# Collaborative Sciences Center for Road Safety

## PROCEEDINGS from “Learning with Each Other: Bringing Voices Together to Explore Safe Systems”

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## May 8, 2018

Jill Kuhlberg, PhD, MSW, runs the Health Matters program out of North Carolina State University. Kuhlberg provides us with an overview of systems dynamics and the value of community-based systems dynamics. The concept of system dynamics came out of MIT in the 1950s, and Kuhlberg’s favorite definition is “the use of informal maps and formal models with computer simulation to uncover and understand endogenous sources of system behavior”[1]. She emphasizes that the parts she likes best in this definition are the inclusion of both informal maps and formal models, and endogenous sources—that is, the feedback perspective. Informal maps are causal maps without data that are typically drawn, while formal models are computer-based and complementary to informal maps. Endogenous sources show us what drives system behavior, and what are the patterns or trends we might see over time.

Kuhlberg illustrates system dynamics through an example scenario: planning a department party. For this example, Kuhlberg is interested in understanding the system behavior of party guests and how to get them to stay and keep partying past 7:00pm. What typically happens at a party is that once the party starts, people share information with others to also join the party through texts or social media posts, which creates a positive feedback loop of more people joining. However, around 7:00pm the food runs out and people start to leave. This demonstrates a simple system diagram with reinforcing elements and resource depletion (shown in Figure 1).



Figure . Dynamics of Party Planning[2]

Models like this example of the party don’t necessarily provide us with answers, but refine our understanding of how things are working. At a deep level, they help us understand why things are happening and to converge our thinking with others about what is actually going on. Formal models are particularly good at getting people on the same page.

At this point, Kulhberg brings in the concept of “leverage points,” created by Donella Meadows[3]. Leverage points are places we can intervene in the system. Kuhlberg again uses the department party example to illustrate different leverage points:

* **Change the** **parameters**
	+ Example: buy more food for the party
	+ The parameters are changed because now there is more food, so people might leave later.
	+ However, these might not be feasible due to budgetary or other constraints, and may not shift behavior dramatically (e.g., one extra tub of hummus might mean people leave at 7:10 instead of 7:00).
* **Regulate feedback loops**
	+ Example: limit the amount of food people can have
	+ Regulating feedback loops attempts to get the loops to work in our favor. Rather than the feedback loop of more people, more food eaten, lack of food, and people leaving, we could pass hors d'oeuvres.
	+ However, this might have an unintended consequence of limiting the fun because people can’t each as much as they want.
* **Change material or information flows**
	+ Example: put food in the closet and bring it out when it runs low
	+ This slows down how fast the food runs out, and thus limits how many people leave right at 7:00.
* **Change the rules**
	+ Example: make food together
	+ Rather than trying to have more and more food to keep people at the party, we can change the rules by engaging people in making a meal together. Or, make it a potluck with adds a reinforcing feedback loop of fun.
* **Rethink the goals**
	+ Example: maximize fun
	+ Instead of maximizing how many people stay at the party past 7:00pm, we could change the goal to maximize the fun for the people who are there.
	+ It is a different way of looking at the system that is more about quality than quantity. This might mean playing a board game or watching a movie together with whoever is there.
* **Change mindset (paradigm shift)**
	+ Example: maximize fun in an entirely new way outside of a party, by going on a hike!
	+ If the group starts with fun, rather than a party there might be a whole different system. The group may decide to go on a hike instead.

Kulhberg’s point through this description of leverage points in our party system illustrate that even with an informal map, we can understand these leverage points and have discussions about goals. These informal system maps can also help structure conversations about system options. Consider a brainstorming or feedback session you’ve probably attended, where someone in the room has responded to a colleague’s idea by saying things such as “that’s a bad idea” or “that won’t work.” Rather than focusing on the merits of the idea itself, using a system map can help people visualize how variables are related, and may lead to colleagues engaging in more productive dialogue such as “that is related to the fun variable, so if we remove that element the fun will decrease.”

Kuhlberg’s last comments related to Community-Based System Dynamics (CBSD). CBSD is “a participatory method for involving communities in the process of understanding and changing systems from the endogenous or feedback perspective”[4]. In short, CBSD goes beyond involving people or asking for their input to actually having people who various policies or systems effect go about developing or creating these models themselves. CBSD falls under a larger umbrella of Group Model Building, but goes farther than simply asking for community input, toward self-mobilization and capacity building within the community itself. It’s all about who is in control – outsiders, or stakeholders[5]?



Figure . Conceptualizing Participation [2], [5]

**Discussion**

Kuhlberg shares many examples of where CBSD has been used successfully, such as to build sustainable cities in Latin America, integrate seamless child health interventions in St. Louis, understand the goals of maternal and child health with Salud Mesoamerica, and leadership by youth during the Summit for Youth Homelessness.

CBSD can be used in many settings. For example, it can be used as a conflict management tool for the community to facilitate deeper dialogue about interdependencies and create a model that is owned and changeable by all. She also points out that CBSD can be so successful because its feedback loops can be refined and scoped – different time scales can be broken out into different models, or areas where groups have more leverage or policy control can be the focus over larger issues like the national economy. CBSD can be very powerful for insiders who see the model’s complexities in their own lived experiences. Kulhberg describes a common paradigm shift during CBSD processes as the “U” – people start with a mental model, then go through confusion, and then flow through the process into a new, shared mental model.

Training on CBSD can be found through many universities, particularly the University of Michigan’s Community-Based Public Health program and UNC’s Department of Health Policy. CSCRS has also compiled readings on bringing system dynamics into transportation.

**References**

[1] G. P. Richardson, “Reflections on the foundations of system dynamics,” *Syst. Dyn. Rev.*, vol. 27, no. 3, pp. 219–243, 2011.

[2] J. Kuhlberg, “Learning with Each Other: Bringing Voices Together to Explore Safe Systems,” presented at the Collaborative Sciences Center for Road Safety: Coffee & Conversation, Chapel Hill, NC, 08-May-2018.

[3] D. H. Meadows, “Leverage Points: Places to intervene in a system,” Sustainability Institute, 1999.

[4] P. S. Hovmand, *Community Based System Dynamics*. NY: Springer, 2014.

[5] J. Kumar, *Methods for Community Participation*. Warwickshire, UK: Practical Action Publishing, 2004.