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Framing Dynamic Problems

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Social System Design Lab
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METHODS BRIEF SERIES **1.04**

System dynamics tools help us uncover the system structures driving the problems we care about, so that we can identify better solutions. The first, and arguably most important, step in any problem-solving process is to clearly define the problem that you want to solve. In other scientific disciplines, this definition of a problem may be *static*, which looks at a particular problem at one point in time – a snapshot. This may look like a single data point, event, or incident. In system dynamics, however, we define problems as *dynamic*, or changing over time. The purpose of this brief is to help the reader recognize problems as dynamic or changing over time, and to present this thinking using graphical tools such as *reference modes*.

+ CONCEPT

Framing problems as dynamic starts to challenge us to think differently about where problems come from. It moves us from thinking in snapshots to thinking in patterns. In this context, "problem" is defined as the difference between where we are and where we want to be. Sometimes all it takes a bit of reframing to see a problem as dynamic. See Table 1 Below.

Table 1: Static vs. Dynamic Problems

STATIC	DYNAMIC
Three teachers quit mid-semester.	After a change in administration, there has been an increase in teacher turnover in our district over the past three years. The district's hope is to decrease the number of teachers leaving per semester, but the fear is the number of teachers leaving will continue to rise.
Nobody is implementing the new curriculum properly.	At the beginning of the school year, most teachers were implementing the new curriculum properly. Throughout this semester, most have abandoned the curriculum and returned to their own content. The principal hopes to understand and reverse this decline.

Specific contributions for each author are as follows:
a: conceptualizing; b: writing; c: providing feedback; d: revising

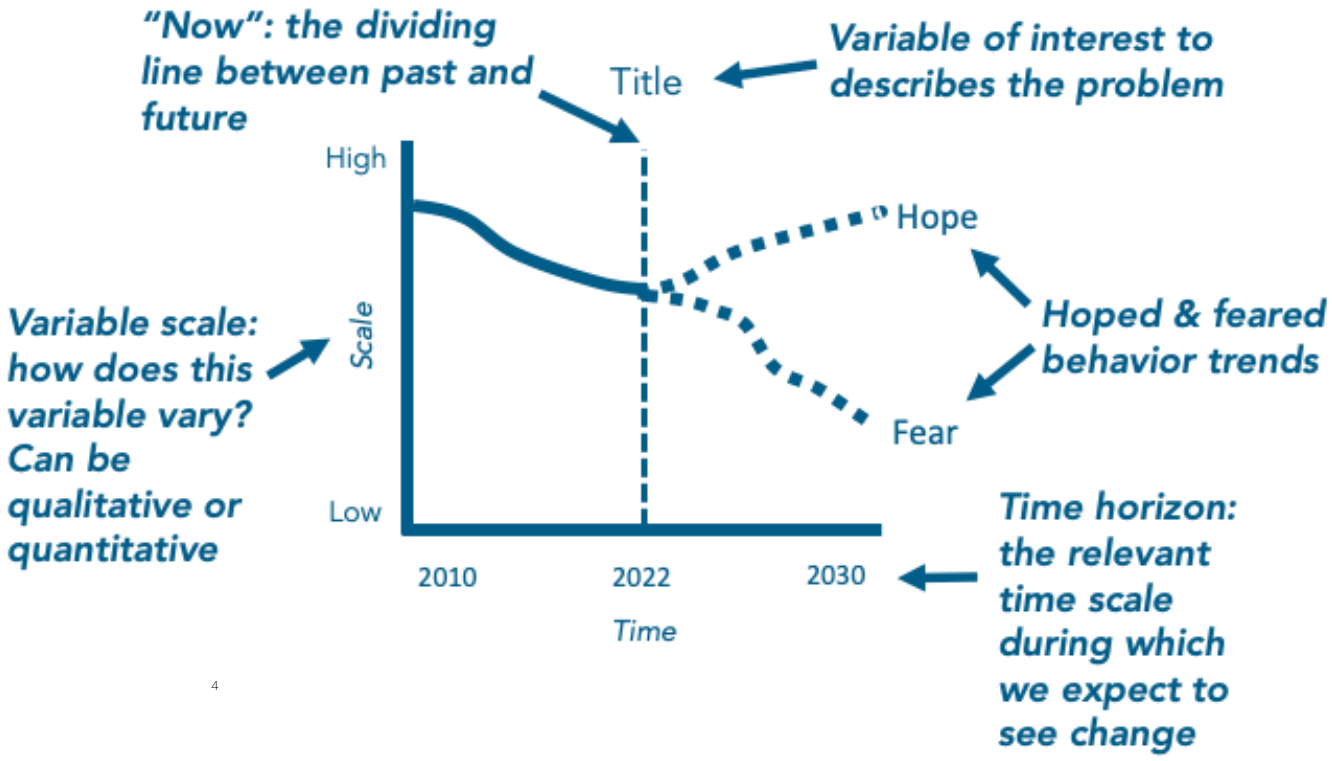
STATIC	DYNAMIC
25% of students are reading at grade level.	In the last 5 years, the number of students reading at grade level has risen from 10% to 25%. We want to continue this upward trend, avoid stagnating at 25%, and avoid going back down to 10%.

+USING REFERENCE MODES TO DESCRIBE DYNAMIC PROBLEMS

Drawn at the beginning of a system dynamics project and revisited throughout, the reference mode is a visual description of the dynamic problem that is the focus of modeling efforts. Often, the reference mode is represented through one or two Behavior Over Time Graphs. We frequently repeat the phrase, "we model problems, not systems". This saying highlights the goal of modeling to advance a solution to a problem, not just to visualize interconnections or describe a system. Without a problem statement in the form of a reference mode, it is very easy to keep building models with no end!

System dynamics models are hypotheses of the systems that can create the behavior of the reference mode. The goal is to build the simplest model possible that can explain the behavior found in the reference mode. Drawing a reference mode helps us define the problem as dynamic, serves as a reference to make sure we're still modeling the right problem, and helps us build a shared definition among a team about the problem we want to solve.

Figure 1: Components of a Behavior over Time Graph



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+A CASE STUDY

Jain is a member of the Washoe Community Educational Equity Board (WCEEB) in Nevada, a community-run committee of residents who work with the local university and state education officials to develop recommendations for curriculum changes and fundraising for elementary schools in the county. In 2016, when Jain was first appointed, they initiated an outreach campaign for public commentary on proposed policies by placing notices in the local paper and keeping the quarterly WCEEB meetings transparent and public. In the first few years attendance grew to an average of 50 community members at each meeting providing feedback. Over time attendance began to decline; even as Jain increased outreach efforts.

The State of Nevada has announced a capacity development and capital project grant for any community educational board which is able to demonstrate consistent community input in its policies. The largest percentage points in the grant rubric are awarded to boards which have 100 community members at each meeting by 2022. As of 2020, the WCEEB had 25 weekly attendees at their meeting. Jain and the WCEEB are interested in using system dynamics to understand why their attendance has started to fall after starting so strong.

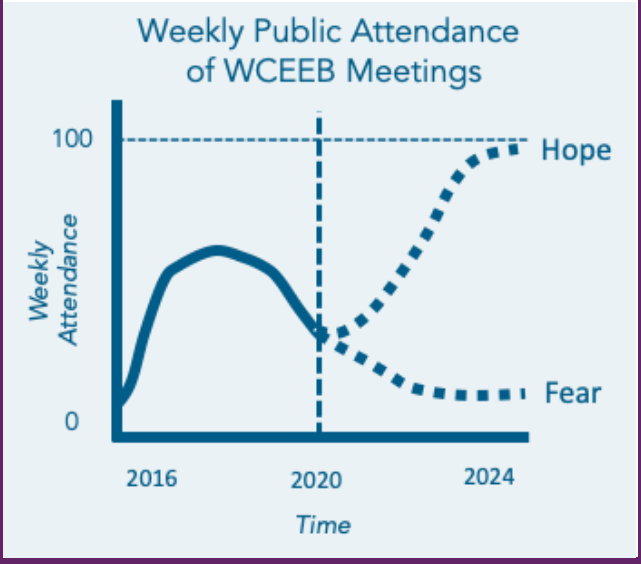
How could WCEEB frame this problem as a static problem?

- There are only 25 people attending meetings, which is not enough.
- Jain's outreach efforts are insufficient.
- WCEB has not met the community input requirements to receive state grant funding

How could WCEEB reframe this problem as a dynamic problem?

- After a rapid increase, there has been a steady decrease in the number of community members attending meetings over the last four years. The hope is to increase the number of letters and community members attending, but the fear is that this number will continue to decline.
- The WCEEB could draw a reference mode to visually define the dynamic problem:

Figure 1: Reference Mode



By developing reference modes for the problem, the WCEEB was able to move beyond an unproductive debate about diagnosing the problem and develop a shared description of the problem.

This discussion led to a **shared process of understanding** why have seen the steady decrease in the past, and what could be done to change the trajectory in the future. As they started to engage stakeholders to understand the structure of the problem more deeply, the Board continued to refer back to this graph to be sure they were still modeling the right problem and not jumping too fast to diagnoses or solutions.

+CONSIDERATIONS

- System dynamics seeks to understand how systems change over time, therefore framing problems as dynamic is a critical first step to applying the methods. However, if it is difficult to frame the problem as dynamic, it may be an indication that the problem is better suited for other methods!
- It is important to ground your reference mode in data. If you have access to numeric data over time, that's great! But sometimes data isn't collected for the factors that matter most. In these situations, you can think about interviews or discussions people with long and deep experience in the system as a source of data to inform your reference mode.

+ACKNOWLEDGEMENTS

- The examples here are adapted from material presented in system dynamics classes at the Brown School. The questions presented in "Getting Started" to create a reference mode were developed for class by Ellis Ballard.

"A problem well-stated is a problem half-solved."

– Charles Kettering

+ GETTING STARTED

- Think of a complex problem in your work that you'd like to change and ask yourself:
  - What is a variable or factor that describes the problem?
  - How would you describe it as something that varies (high-low? Many-few? Etc)
  - What is the current state of that variable? What is the goal?
  - What is the history of the variable? How far back do you need to look to understand the history?
  - What are your hopes and fears for the future? How far in the future are you looking?
- Draw a behavior over time graph of this problem to frame it as dynamic, using the template above.
- How does this framing change or refine how you think about the problem?
- Share this reference mode with someone else or a team– would they describe the problem in the same way? What would be different?

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+ SUGGESTED CITATION

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+ ABOUT THE SERIES

Social System Design Lab Methods Briefs are short, digestible notes on applications of system dynamics and systems thinking in community settings. They are meant to capture and share out our current thinking on core ideas.

"Series 1: Systems Thinking Foundations" focuses on introducing core concepts of systems thinking and system dynamics as they relate to issues of education equity. This series draws from community-based modeling work with educators and students over the last ten years. Other briefs in this series include:

- Systems Thinking Iceberg | **1.01**
- Characteristics of Complex Problems | **1.02**
- Mental Models | **1.03**
- Understanding Systems from a Feedback Perspective | **1.05**
- Accumulations | **1.06**
- Systems Archetypes | **1.07**

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