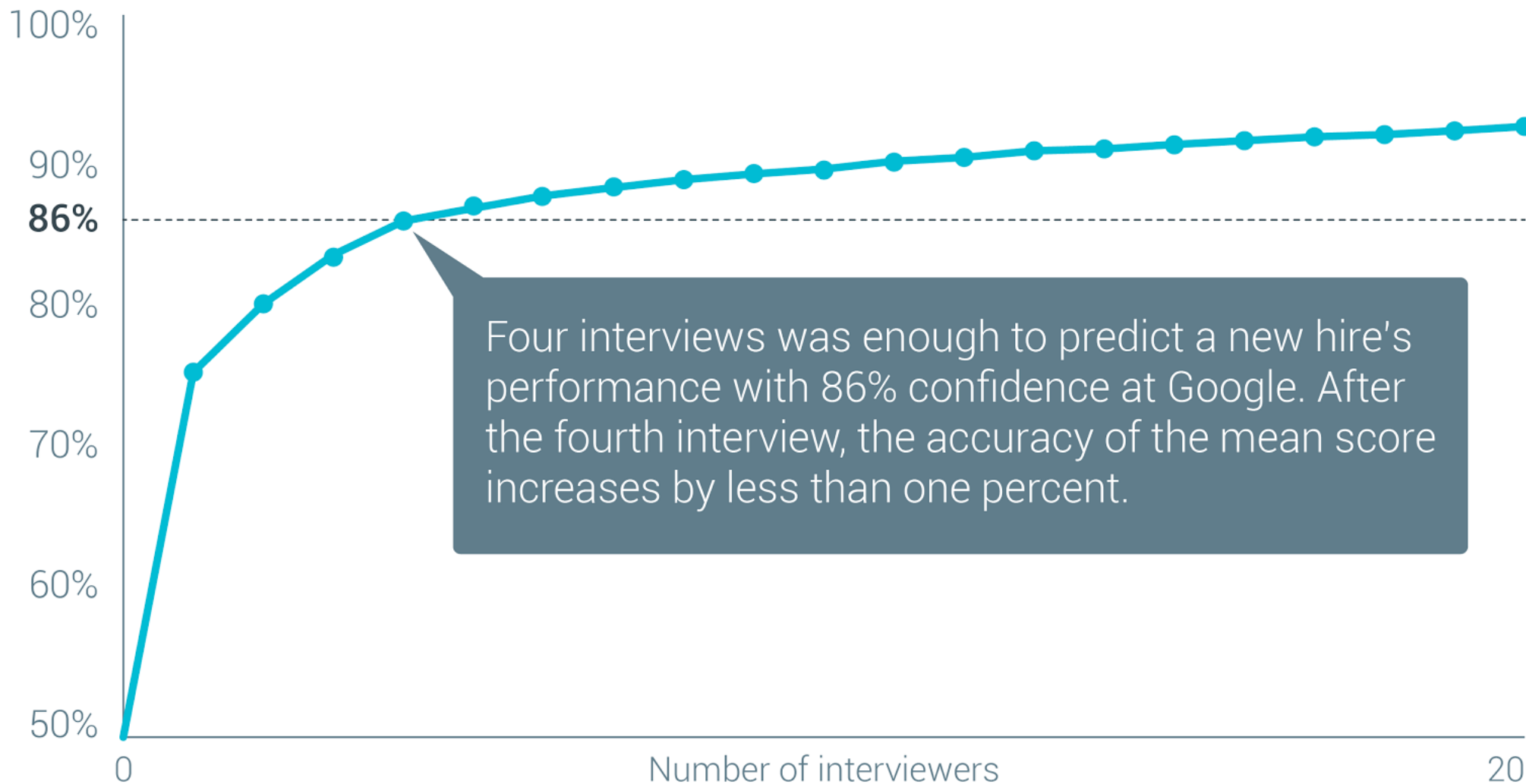
$$(c - \theta)^2 = \frac{1}{n} \sum_{i=1}^n (s_i - \theta)^2 - \frac{1}{n} \sum_{i=1}^n (s_i - c)^2$$

# Galton's Steer

Crowd Error = Average Error – Diversity

$$2 = 5410 - 5408$$

# Increase in accuracy (ability to predict hire/no hire decision) of the mean interview score



# Why on Complex Problems?

Crowd Error = Average Error – Diversity

= BIG



# Why on Complex Problems?

Crowd Error = Average Error – Diversity

small = BIG

# Why on Complex Problems?

Crowd Error = Average Error – Diversity

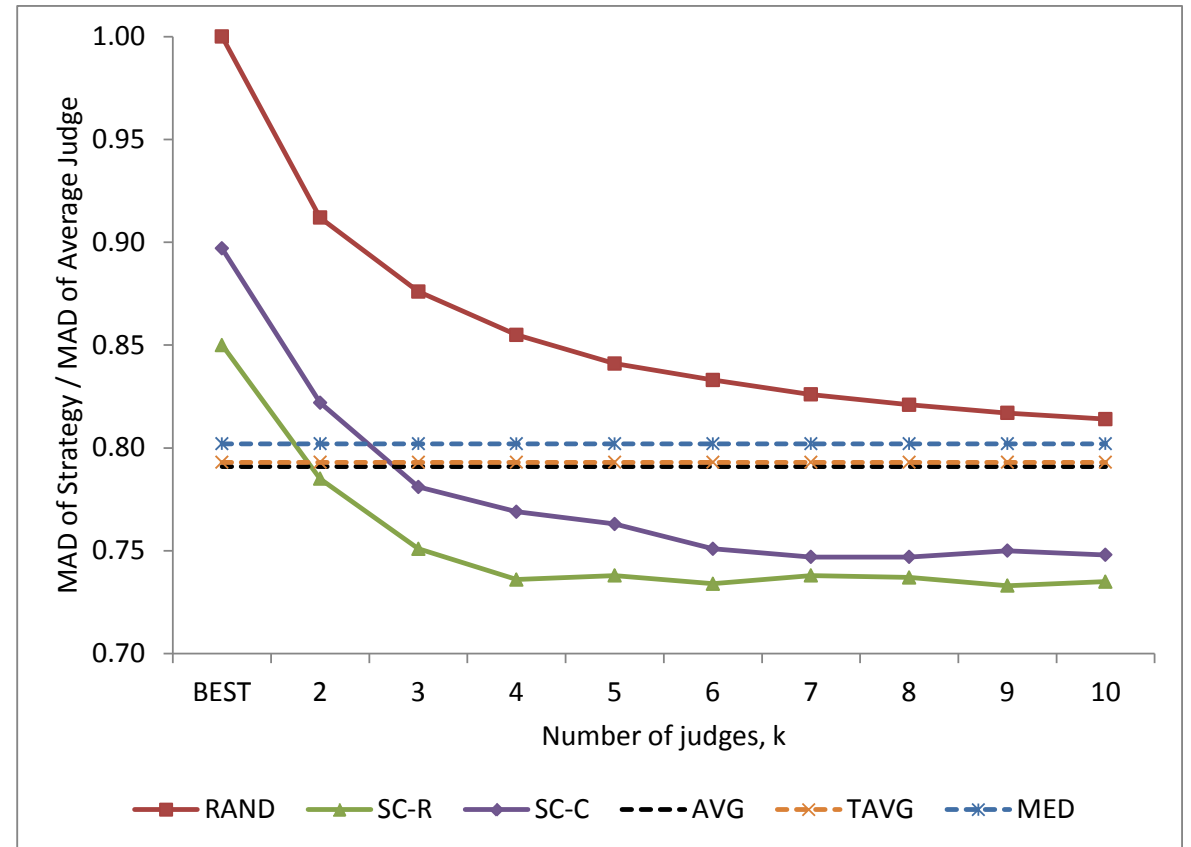
small = BIG – BIG

# Economic Forecasts 1969-2009

28,000 forecasts by  
professional economists  
6 economic indicators

Crowd mean 21% better than  
average economist

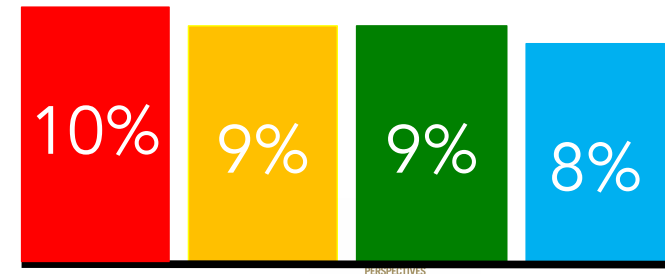
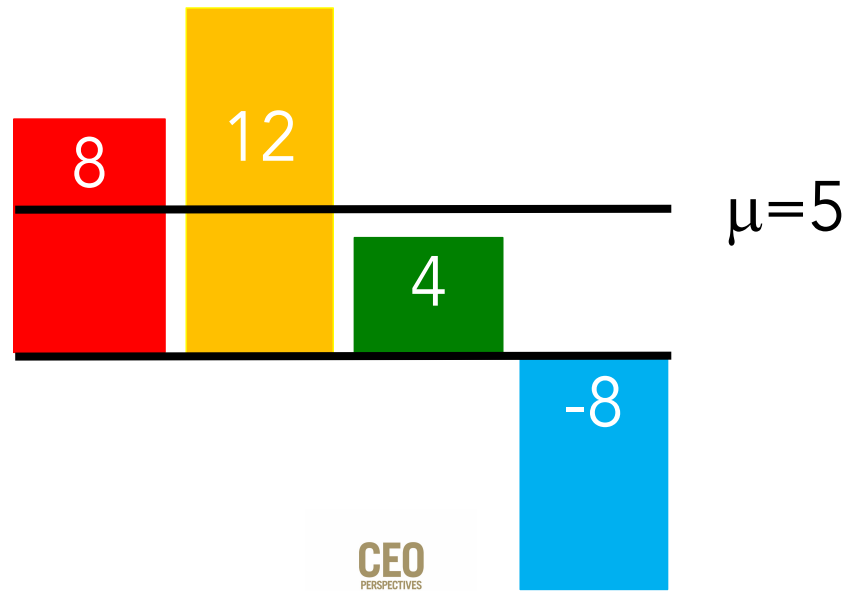
Mannes, A. E., Soll, J. B., & Larrick, R. P. (2014). "The wisdom of select crowds." *Journal of Personality and Social Psychology*, 107, 276-299.



## Predictors: Bonus

Crowd = 22%

### Portfolio: Average



# Multi-Criterion Decision Making

# Multi-Criterion Decision Making: Certainty

# Continue a Program?

Known Criteria:

Quality

Importance

Attendance

Student Involvement

.....

# One on One Tutoring: Zoom or In Person?

Criteria?



# One on One Tutoring: Zoom or In Person?

Evaluation

Safety

Sound

Technique

Community

.....

# Allow Community to Weight Importance

**Very Important (irreparable)**

**Moderately Important (reparable)**

Evaluation

Safety

Sound

Technique

Community

.....

# Voice

Safety: ZOOM ++

Sound: Person +

Technique: Person +

Community: Person +

.....

# Piano

Safety: ZOOM +

Sound: Person +

Technique: Person ++

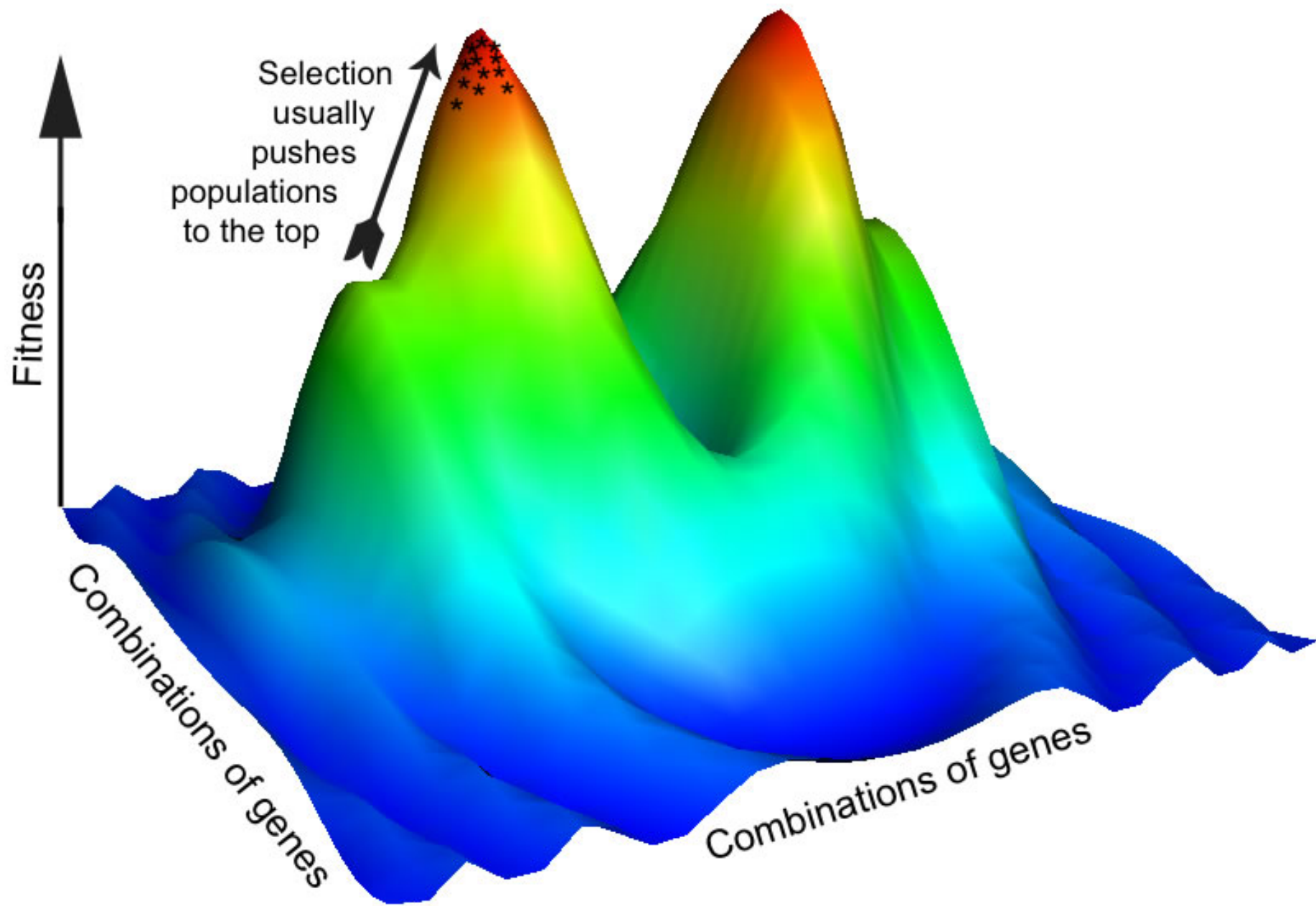
Community: Person +

.....

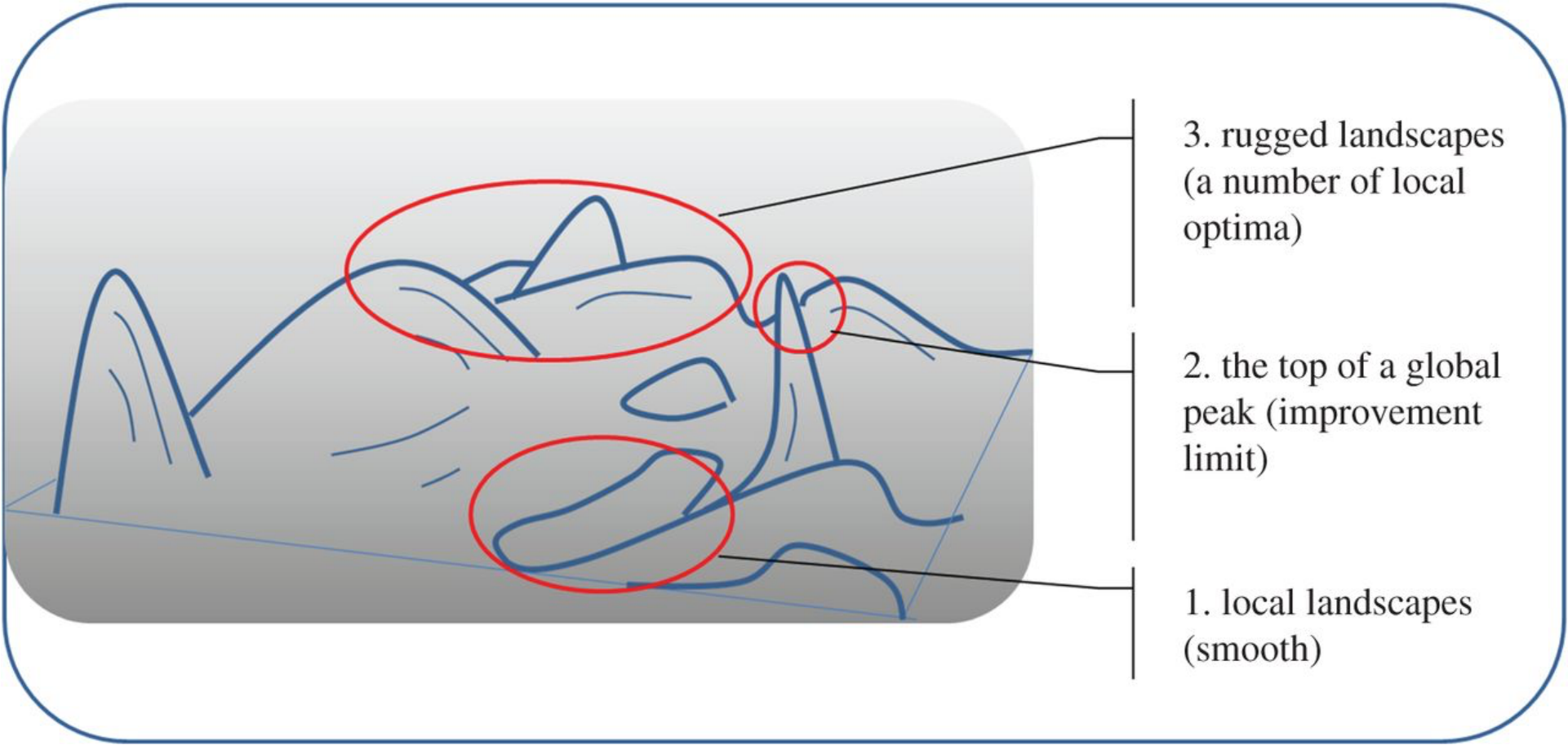
# Part 2: Conceptual Models

Dancing Landscapes

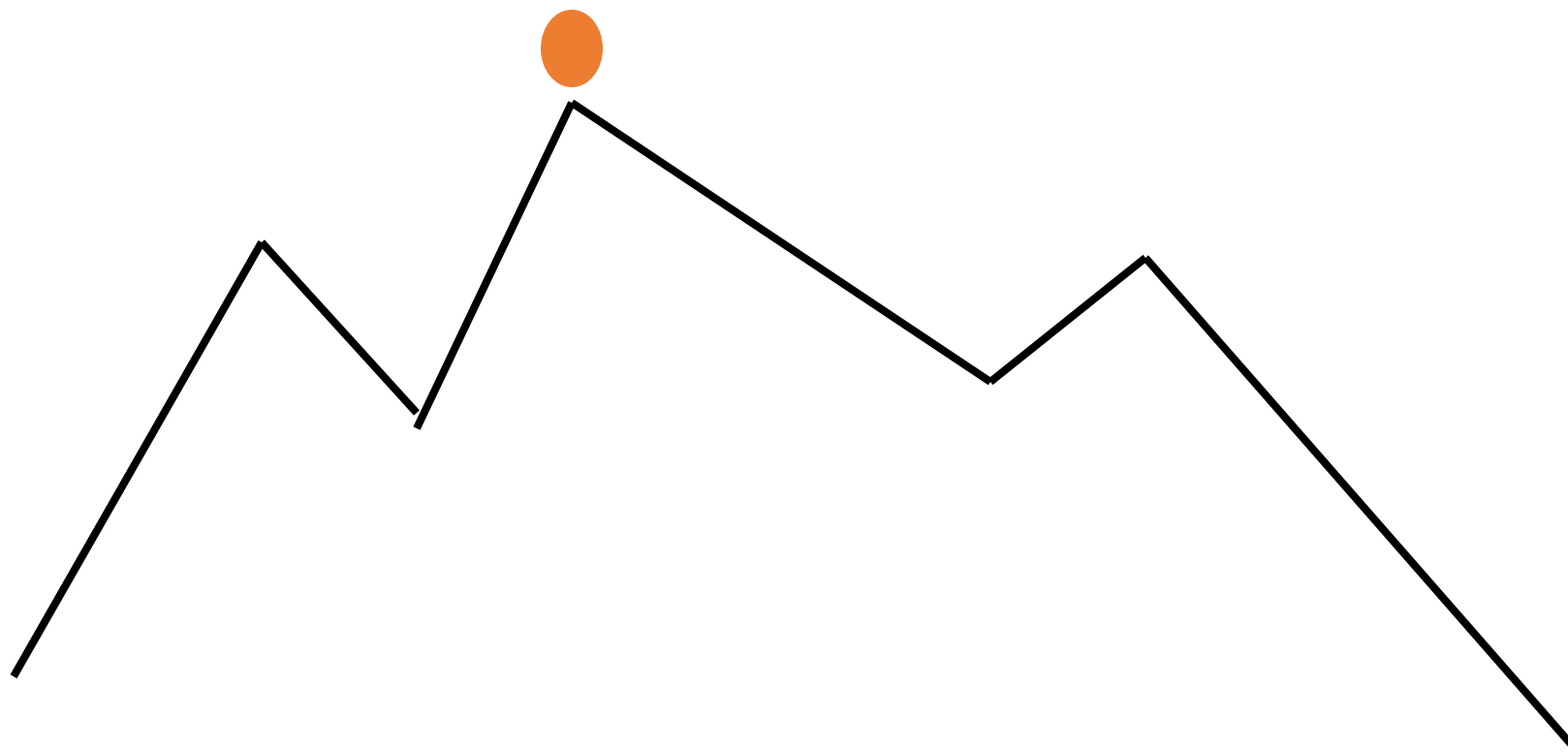
Multi-Armed Bandit: Value of Information



## the landscape metaphor

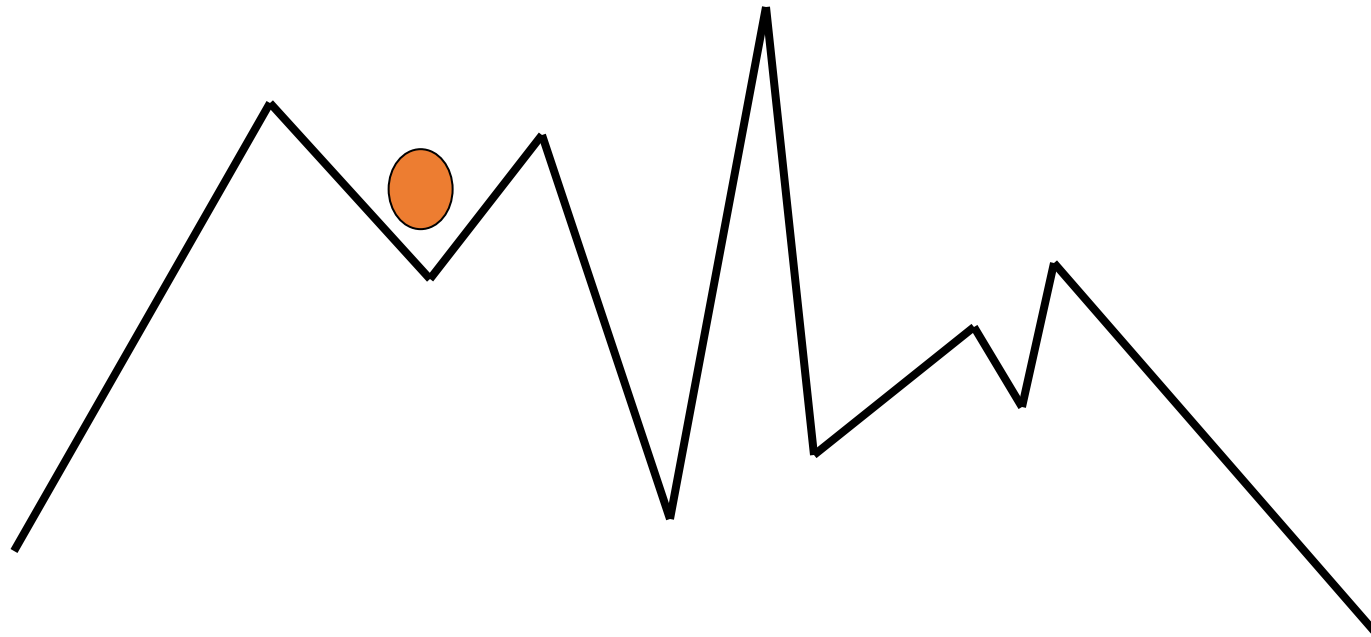


# Local Optima





# Dancing Landscape



# Fixed Versus Dancing Landscape

## Fixed

Locate Global Peak

Coordinated

Past Information Useful

Peak Tweaking

Know Yourself

## Dancing

Constantly Adapt

Allow Experimentation

Emphasize Newest

All Roads up from Trough

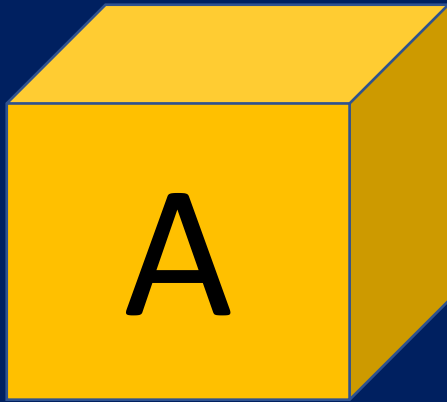
Community Knowledge

# Part 2: Conceptual Models

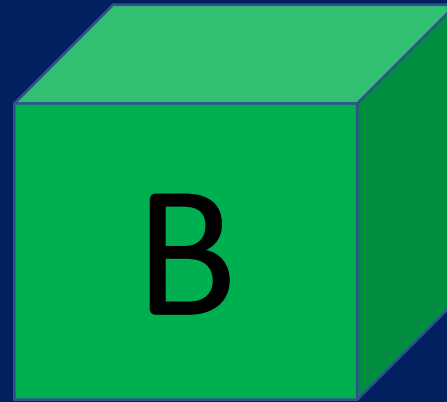
Dancing Landscapes

Multi-Armed Bandit: Value of Information

# Multi Armed Bandit



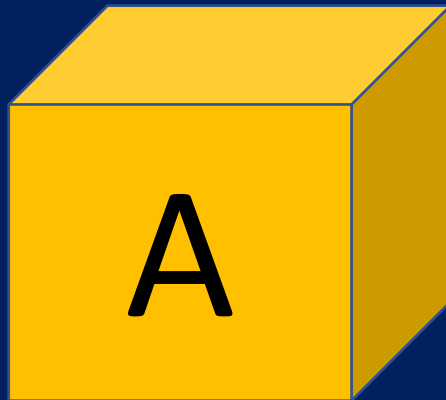
Close



New

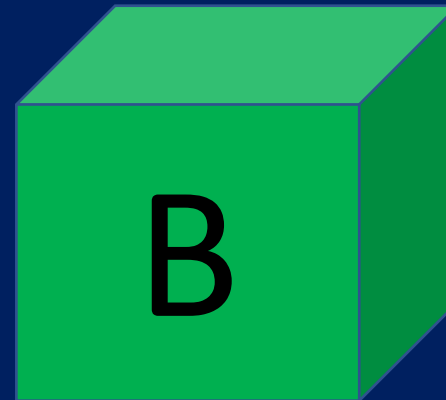
# Multi Armed Bandit

Safe



Close

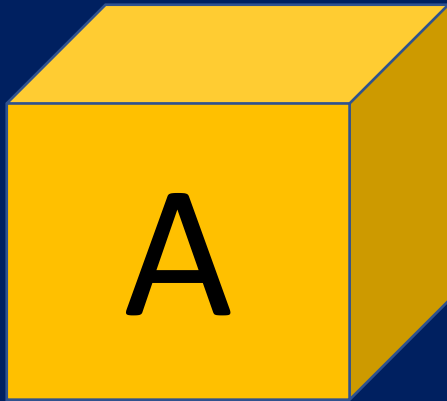
Risky



New

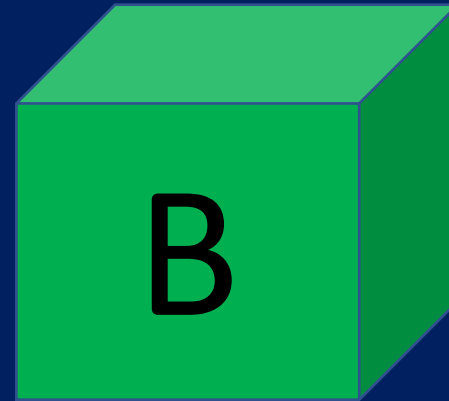
# Information Gain

None



Close

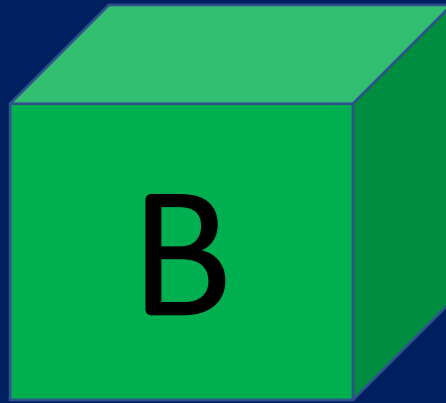
High



New

# Growth Mind Set

High



New

# Takeaway #1

Within high complexity, you cannot make decisions like you did in the past.



# Takeaway #2

You have less certainty about options, how world will unfold, and implications

# Takeaway #3

Lean on your community – you need DIVERSITY – during complex periods

# Takeaway #4

Complex means perpetual novel – monitor, think, experiment

# Takeaway #5

New actions build new skills and capabilities – be biased towards action.

Questions?