EXPLORING THE NATURE OF *INSIGHT* IN PARTICIPATORY SYSTEM DYNAMICS MODELING

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(Selected slides)

- Ongoing work with:
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Observations that started this work

- Experiences with "AHA!" moments
  - Our own
  - Observations of people in our modeling workshops
- System dynamics emphasis on *dynamic insight*, a deep, intuitive understanding about structure—behavior relationships
- A sense from our experience that the range of insights possible from system dynamics is richer
- A question about what we really mean by "insight" in SD

Questions

- What do we really mean by "insight" in SD?
- What is the full range of insights possible?
- When do insights happen? What generates insight?
- Is it possible to be more deliberate about designing group modeling processes to facilitate participant insight?
- Can we connect particular kinds of system dynamics activities with particular kinds of insights?

Overview

- Why collaborative modeling
- Key features of system dynamics modeling
- Benefits of participatory SD modeling
- What is insight?
- System Dynamics Insights
  - Behavioral insights
  - Structural insights
  - Dynamic insights
  - Paradigmatic insights
- Why thinking more deeply about insights is important

Why involve stakeholders in collaborative modeling?

- **Normative**: participation is a democratic right
- **Substantive**: participation improves the quality of decisions
- **Instrumental**: increases the legitimacy of decisions, reduces conflict, builds trust and ongoing relationships among participants, improves the social context of future decisions.

(e.g. Bierle and Cayford 2002, Dietz and Stern 2008)

Analytic-deliberation

- (Environmental) policy decisions involve values as well as facts, tradeoffs among conflicting values, incomplete or uncertain information.
- Reasonable people disagree about which information is most needed to understand the choices facing them, how best to get it, and how to interpret the information that is available.
- Scientific analysis should be directed by and in support of deliberation.

•Thomas Dietz (2013) **Bringing values and deliberation to science communication**PNAS 2013 110 (Supplement 3) 14081-14087; published ahead of print August 12, 2013,doi:10.1073/pnas.1212740110

Models and Modeling

- Support both analysis and deliberation

"When we try to pick out anything by itself we find that it is bound fast by a thousand invisible cords that cannot be broken, to everything in the universe."

-- John Muir, 1869

Models abstract from complexity

- Some connections are more relevant than others for explaining particular observed phenomena.
- We create models – abstractions of a subset of reality – to help reduce detail complexity and reveal dynamic complexity -- "how things work"

Socio-ecological problems are messy

- Multiple stakeholder perspectives
- Paradigms supported by very strong reinforcing loops (Kuhn). You subscribe to a particular paradigm because you believe that's the way the world works. You use the paradigm to structure the way you collect evidence about how the world works. Your evidence supports the paradigm.
- Reconciling or communicating effectively across paradigms is difficult
- Requires re-structuring participant thinking

Why involve stakeholders in collaborative modeling?

- **Normative**: participation is a democratic right
- **Substantive**: participation improves the quality of decisions
- **Instrumental**: increases the legitimacy of decisions, reduces conflict, builds trust and ongoing relationships among participants, improves the social context of future decisions.
- **Learning**: participatory modeling can restructure the way people see the system and build capacity for future problem-solving

SD Paradigm

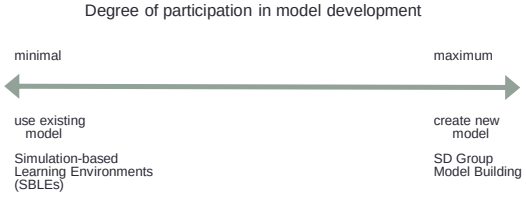
- Explains trends over time
- System behavior is a function of structure
- By structure we mean causal structure
- Describing structure in operational form allows us to test structural changes that → behavioral changes
- Solutions to dynamic problems take the form of interventions in system structure

Key features of system dynamics

I.	Define the problem	• Graphs of problematic behavior over time
II.	Identify problem causes	• Causal diagrams (Behavior is caused by structure)
III.	Identify potential solutions	• Identify leverage points
IV.	Evaluate potential solutions	• Use simulation model to test "what if" scenarios
V.	Choose and implement	• Use model results to choose

Participatory system dynamics modeling

Including stakeholders in "formal" decision analysis

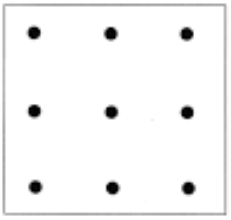


What is insight?

- *Common usage*
  - "deep intuitive understanding"
- *Psychology*
  - Insight happens when you have a sudden restructuring of the way you see a problem
  - **Problem-solving Impasse → restructuring → "Aha!", solution**
  - Impasse: incremental application of known methods doesn't work
  - The restructured way of seeing makes the solution instantly clear

What is insight?

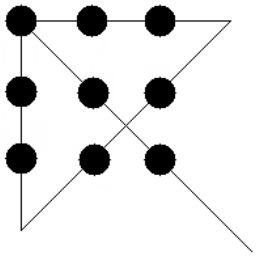
- Product
- Process



http://www.psywww.com/intropsych/ch07_cognition/thinking_outside_the_box__with_the_9-dot_problem.html

The 9-dot problem:

- Connect all the dots with 4 (or fewer) straight lines without taking your pencil off the paper.



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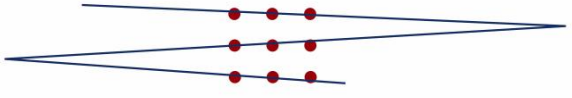
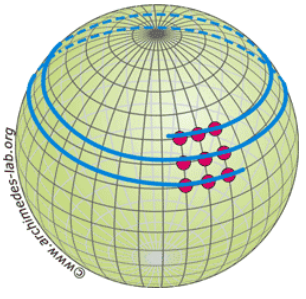


https://www.linkedin.com/pulse/can-you-connect-9-dots-tyrone-lingley-pmp-bcom-dipit



- *Philosophy* *(Lonergan 1974/1992, Marroum 2004)*

1. Insight comes as **release of tension of inquiry after an active period of struggle**.

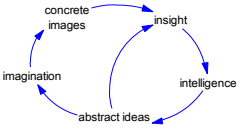
2. Insight is different from remembering. It is a matter of **understanding something that was not understood before** rather than recalling previous understanding.

3. **Insight emerges from the interplay between images and ideas**, where "images are concrete and produced by the imagination. Ideas are abstract and are produced by intelligence. To have an insight, you have to have an image. You get a schematic image, and you get hold of something and you compare your schematic image with your data. And you see, well, your schematic image has to become more complex; and you get an insight into that. And you keep building up. So there's a development of imagination in connection with understanding itself, even a very technical type of understanding." (Lonergan, 1974, p. 223)

4. Insight passes into the habitual texture of the mind. "**It becomes difficult to forget what has been understood**."

Recap

- Impasse → **restructuring** → sudden solution
- Breakthrough after active period of struggle
- Understanding in a new way
- From interplay between images and ideas



System dynamics insights

Insights about the dynamic behavior of systems:

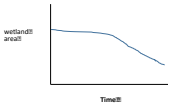
System **behavior** = f(system **structure**)

But to understand the relationship, first you have to understand behavior and structure

Unpacking system dynamics insights

- *Problem-related or Behavioral insights:* seeing problems as trends over time
- *Structural insights:* seeing causal and operational relationships
- *Dynamic insights:* seeing relationships between structure and behavior
- *Paradigmatic insights:* seeing the world in system dynamics terms

Problem-related or Behavioral insights



- Seeing a graph of some system indicator fluctuating over time as the problem definition instead of an event
- Understanding a problematic behavior in relation to a desired behavior, understanding what success would look like when a dynamic problem is solved
- Seeing that a dynamic problem is associated with a particular time horizon
- Seeing that different stakeholders might define the problem with different sets of trends

Structural insights

- See system structure as components and connections
- Recognize that structure is defined relative to a subjective standpoint or problem
- Understanding the concept of a system boundary
- Seeing **causal** connections
- Seeing where things accumulate
- Understanding how causal links work, seeing link polarity
- Seeing feedback structure, understanding loop polarity
- Seeing multiple causes/ effects, seeing how a variable can be both cause and effect at different points in a loop
- Understanding parameters, identifying policy levers
- Seeing connections in mathematical terms

- Feedback structure empowers participants to see their potential as agents of change (Luis Reyes-Luna)
- The collective *production* of common thought is the goal of collaboration (Laura Black)

Dynamic insights

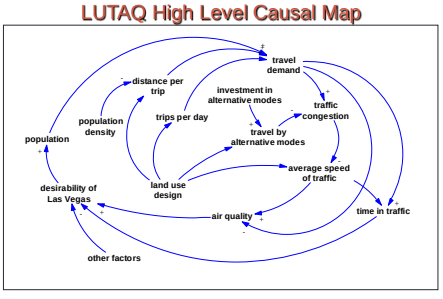
- Understanding …
  - … relationship between feedback loops and behavior
  - … principles of accumulation
  - … Behavior of multiple loops
  - … Effect of delays
  - … Behavior of complex systems
- Understanding that structure is a dynamic hypothesis -- a hypothesis about what is causing the dynamic behavior of the system

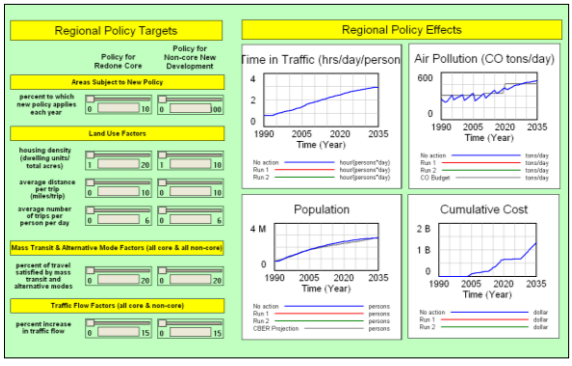
Paradigmatic insights

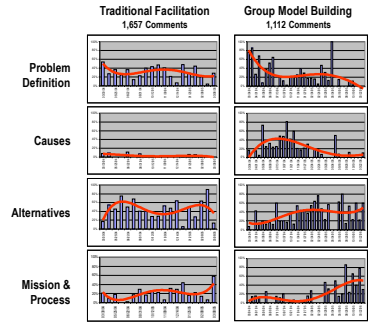
- Seeing the world as a system, with a causal, feedback structure that endogenously generates dynamic behavior

Land Use, Transportation, Air Quality in LV

- Compared behavior and outcomes in two parallel, real-world problem solving teams
  - Both examining urban growth issues in Las Vegas, Nevada
  - Same two-year time period.
  - One followed a system dynamics group model building process.
  - Other used a more 'traditional' group facilitation process.







(Dwyer and Stave 2008)

How this helps think about SD insight

- SD activities restructure thinking
- Policy resistance, counter-intuitive behavior indicate "impasse"
- "Surprising" results facilitate "Aha!" experiences
- Insight emerges from the interplay between images and ideas
- Double-loop learning describes the restructuring of mental models

Why thinking more deeply about insights is important for participatory modeling

- Clarifying the goals (solving a specific problem, fostering insight, building social capital) helps:
  - Design processes better
  - Manage expectations
  - Allocate limited resources

Thanks for listening!