HHS Public Access

Author manuscript

Syst Dyn Rev. Author manuscript; available in PMC 2019 July 08.

Published in final edited form as:

Syst Dyn Rev. 2017 ; 33(3-4): 347–358. doi:10.1002/sdr.1593.

First Eight Years: A Case Study of Starting a Social System Design Lab

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Keywords

system dynamics profession; organizational dynamics; system dynamics groups; design labs

> *Now, think of some future time when students come to colleges already having 12 years of exposure to systems. They will be advanced far beyond what is now taught in the universities. What then are the universities to do in building on that foundation? I do not see universities preparing for that day. Nor do I see the universities even planning 4- or 6-year systems programs for students who have not had an earlier exposure to systems.*
>
> *When might we expect to have universities of social system design? What public background must be established to make a system dynamics profession possible? Who might be the people to lead creation of a powerful systems education?* (Forrester 2007, p. 367)
>
> *How we start new [system dynamics] programs, hire faculty and attract students it is beyond the scope of this note. As Prof. Forrester also states, creating [system dynamics] programs at universities is a formidable task.… A much more realistic and productive goal may be to create "systems" programs, by joining forces with other systemic disciplines that have much in common with [system dynamics]. Such programs would have foundation courses common to all systemic fields and then special courses for various tracks like [system dynamics].* (Barlas, 2007, p. 473).

Introduction

There are many ideas about how to build the field of system dynamics, but at the core of system dynamics is a community of practice applying the tools to a wide variety of topics from business to public health (e.g., Barlas, 2007; Forrester, 2007; Homer, 2007; Homer and Richardson, 2018). This community is diverse in our international membership, training, disciplines, and places of work. We generally seek to help our clients, organizations, and communities solve problems using system dynamics. While we recognize that growth of any field has limits, we need not worry about running out of dynamically complex problems to solve anytime soon nor the potential demand for what we do. If anything, we have a recurring theme at our conferences and journal about the widening gap between the growing

demand for system dynamics and supply of people who can appropriately apply system dynamics to problem solving. So we ask, “What should we do?”

As a community of practice (Lave and Wenger 1991; Wenger, McDermott, and Snyder 2002; Wenger 1999), we pursue multiple strategies to address this gap, often complementary, but sometimes in tolerated contradiction. We have sought to make system dynamics more accessible by writing blogs, editorials, and newsletters; hosting and attending conferences; developing chapters and special interest groups; introducing people earlier to systems thinking/system dynamics in K-12 education; involving stakeholders in the process of building models; writing books and papers in academic journals; developing software tools; talking with policy makers; conducting training institutes and workshops; creating and improving university courses and programs in system dynamics; and, developing standards for system dynamics practice.

Curiously, the processes underlying these activities typically go undocumented, and hence we shortchange ourselves in our ability to collectively learn as we seek to build the field of system dynamics. For example, while we have papers that speak to results from successful projects (e.g., Lyneis, Cooper, and Els, 2001), we generally do not have adequate descriptions of how to develop and run the successful research team or consultancy that led to the successful projects (with exception, Lane, 1992). This does not mean we are not using system dynamics to be successful and learn. It seems at least from informal conversations with colleagues and friends, and more open conversations at conferences, that we do use the tools in a variety of ways. However, our dialogue is largely limited to anecdotes and references to insights we might have developed from models that we would rarely share. But, if we believe that “system structure determines behavior” and that the most important decisions are the ones we make when we design the system, then we need to talk more openly using our tools about our design choices for practicing system dynamics and building the field.

With this in mind, this paper is about the design and first eight years of an academically based system dynamics lab with the mission of developing the science and application of system dynamics in human services and communities. It is a success story of sorts in having been created in an environment where demand was increasing, but success was not at all certain as evidenced by a number of similar efforts at other institutions during the same period that no longer exist or had to be significantly reinvented. It is also a story about how the applications of system dynamics and lessons from system dynamics are, I will argue, an essential part of that success. And lastly, it is also a report on an experiment in organizational design that was intended from the outset to provide lessons that other organizations could benefit from, and therefore needs to be presented and critically evaluated. As the demand in system dynamics continues to grow, it is this last point that ultimately seems the most urgent.

Founding and Inspiration

The Social System Design Lab (SSDL) was founded in 2009 with the mission to “develop the science and field of practice of system dynamics in human services and communities”

with three main activities: teaching, research, and professional development. The motivation was in response to the rapid growth in demand and opportunities for US federally funded system dynamics modeling research in public health (e.g., obesity and cancer, intentional injury), health and mental health services (e.g., statewide mental health services, management of diabetic retinopathy), and work in coupled human natural systems (e.g., climate change, collective management of forest resources).

The SSDL was started with an initial $100,000 in seed funding, 350 SF of office space, a commitment to a portion of the director's salary, freedom from many of the obligations of academic life (e.g., no specific requirements for teaching loads, committee assignments, or student advising), and a broad mandate to "do whatever it takes" to build the science and field of practice of system dynamics in human services and communities.

While such initiatives are not uncommon in academic environments, this was a highly unusual move within the tradition of the school and university as there were few precedents to draw on. Research centers and labs conducted mostly research, and had no responsibilities for developing and teaching courses. Professional development programs provided training to professionals in the community, but were generally not responsible for conducting research. And, the development of courses and assignment of teaching responsibilities were largely separated from research activities and professional development. The founding of the SSDL was therefore also an experiment in a new organizational design within the school and university.

The start of a new venture rarely comes without some inspiration. For the Social System Design Lab, there were Forrester's words in his 2007 address and a call for universities of social system design. The dean had also wanted for some time to have a "Bell Labs for social work, but the old Bell Labs" and frequently cited the work by Bennis (1997). Building on earlier efforts to build a lab focusing on system dynamics modeling and simulation, we also realized that the point of modeling and simulation was not the development of models as the ultimate goal, but *better design* of human services and communities.

There are many ways that one might interpret what this might mean, i.e., better design. Certainly, there are plenty of examples of where human services can be improved in significant and meaningful ways through greater input of users (e.g., user-centered design). There are also any number of ways that we might think of improvements in efficiency of outcomes from better technology, whether that means the more effective use of information technology or more generally in the improvements of intentional procedures (e.g., treatment protocols). The challenge for a university-based design lab is figuring out what could add sufficient value to justify the investment in better design. For better design to matter, it would need to add some distinct and lasting value for our future clients.

While technical policy analyses and program evaluations are important, we could not see a viable business model from this alone. For example, in our community, for-profit firms were able to conduct program evaluations of social services and public health programs with a 10 percent markup and remain profitable, while a university based effort would be *losing*

money with a much higher indirect rate due to the high costs of maintaining an academic research infrastructure.

Verganti's (2009) study of design-driven innovation had some appeal. Verganti defines design-driven innovation as design that changes the *meaning* in some radical way around some design object. Examples include the Apple iPhone and Bang & Olufsen's stereos. While we didn't imagine ourselves as designing luxury products, we did see the potential role of using system dynamics to engage communities and organizations to radically *change meaning* of services, interventions, issues, etc.

Design-driven innovation in this sense requires both an understanding of the current meaning around some issue within a community or organization, and some way to systematically transform that meaning into something different that has value. System dynamics models have this potential as boundary objects (Black and Andersen 2012). Models, in this sense, function as both metaphors for explanation and understanding (Black 1962), and generative generative metaphors (Schön 1979) that can be used to support novel service system design.

This also fit with the notion that this type of work—the creation of new interpretations and meaning—was essentially through construction of what some might call a new language game (Wittgenstein 1958), a linguistic community being developed through interactions around the boundary object. For such an approach to be inclusive and capable of addressing topics related to social justice, oppression, and marginalization, we recognized the importance of building up a language of system dynamics from the stories through group model building practice (Andersen and Richardson 1997; Vennix 1996). The approach here was specifically influenced by adult education and literacy movements by scholar/activists such as Paolo Freire and Myles Horton (Horton and Freire 1990) who developed methods for community organizing and education that emphasized empowerment and collective action.

Organizational Design and Strategy

Forrester has always placed the importance of design as one of the prominent roles for system dynamics through his rhetorical question about the most important person in the flying of an airplane, and pointed out that it's the design of the aircraft that ultimately has the greatest influence on the outcomes (Sterman 2000). So the fundamental questions facing the SSDL in 2009 focused on organizational design and developing a corresponding strategy for the initial startup and growth in research, teaching, and professional development activities.

The strategic challenge in this type of environment are familiar in system dynamics. The situation reminds one of Forrester's (1968) model of market growth where demand is infinite and yet the tendency of managers is to drive the company out of business. Then there is the case of People Express (Morecroft 2008) airline where the long delays in selecting and recruiting employees ultimately contributes to a decline in quality and service that eventually leads to a downward spiral.

Moreover, sustainable growth is in many ways an oxymoron as Schwaninger (2013) reminds us, which runs counter to many implicit goals within organizations. There is also evidence that for the most part, design labs tend to consist of relatively small teams of 4 or 5 people (Verganti 2009). The strategic dilemma facing the design of the SSDL from the outset was therefore how to increase activity and impact over time while keeping the footprint relatively small and in a dynamic equilibrium.

Beyond Ideas

During the summer of 2009, this strategic dilemma was framed as a dynamic problem of how to increase the modeling activity without compromising quality. The feared scenario was a situation not unlike the rise and fall of People Express airlines where demand grows faster than than the rate that one can expand the workforce. It is worth noting that in 2009 we were presenting a strategic problem to our dean and management team of growing too fast, talking about limits to growth and arguing for additional space before we had any funding beyond the initial seed money. We were challenging the dominant logic of a typical research center startup, and in turn arguing for a strategy that stretched our credibility within the university and risked our social capital.

One of the basic lessons of system dynamics is that one should look to restructure the system and/or change the model boundary to gain some leverage. The proposed solution recognized that different types of models can generate different types of insights that can lead to positive impact. The corollary is that not all models need to be developed into full computer simulation models to have a positive impact. This view built on Constanza and Ruth's (1998) distinction between scoping models, research models, and management models, and essentially focused on building many scoping models quickly, prioritizing them, and focusing scarce expert modeler resources on the selection of the best scoping models and development of research and management models.

Another aspect of this approach is that if one can sustain a growing demand for modeling, then this will attract more involvement of stakeholders and technical experts in model development, and this will in turn pull in more novice modelers. This can either be through social network effects where changes in perceptions of system dynamics by stakeholders and technical experts makes system dynamics more appealing to potential modelers, or by stakeholders and technical experts seeking out opportunities to learn modeling.

Internally, there were also a number of core ideas driving how we managed our intangible assets to facilitate rapid innovation, organizational learning, and buffer transitions from turnover and external shocks. Many organizations seek to create buffers of tangible resources, but some of our earlier research showed that, at least in nonprofits, large buffers of tangible resources also weaken the signals and pressure to change strategic orientation. By the time organizations get around the changing their direction, they have "locked into" suboptimal goals (Hovmand and Gillespie 2010). The implication is that organizations that are highly efficient (Pfeffer and Salancik 1978; Sastry 1997) are more likely to improve in organizational performance as they tend to be more responsive to changes in their environment. Christensen (2003) makes a similar argument with respect to challenges of

pursuing disruptive innovations within larger organizations that must focus on sustaining innovations in order to remain competitive in the short term.

For the lab, we drew on our earlier research that included several organizations that had successfully managed growth in dynamic environments, in particular, our National Science Foundation funded study on innovation implementation and organizational performance (SES-0724577) and a case study of an organization that had managed to scale up behavioral health interventions (e.g., Hovmand et al, 2008a; Hovmand et al, 2008b; Hovmand and Gillespie, 2010). In this work, organizations tolerated a high turnover rates of frontline delivery teams, but paradoxically, invested more heavily than any other organization in our study in orienting their front line staff to the philosophy and organizational culture of their program. However, as Winch and Arthur (2002) point out, in small to medium enterprises, high turnover can lower organizational inertia and help facilitate organizational change. Hence, our hypothesis was that investing in the continuous design and management of organizational culture could provide a sufficient buffer to weather exogenous shocks without incurring the liability of accumulating organizational inertia.

Dynamics of Growth

Within a month, we secured our first major grant. Although small by university standards, it allowed us to increase our staff by hiring a former student who had training in system dynamics bringing our staff to 3.25 FTE and doubling our office space to approximately 750 SF. By 2011, our office space had increased to approximately 2,700 SF in a new facility where we had opportunity to work with architects and design the plan to better support group model building activities. The funding, staffing, and space have remained relatively stable since, with one exception in 2015 discussed later in the paper, while the number of students involved in system dynamics work have steadily increased. Most recently, the institutionalization of a 10-credit graduate system dynamics specialization as part of the MSW program has led to both more students *and* depth in their training that includes an introduction to group model building (3 credits), system dynamics modeling and simulation (3) credits, advanced problem based methods (3 credits), and practicum (1 credit).

We were also able to significantly increase our teaching capacity without increasing the number of fulltime faculty trained in system dynamics by moving to a team teaching approach, and tightly coupling our research and teaching activities in our new space where the classroom was collocated and physically part of the lab. This provided a number of benefits including an ability to rapidly prototype and test methods in classroom exercises and incorporate what we were learning from teaching into our research activities; building up teaching skills of lab staff; and, improving the feedback cycles for students learning system dynamics with more immediate access to instructional resources. Moreover, by improving our teaching methods, we were also able to cover more material in shorter time and more effectively than we had before. One student evaluation summarized the effect as a “well calibrated learning curve.”

Throughout this period, the quality of our models continued to improve. Where we initially focused all of our attention on eliciting initial scoping models using scripted group model

building (e.g., Andersen and Richardson, 1997; Vennix, 1996) with a few examples of developing simulation models, we were now routinely developing more insightful and high quality scoping models and increasingly moving more of these models into some form of computer simulation for more rigorous insights. A key theme throughout this period was managing the purpose of models and the appropriateness of model based system insights.

Over the course of this time, our research portfolio and service contracts have been remained focused on the use of system dynamics in communities and human service organizations with ongoing projects and collaborations around the world including Afghanistan, Australia, Brazil, Chile, China, Ethiopia, Guatemala, Honduras, India, Kenya, Malawi, Mongolia, New Zealand, Pakistan, Panama, Singapore, United Kingdom, and the United States. Topics typically focus on various areas of service design and community engagement in social work, public health, and preventing medicine including mental health (Trani et al, 2016), "long-tails" in health disparities (Kreuter et al., 2014), access to primary care (Rose et al., 2013), housing and homelessness (Fowler et al, 2017), cancer disparities (Williams et al., 2016; Williams et al., 2018), clinical guidelines (Markham, Hovmand, and Doctor, 2017), obesity (Colditz et al., 2016; Hoehner et al., 2015; Sabounchi et al, 2014), energy security among the poor (Chalise et al., 2018; Yadama, 2013), implementation science (Proctor et al, 2011), and gender based violence (Hovmand et al., 2012).

What organizes this work is a set of principles called community based system dynamics (Hovmand, 2014), which began in the lab with a set of ideas around how to engage and work with communities in the use of system dynamics. At the time, we were primarily focused on how to do this in schools, villages, and neighborhoods. Overtime, we learned that the techniques that work well in these settings eventually extend to working with organizations and transdisciplinary research teams. The experience of the lab is, in many ways, consistent with Homer and Richardson's (2018) view on the growth of the field of system dynamics.

Conclusion

This paper has highlighted some of the key issues we faced in starting the Social System Design Lab and the critical role of system dynamics practice to support both the design and management of the first eight years. Today, the lab continues more or less along the same design, but we have also recognized the need for some modifications as interest among faculty, students, and community partners have continued to grow. However, we have the tools and experience to continue to manage this growth.

For the field of system dynamics, how can we convince others to use system dynamics and continue to build the field? From the experience of the first eight years of the Social System Design Lab, the answer is not about pitching projects that appeal to the expectations of potential clients, trying to convince others of the merits of system dynamics, or increasing the visibility of system dynamics through better and more aggressive marketing of our successes. When we move past the superficial changes we can make at the edges of a system, we are asking people to make much larger and deeper changes. I believe that the way we can best go about building the field and a strong community of practice starts from within, from understanding and applying system dynamics within our organizations in ways

that align us with our client organizations and communities, build trust, and inspire them with courage to take the time to look for the deeper leverage points to change systems.

Acknowledgments

Timothy Hower was the first Associate Director of the Social System Design Lab and played a critical role during the first several years. I could not have asked for a better collaborator, and will always deeply value the intellectual contributions and support during this early period. Students, alums, and staff have all played significant roles along the way. They have and continue to be willing to take risks, innovate, and provide open and frank feedback. Likewise, many of our community partners and participants in workshops provided key insights and critical feedback along the way. My hope is that what we continue to develop does justice to the time and energy they shared.

Three colleagues stand out in the founding of the lab. Edward Lawlor, the dean of the Brown School at the time, created the space and proposal for the founding of the lab. Enola Proctor and Gautam Yadama played critical roles early on at the toughest moments. Without their emotional support and honest feedback, things would be very different.

The work reported here was supported through multiple grants including the National Science Foundation (SES-0724577), Washington University Translational Research on Energetics and Cancer Project 4; contract U54 CA155496), the National Institutes of Health Office of Behavioral and Social Sciences Research (contract NNSN276200900017C/HHSN276201200027C), Centers for Disease Control and Prevention through the Brown School Violence and Injury Prevention Center (1R49CE001510), St. Louis Federal Reserve Bank, Robert Wood Johnson Foundation (#67099), Bill and Gates Foundation, and Lupina Foundation.

A version of this paper first appeared as a plenary at the 2013 International System Dynamics Conference, Cambridge, MA. At the time, the reflections felt a bit bold still being a relatively new organization, and wanting of more time to see these ideas held. Time has helped answer lingering questions from the 2013 paper, and I very much appreciate the constructive feedback from reviewers and encouragement of the editors.

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