Polycrisis Core Model, v3.0

Pathways to the Hope Attractor

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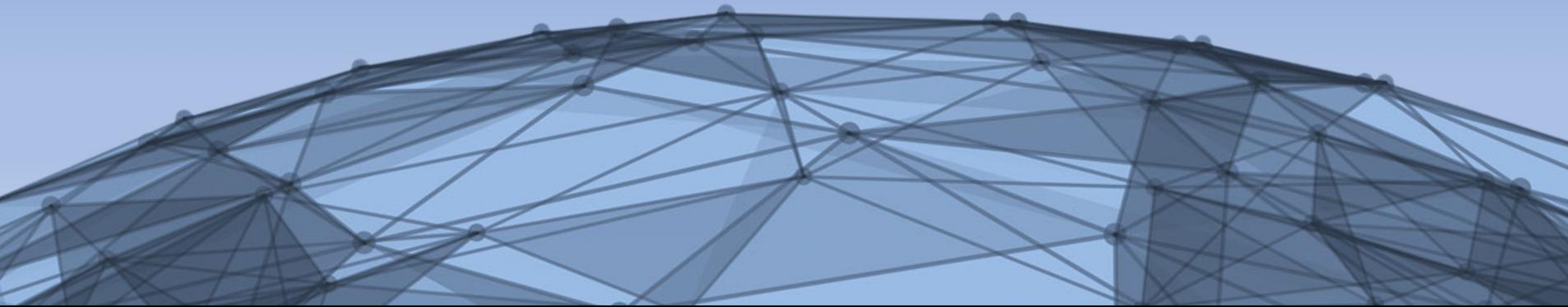
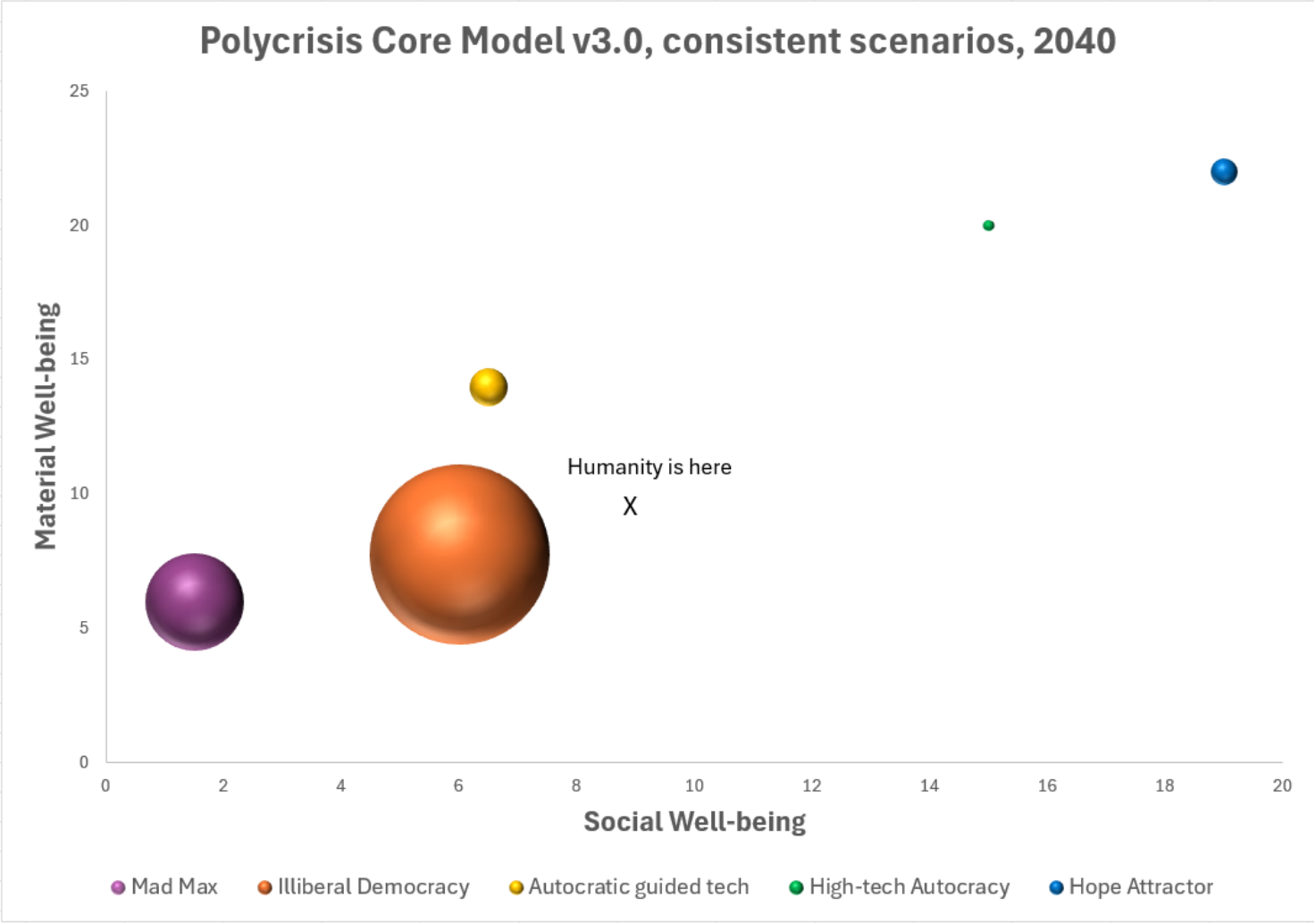
Cascade Institute
April 30, 2026



The Cascade Institute's PCM team

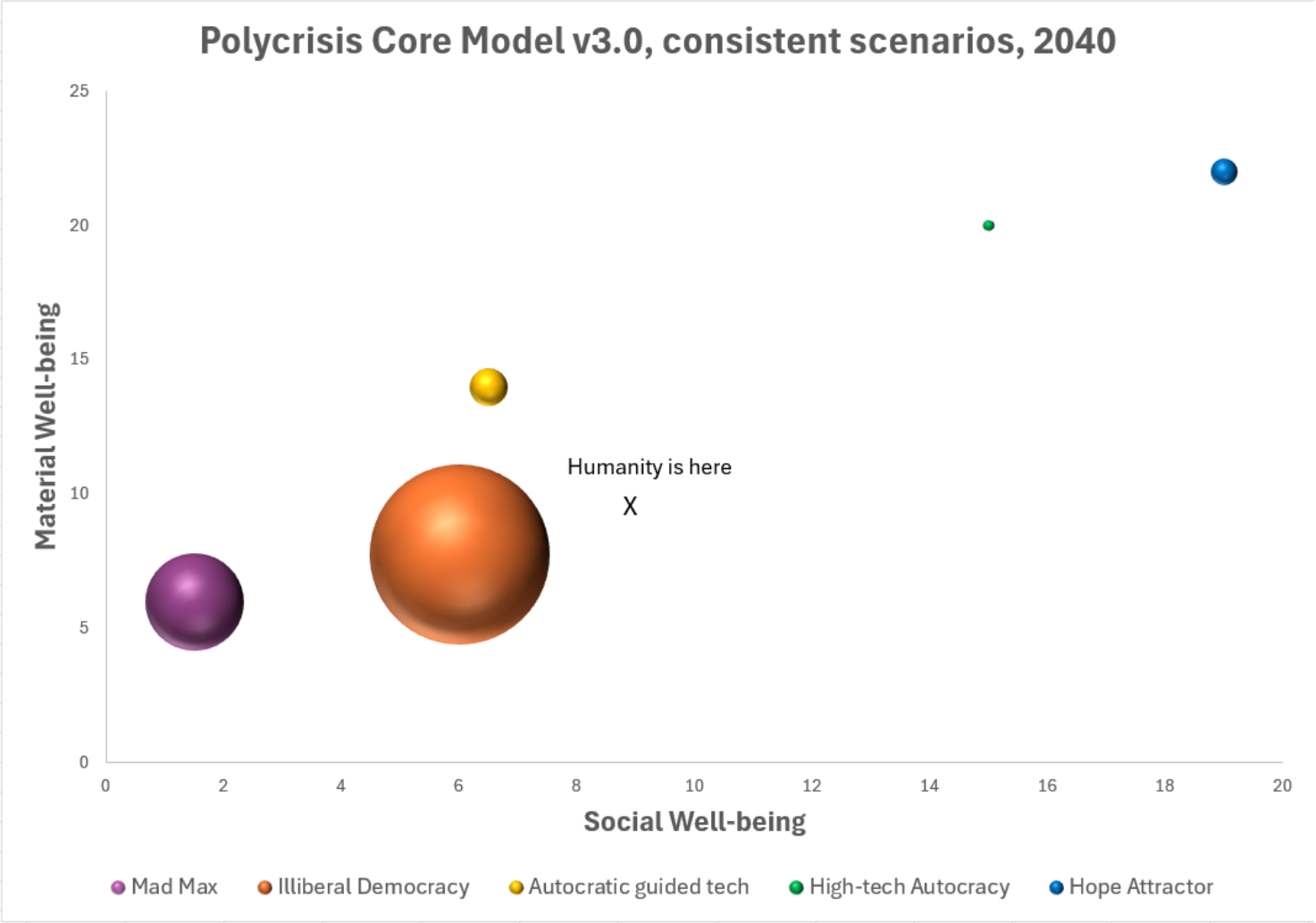
Thomas Homer-Dixon	Team lead
Michael Lawrence	Lead, model structure
Megan Shipman	Lead, CIB analysis
Scott Janzwood	Judgment/descriptor contributor
Luke Kemp	Judgment/descriptor contributor
Simone Philpot	Judgment/descriptor contributor
Chris Collins	Judgment/descriptor contributor
Kasra Motlaghzadeh	Lead, model software, visualization
Katherine Matos Meza	Research

This slide presentation explains the structure, assumptions, computational method, and empirical grounding of the Polycrisis Core Model (PCMv3.0). It shows how we arrived at the key finding illustrated in the adjacent image.

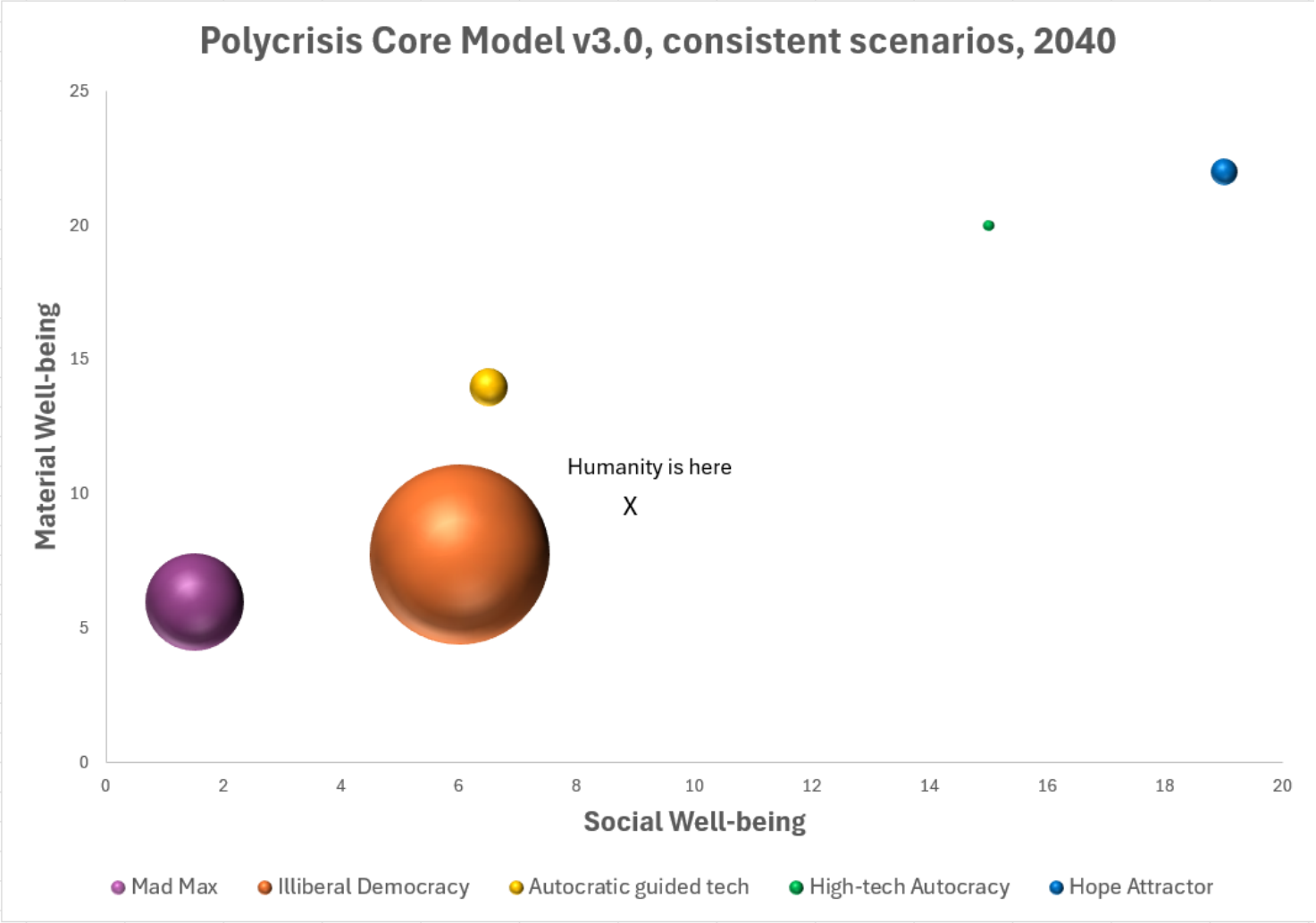


The Hope Attractor is **neither speculative nor aspirational.**

It emerges from the mathematical interpretation of nearly two thousand scientifically grounded causal judgments about interactions between global systems.



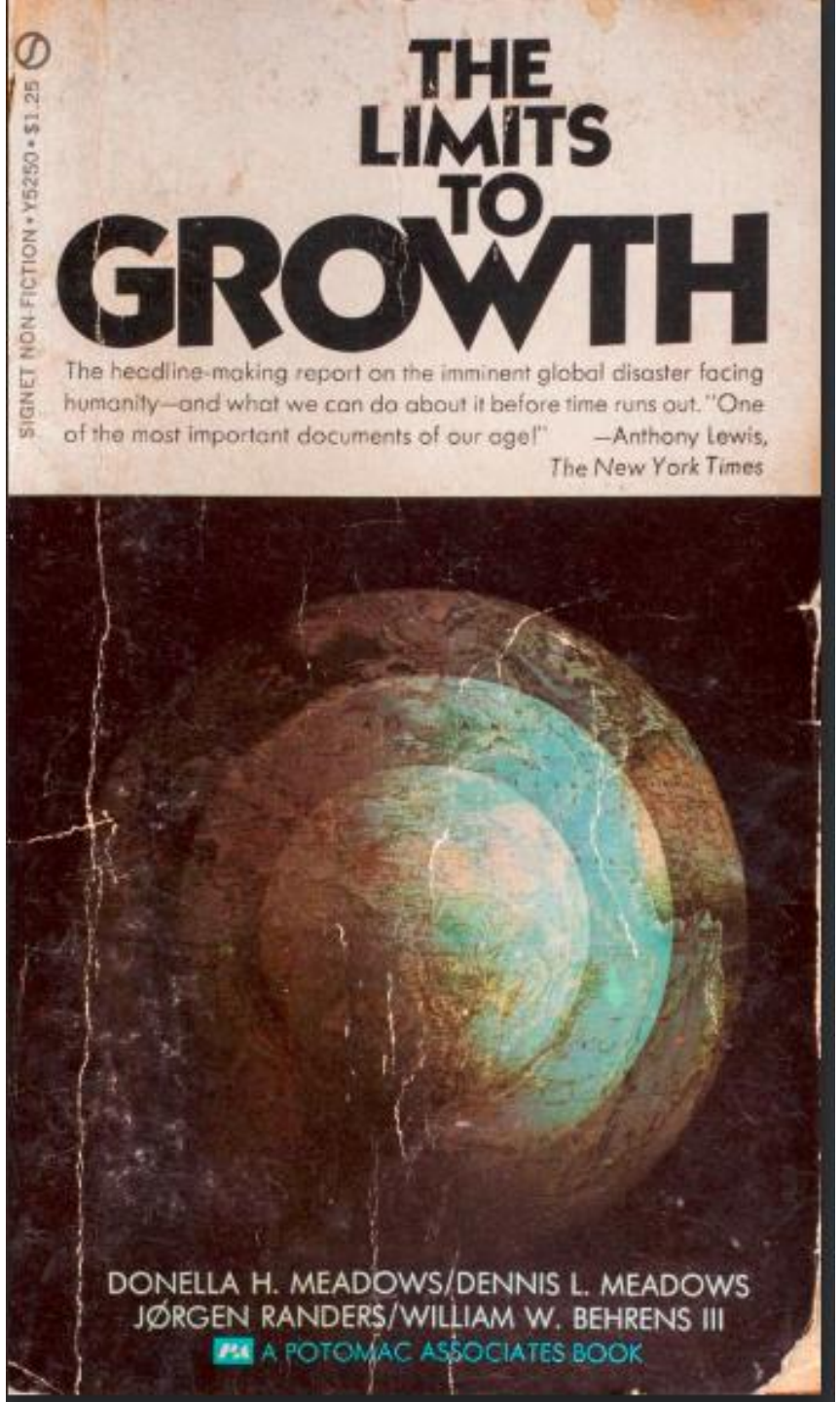
The Polycrisis Core Model is telling us that the Hope Attractor is real.



The Polycrisis Core Model is a highly aggregated, coarse-grained “crude look at the whole” (Gell-Mann). It follows in a storied tradition of global models.

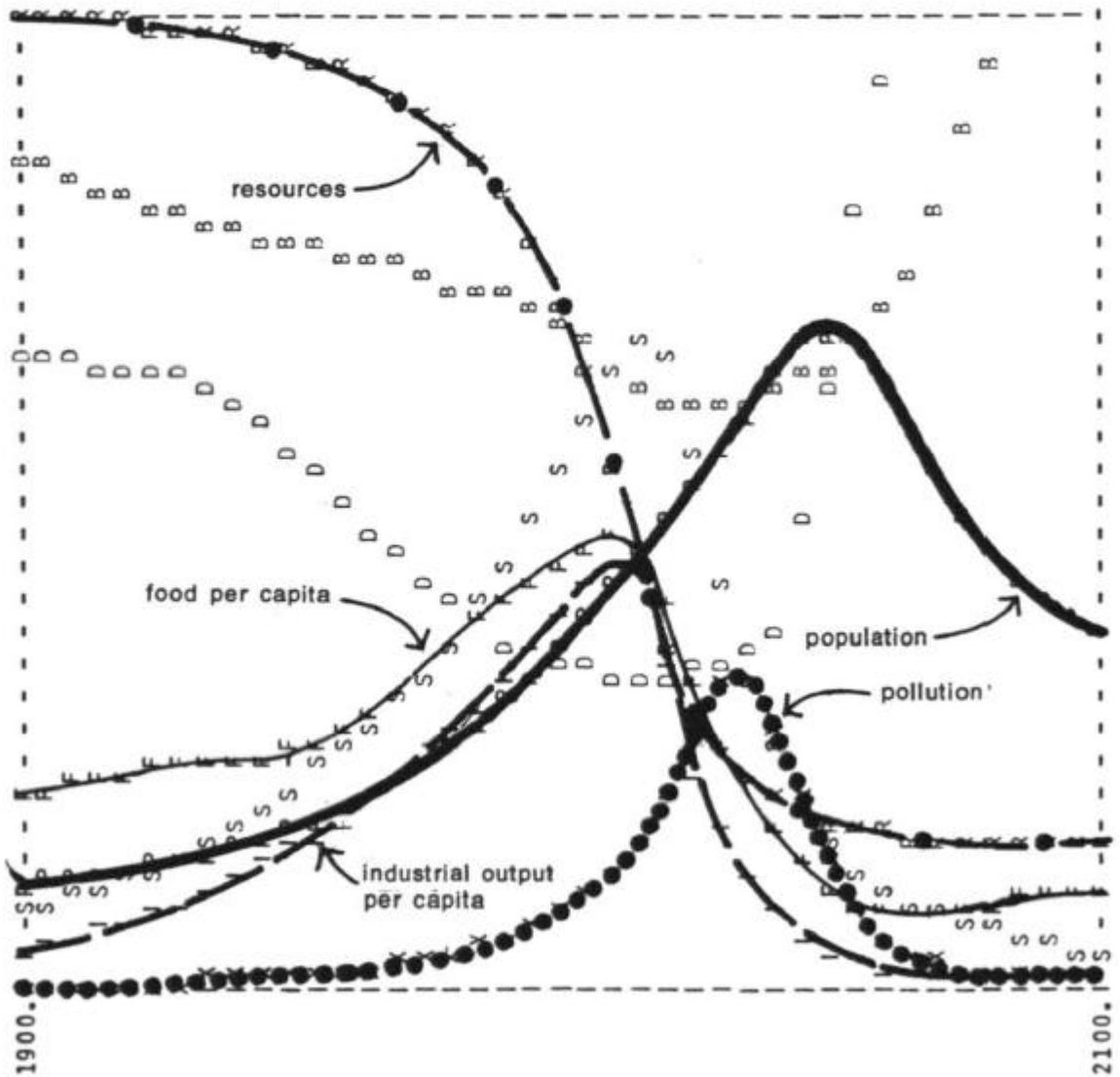
World 3 (1972) was the first of these models. It’s still widely used.

An assessment of World 3’s strengths and weaknesses can be found here.



In its 1970s iterations, World 3 produced results that looked like this.

Figure 35 WORLD MODEL STANDARD RUN



World 3 applies system dynamics (developed by Jay Forrester at MIT in the 1950s-70s).

System dynamics models use coupled first-order differential equations.

Understanding such models requires competence in calculus, so they're not accessible to a wide audience.

TABLE 2.1 EQUATIONS OF THE CAPITAL AND RESOURCE SUBMODEL

State equations		*Initial conditions*
1. $\dot{IC}$	= FIOAI * IO - IC/ALIC	IC(1900) = ICI = $2.1*10^{11}$
2. $\dot{SC}$	= FIOAS * IO - SC/ALSC	SC(1900) = SCI = $1.44*10^{11}$
3. $\dot{NR}$	= - NRUF * PCRUM * POP	NR(1900) = NRI = $1.0*10^{12}$
*Coupling equations**		
4. FIOAI	= U - FIOAS	
5. U	= 1 - FIOAC - FIOAA	
6. FIOAS	= f_{64}(IOPC)	(Figure 3b)
7. SOPC	= SO / POP	
8. SO	= SC * CUF / SCOR	
9. ISOPC	= f_{61}(IOPC)	(Figure 3a)
10. IOPC	= IO / POP	
11. IO	= IC * CUF * (1 - FCAOR) / ICOR	
12. FCAOR	= f_{135}(NRFR)	(Figure 3d)
13. NRFR	= NR / NRI	
14. PCRUM	= f_{132}(IOPC)	(Figure 3c)
Constants		
ALIC	= 14	NRUF = 1
ALSC	= 20	SCOR = 1
FIOAC	= 0.43	CUF = 1 (unless the job
ICOR	= 3	subsector is active)
Input variables		
POP	(Population sector)	
FIOAA	(Agricultural sector)	

* f_i denotes a table function, the index referring to the equation number in /16/.

The modeling method largely determines the types of data that can be used as inputs.

There are four, progressively more quantitative, levels of data measurement

Nominal →	Ordinal →	Interval →	Ratio
Categories with no order	Rankable order without equal intervals	Order by equal intervals, but without a 0 point	All properties, with a 0 point
e.g., gender	e.g., education level	e.g., temperature in Celsius (arbitrary 0 point)	e.g., mass; temperature in Kelvin

System dynamics is still a dominant approach to modeling complex processes within and among large global systems.

But system dynamics models generally require inputs of **ratio level data**, which biases modeling towards measurable physical processes.

Social processes tend to be neglected or poorly represented.

Also, most expert knowledge about macro/global social mechanisms is “fuzzy.”

It’s based on pattern recognition, often informed by decades of real-world experience, and is expressed in **nominal or ordinal** statements of the type:

“If X happens, then I have low/medium/high confidence that Y will happen.”

The cross-impact balance (CIB) method used in the PCMv3.0 can effectively integrate into a single analysis **large amounts of these kinds of data.**

The German scholar Wolfgang Weimer-Jehle pioneered cross-impact balance methods in the early 2000s

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Technological Forecasting and Social Change

Cross-impact balances: A system-theoretical approach to cross-impact analysis

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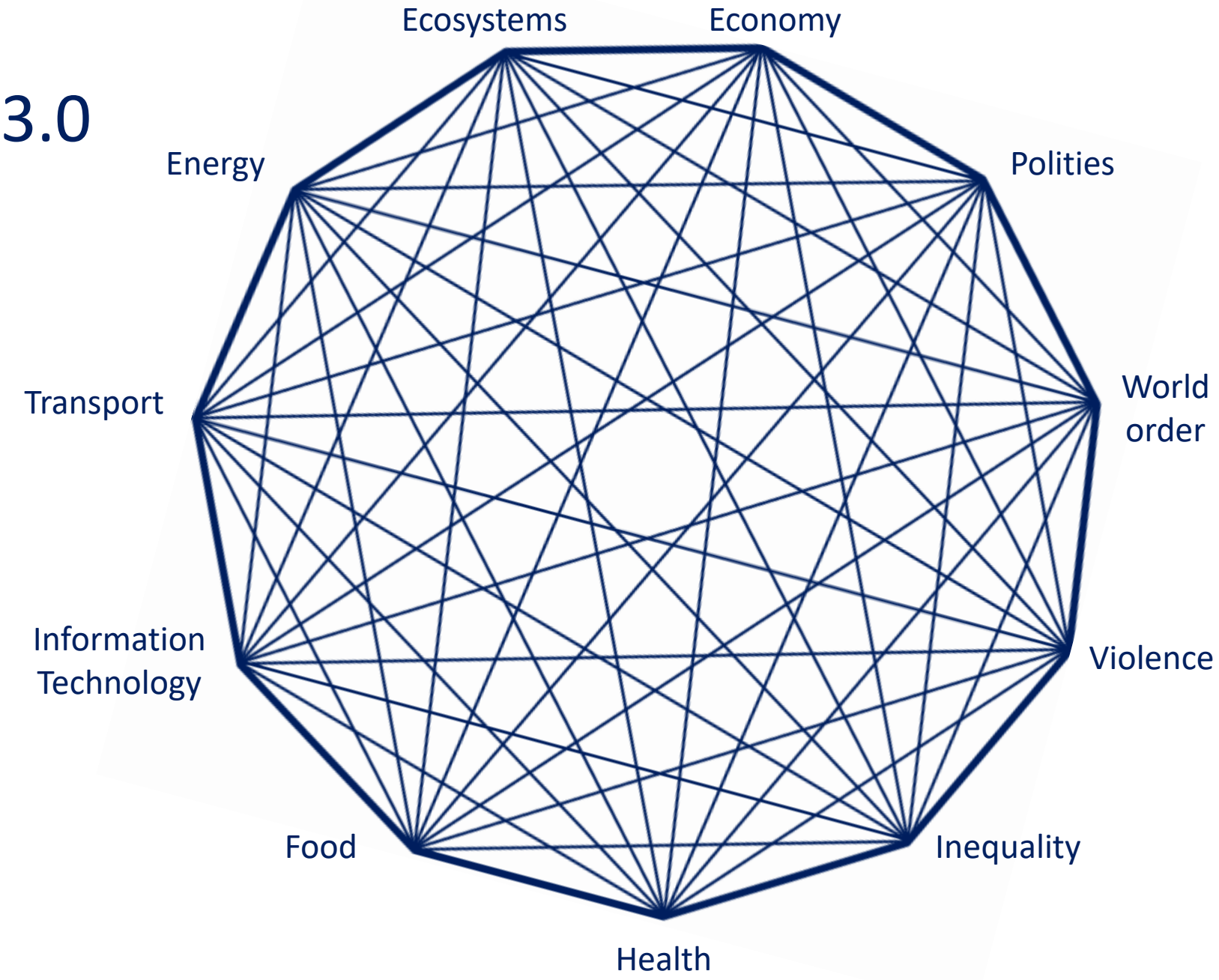
Using the CIB method, the PCMv3.0 disaggregates the world into the 11 subsystems (or “descriptors”) shown here. It models every causal link between every descriptor.



The PCMv3.0 groups descriptors into “social” and “material” categories. Each descriptor has a set of between 3 and 5 discrete “states”; it can take any one of these states at any time between now and 2100.

We provide detailed explanations of descriptors—and rationales for our choice of descriptor states—in model supplemental information.

	Descriptor (system):	States:
Social descriptors	Economy	Laissez-faire growth
		Guided growth
		Low growth
		Intentional contraction
		Unintentional contraction
	Inequality	Lower international inequality, lower domestic inequality
		High international inequality, lower domestic inequality
		Lower international inequality, high domestic inequality
		High international inequality, high domestic inequality
	Polities	Strong democracy
		Illiberal democracy
		Strong autocracy
		Weak autocracy
		Nonocracy
	Violence	Low violence
		Widespread non-state violence
		Civil/proxy war
		International war
		Great power war
	World order	International fragmentation
		Multipolarity
		Consolidated blocs
		Multilateral rules-based order
		Thick global governance
Material descriptors	Ecology	<2.5°C warming by 2100
		2.5-4°C warming by 2100
		>4°C warming by 2100
	Energy	Mostly fossil fuels
		Peak oil and gas
		Cleantech breakthrough
		Low-carbon contraction
	Food	Status quo industrial production
		Agritech industrial breakthrough
		Agroecological production
		Variable regionalized production
		Failed industrial production
	Health	Low burden of disease
		Medium burden of disease
		High burden of disease
	Information technology	Limited AI rollout
		Managed AI rollout
		Unmanaged AI rollout
	Transportation	Fit for the future
		Fit for now
		Fragmented and failing

The PCMv3.0's **social descriptors** and their states (expanded from previous slide):

	Descriptor (system):	States:
Social descriptors	Economy	Laissez-faire growth
		Guided growth
		Low growth
		Intentional contraction
		Unintentional contraction
	Inequality	Lower international inequality, lower domestic inequality
		High international inequality, lower domestic inequality
		Lower international inequality, high domestic inequality
		High international inequality, high domestic inequality
	Polities	Strong democracy
		Illiberal democracy
		Strong autocracy
		Weak autocracy
		Nonocracy
	Violence	Low violence
		Widespread non-state violence
		Civil/proxy war
		International war
		Great power war
	World order	International fragmentation
		Multipolarity
		Consolidated blocs
		Multilateral rules-based order
		Thick global governance
		<2.5°C warming by 2100

The PCMv3.0's **material descriptors** and their states:

	World order	Multipolarity
		Consolidated blocs
		Multilateral rules-based order
		Thick global governance
Material descriptors	Ecology	<2.5°C warming by 2100
		2.5-4°C warming by 2100
		>4°C warming by 2100
	Energy	Mostly fossil fuels
		Peak oil and gas
		Cleantech breakthrough
		Low-carbon contraction
	Food	Status quo industrial production
		Agritech industrial breakthrough
		Agroecological production
		Variable regionalized production
		Failed industrial production
	Health	Low burden of disease
		Medium burden of disease
		High burden of disease
	Information technology	Limited AI rollout
		Managed AI rollout
		Unmanaged AI rollout
	Transportation	Fit for the future
		Fit for now
		Fragmented and failing

CIB analysis involves constructing a matrix that stipulates the **causal relationship** between every state of every descriptor and every state of every other descriptor. This is the PCMv3.0 matrix:

	Str. dem	Il. dem	Polity Str. auto	Weak auto	Nono	Fragment	Multipolar	W. order Blocs	Multilateral	Thick gl. gov	Low	Non-state	Violence Civil war	Int. war	GP war	Limited	IT Managed	Unmanaged	L-f growth	G-growth	Econ Low growth	Man. contract	Unman. fail	High	Health Med	Low	S-Q ind	Agri-tech	Food Agro-eco	Var region	Failed ind	Fossil-fuel	Peak oil	Energy Clean-tech	Low C cont.	Future	Transp Now	Frag. fail	<2.5	Ecol 2.5-4	>4	Low Ineq	Int. ineq	Ineq Dom. ineq	High ineq
Polities																																												
Strong democracy						-1	-1	-1	2	1	3	-1	-1	-1	0	1	1	-2	1	2	0	0	-3	-3	1	2	2	1	0	-1	-2	1	0	1	-2	1	1	-2	0	1	-1	1	1	-1	-1
Illiberal democracy						1	1	1	-1	-2	-1	0	1	0	0	-1	-1	2	1	0	1	-1	-1	-1	1	0	1	0	0	0	-1	2	0	-1	-1	0	1	-1	0	0	0	-1	-1	1	1
Strong autocracy						1	2	2	-2	-3	0	-2	0	2	0	0	2	-2	0	1	0	0	-1	-1	1	0	1	0	-1	0	0	1	0	0	-1	0	1	-1	0	0	0	-1	-1	1	1
Weak autocracy						2	1	1	-2	-2	-2	1	1	1	-1	0	-1	2	0	0	1	-2	1	1	1	-2	1	1	-2	-1	1	1	1	1	-3	1	-2	1	1	0	0	0	-1	-1	1	1
Nonocracy						3	1	-1	-2	-1	0	2	2	-2	-2	2	-2	0	-1	-2	2	-1	2	2	1	-3	-2	-3	1	1	3	1	0	-2	1	-2	-1	3	0	0	0	1	0	0	-1
World Order																																													
International fragmentation	0	0	0	0	0						-1	0	0	1	0	2	-2	0	-1	-1	1	0	1	1	1	-2	-2	-3	1	2	2	0	1	-2	1	-2	-1	3	-2	1	1	-1	1	-1	1
Multipolarity	0	0	0	0	0						-1	-1	1	1	0	0	0	0	0	0	1	-1	0	-1	1	0	-1	-1	0	1	1	0	0	-1	1	-1	1	0	-1	1	0	-1	1	-1	1
Consolidated blocs	0	1	1	-1	-1						-2	-1	1	1	1	0	1	-1	0	1	0	-1	0	-1	1	0	-1	0	0	1	0	1	0	0	1	-2	0	1	-1	0	0	0	-1	1	-1
Multilateral rules-based order	1	0	0	0	-1						2	0	0	-1	-1	0	1	-1	1	1	0	0	-2	-2	1	1	1	1	0	-1	-1	1	0	1	-2	1	1	-2	0	1	-1	1	-1	1	-1
Thick global governance	2	-1	0	-1	0						3	0	-1	-1	-1	1	2	-3	1	2	0	0	-3	-3	1	2	1	2	0	-1	-2	0	0	2	-2	2	1	-3	1	2	-3	2	0	0	-2
Violence																																												
Low violence	0	0	0	0	0	0	0	0	0	0						0	0	0	1	1	0	0	-2	0	0	0	1	1	0	0	-2	0	0	1	-1	1	0	-1	0	0	0	0	0	0	0
Widespread non-state violence	-2	1	1	-1	1	1	-1	0	0	0						0	0	0	-1	-1	1	0	1	0	1	-1	0	0	-1	1	0	0	1	-1	0	-1	0	1	0	0	0	-1	-1	1	1
Civil/proxy war	-2	1	-1	1	1	0	0	0	0	0						0	0	0	-1	-1	1	0	1	1	1	-2	0	0	-1	1	0	0	1	-1	0	1	-1	0	1	0	0	-1	0	0	1
International war	0	0	1	-1	0	0	1	1	-1	-1						1	1	-2	-2	-1	1	1	1	2	1	-3	-1	-2	0	2	1	1	1	-1	-1	2	-1	-1	2	0	0	-1	0	0	1
Great power war	-1	1	1	-1	0	0	2	3	-2	-3						2	1	-3	-3	-1	-1	2	3	3	0	-3	-3	-2	0	2	3	1	1	-2	0	-2	-1	3	0	0	0	2	0	0	-2
Information Technology																																												
Limited rollout	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				-1	-1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	-1	1	0	0	0	0	0	0	0	0
Managed rollout	1	0	1	0	-2	-2	0	1	1	0	1	-1	-1	1	0				0	1	-1	1	-1	-1	0	1	0	1	0	0	-1	0	0	1	0	2	0	-2	0	1	-1	0	0	0	0
Unmanaged rollout	-2	1	1	0	0	1	0	1	-1	-1	-3	1	1	1	0				2	-2	0	-2	2	1	0	-1	0	0	-1	0	1	1	0	0	-1	0	0	0	1	-1	0	1	-2	0	0	2
Economy																																												
Laissez-faire growth	-1	1	0	0	0	-1	0	0	1	0	-2	1	1	0	0	-1	-2	3						-1	1	0	1	0	-2	0	1	1	1	0	-2	0	1	-1	-3	1	2	-3	0	0	3
Guided growth	1	1	1	-1	-2	0	0	0	0	0	1	-1	0	0	0	0	1	-1						-3	2	1	0	2	0	0	-1	-1	1	0	1	-2	0	1	-2	1	1	-1	1	-1	-1
Low growth	-1	1	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	1	-1	2	-2	0	0	-1	1	0	-1	0	0	1	-1	0	0	0	0	1	-1	0	1
Managed economic contraction	0	0	0	0	0	0	0	0	0	0	-2	1	1	0	0	1	0	-1						-2	1	1	-3	1	2	2	-2	-2	-1	2	1	1	0	-1	2	1	-3	1	0	0	-1
Unmanaged economic failure	-1	0	-1	1	1	2	0	0	-1	-1	-3	1	1	1	0	2	-1	-1						1	1	-2	-2	-3	1	2	2	1	0	-2	1	-2	-1	3	1	0	-1	-1	0	0	1
Health																																												
High burden of disease	-3	1	-2	1	3	2	1	0	-1	-2	-1	1	0	0	0	1	-1	0	-2	-3	3	-1	3				-1	0	-1	1	1	1	0	-1	0	-2	0	2	0	0	0	-2	0	0	2
Medium burden of disease	-2	1	1	0	0	-1	0	0	1	0	0	0	0	0	0	0	0	0	-1	-1	2	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	1
Low burden of disease	1	0	1	0	-2	0	0	0	0	0	1	-1	0	0	0	0	0	0	1	1	-1	1	-2				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food																																												
Status-quo global industrial production	1	0	1	0	-2	-1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	-1	0	0	1	-1						2	1	-1	-2	0	1	-1	-2	1	1	-1	1	0	1
Agri-tech industrial breakthrough	1	0	1	0	-2	-1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	-1	1	-2	-2	1	1						1	-1	1	-1	0	0	0	1	1	-2	0	0	0
Agro-ecological production	0	0	0	0	0	1	1	0	-1	-1	0	0	0	0	0	0	0	0	-1	-1	1	1	0	-1	1	0						-1	0	0	1	0	0	0	0	1	-1	1	0	-1
Variable regionalized production	-1	1	-1	1	0	0	0	0	0	0	-2	1	1	0	0	0	0	0	-1	-1	2	-1	1	1	1	-2						0	0	0	0	-1	2	-1	-1	1	0	0	1	0	0
Failed global industrial production	-3	1	-1	1	2	3	0	0	-1	-2	-3	1	1	1	0	1	-1	0	-3	-3	3	0	3	-3	-1	2						1	0	-2	1	-1	0	1	-1	1	0	-2	0	0	2
Energy																																												
Mostly Fossil fuels	-1	1	1	0	-1	0	0	0	0	0	-2	0	1	1	0	0	0	0	1	1	1	-3	0	0	1	-1	-2	1	-1	0	-2					1	2	-3	-3	1	2	-1	1	-1	1
Peak oil and gas	-2	1	-1	1	1	1	1	0	-1	-1	-3	1	1	1	0	2	-1	-1	-2	-2	1	0	3	1	1	-2	-2	-2	1	1	2					-2	-1	3	-2	1	1	0	0	0	0
Clean tech breakthrough	1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	-2	-1	0	1	-1	2	1	0	-2					2	1	-3	2	0	-2	1	0	0	-1
Low-carbon energy contraction	-1	0	-1	0	2	1	1	0	-1	-1	-3	1	1	1	0	2	-1	-1	-2	-2	1	0	3	2	1	-3	-2	-2	1	1	2					-2	-1	3	0	1	-1	1	0	0	-1
Transportation																																												
Fit for the future	-1	0	1	0	-2	-2	0	0	1	1	-1	0	0	-1	0	-1	1	0	2	2	-2	0	-2	-1	1	0	1	1	0	-1	-1	-1	0	1	0				0	1	-1	1	0	0	-1
Fit for now	0	0	0	0	0	-1	0	0	1	0	0	1	0	-1	0	0	0	0	1	1	-1	0	-1	0	0	0	1	0	0	-1	0	1	0	-1	0				-1	0	0	0	0	0	0
Fragmented and failing	-1	0	-1	0	2	2	1	-1	-1	-1	-1	1	0	0	0	2	-1	-1	-2	-2	2	0	2	1	1	-2	-3	-1	1	1	2	-1	1	-1	1				-1	1	-1	1	0	-1	1
Ecology																																												
<2.5 warming by 2100	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-1	0	0	0	0	-1	0	0	0	0	0	0	0	0	1	1	-2				0	0	0	0
2.5-4 warming by 2100	-2	1	0	1	0	0	0	0	0	0	-1	1	0	0	0	0	0	0	0	-1	1	0	1	0	1	-1	-2	0	0	1	1	0	0	0	0	0	0	0				-1	0	0	1
>4 warming by 2100	-3	1	0	1	1	1	0	0	0	-1	-3	1	1	1	0	0	-1	1	-2	-2	1	1	2	1	1	-2	-3	0	0	2	1	0	0	0	0	-1	-1	2				-2	0	0	2
Inequality																																												
Low world inequality	3	-1	-1	-1	0	-2	-1	-1	2	2	3	-1	-1	-1	0	1	0	-1	-2	2	0	1	-1	-2	0	2	-1	0	1	0	0	0	0	0	0	0	1	-1	0	1	-1				
International inequality	2	-1	-1	0	0	0	1	1	-1	-1	-1	0	0	1	0	0	0	0	0	0	0	0	0	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	1	0				
Domestic inequality	-2	1	1	0	0	0	-1	-1	2	0	-1	1	1	-1	0	0	0	0	0	0	0	0	0	1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	-1	1	0				
High world inequality	-3	1	1	1	0	2	1	1	-2	-2	-3	1	1	1	0	-1	0	1	2	-2	0	-1	1	2	0	-2	1	0	-1	0	0	2	1	-2	-1	0	0	0	0	0	0				

Both matrix axes show all descriptors and their states.

	Polity						W. order						L
	Str. dem	Il. dem	Str. auto	Weak auto	Nono		Fragment	Multipolar	Blocs	Multilateral	Thick gl. gov		
Polities													
Strong democracy							-1	-1	-1	2	1		
Illiberal democracy							1	1	1	-1	-2		
Strong autocracy							1	2	2	-2	-3		
Weak autocracy							2	1	1	-2	-2		
Nonocracy							3	1	-1	-2	-1		
World Order													
International fragmentation	0	0	0	0	0								
Multipolarity	0	0	0	0	0								
Consolidated blocs	0	1	1	-1	-1								
Multilateral rules-based order	1	0	0	0	-1								
Thick global governance	2	-1	0	-1	0								
Violence													
Low violence	0	0	0	0	0		0	0	0	0	0		
Widespread non-state violence	-2	1	1	-1	1		1	-1	0	0	0		
Civil/proxy war	-2	1	-1	1	1		0	0	0	0	0		
International war	0	0	1	-1	0		0	1	1	-1	-1		
Great power war	-1	1	1	-1	0		0	2	3	-2	-3		
Information Technology													
Limited rollout	0	0	0	0	0		0	0	0	0	0		
Managed rollout	1	0	1	0	-2		-2	0	1	1	0		
Unmanaged rollout	-2	1	1	0	0		1	0	1	-1	-1		
Economy													
Laissez-faire growth	-1	1	0	0	0		-1	0	0	1	0		
Guided growth	1	1	1	-1	-2		0	0	0	0	0		
Low growth	-1	1	-1	1	0		0	0	0	0	0		
Managed economic contraction	0	0	0	0	0		0	0	0	0	0		
Unmanaged economic failure	-1	0	-1	1	1		2	0	0	-1	-1		
Health													

Causal relations are represented using a Likert scale from +3 to -3. Each score indicates a **level of confidence** in a "promoting" or "inhibiting" causal impact of one descriptor state on another. (In other words, the PCM team used a Bayesian rather than frequentist approach to estimating causality.)

	Polity					W. order				
	Str. dem	Ill. dem	Str. auto	Weak auto	Nono	Fragment	Multipolar	Blocs	Rules-base	Thick gl. gov
Polity Type										
Strong democracy						-1	-1	-1	2	1
Illiberal democracy						1	1	1	-1	-2
Strong autocracy						1	2	2	-2	-3
Weak autocracy						2	1	1	-2	-2
Nonocracy						3	1	-1	-2	-1
World Order										
International fragmentation	0	0	0	0	0					
Multipolarity	0	0	0	0	0					
Consolidated blocs	0	1	1	-1	-1					
Multilateral rules-based order	1	0	0	0	-1					
Thick global governance	2	-1	0	-1	0					

A score of 0 indicates a judgment of either: 1. no identifiable causal influence; 2. high uncertainty about the degree or direction of causal influence; or 3. countervailing causal influences.

	Polity					W. order				
	Str. dem	Ll. dem	Str. auto	Weak auto	Nono	Fragment	Multipolar	Blocs	Rules-base	Thick gl. gov
Polity Type										
Strong democracy						-1	-1	-1	2	1
Illiberal democracy						1	1	1	-1	-2
Strong autocracy						1	2	2	-2	-3
Weak autocracy						2	1	1	-2	-2
Nonocracy						3	1	-1	-2	-1
World Order										
International fragmentation	0	0	0	0	0					
Multipolarity	0	0	0	0	0					
Consolidated blocs	0	1	1	-1	-1					
Multilateral rules-based order	1	0	0	0	-1					
Thick global governance	2	-1	0	-1	0					

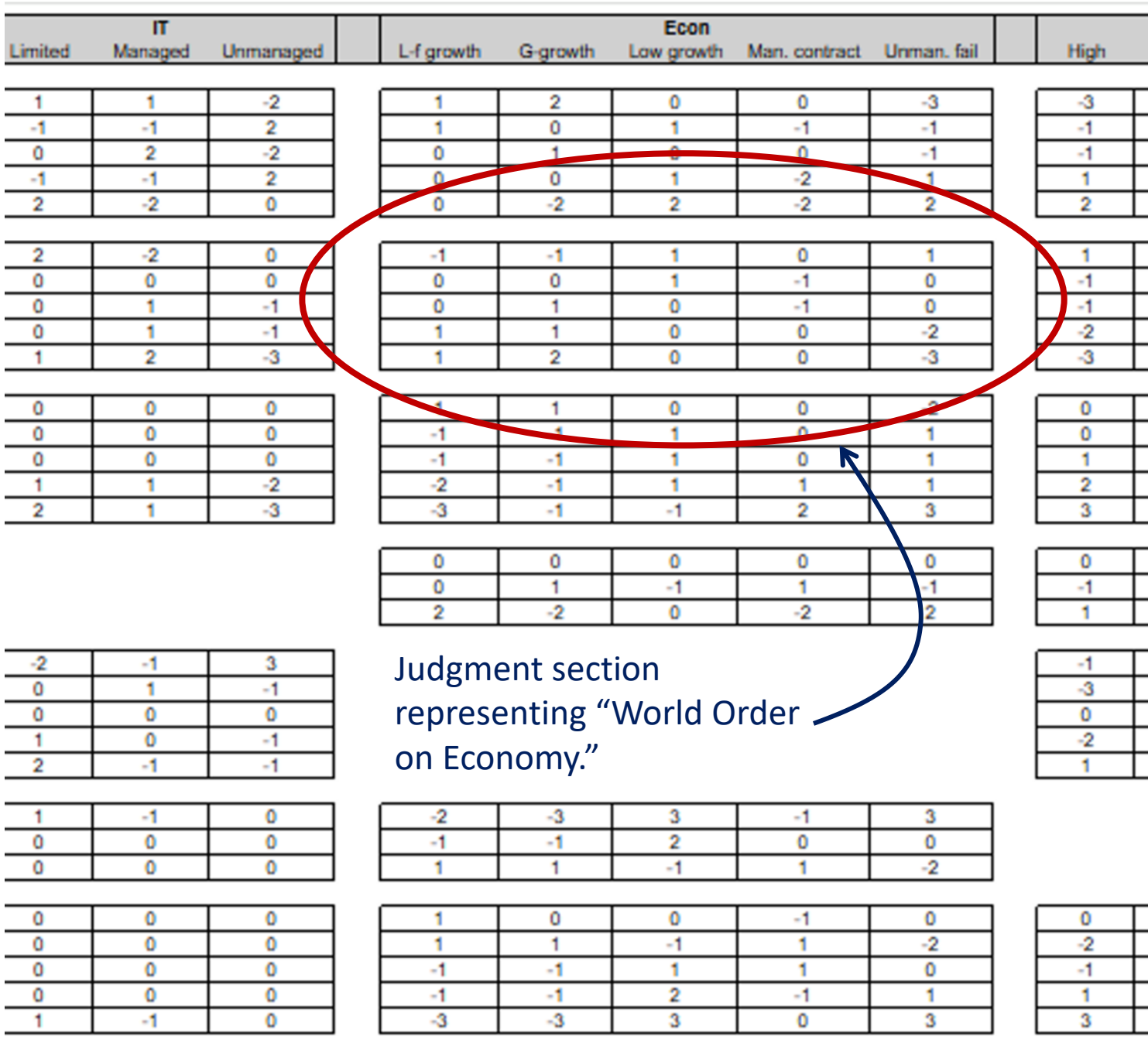
Causation is read from a descriptor state on the left to a descriptor state on the top, as indicated by the arrows. The circled “3” below indicates high confidence that the polity state of “nonocracy” (severe weakness of states), if wide-spread in 2040, would cause fragmentation of world order.

	Polity					W. order				
	Str. dem	Ll. dem	Str. auto	Weak auto	Nono	Fragment	Multipolar	Blocs	Rules-base	Thick gl. gov
Polity Type										
Strong democracy						-1	-1	-1	2	1
Illiberal democracy						1	1	1	-1	-2
Strong autocracy						1	2	2	-2	-3
Weak autocracy						2	1	1	-2	-2
Nonocracy						3	1	-1	-2	-1
World Order										
International fragmentation	0	0	0	0	0					
Multipolarity	0	0	0	0	0					
Consolidated blocs	0	1	1	-1	-1					
Multilateral rules-based order	1	0	0	0	-1					
Thick global governance	2	-1	0	-1	0					

Scores in a “judgment group” (highlighted) must add to 0. This critical balancing or “conservation of confidence” requirement ensures that any judgment indicating a given outcome WILL happen must be balanced by an equivalent judgment that some other outcome(s) will NOT happen.

	Polity					W. order				
	Str. dem	Ill. dem	Str. auto	Weak auto	Nono	Fragment	Multipolar	Blocs	Rules-base	Thick gl. gov
Polity Type										
Strong democracy						-1	-1	-1	2	1
Illiberal democracy						1	1	1	-1	-2
Strong autocracy						1	2	2	-2	-3
Weak autocracy						2	1	1	-2	-2
Nonocracy						3	1	-1	-2	-1
World Order										
International fragmentation	0	0	0	0	0					
Multipolarity	0	0	0	0	0					
Consolidated blocs	0	1	1	-1	-1					
Multilateral rules-based order	1	0	0	0	-1					
Thick global governance	2	-1	0	-1	0					

The matrix includes 1,832 individual, empirically grounded causal judgments about likely causal relations between descriptor states in 2040. They are grouped into 110 “judgment sections.”



By selecting one state of each descriptor, we can generate a “scenario” of a possible world future, as shown on the right.

The 45 states across 11 descriptors in the PCMv3.0 produce a total of **4,050,001 scenarios**.

	Descriptor	Descriptor states
Social	Economy	Laissez-faire growth Guided growth Low growth Managed economic contraction Unmanaged economic failure
	Polity Type	Strong democracy Illiberal democracy Strong autocracy Weak autocracy Nonocracy
	World Order	International fragmentation Multipolarity Consolidated blocs Multilateral rules-based order Thick global governance
	Inequality	Low international/low domestic inequality High international/low domestic inequality Low international/high domestic inequality High international/high domestic inequality
	Conflict & Security	Low violence Widespread non-state violence Civil/proxy war International war Great power war
Material	Energy	Fossil-fuel dependence Peak oil and gas Green-tech breakthrough Low-carbon energy contraction
	Climate	<2.5 degrees C in 2100 2.5-4 degrees C >4 degrees C
	Health	High burden of disease Medium burden of disease Low burden of disease
	Food	Status-quo global industrial production Agri-tech industrial breakthrough Agro-ecological production Variable regional production Failed global industrial production
	Transportation	Fit for the future Fit for now Fragmented and failing
	Information technology	Limited rollout Managed rollout Unmanaged rollout

The **mathematics** used by the cross-impact balance (CIB) method then determines which scenarios are “consistent.”

A consistent scenario is in equilibrium, because the matrix’s causal relations act to reinforce its stability.

CIB mathematics determines consistency by adding up a given scenario's

total causal impacts for each state of each descriptor.

A descriptor is consistent (in a scenario) if the descriptor state showing the biggest total impact is the same as the scenario's input state for that descriptor.

A “fully consistent” scenario is consistent across ALL its descriptors.

Its output states are the same as its input states.

Of PCMv3.0’s 4,050,000 scenarios, **only 11 are fully consistent.**

A mathematical procedure called “succession analysis” then changes each remaining “inconsistent” scenario—through a series of steps—to a fully consistent scenario.

The CIB method assumes that inconsistency represents a **causal imbalance** that will tend to drive the system towards equilibrium or **causal balance**.

The following 9 slides describe these mathematical steps.

An example of a 3-descriptor matrix

		Descriptor 1		Descriptor 2		Descriptor 3		
		State A	State B	State A	State B	State A	State B	State C
Descriptor 1	State A			3	-3	-1	-2	3
	State B			1	-1	0	-1	1
Descriptor 2	State A	1	-1			2	-1	-1
	State B	0	0			3	0	-3
Descriptor 3	State A	-3	3	0	0			
	State B	0	0	0	0			
	State C	2	-2	0	0			

Remember: The number in a cell represents the posited causal impact of the descriptor state immediately to the left on the descriptor state immediately above.

A scenario in this matrix

		Descriptor 1		Descriptor 2		Descriptor 3		
		State A	State B	State A	State B	State A	State B	State C
Descriptor 1	State A			3	-3	-1	-2	3
	State B			1	-1	0	-1	1
Descriptor 2	State A	1	-1			2	-1	-1
	State B	0	0			3	0	-3
Descriptor 3	State A	-3	3	0	0			
	State B	0	0	0	0			
	State C	2	-2	0	0			

This scenario consists of Descriptor 1, State B; Descriptor 2, State A; and Descriptor 3, State C. This matrix generates a total of 12 possible scenarios.

The scenario's impact totals

		Descriptor 1		Descriptor 2		Descriptor 3		
		State A	State B	State A	State B	State A	State B	State C
Descriptor 1	State A			3	-3	-1	-2	3
	State B			1	-1	0	-1	1
Descriptor 2	State A	1	-1			2	-1	-1
	State B	0	0			3	0	-3
Descriptor 3	State A	-3	3	0	0			
	State B	0	0	0	0			
	State C	2	-2	0	0			
IMPACT TOTALS		3	-3	1	-1	2	-2	0

Largest impact in each descriptor column is circled in red.

		Descriptor 1		Descriptor 2		Descriptor 3		
		State A	State B	State A	State B	State A	State B	State C
Descriptor 1	State A			3	-3	-1	-2	3
	State B			1	-1	0	-1	1
Descriptor 2	State A	1	-1			2	-1	-1
	State B	0	0			3	0	-3
Descriptor 3	State A	-3	3	0	0			
	State B	0	0	0	0			
	State C	2	-2	0	0			
IMPACT TOTALS		3	-3	1	-1	2	-2	0

This scenario is **not fully consistent.**

		Descriptor 1		Descriptor 2		Descriptor 3		
		State A	State B	State A	State B	State A	State B	State C
Descriptor 1	State A			3	-3	-1	-2	3
	State B			1	-1	0	-1	1
Descriptor 2	State A	1	-1			2	-1	-1
	State B	0	0			3	0	-3
Descriptor 3	State A	-3	3	0	0			
	State B	0	0	0	0			
	State C	2	-2	0	0			
IMPACT TOTALS		3	-3	1	-1	2	-2	0

A descriptor is consistent in a given scenario if the state showing the biggest impact in the descriptor's column is the SAME as the scenario's input state (in yellow) for that descriptor. It's inconsistent if the state showing the biggest impact is NOT the same as the scenario's input state for that descriptor.

Two descriptors are inconsistent; one is consistent.

		Descriptor 1		Descriptor 2		Descriptor 3		
		State A	State B	State A	State B	State A	State B	State C
Descriptor 1	State A			3	-3	-1	-2	3
	State B			1	-1	0	-1	1
Descriptor 2	State A	1	-1			2	-1	-1
	State B	0	0			3	0	-3
Descriptor 3	State A	-3	3	0	0			
	State B	0	0	0	0			
	State C	2	-2	0	0			
IMPACT TOTALS		3	-3	1	-1	2	-2	0

Inconsistent descriptor
(State A shows the largest impact, **but** the scenario input for descriptor 1 was State B.)

Consistent descriptor
(State A shows the largest impact, **and** the scenario input for descriptor 2 was State A.)

Inconsistent descriptor
(State A shows the largest impact, **but** the scenario input for descriptor 3 was State C.)

“Local” succession analysis then adjusts the input scenario (see red arrow on next two slides) to reflect the causal push of the descriptor state with the **biggest** inconsistent impact, which is Descriptor 1, state A.

This change produces full consistency.

Succession to full consistency sometimes takes several steps.

Local succession adjusts the input state of Descriptor 1.

		Descriptor 1		Descriptor 2		Descriptor 3		
		State A	State B	State A	State B	State A	State B	State C
Descriptor 1	State A			3	-3	-1	-2	3
	State B			1	-1	0	-1	1
Descriptor 2	State A	1	-1			2	-1	-1
	State B	0	0			3	0	-3
Descriptor 3	State A	-3	3	0	0			
	State B	0	0	0	0			
	State C	2	-2	0	0			
IMPACT TOTALS		3	-3	1	-1	2	-2	0

Of the two inconsistent descriptors, Descriptor 1 shows the biggest difference (6) between its largest total (3) and the total under its input state (-3). The difference for Descriptor 2 is less (2-0=2). “Local” succession analysis therefore adjusts Descriptor 1 in the scenario from state B to state A.

The result is full consistency.

		Descriptor 1		Descriptor 2		Descriptor 3		
		State A	State B	State A	State B	State A	State B	State C
Descriptor 1	State A			3	-3	-1	-2	3
	State B			1	-1	0	-1	1
Descriptor 2	State A	1	-1			2	-1	-1
	State B	0	0			3	0	-3
Descriptor 3	State A	-3	3	0	0			
	State B	0	0	0	0			
	State C	2	-2	0	0			
IMPACT TOTALS		3	-3	3	-3	1	-3	2

Consistent Consistent Consistent

The PCMv3.0's fully consistent scenarios can be considered "basins of attraction" or

attractors

in an 11-dimensional state space, where each descriptor represents a dimension.

An attractor is a point where the whole system is in equilibrium, like a ball in a basin.

In CIB terminology, a fully consistent scenario's "weight" is a measure of the number of inconsistent scenarios that migrate—through succession—towards it.

We can think of "weight" as an indicator of the basin's width.

A scenario's "total impact score" is a measure of the scenario's stability or resilience to perturbation.

We can think of it as an indicator of the basin's depth.

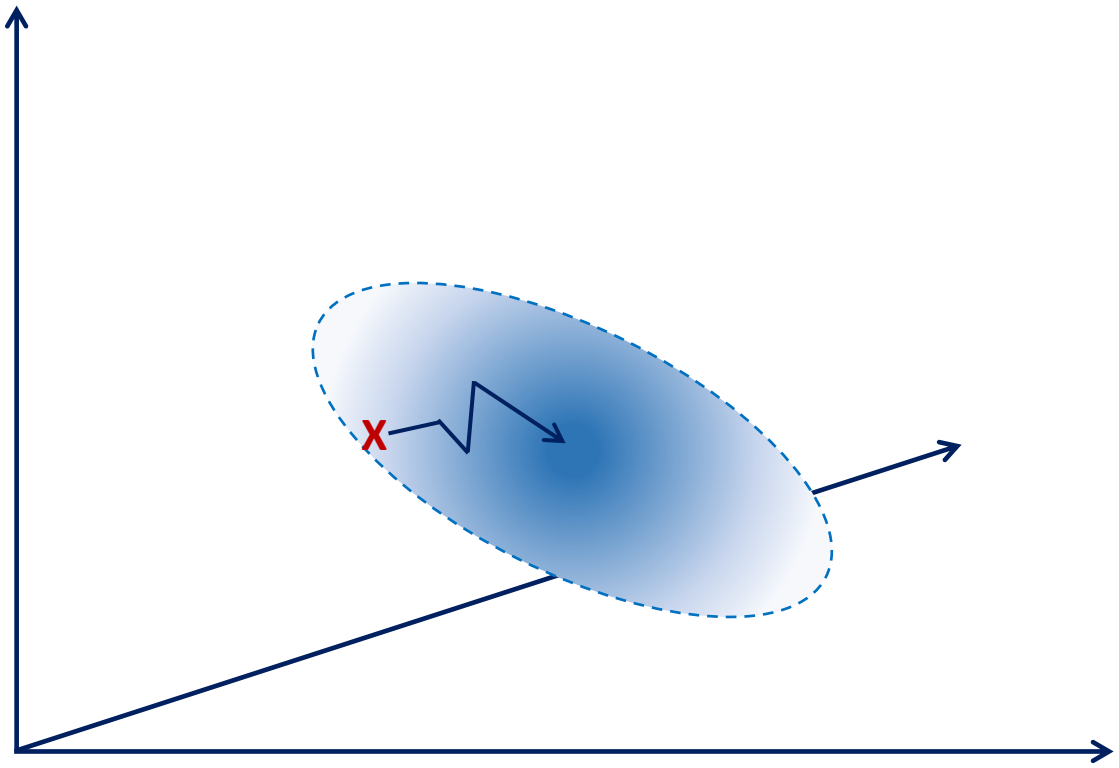
The next slides show details of **three** of PCMv3.0's most important consistent scenarios, including their weights, total impact scores, and states.

Illiberal blocs	
Weight: 1,674,576	
Total impact score: 66	
Polity Type	Illiberal democracy
World Order	Consolidated blocs
Conflict & Security	Civil/proxy war
IT	Unmanaged rollout
Economy	Low growth
Health	Medium burden of disease
Food	Status-quo global industrial production
Energy	Mostly fossil fuels
Transportation	Fit for now
Climate	2.5-4 degrees C
Inequality	High international/high domestic inequality

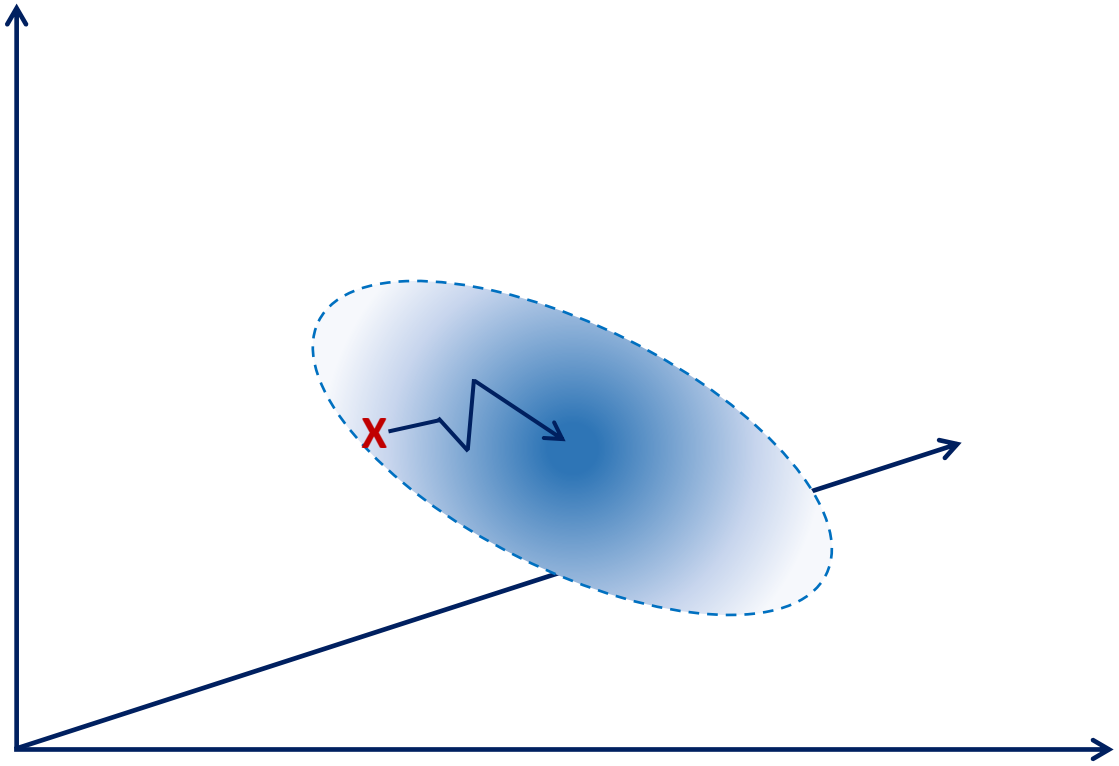
Mad Max	
Weight: 688,451	
Total impact score: 103	
Polity Type	Nonocracy
World Order	International fragmentation
Conflict & Security	Widespread non-state violence
IT	Limited rollout
Economy	Unmanaged economic failure
Health	High burden of disease
Food	Failed global industrial production
Energy	Mostly fossil fuels
Transportation	Fragmented and failing
Climate	2.5-4 degrees C
Inequality	High international/high domestic inequality

Hope Attractor	
Weight: 51,733	
Total impact score: 85	
Polity Type	Strong democracy
World Order	Multilateral rules-based order
Conflict & Security	Low violence
IT	Managed rollout
Economy	Guided growth
Health	Low burden of disease
Food	Agri-tech industrial breakthrough
Energy	Clean-tech breakthrough
Transportation	Fit for the future
Climate	2.5-4 degrees C
Inequality	Low international/low domestic inequality

Succession analysis plots the trajectory of each **inconsistent** scenario (represented here by the red X) through the 11-dimensional state space to the equilibrium point of one of the fully consistent attractors.



The rule that’s used to guide this succession analysis is critically important.



Possible succession rules

Global: ALL inconsistent descriptors are simultaneously changed to their states with the highest impact scores.

Local: Only the most inconsistent descriptor (as measure by the difference between its highest impact score and the score produced for that descriptor by the input scenario) is changed to the state with the highest impact score.

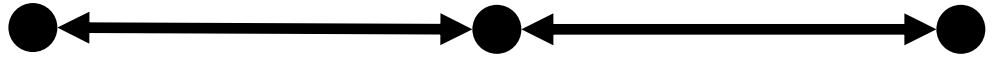
Allowed-local: Same as local, but the change must be an “allowed move.” Allowed moves are specified for each descriptor, because some jumps between states are impossible.

PCMv3.0 uses the **allowed-local succession** rule.

The allowed shifts between states are specified in advance for each descriptor, as shown in the following illustrative slides.

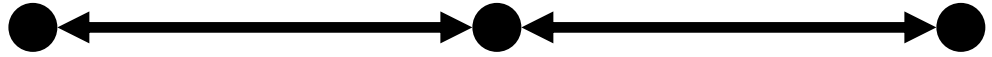
Allowed shifts between descriptor states

Ecology



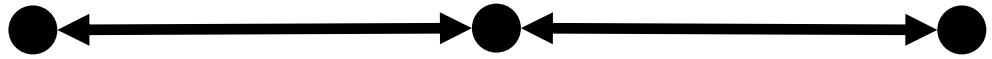
<2.5°C warming by 2100 | 2.5-4°C warming by 2100 | >4°C warming by 2100

Health



High burden of disease (H) | Medium burden of disease (M) | Low burden of disease (L)

Transportation



Fit for the future (FF) | Fit for now (FN) | Fragmented and failing (ff)

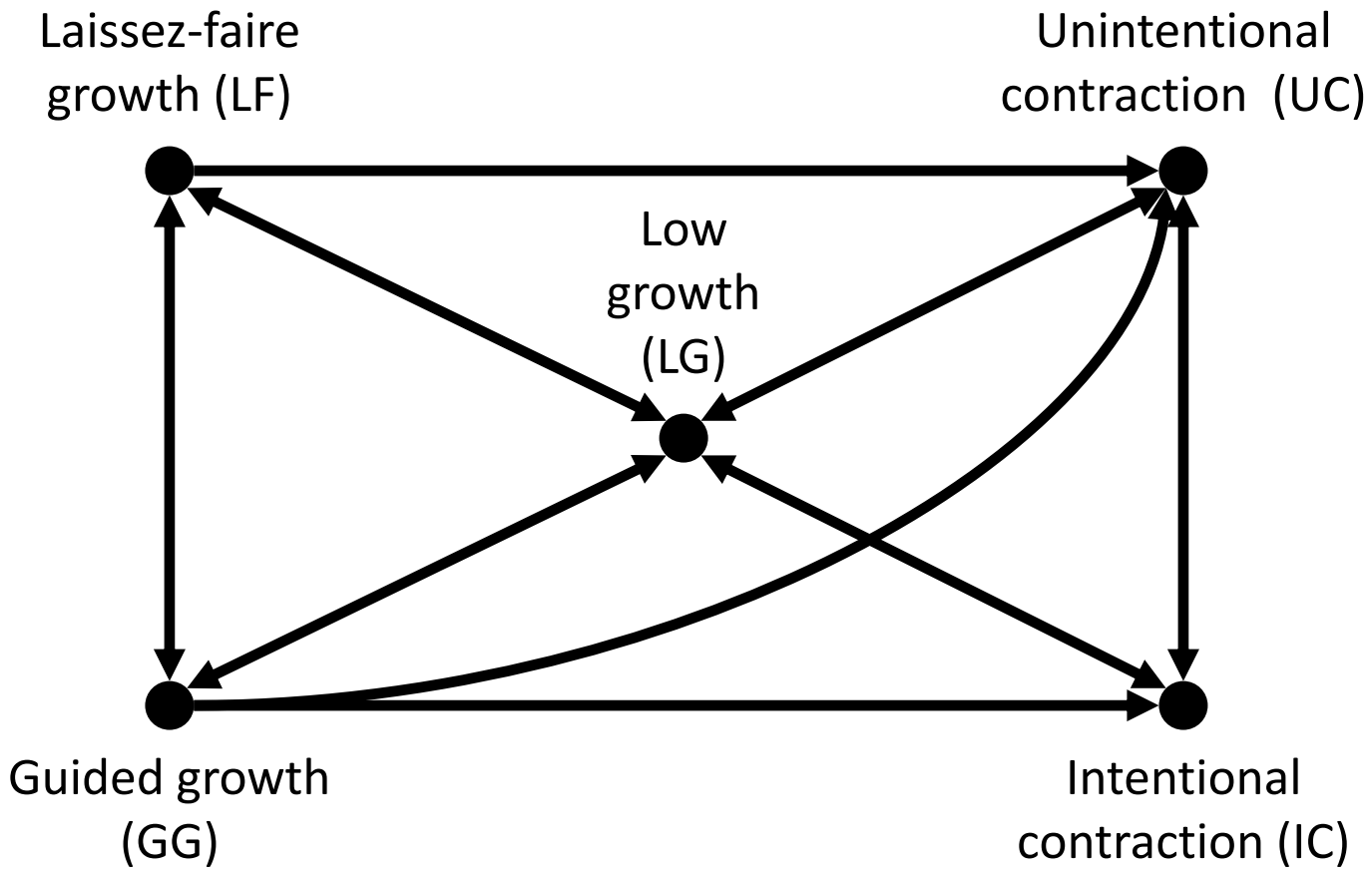
Number of steps between states

	<2.5	2.5-4	>4
<2.5	0	1	2
2.5-4	1	0	1
>4	2	1	0

	H	M	L
H	0	1	2
M	1	0	1
L	2	1	0

	FF	FN	ff
FF	0	1	2
FN	1	0	1
ff	2	1	0

Allowed shifts between descriptor states



Number of steps between states

	LF	GG	LG	MC	UF
LF	0	1	1	2	1
GG	1	0	1	1	1
LG	1	1	0	1	1
IC	2	2	1	0	1
UC	2	2	1	1	0

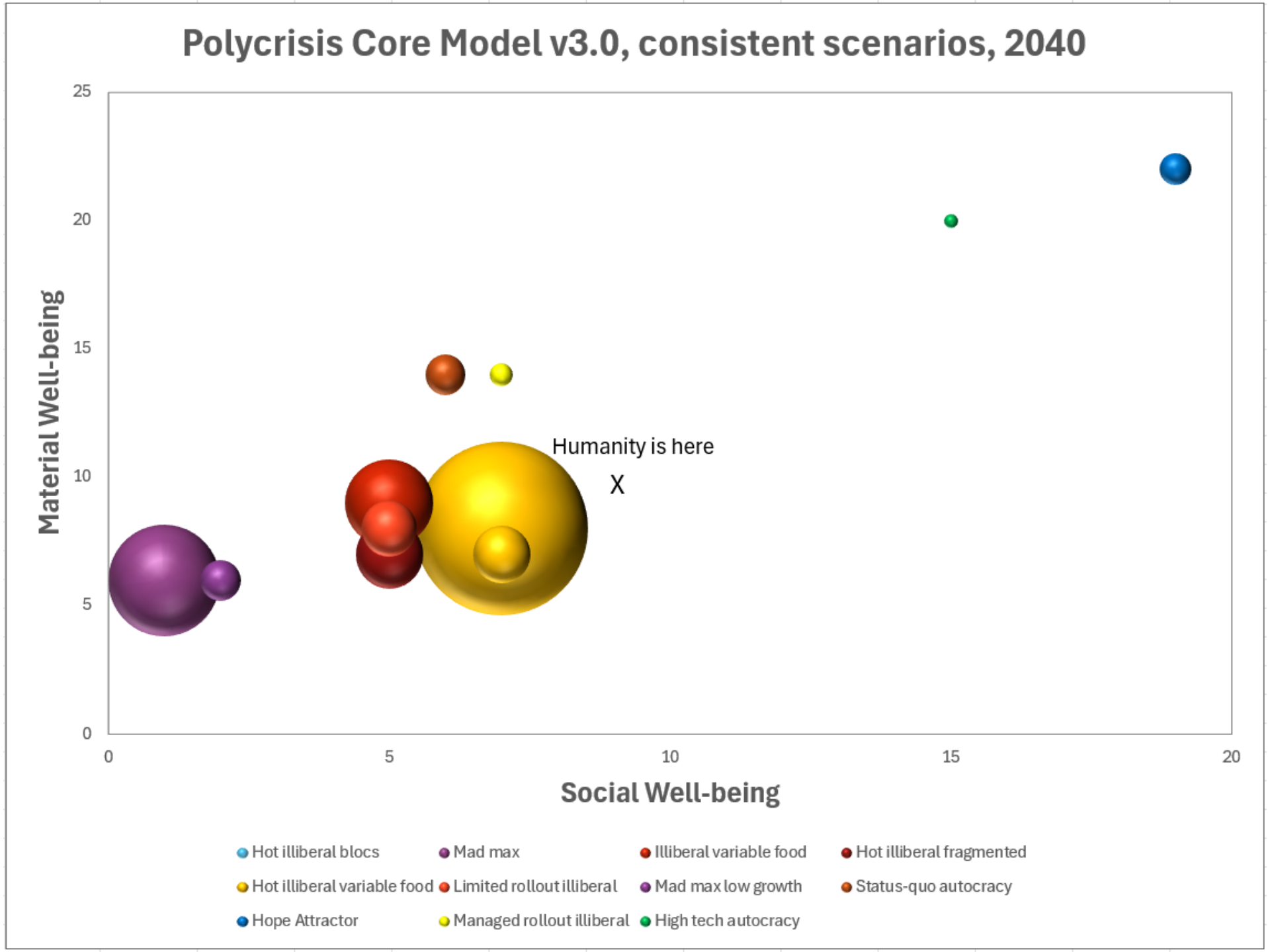
By assigning each descriptor state a normative wellbeing score from 0 to 4 (0 being very poor and 4 being very good), we can graph the PCMv3.0’s 11 consistent scenarios in a two-dimensional normative state space.

PCMv3.0 normative scores

Polity type	Strong democracy	4
	Illiberal democracy	3
	Strong autocracy	2
	Weak autocracy	2
	Nonocracy	0
World Order	International fragmentation	0
	Multipolarity	1
	Consolidated blocs	2
	Multilateral rules-based order	3
	Thick global governance	4
Conflict & Security	Low violence	4
	Widespread non-state violence	1
	Civil/proxy war	1
	International war	1
	Great power war	0
IT	Limited rollout	2
	Managed rollout	4
	Unmanaged rollout	0
Economy	Laissez-faire growth	2
	Guided growth	4
	Low growth	1
	Managed economic contraction	2
	Unmanaged economic failure	0
Health	High burden of disease	0
	Medium burden of disease	2
	Low burden of disease	4
Food	Status-quo global industrial production	2
	Agri-tech industrial breakthrough	4
	Agro-ecological production	2
	Variable regional production	1
	Failed global industrial production	0
Energy	Fossil-fuel dependence	2
	Peak oil and gas	1
	Green-tech breakthrough	4
	Low-carbon energy contraction	0
Transportation	Fit for the future	4
	Fit for now	2
	Fragmented and failing	0
Earth	< 2.5 degrees C	4
	2.5-4 degrees C	2
	>4 degrees C	0
Inequality	Low international/low domestic inequality	4
	High international/low domestic inequality	2
	Low international/high domestic inequality	2
	High international/high domestic inequality	0

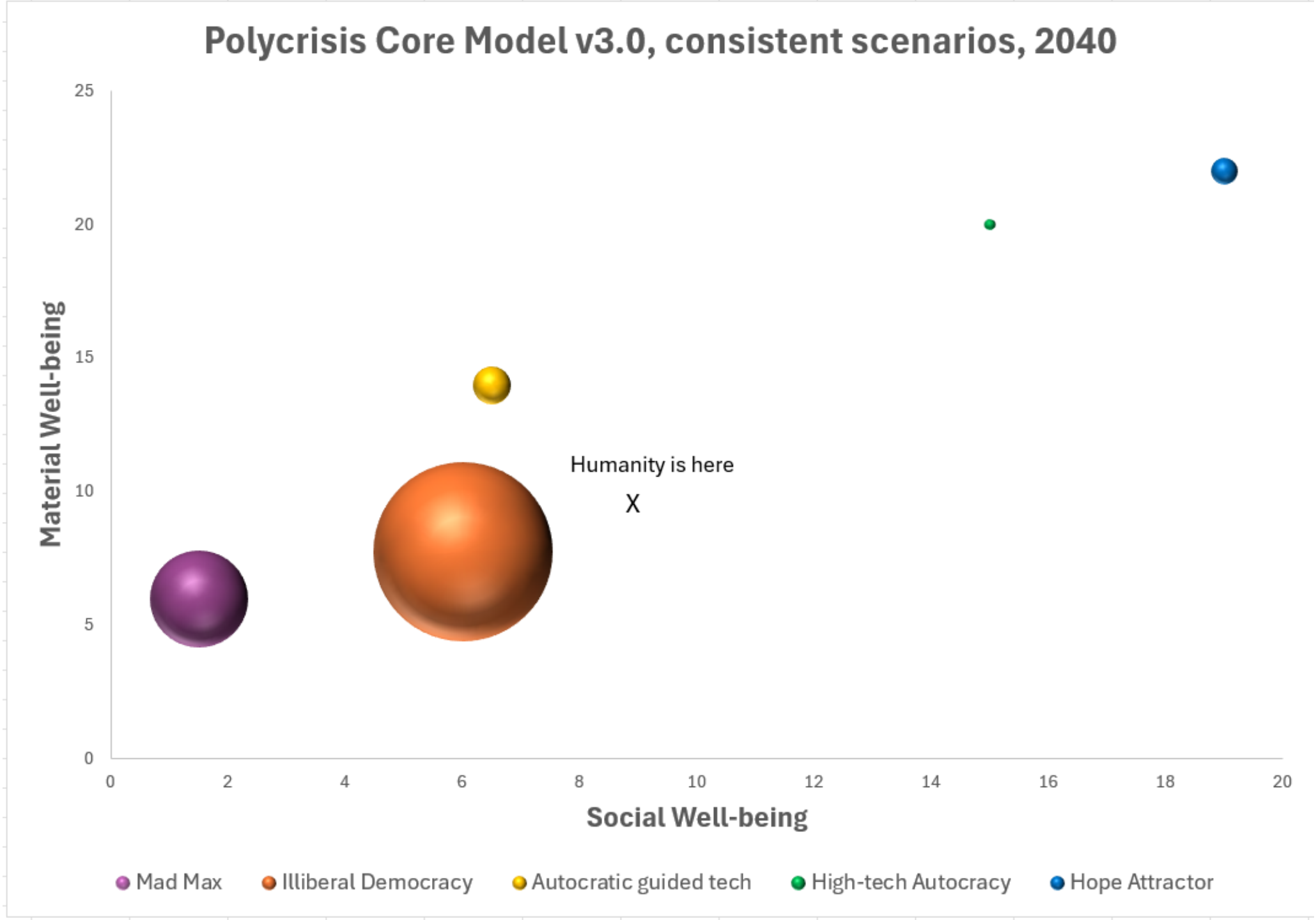
The next slide shows all 11 consistent scenarios arranged in a two-dimensional material and social wellbeing state space.

Bubble size corresponds to scenario weight (attractor basin width).

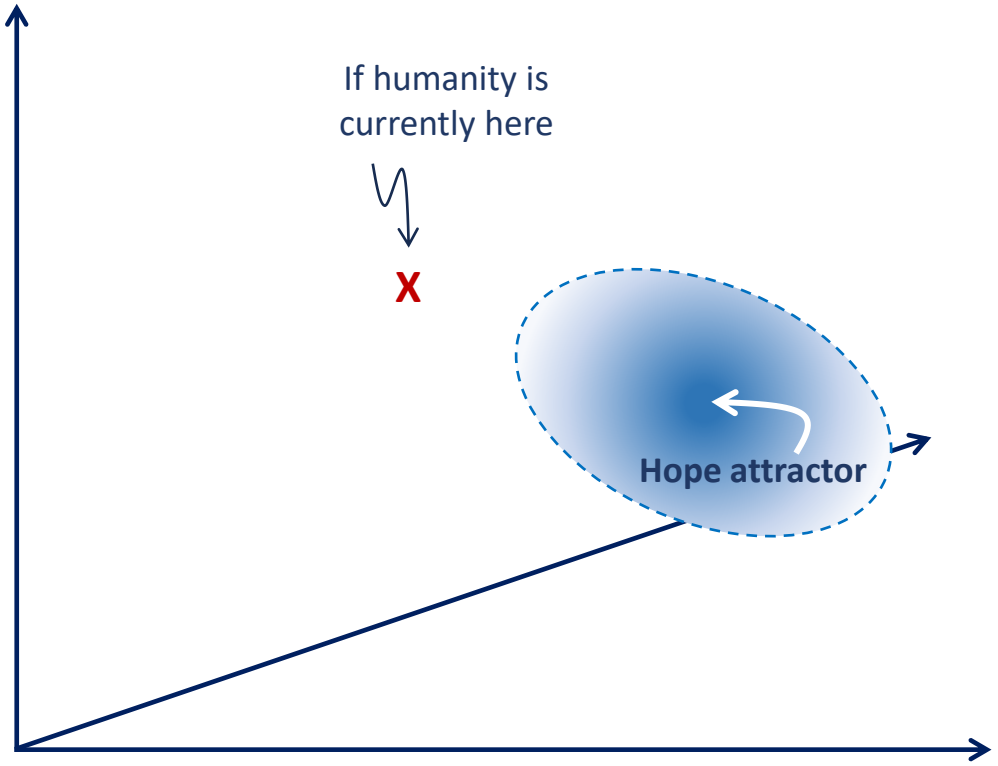

Polycrisis Core Model v3.0, consistent scenarios, 2040
Material Well-being
Social Well-being
0
5
10
15
20
25
Humanity is here
X
Hot illiberal blocs
Mad max
Illiberal variable food
Hot illiberal fragmented
Hot illiberal variable food
Limited rollout illiberal
Mad max low growth
Status-quo autocracy
Hope Attractor
Managed rollout illiberal
High tech autocracy

The next slide consolidates scenarios—all closely clustered in the normative state space—that have common properties.

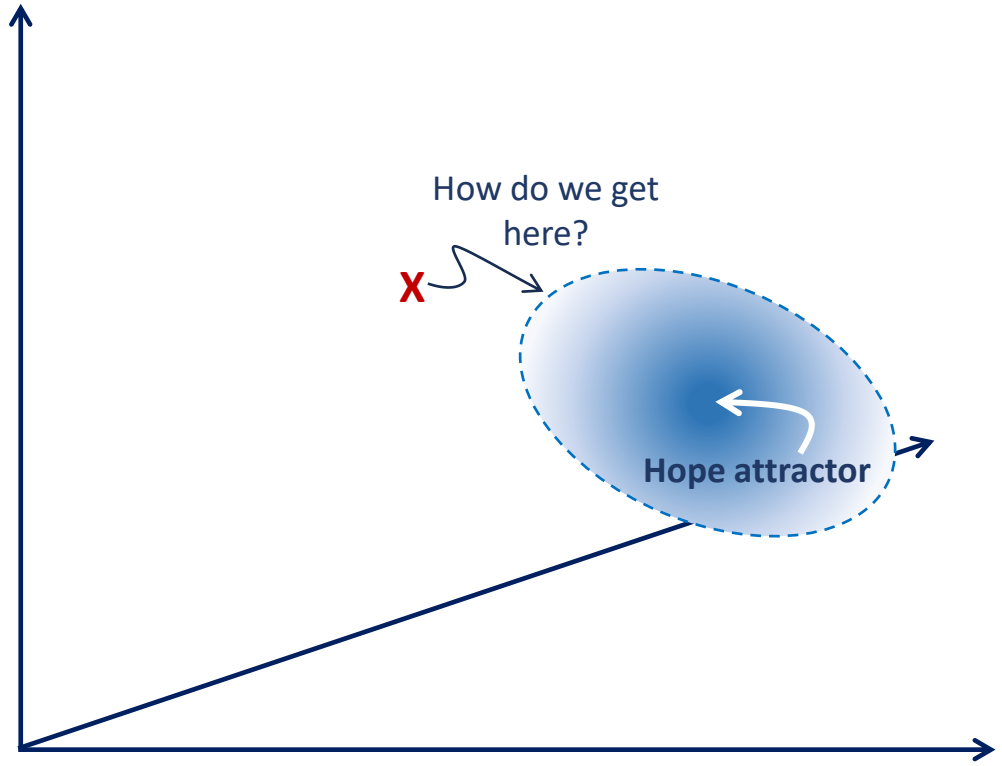
The X shows humanity's current position. The distance between the X and the Hope Attractor does not indicate the difficulty of migrating to that attractor. Rather, it's an indication of the enormous wellbeing gap between where humanity is today and the wellbeing that the Hope Attractor represents.


Polycrisis Core Model v3.0, consistent scenarios, 2040
Material Well-being
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
Social Well-being
Humanity is here
X
Mad Max
Illiberal Democracy
Autocratic guided tech
High-tech Autocracy
Hope Attractor

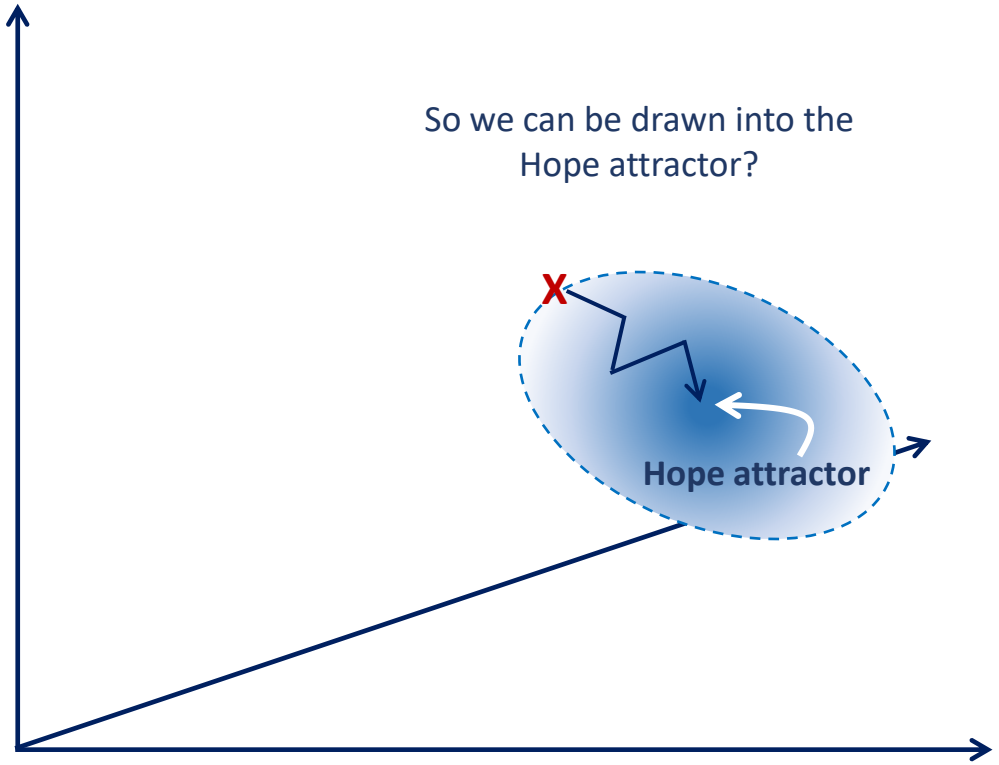
The PCM team is currently doing a pathways analysis to determine what are the most plausible routes—through the model's 11-dimensional state space—from where we are now to the Hope attractor.



This involves finding the points at the edge of the basin of attraction that are closest to where humanity is now.



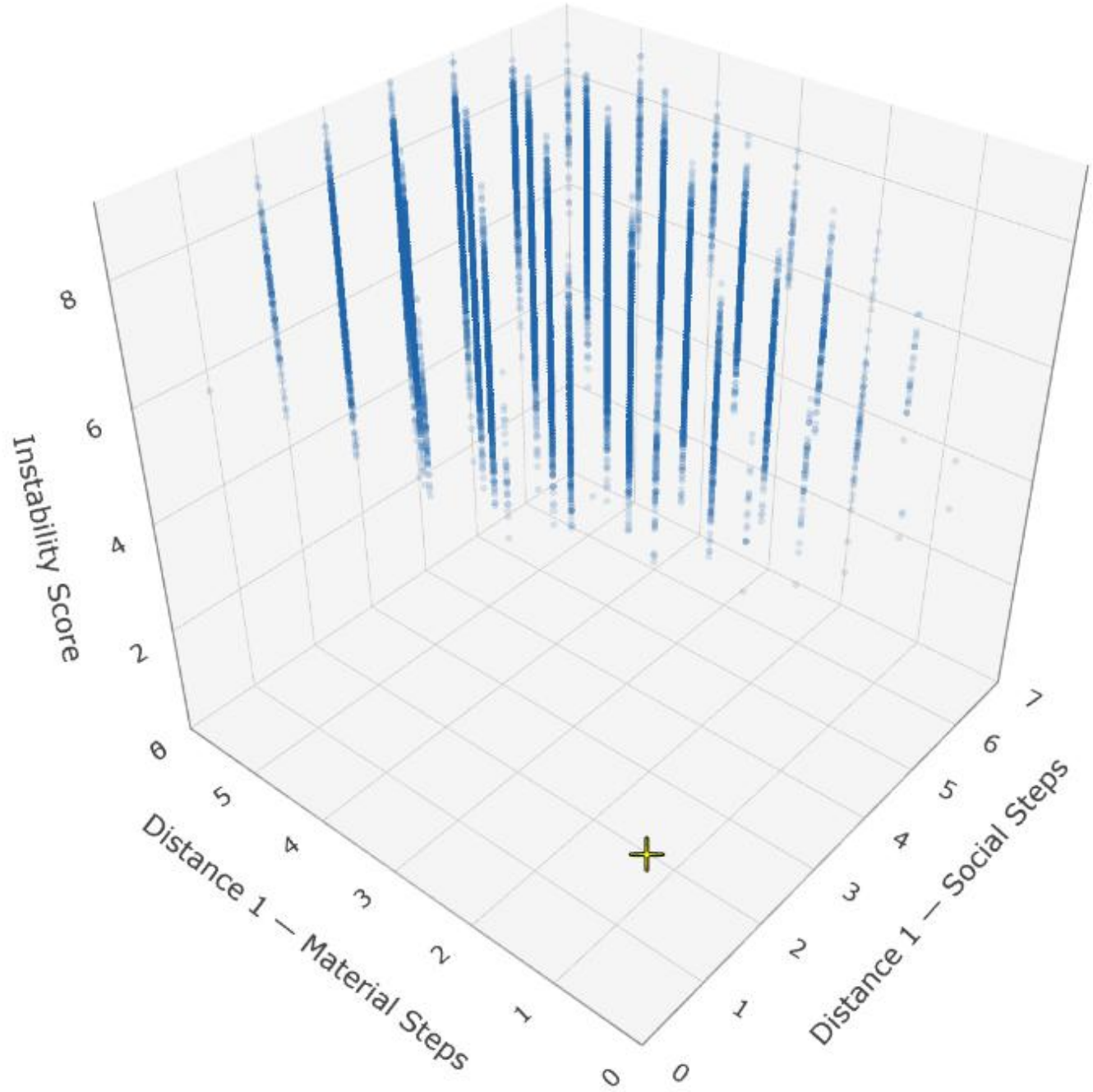
If we can get to one of those points, then the self-reinforcing processes may draw us deeper into the basin.



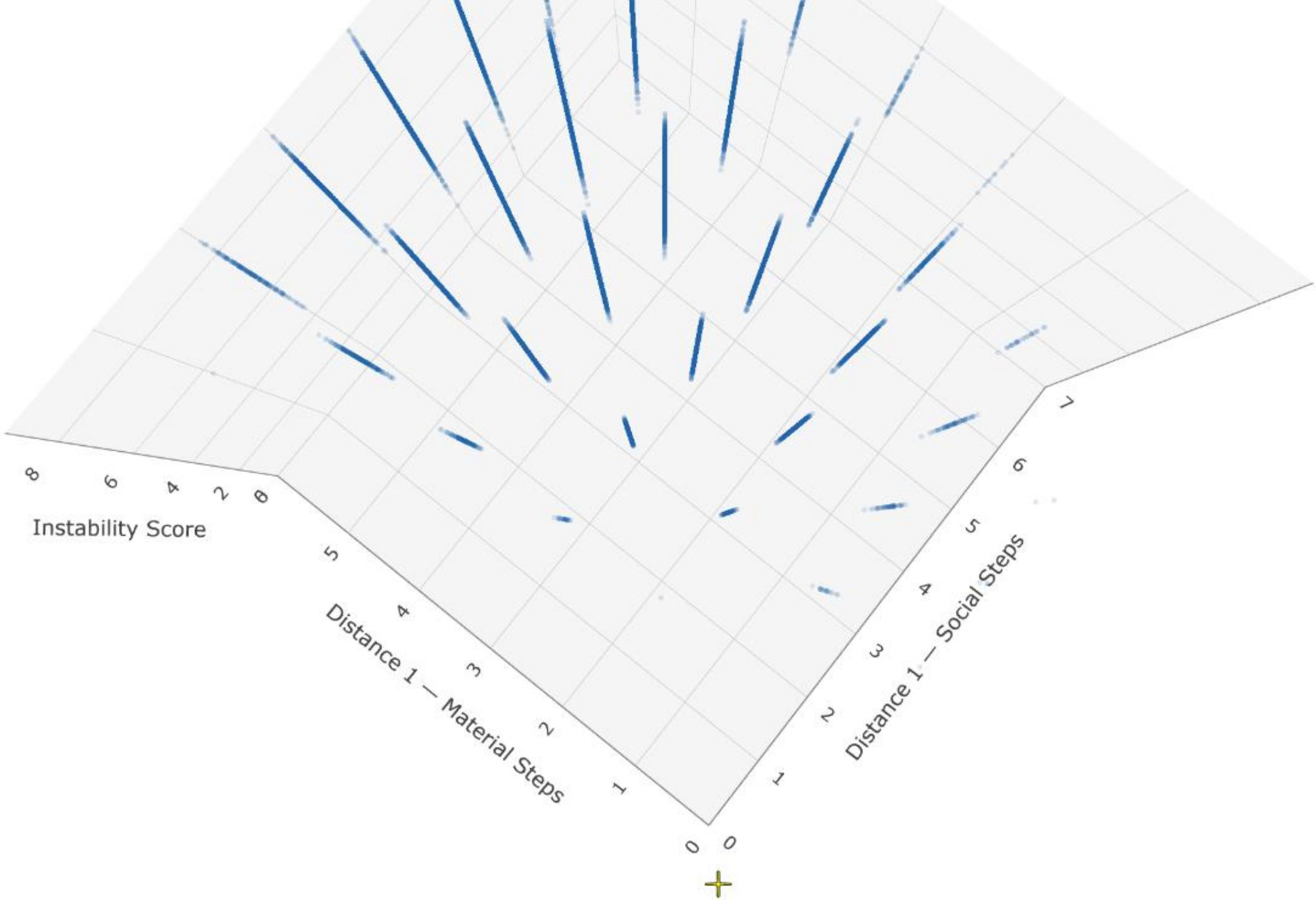
The next slides shows the ~50,000 inconsistent scenarios that migrate to the Hope Attractor arranged in a 3D state space, with the number of material and social “steps” on the bottom plane and scenario instability (the inverse of total impact score) on the vertical axis.

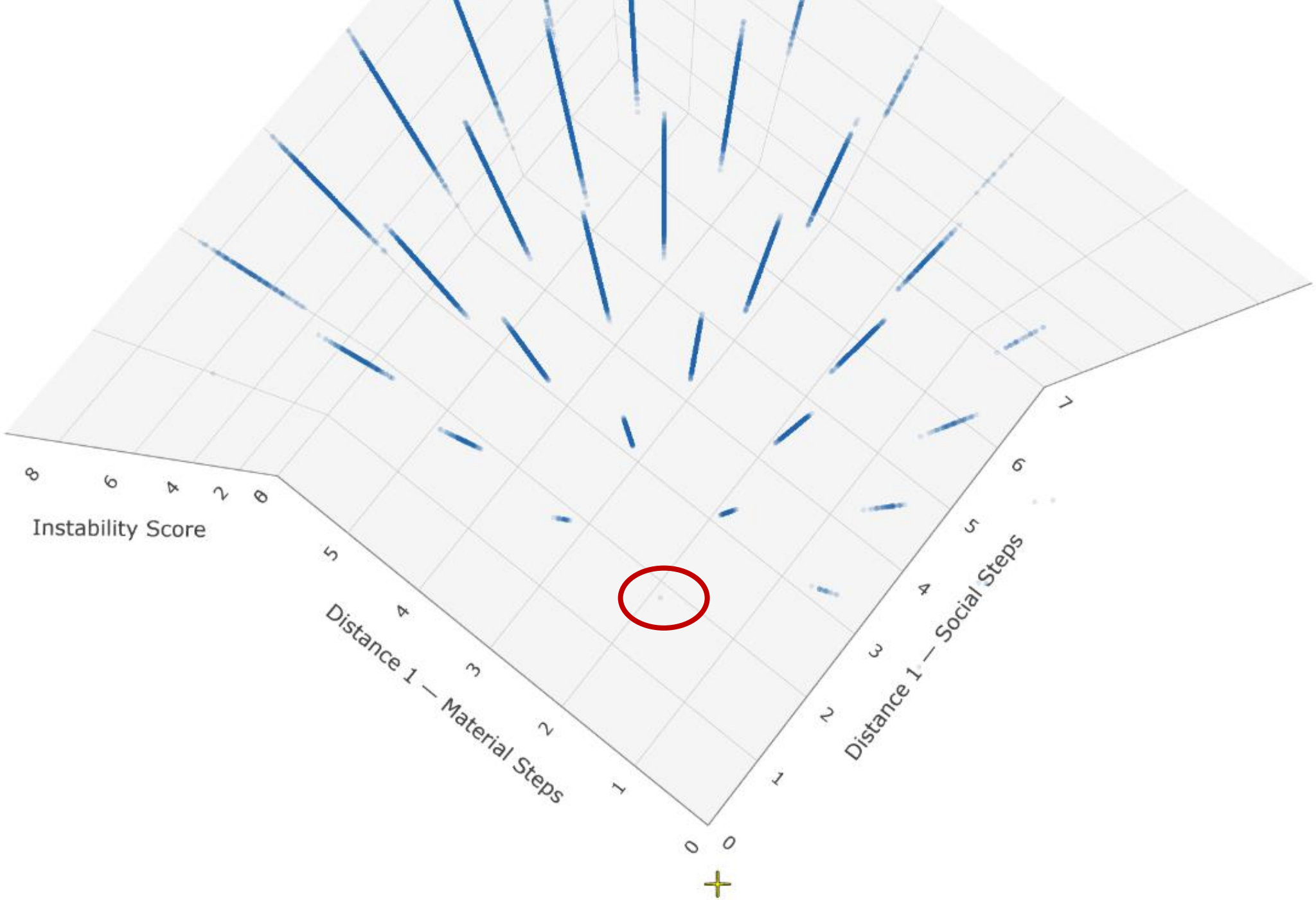
Each of the inconsistent scenarios represents a starting point for migrating to the Hope Attractor.

The cross represents the CSW or “current state of the world.” We are looking for the scenario starting points closest to the CSW.


Instability Score
0
2
4
6
8
Distance 1 — Material Steps
0
1
2
3
4
5
6
Distance 1 — Social Steps
0
1
2
3
4
5
6
7

The next three slides show that one of these scenarios is only two material and two social steps (highlighted in yellow) away from the CSW.


Instability Score
8
6
4
2
0
Distance 1 — Material Steps
0
1
2
3
4
5
Distance 1 — Social Steps
0
1
2
3
4
5
6
7


Instability Score
8
6
4
2
0
Distance 1 — Material Steps
0
1
2
3
4
5
Distance 1 — Social Steps
0
1
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4
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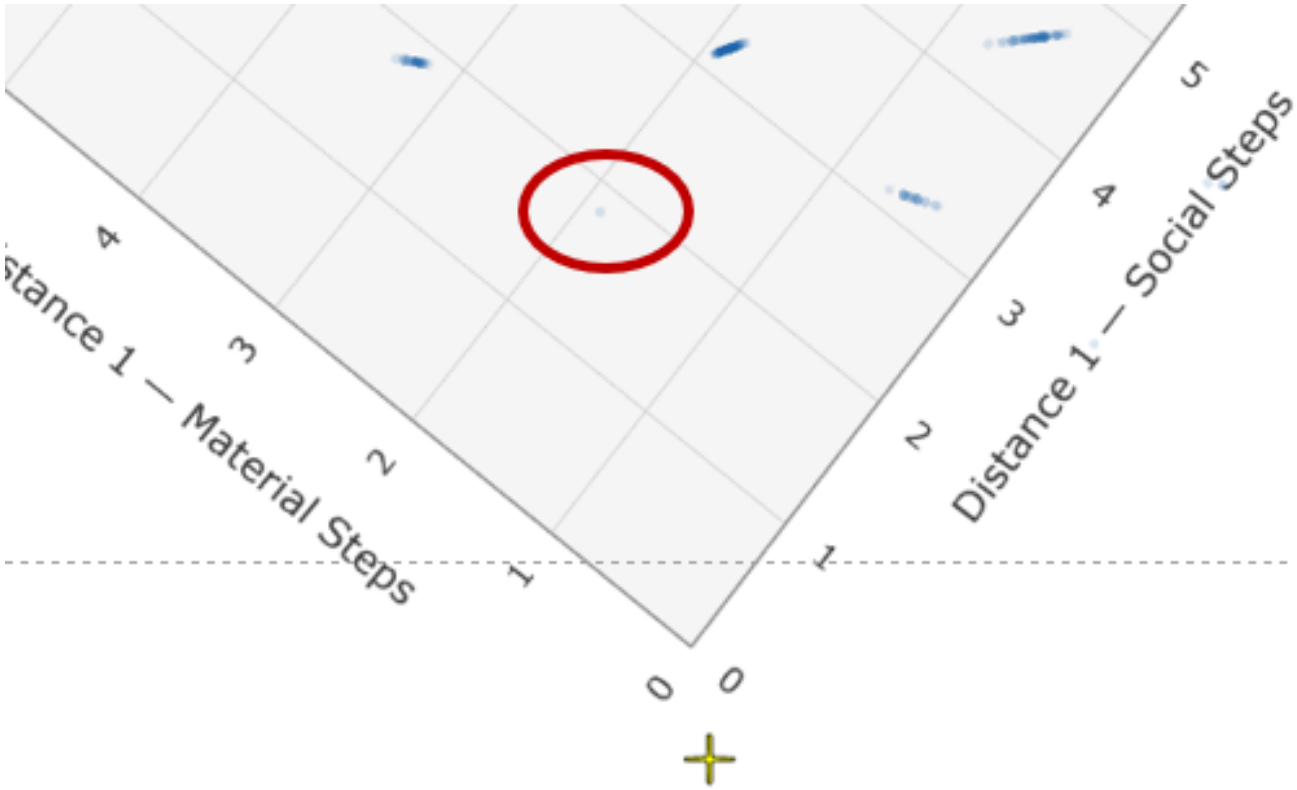
7



DESCRIPTORS	
Polities	Illiberal democracy
World Order	Multilateral rules-based order
Violence	International war
Information technology	Unmanaged AI rollout
Economy	Guided growth
Health	Medium burden of disease
Food	Status quo industrial production
Energy	Cleantech breakthrough
Transportation	Fit for the future
Environment	2.5-4°C warming by 2100
Inequality	Lower international inequality, lower domestic inequality

Final remarks

The CIB method ensures that the PCM is both **legible** and **corrigible**. It's legible in the sense that people without specialized expertise can grasp the PCM's judgments and mathematical logic, something that's not true of models using, for instance, system dynamics. The PCM will be corrigible, because the descriptor and state rationales, scoring justifications, and matrix itself will be publicly available. Interested people will be able to run the model using their own assumptions and knowledge to test alternative outcomes and pathways.

In this sense, CIB and the PCM will help democratize humanity's decision making about its complex challenges.