31st Annual INCOSE international symposium

virtual event

July 17 - 22, 2021

Opportunities and Challenges of Sociotechnical System Engineering

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Beginning with the End in Mind…

- The artificial boundary we create to define a proposed system enables bias that renders globally imbalanced solutions and incurs negative consequences
- Solutions are imbalanced in two ways. The boundary…
  - Renders a locally-optimized solution created under a partial requirements set
    - Often highly-motivated by profitability/affordability
  - Distances Systems Engineers from the global consequences of design decisions
- Authors' Assertion – A holistic, unified approach to creating system solutions must include consideration of the resources to be consumed and the consequences of the design choices

How much trouble can a simple boundary cause?

My Relevant Life Lessons

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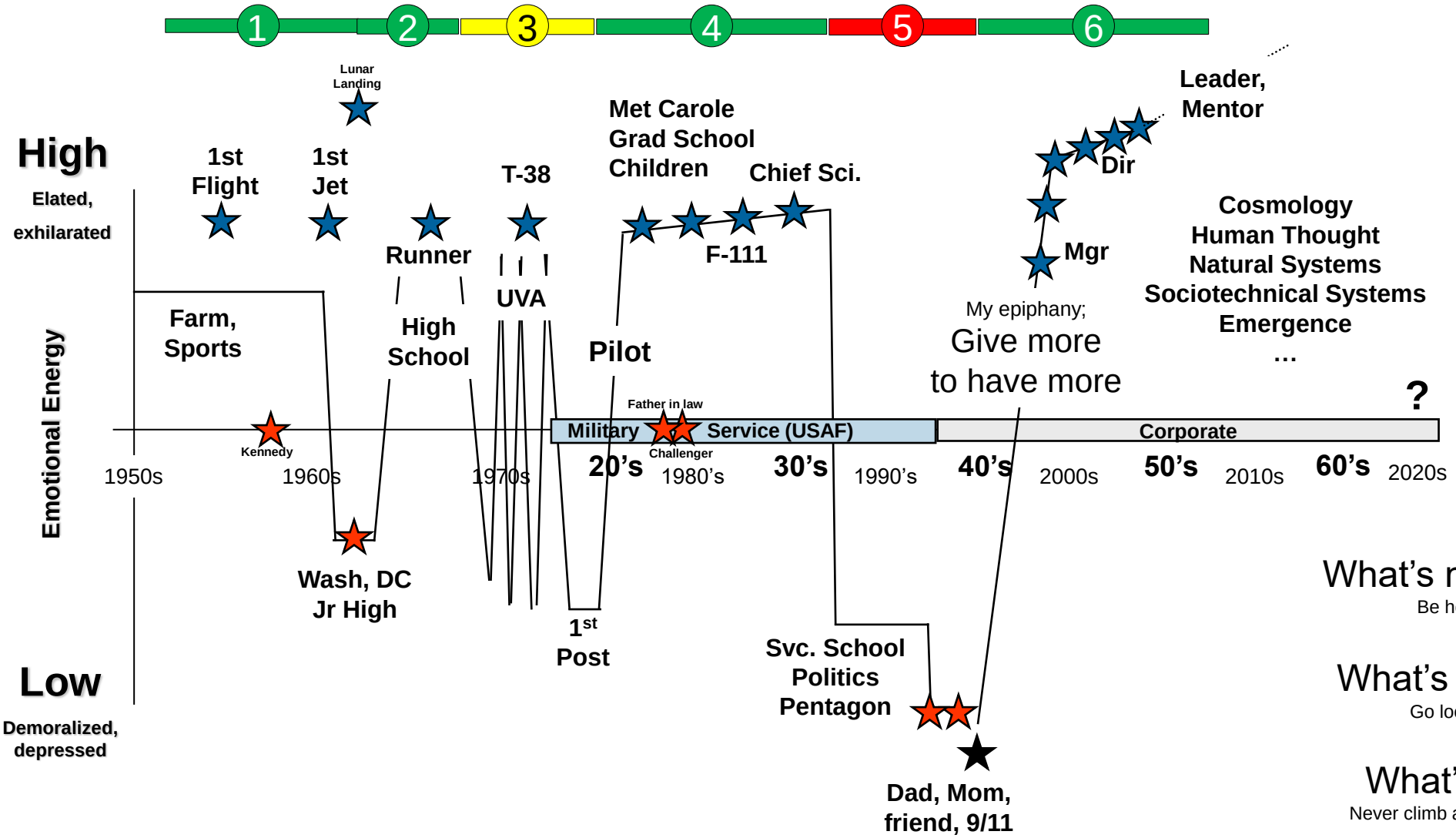


1. Try to make sense of it all
2. The race isn't all about you
3. It's not always easy and fun
4. It's easy to convince yourself you know what you're doing
5. Life is relational, not individual
6. Exert influence, not control. Timely course corrections

What's motivating you?

Be honest with yourself

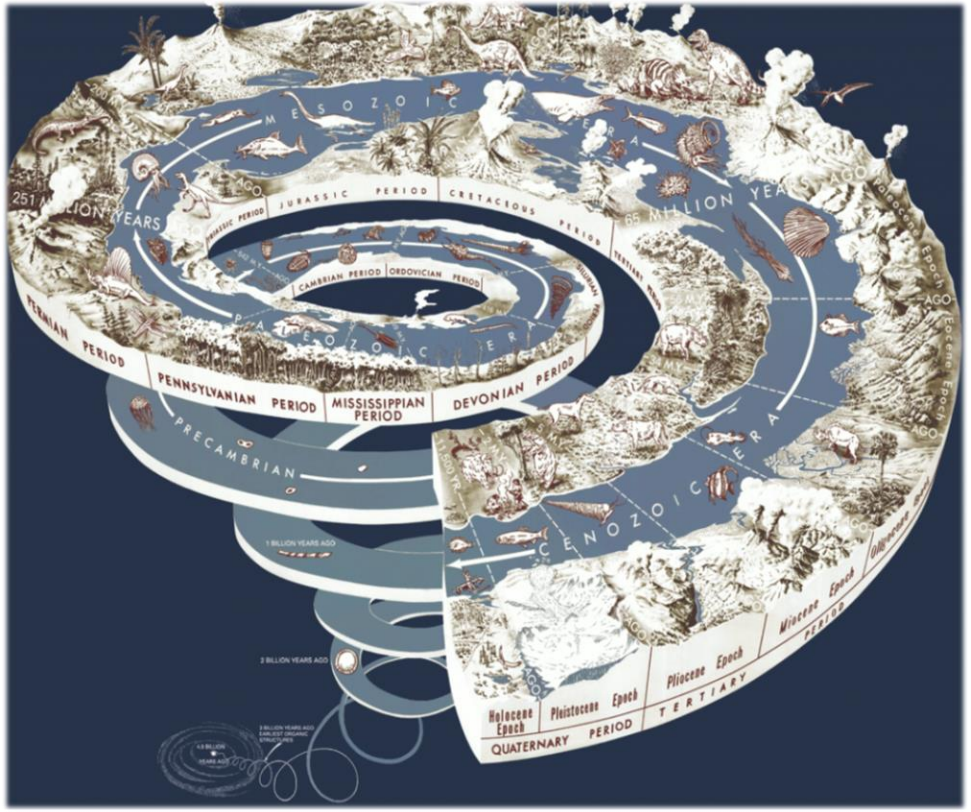
What's stopping you?

Go look in a mirror first…

What's your goal?

Never climb alone. Rise with the group.

A little perspective…



The Age of Earth, ZME Science

Nature's Mission; Carbon Sequestration Product; A balanced (life) equation

Our Industrial Revolutions are fueled by compounds that nature has sequestered to create life balance

4 It's easy to convince yourself you know what you're doing

Efficiency = 100%
Waste = 0.

Life

Birth **Death**

Reproduction **Decomposition**

?

Machine Learning, Artificial Intelligence

Productivity & Efficiency

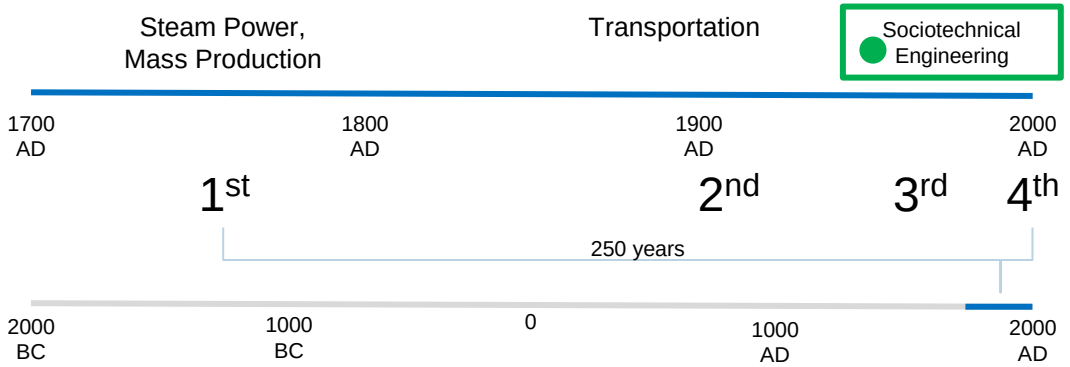
Tools and Power Sources

Infrastructure and Machines

Information Revolution

Ubiquitous Computing

Resource Consumption



Humans – 3.0 x 10^{-4} Bn years, IR's – 2.5 x 10^{-7} Bn years

Earth – 4.5 Bn years, Life - 3.7 Bn years

Big Forces at work… System Dynamics provides insight

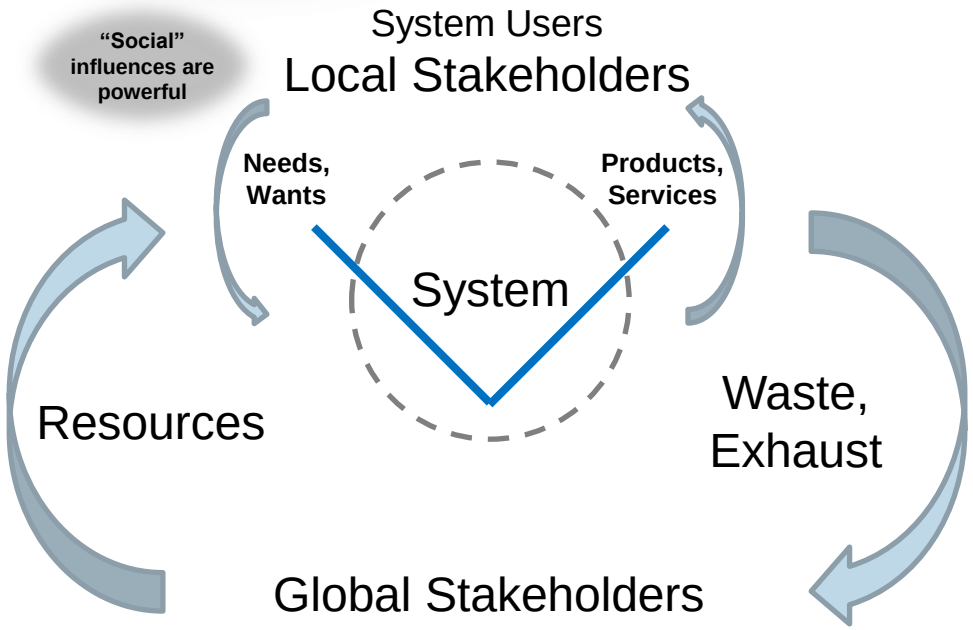
Jason Hickel; economic anthropologist whose research focuses on global inequality and political ecology

Economic System Influences

Eat epic meals, then diet
Wellness through Medication
Conspicuous Consumption
Instant Gratification

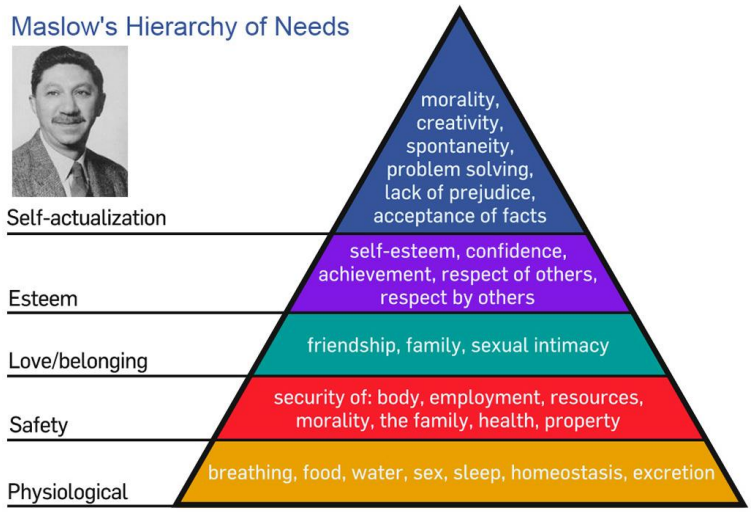
3

It's not always easy and fun to get out of what's easy and fun to get into



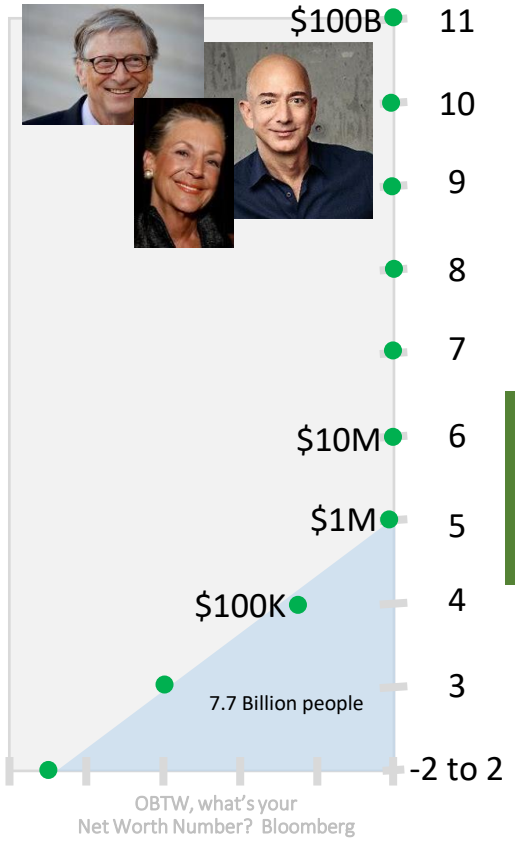
Sociotechnical Engineering; Restoring Natural Balance

2 The race isn't all about you



However we got here… Today's polarization may be viewed as an artifact (emergent behavior) of the economic system currently in place

Those who spend…

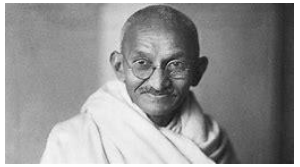


Those who pay…

Need vs. Greed
Who decides?

The crux of the Sociotechnical Engineering Need statement

The world has enough for everyone's need, but not enough for everyone's greed. Mahatma Ghandi

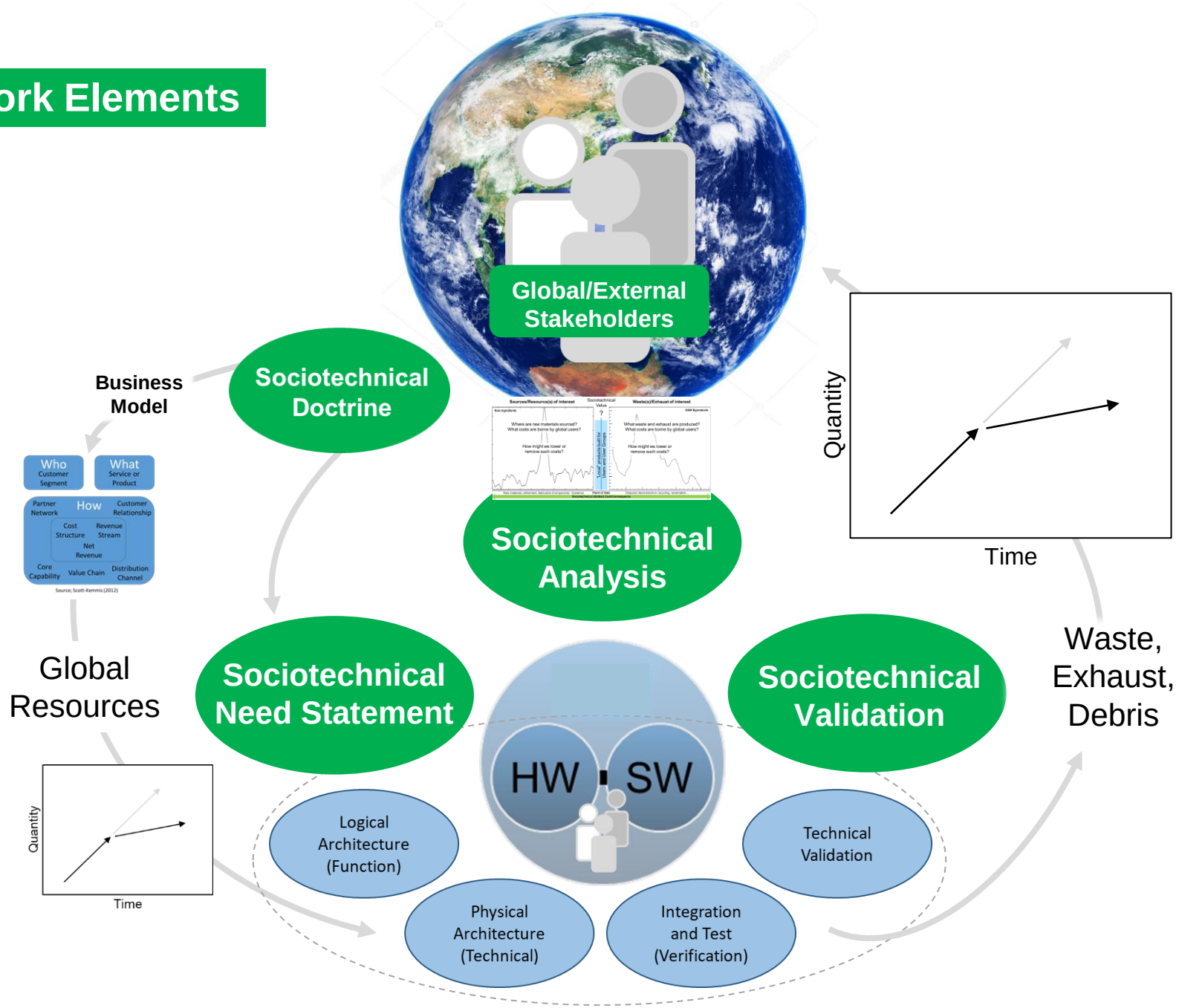


Can there be balance?

What might that look like?

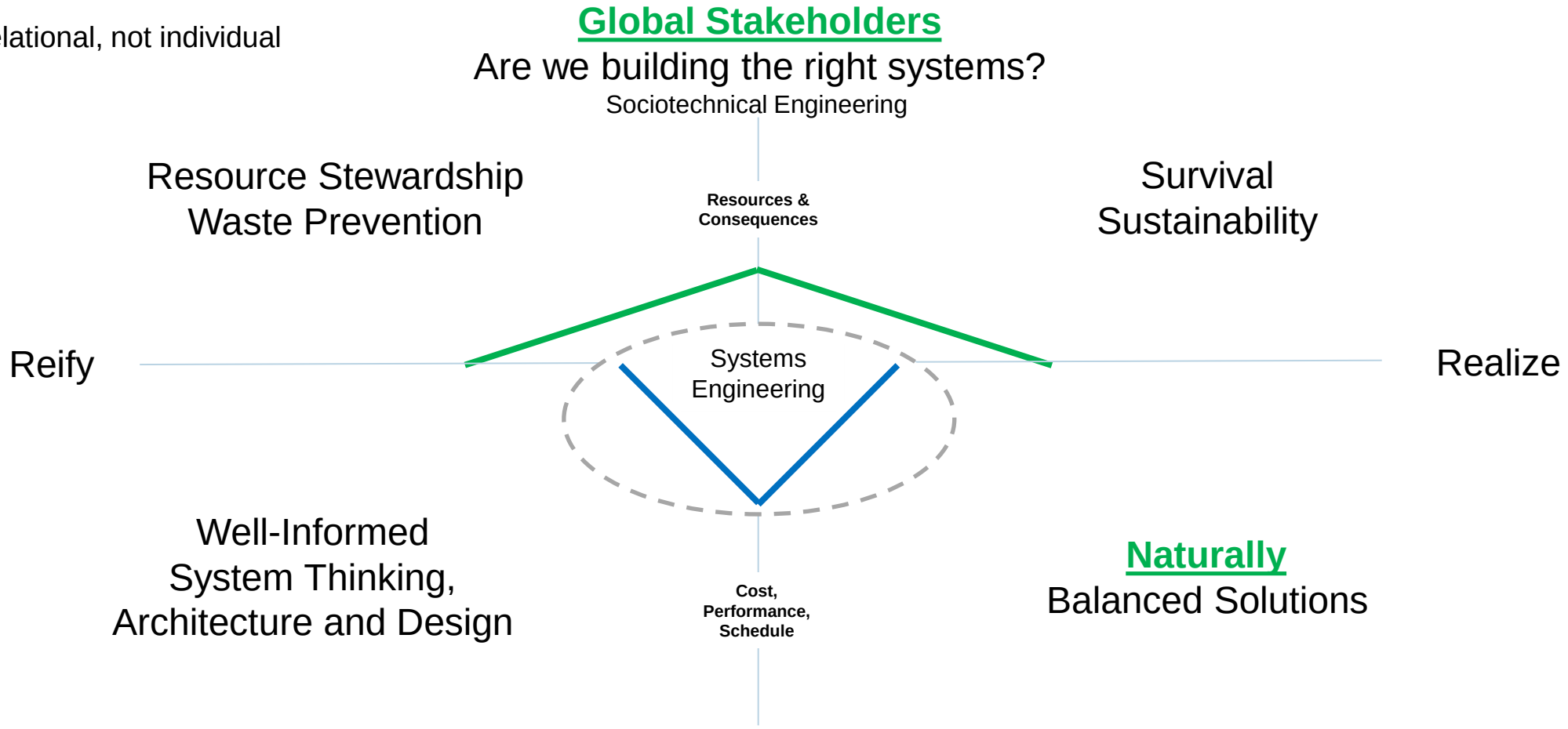
How might we get there?

STSE Framework Elements



A Unified Approach to Sociotechnical Thinking and Systems Engineering

5 Life is relational, not individual



*Reify; to make something abstract real

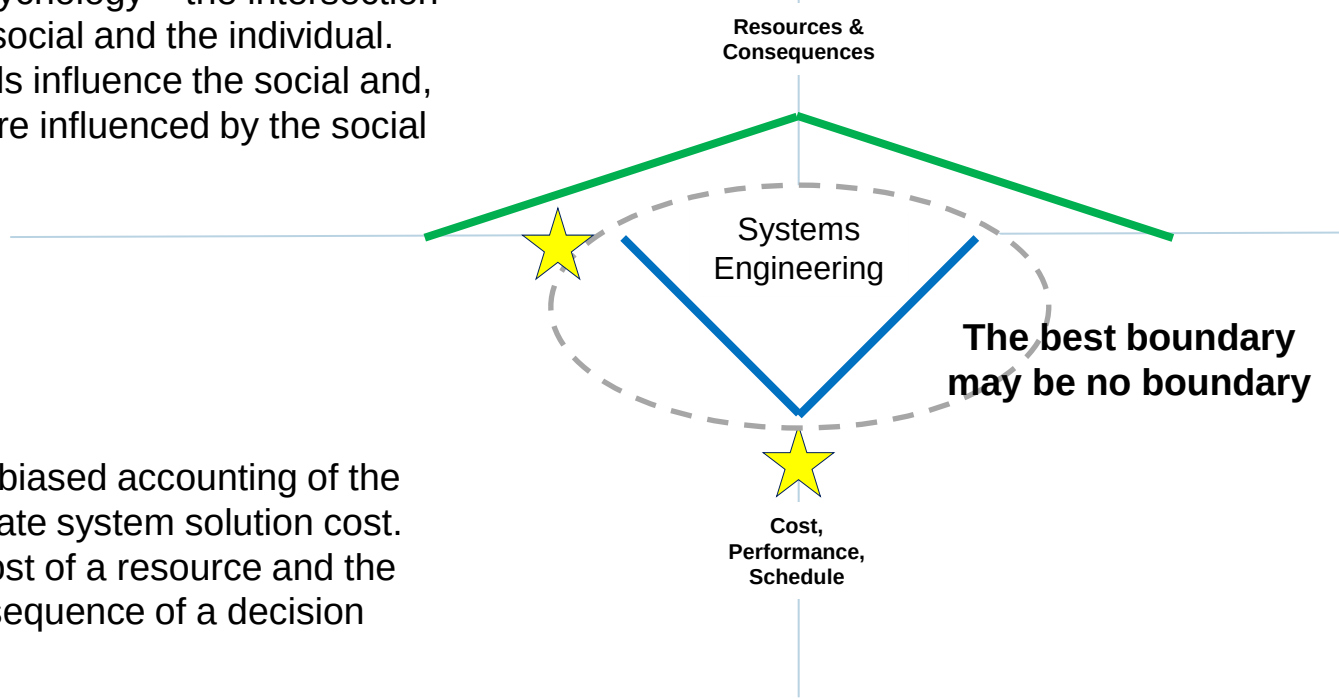
A Unified Approach to Sociotechnical Thinking and Systems Engineering

Global Stakeholders

Are we building the right systems?

Sociotechnical Engineering

Social Psychology – the intersection of the social and the individual. Individuals influence the social and, in turn, are influenced by the social



An un-biased accounting of the candidate system solution cost. The cost of a resource and the consequence of a decision

6 Exert influence, not control. Timely course corrections

Change our Trajectory

Campaigns to reduce consumption and prevent waste (course corrections)

Local Stakeholder

Are we building the system right?

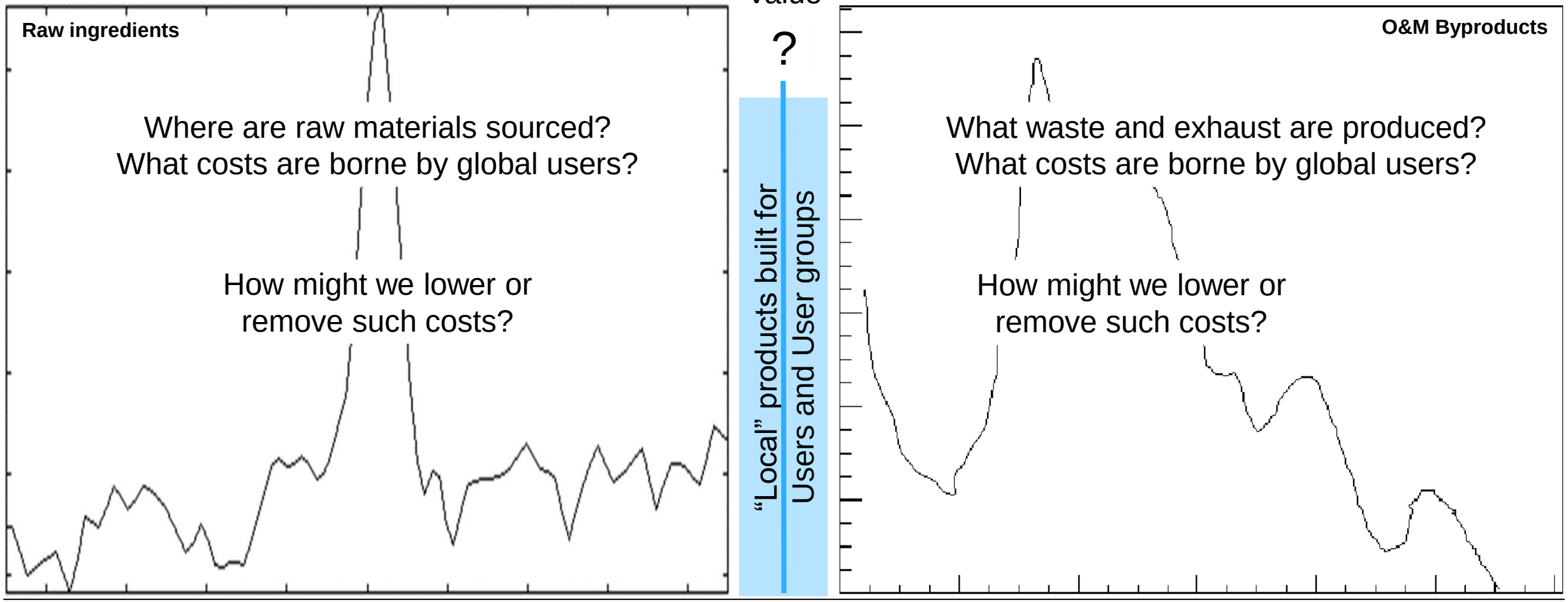
Assessing Sociotechnical Value against Cost of Resources and Byproducts

Sources/Resource(s) of interest

Sociotechnical Value

?

Waste(s)/Exhaust of interest



Raw materials, refinement, fabrication (Components - Systems) **Point of Sale** Disposal, deconstruction, recycling, reclamation…

Sociotechnical (Global) Cost/Consequence

Unified Sociotechnical Thinking and Systems Engineering

Challenges

- Systems without boundaries?
- Designing under the influence of…?
- Sociotechnical Valuation

Opportunities

- Prevention beats prescription
- Global Stakeholder inclusion
- Natural balance in our systems

Further consideration…

- Is this framework merely derivative thought?
- What would Need Statements / Validation look like?
- How might Requirements change?

Final thoughts

- We all buy and we all pay
- Small influences alter outcomes
- Shape the future

Key learning points

- Sociotechnical thinking balances the affordability of a solution against the cost of its implementation
- This vision and framework promotes global benefits by influencing local choices
- It is well within our goals and aspirations to deliver solutions that enhance survivability and sustainability

A unified approach to Sociotechnical Thinking and Systems Engineering leads us to better local choices now and a better global future

Good for All

Good for One

How do we build a better tomorrow?

Together

Global perspective, individual action

Change your choice, change our future