Patterns of Performance
HSD and HPT

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Complex human interactions involve more than just performance toward pre-determined goals. For this reason, systems that measure and seek to improve performance must adapt to a wide range of ever-changing patterns of individual and group behavior. Historically, HPT professionals have recognized these complexities and responded in a variety of ways. This article uses a case study of community change to explore principles from human systems dynamics (HSD), an emerging field of theory and practice that explores the intersection between nonlinear dynamics and the wide range of social sciences. Given that human performance technology (HPT) draws methods and measures from a variety of disciplines to solve problems and pursue opportunities to improve, HSD and HPT could be mutually informing. The case study and analytical model described in this article draw metaphorically from the nonlinear dynamical concept of attractor patterns. Patterns are recognized, and their influences on performance are explored. Each of the patterns captures options for action to observe, measure, evaluate, and intervene in human systems to improve performance.

Introduction to the Kids Summit and its Aftermath

The story you are about to read is true. The names and details have been changed to avoid disrupting the complex, self-organizing process that continues in the community today.

Eight counties lie in a 150-mile square on the prairie in a mid-western state. Ten villages and two relatively small towns lie within the region. Most residents make their livings in agriculture, light manufacturing, healthcare, education, or retail and food service delivery. For generations, the populations have been stable. High school sports rivalries sparked what passed for violence, and the parking lot beer of the all-night graduation party was the worst drug abuse threat faced by youth. Kids grew up safe and cared for by their families, neighborhoods, faith communities, and schools. Even when they left to pursue education or military service, young adults reinvested in their communities by returning to live, work, and raise their own children.

Things began to change in the mid-1990s. School consolidations shifted identity and loyalties for youth and increased the amount of unstructured time they spent on buses and waiting for transportation. More purchased their own cars and worked at least half-time to pay for the extras their parents couldn't afford. Meth labs sprang up in the most isolated parts of the rural landscape, and youth were a ready market. Out-migration drew families toward more prosperous jobs in cities, and seasonal agricultural jobs drew families in who were diverse in culture and ethnicity. As average wages decreased, parents spent more time at work and less time focused on home and family.

By 2004 The Future Foundation, a family foundation located in the region and committed to its development, began to look for ways to improve the future prospects for youth in the community. The Foundation convened a two-day Kids Summit that drew 72 professionals and community members from across the region to talk about "Helping children reach for the future." The participants lived and/or worked in eight different counties

and represented nine sectors: education, health care, judiciary, child care, economic development, faith communities, public sector human services, youth programs, and mental health. Prior to the session, a steering committee was formed to plan and implement the event. Members of this group hosted conversations with various constituencies across the region to explore issues and frame the agenda for the event. Children, youth, parents, and professionals were included in the focus groups from across the wide geographical, cultural, and socioeconomic range.

The event included time for people from the same area to get to know each other across sectors as well as time for people from the same sector who were geographically dispersed to explore current situations and options for future action. An expert lecturer shared perspectives on financing and public policy related to human services for children and youth. Findings from the focus groups were shared and discussed in small groups. All of these functions were a preamble to a Community Matters session. Community Matters is a variation on Open Space Technology (Owen, 1997). In this format, a conference agenda self-organizes as participants name issues and opportunities that speak to their own passions and responsibilities. Each named issue becomes a breakout session, and individuals select from among and wander between groups of people who are talking about the facet of the question that most appeals to them. At the end of the exploration time, participants come back together to report the progress and findings of each group. In the second round of Community Matters, groups again self-organize, but this time it is around options for action they commit to pursue. The session ends with a report out and ritual to close the experience and to launch new action for the future.

Following the session, both individual and institutional behavior shifted. People who had met for the first time at the Summit invited each other to join boards, submit shared grants, and coordinate communication and action. The Future Foundation funded a Transition Team to explore opportunities to facilitate on-going change and collaboration. The Transition Team recommended, and The Future Foundation agreed to fund, grants to be solicited and rewarded by a team of people from diverse sectors and parts of the region. A Kids First list serve was launched to support communication across geography and service sectors. One of the pre-meeting focus groups found the conversation so helpful that they continue to meet monthly to explore how they can personally influence the future of kids.

The Board of Directors for The Future Foundation expects to see "return on investment" in terms of performance of the individuals, community agencies and institutions, and their own programs. Their question, and the question that motivates this article is, "How can patterns of performance be recognized and influenced in this open, complex, and self-organizing system?"

Why Not Standard Performance Measures?

Many assumptions of traditional performance management are not valid in complex, emergent systems. Methods that are based on linear causal

models assume that the future is predictable; outcomes are knowable; and significant variables are few and not mutually dependent. In systems driven by linear dynamics, change follows a smooth path from past through present and into future; a snapshot view of the system is sufficient; and clear and distinct boundaries exist between the system to be measured and its environment.

Expert practitioners know that their contexts are neither predictable nor simple. They find ways—often ingenious ones—to transcend linear assumptions and deal with the complex realities that surround them. These practical adaptations derive from real-world experience. This article explores an emerging set of metaphors to help professionals and lay persons see and influence the complex, nonlinear dynamics of human systems (Eoyang, 1997).

None of the linear system assumptions is true of the Kids Summit. At every stage of the project, the future was clearly unknown.

When the Design Team met the first time; when the idea of the focus groups emerged; as the Community Matters event began; and as the follow-up work moved forward, people reflected on the anxiety and exhilaration they felt in the face of the truly unpredictable future.

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The Future Foundation and its board believed that something good for kids would come out of bringing people together across geography and professional discipline, but they didn't know what the outcomes would be.

Patterns for the future of children in the region depend on variables that are too numerous and massively entangled to understand any of them in isolation. Youth development involves a complicated combination of factors. Search Institute research, for example, identifies forty developmental assets that influence the success of children and youth. All of these issues influenced child and youth well-being in the region, and none of them is totally dependent from the others (Moore & Lippman, 2005).

The path of deterioration in the region had not been slow and steady. The drop in graduation rates and increases in child protection reports had been precipitous. Given the experience and intuition of leaders in the effort, there was reason to hope that the new energy and opportunities would not develop gradually, but show up in a burst of creative energy.

A snapshot view of the well-being of children and youth served to reinforce traditional expectations and prejudices. For example, cultural and socio-economic variables were the strongest influences on success. Professionals who worked directly with children, however, saw the importance of considering issues and opportunities in the context of specific families, historical experiences, and stability over time. For them, history counted. A snapshot view was simply not sufficient.

Clear and distinct boundaries did exist among the geographic communities, disciplinary loyalties, and powerful institutions in the com-

munities, but these were not the boundaries that interested The Future Foundation as they began this work. The field of interest—the future of children and youth—lives within massively entangled and fuzzy boundaries. Though the region is marked at county boundaries, the social and economic interactions depend on larger regional, state, and national contexts. Though "family" can be seen as the place of growth for children, neighborhood, school, workplace, social gatherings, and many other contexts contribute to frame the potential for choices for kids as they grow. Though service sectors traditionally focus on only one facet of child welfare (mental, physical, emotional), the living, breathing individual depends on all facets.

Considering the situation that The Future Foundation confronted with its project, it is easy to see why methods that depend on predictability, simple relationships, and controlled phenomena would be insufficient to capture the improvements in performance that were hoped for, and even expected, in the course of the Kids Summit project.

HSD Assumptions for Performance and Change

Human systems dynamics (HSD) is an emerging field at the intersection of nonlinear dynamics (including chaos theory and complexity science) and social sciences (including management, organization development, anthropology, political science, education, and so on) (Eoyang, 2001). HSD practitioners and scholars derive practice and theory from nonlinear sciences and mathematics and apply those insights to see and influence productive patterns for individuals, teams, organizations, and communities. At the beginning of their project, The Future Foundation invited us, the Human Systems Dynamics Institute (HSD Institute), to support them as they planned and implemented a systemic intervention to help children and youth in their region "reach for the future."

We worked with the leadership of the initiative as they considered options for bringing the community together, articulating mission and goals, and inspiring on-going action. In this article, I will focus on the patterns that emerged in the process and how ideas from nonlinear dynamics set a foundation for evaluating performance of such a broad-based and emergent initiative. My analysis will be based on the fundamental concept of attractor patterns, which comes from mathematics, physics, and mechanical engineering. I use the concept of attractor patterns metaphorically to identify and influence emergent phenomena in complex dynamical interactions. I will describe each of the four attractor patterns, demonstrate how we used them to see and influence the work of the Kids Summit project, and how each might be used to develop qualitative and quantitative assessments of the program over time. We have not yet designed or implemented a formal evaluation program for the initiative, but we expect that the approaches described here will inform future processes of data collection and analysis. The question I deal with in the remainder of this article is:

How can the metaphor of attractor patterns that are characteristic of complex, self-organizing processes, inform action and evaluation in a dynamic human system?

Attractor Patterns in Self-Organizing Human Systems

An attractor pattern describes the structures that emerge over time in systems where complex and dynamic forces interact. Four different kinds of patterns have been identified: random, point, periodic, and strange. Each of these describes a kind of movement that characterizes a particular kind of change. Random attractor patterns have no recognizable structure at all. Point attractor patterns circle around a single point of termination. Periodic attractor patterns repeat at regular intervals. Strange attractor patterns include infinite variety into a bounded space. This section will consider all of these attractor patterns and how they relate to the dynamical patterns of the Kids Summit.

An attractor pattern describes the structures that emerge over time in systems where complex and dynamic forces interact. Four different kinds of patterns have been identified: random, point, periodic, and strange.

In this article I use the phrase "attractor pattern" rather than the more familiar "attractor" to avoid the common misperception that the attractor is the thing toward which a complex system is drawn. This confusion occurs often with point attractor patterns, where it is easy to think that the attractor is the thing toward which agents in the system are drawn—as if it were a magnet. It is more accurate (and more useful in human systems) to recognize that the system-wide pattern of behavior is the attractor, and the point at the center of the pattern is only an occasion for the pattern that affects the whole.

Sometimes, attractor patterns are referred to as the tracks that are left behind after a complex process is complete. Technically, attractor patterns are observed when a series of data points are taken over time and analyzed graphically to reveal relationships that were not apparent in the original data. This process allows one to see that apparently random phenomena can generate coherent patterns (attractor patterns). In human systems, it is often impractical to accumulate sufficient data to reconstruct attractor patterns reliably, so we have taken a more qualitative, broader view of the phenomenon. We find that this metaphorical application of the concept, while not mathematically precise, can inform meaning making in complex systems. We also find that this approach allows experienced practitioners to recognize and talk about their system-level intuitions in ways that are helpful.

Several factors complicate the process of identifying and classifying attractor patterns. First, the pattern depends on both the observer and the phenomenon. The observer will see the pattern differently depending on the point of view, expectations, and experience with the system. System boundaries and historical interactions can also affect the attractor patterns. Second, attractor patterns shape systemic behavior at multiple levels. One

can observe different patterns in individual, small group, or community interactions, and those patterns may be massively entangled across scales. Third, almost all groups exhibit all attractor patterns simultaneously and the patterns can interact and distort each other.

Even considering these complications and the limitations of a metaphorical application, we find attractor patterns helpful as we move toward shared meaning and action in human systems (Olson & Eoyang, 2001). Our Kids Summit case demonstrates each of the four attractor patterns and allows us to illustrate how helpful attractor patterns can be in assessing and improving performance in human systems that are unpredictable and under no one's control.

Random Attractor Patterns

A random attractor pattern (see Figure 1) exists when no coherent similarities, differences, or relationships are discernible across a system over time. We consider a random attractor pattern when each local area of the system appears to be acting independently of the others, so that a coherent system-wide pattern is not apparent.

In our case study, one random attractor pattern appears in the region with regard to the success of children and youth because of diverse capacities, connections, and cultures. Individuals of all ages respond to their unique environmental cues, process information based on world views and learned rules of engagement, and act in accordance with their capacities. At the level of individual decision making, there are many degrees of freedom, so it is difficult to see coherent patterns of action and interaction. Other random attractor patterns included external influences of economics and federal regulatory action, personal experiences of professional staff members, physical and emotional transitions as children grow up, and issues related to youth as they transition from child to adult service systems between the ages of 17 and 21. Within the event, transition times in the agenda (breaks, meals, and evening entertainment) introduced random patterns that proved to be quite generative and productive.

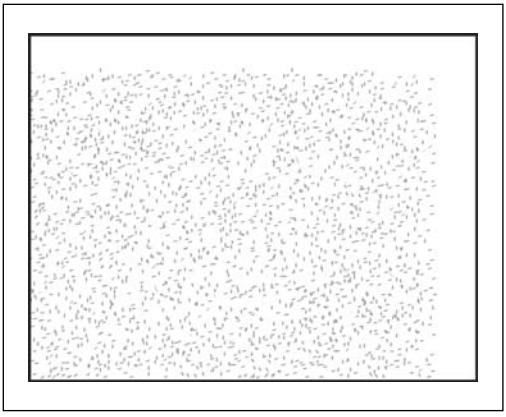

FIGURE 1. Random Attractor Pattern.

When we consider ways to understand and assess the performance and systemic nature of such a random dynamical process we need ways to collect and analyze data to see how the randomness changes over time. Considering tools and techniques available and the underlying nature of the random attractor pattern, three options arise:

- Traditional statistical analysis techniques
- Pattern formation
- Recovery time

Traditional statistical analysis techniques. Statistical analysis begins with the assumption of random distribution and looks for ways in which phenomena vary from a random state. Such tools, implemented periodically over time, can signal changes in underlying patterns and show a potential for new self-organizing structures to emerge. Considering such data in terms of a random attractor pattern, however, requires some analysis questions that are different from traditional ones. What are the outliers and what can we learn from them? What changes do we see across time as we collect and analyze data periodically? What meaning can be made when interpretations of the same findings come from various points of view?

In the Kids Summit project, the Design Team reviewed prior statistical studies to look for outliers, exceptions, and data anomalies to understand the random nature of the community system.

Pattern formation. Over time, even without intervention, random attractor patterns collapse into other attractor patterns as individuals spend time in the system and seek their own coherence. One measure of performance in a system under random stress is the capacity for an individual or group to make meaning (identify non-random patterns) in spite of apparent randomness. Multiple methods exist to assess the ability of an individual or group to make meaning collectively. Storytelling, dialogue, problem solving, meeting efficiency and effectiveness, and many other indicators can be used to track the changes in the ability of a group to see emergent patterns and/or to make meaning together. Appropriate evaluation questions might include the following: What are the relative similarities and differences in the stories we tell about our experience (shared or not)? How are individuals or members of our communities the same as and different from each other? Which of those differences might be considered significant? Which are productive or non-productive differences and why? How do our perceptions of our similarities and differences change over time?

The focus groups that preceded the Kids Summit allowed individuals to articulate their concerns and to see surprising patterns that emerged out of apparent randomness across the community.

Recovery time. Random systems are in constant motion, so one of the performance criteria is to recover quickly from surprises and shocks to the system. Data regarding this indicator can come from periodic reflections by a group on its own decision-making processes, analysis of meeting minutes, and interviews with individuals who express frustration that a group is moving too slowly or too quickly. Assessment questions might include the following: How long does it take for us to move from total confusion to shared clarity around a particular issue? How long does it take for the group to absorb new members or to recover when members leave the group? What is our average time between one crisis and another?

During the Kids Summit, the group demonstrated its ability to recover its coherence quickly. One example came when the luncheon keynote offended, confused, or dismayed many participants. The open energy and random nature of the group allowed them to move beyond those particular concerns and explore other shared options.

In the Kids Summit case, all three of these evaluation processes were used informally. The team used data and statistical analysis to get the initial picture of the baseline patterns of child well-being across the region. Discussion of the data brought significant differences to the surface and allowed the group to spot patterns among themselves, in the community, and with the children and youth in the region. New questions emerged that inspired new rounds of data collection and analysis to dig more deeply into the randomness below the patterns that appeared in the cumulative data.

Participants also noticed and commented on their growing capacity to recover quickly in that each round of the Community Matters experience required less start-up time as people moved quickly from the randomness of the open space and into the coherence of a new group.

Over time, we are hoping to use the on-line conversation that is emerging to observe how the group welcomes, incorporates, and responds to the random shocks that are sure to continue to shape the dynamics for the future of children and youth in the region.

Point Attractor Patterns

A point attractor pattern (see Figure 2) exists when all agents, wherever they are in the system, migrate along paths that converge in a single point. The classic physical example is a ball and a round-bottomed bowl. Regardless of where the ball begins its journey, it follows some path and ultimately reaches the center of the bottom of the bowl. The pattern that is formed in such a space qualifies as a point attractor pattern. Like the random attractor pattern, the point attractor pattern appears in physical systems (e.g., around the water cooler in an office) or metaphysical systems (e.g., around a visionary leader). Point attractor patterns also affect individuals (e.g., around a hope or expectation), teams (e.g., around the time of a meeting), organization (e.g., surrounding the mission or vision), and communities (e.g., in relation to shared religious practice). In all of these examples, converging patterns form as the components of a system move toward a single, shared point, so they are considered to be shaped by point attractor patterns.

In our case study, many point attractor patterns existed before we began our work, including the school's expectation of high school graduation for every student; transportation to the single, consolidated high school; and travels of youth who leave and return to raise their families. Other point attractor patterns emerged as a result of our work, including behaviors around the Kids Summit event; the individual involvement in focus groups held in preparation for the Summit; influence of gifted individuals who participated in Design Team and drew their friends and colleagues into the process.

Traditional approaches work quite well to assess performance in systems shaped by point attractor patterns. Most of the assumptions of linear dynamics, on which outcomes and process evaluation designs are based, hold true. In the vicinity of a point attractor pattern, the future is predictable; outcomes are knowable; significant variables are few and not mutually dependent; change follows a smooth path from past through present and into future. For the most part, logic models and outcome evaluation tech-

niques are sufficient to depict changes in performance in point attractor regions.

On the other hand, two factors provide options to improve assessment of performance in complex systems that are influenced by point attractor patterns:

- Observation in and over time
- Boundary critique

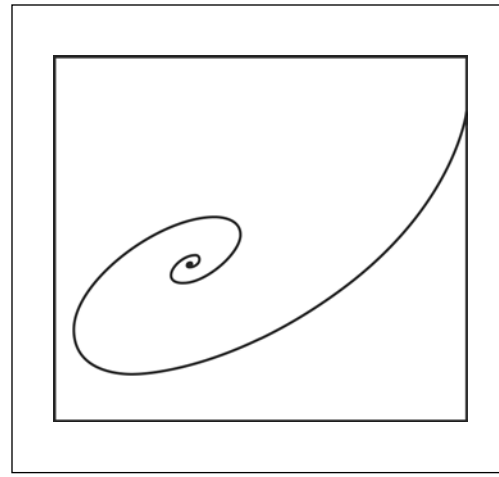

FIGURE 2. Point Attractor Pattern.

Observation in and over time. Many complex systems—even ones that are shaped around a point—exhibit a surprising behavior called equipotentiality. That means that between the same starting and ending points, agents may take many different paths. The implications for assessment of performance are significant because a pre- and post-test may tell you nothing about what happened in between. Depending on variables beyond your knowing or control, you might measure at time intervals such that the agents seem quite far apart when, in fact, they are headed toward the same outcome. Experienced practitioners have developed ways to react to these complexities, two specific approaches emerge from human systems dynamics. Both of them have to do with time. One focuses on history and direction at a given point of measurement (observe in time), and the other collects data at various points in time (observe over time). We conceptualize this process as taking a video, rather than a snapshot, of the performance we wish to assess.

Traditional practice also values short-term and longitudinal studies. Human systems dynamics incorporates the traditional approaches and articulates the dynamic nature of the phenomena. For example, the Kids Summit, like many community projects, adjusted to external circumstances and took longer than expected (nine rather than three months). The Design Team used this time to collect stories, watch for emergent patterns, and disseminate information about the Summit-to-come. These efforts helped expand the scope in influence of the project, while still moving toward the pre-defined project purpose.

Boundary critique. To ensure predictable outcomes, a domain must contain one, and only one, point attractor pattern. If there are two or more, then many other variables come into play, and the motion in the system may no longer be predictable. That means that to assess or improve performance using the point-attractor tools of tradition, one must consider other attractor patterns that might distort the apparently predictable and controllable domain of the point-attractor pattern. Boundary critique involves becoming conscious of multiple options for setting boundaries of your system of interest, choosing the bounded unit of analysis that fits your evaluation questions, and being brutally honest about what you can and cannot know within the boundary you have chosen.

The Kids Summit project dealt with multiple point attractor patterns in the community by establishing multiple boundary conditions. Focus groups were held within specific institutions or communities, and the Summit event crossed over boundaries of community and service sector. The Open Space design also challenged habitual point attractor patterns that influence traditional youth development.

We used a variety of point attractor pattern evaluation techniques in the Kids Summit project. At the end of each meeting of the Design Team, we asked three questions: What went well? What could have gone better? What questions do you have going forward? This allowed us to adapt and adjust the process over time. We distributed a standard session evaluation form at the end of the Summit to test our performance against pre-determined goals and objectives. We also noticed and documented a shift over the course of the project from the point attractor patterns that influenced individual communities to ones that affected the entire region. The patterns of drug use and trafficking that surrounded the meth labs were countered by locally-defined projects to engage youth and revitalize neighborhoods. Finally, we expect that individual projects—to be funded in future project phases—will establish point attractor patterns that will be evaluated according to their predictable outcomes and processes.

Periodic Attractor Patterns

A periodic attractor pattern (see Figure 3) appears in a system where there is closed-loop, repetitive change. Sometimes referred to as a limit cycle, a periodic attractor pattern generates cyclical system-wide behavior. One classical example is the predator/prey cycle where changes in one population influence changes in the other, so that populations of both species oscillate between predictable bounds. Another example is the swimsuit industry where activities follow a rigid seasonal cycle.

How do you assess and improve performance in a system driven by a periodic attractor pattern? We have found three approaches to be helpful:

- Linear time series analysis
- Look for trends
- Collect surprises

Linear time series analysis. In this approach you collect and analyze data over time to reveal periodic patterns as they emerge. Sometimes the driver for the periodic pattern is immediately obvious (e.g., school year, budget planning, seasons). Other times the cause of the oscillation may be a complex interdependency of many factors (e.g., economic cycles, ecological and environmental changes, winning and losing seasons in football). The main factor to watch is the length of the cycle. How long does it take to go from one point to visit all others and return to the first? The longer the cycle, the smoother the process, but it is also difficult to track change that occurs gradually over a long period of time.

Another question relates to the number of points visited in the course of one cycle. If the cycle includes only two points, the pattern will feel like a bouncing ball. If many points are included in the cycle, it might feel smoother, but it might also be more difficult to shift the pattern out of its habitual path. Ask, "What are the significant points along the cycle of behavior? How do they contribute to the health and/or productivity of the system as a whole?

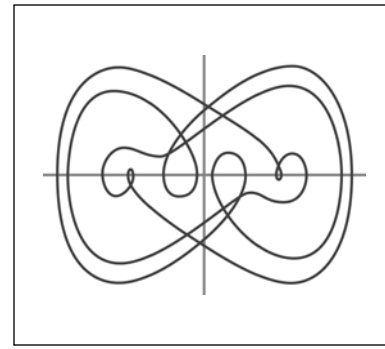

FIGURE 3. Periodic Attractor Pattern.

Look for trends. In addition to time series analysis, trend analysis can be quite helpful in spaces driven by periodic attractor patterns. A variety of questions help people become aware of and articulate shifting attractor patterns. What new things are you noticing? How do those observations relate to each other? What did you expect? How is the emerging reality the same as and different from what you expected? How is this periodic cycle the same as and different from ones that went before?

Many examples of trend-spotting influenced the Kids Summit project. For example, the project was delayed six months to accommodate various cyclical scheduling systems including liturgical calendars, seasonal weather conditions, school calendars, and events for long-standing community traditions. In this process the Design Team discovered that Islamic, Jewish, and Hispanic traditions were beginning to help shape their community calendars.

Collect surprises. If the system is "going in circles" that are driven by a periodic attractor pattern, then it might seem strange to search for surprise. Human systems can be stuck for a short time in a periodic attractor pattern. Over time, with the complications of many interactions, the attractor pattern begins to fall apart. Surprises—out of the range of the expected cyclical path—are indications that the attractor pattern is weakening. That is the point when options for action increase either to improve the old pattern or to encourage migration to a new pattern. To evaluate the capacity to see and share surprises, ask some of the following questions: What surprises have you experienced individually in the past day or week? What have we experienced together? As you read the news and talk to your neighbors, what surprising things are happening around us? Of the surprises we named last time, which are still relevant? Which are no longer surprising?

The Kids Summit considered trends and trend-breaking in its efforts to see emergent patterns. Quotes from focus groups were posted around the room during the Summit. Participants were invited to select and discuss the ones that were surprising—counter to trends they had observed before.

The Kids Summit case includes a variety of naturally occurring periodic attractor patterns and a few planned patterns that we included to help bring coherence to the apparent randomness. The school year and the transportation cycle of getting to and from work turned out to be significant attractor patterns for teenagers in the region. Stability of the past depended on the cyclical pattern of young adults leaving the communities and returning after

a few years. The periodic attractor pattern of agricultural work leads to the waves of migrants into the community and schools.

In the project plan and the design for the Summit itself, we included a variety of periodic activities to encourage movement without feeding into the random patterns that might confuse shared understanding and action. Attendance at our meetings, preparation and participation of team members proved an excellent measure of the periodic pattern informed by our meeting schedule. We are also watching the participation levels on the list serve to see if some periodic pattern emerges besides the one we have already noticed. Sunday afternoon is the high time for communications, and Monday morning is the low. It is also clear that a project that focuses on children and youth will have seasonal swings that match the school calendar. Seeing such a pattern allows us to track and influence communication patterns across the communities over time.

Strange Attractor Patterns

Random, point, or periodic attractor patterns had been staples of physics and mathematics for some time, when strange attractor patterns (see Figure 4) came on the scene. They were called "strange" because they were clearly coherent patterns, but they did not conform to the simple characteristics of the other attractor patterns. Three characteristics distinguish strange from other attractor patterns: (1) A strange attractor pattern is bounded. Unlike a random attractor pattern, the strange attractor pattern has definable edges that limit how widely the system behavior will vary; (2) The strange attractor pattern is infinitely varied. Unlike periodic or point attractor patterns, no two points in a strange attractor pattern intersect. In Figure 4, the lines appear to cross, but this particular attractor pattern is three-dimensional, so from another perspective you could see that they don't overlap; (3) A strange attractor pattern is coherent. Within its bounds, the infinite number of possible points arrange themselves in some identifiable shape. No two points are identical in the strange attractor pattern, but every point fits in a coherent relationship to the whole system-wide pattern. Physical examples have been found in weather patterns, brain waves, and dripping water faucets. The phenomenon (weather, brain activity, leaky faucet) appears to be random or periodic, but when time series are plotted in phase space, complex and coherent patterns emerge. Examples in human systems include birth rates to teenage mothers and accident rates in factories (Guastello, 1995).

Strange attractor patterns are the most different from standard patterns of what we consider "measurable" performance, but the performance literature is full of examples. High performing teams, artistry, leadership, and mastery might all be considered as bounded spaces within which infinite possibilities emerge. We consider three ways to capture and/or measure the coherence of strange attractor patterns in human systems:

- Nonlinear time series analysis
- Scale-free networks
- Simple, iterative decision making models

Nonlinear time series analysis. This process is called by some qualitative mathematics because it produces qualitative results—more or less coherent attractor patterns—from numerical data. A complex mathematical algorithm transforms a long time series of measurements into a phase space diagram. If the data came from a system working in the domain of a strange attractor pattern, the resulting graphic is bounded and infinitely variable and patterned within the bounds. This process, called attractor reconstruction, requires thousands of data points taken at regular intervals of a continuing process, but it can detect changes in coherent patterns within what appears to be a random system.

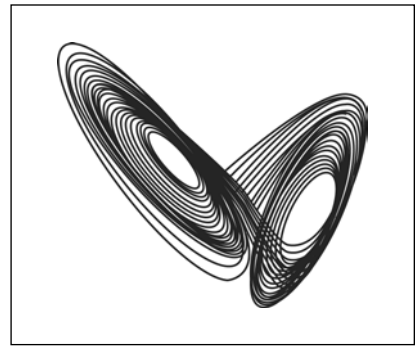

FIGURE 4. Strange Attractor Pattern.

The Kids Summit did not collect and analyze data to detect strange attractor patterns, but the Design Team did recognize that its interaction with each other and with the community became more coherent, though not more predictable, over time. This metaphor helped the group preserve a creative tension between the boundaries of purpose and project and the infinite diversity of individual and community needs.

Scale-free networks. A second way to detect the complex, yet coherent patterns of strange attractors is to work with social network theory. In closed systems where connections are relatively dense, social network theory can be used to describe the structural integrity of the network. Over time, changes in the network can be captured and analyzed with social network analysis tools.

In designing the focus groups, the Design Team brainstormed and created a mind map of constituencies and relationships across the community, but we had neither data nor resources to generate a valid and reliable social network model. The mind map helped members of the Design Team feel confident that the focus group data represented significant patterns in the community, though the data could not be considered statistically significant.

Simple, iterative decision making models. Many performance management and evaluation clients are more interested in qualitative descriptors and options for action than they are in quantitative analysis. They understand the inherent complexity of their situations and the inherent limitations of linear and control-oriented measurement methods. Still, they need to be able to assess and improve performance of their human systems. A particular lesson from strange attractor patterns provides an approach.

Strange attractor patterns are generated by processes that are repeated over and over again. The iteration of the process is much more important that its complicatedness. Iteration of simple processes can be used to generate and evaluate the strange attractor patterns in specific contexts.

One iterative method is a three-question decision-making model. The questions are: What? So what? Now what? As participants on the team encounter new challenges, together they address these three questions.

We use a variety of measures to test improvement of performance on this adaptive action model, including number and variety of variables considered, number of people engaged in the iterative dialogue, cycle time from identification to action. This simple process was the core decision-making method for the Design Team as they prepared for the Kids Summit.

In the Kids Summit project we did not use either of the mathematical methods of collecting and analyzing data (time series analysis or social network theory) because of limited resources and time for the project. We did rely on the three questions to establish and assess the coherence of the work of the Design Team during preparations and the assembled group during the Summit. Over time, as the grant-making process is established and projects are supported, we would expect to use a variety of tools and techniques to track the effectiveness and coherence of strange attractor patterns as they emerge for individuals, families, project teams, and the communities across the region.

Lessons Learned

The original project met its objectives, and the community anticipates a continuing relationship as the findings of the Summit are transformed into infrastructure for shared decision making. In the course of this project the team reflected on the lessons we had learned about complex human systems dynamics, attractor patterns, and tools for performance improvement. Three lessons are particularly significant for evaluation and organizational practitioners.

First, every human system may include all four of the attractor patterns at any given time. In designing performance measurement and improvement systems, we need to be conscious of which attractor patterns most influence the performance of interest so we can focus our attention and adopt realistic assumptions about the dynamics of change. We also need to be sure that we are designing methods of data collection, analysis, and reporting that respect the special characteristics of the attractor patterns that play significant roles in the system. We expect that this lesson will lead us to multi-leveled evaluation designs in which some facets of performance can be addressed as point attractor patterns with specific outcomes, while other facets will require pattern-forming measures of random, repetitive patterns of periodic, or bounded and braided phenomena of strange attractor patterns.

Our second lesson is reflected in the experience of gifted practitioners: point of view matters. The external, objective eye will see quite different patterns than the at-home expert or the deeply embedded professional. Each one is aware of different attractor patterns at different levels of the system. We need to explore and establish reasonable boundaries for investigation and be as certain as we can be that our work is informed by pattern spotters most likely to see similarities, differences, and relationships that are most relevant to performance.

Third, we learned again that no human system stands still. Every event is just the next emergent consequence of the past and the jumping-off place

for the future. No snapshot provides a complex, realistic, and robust picture of the dynamics of a human system. The past, present, and future of each pattern are braided together into a picture that can be seen most effectively in the context of systemic patterns across time.

Conclusion and Future Research

The Future Foundation observed emergent patterns that affected the health and well-being of children and youth in their region. They wanted to invest, but they also recognized the difficulty of measuring or controlling improvement in performance of a "system" that was as loosely coupled and out of control as the one that shaped the future for children and youth. They chose to apply human systems dynamics to see and influence the complex patterns of change in their community.

This article presents the journey of learning and dynamical interactions that brought people together into coherent meaning making and shared action. We have used the metaphors of attractor patterns (random, point, periodic, and strange) to demonstrate how characteristic behaviors of complex dynamical systems can be used to derive ways to improve and measure improvement in complex systems of human performance.

At the Human Systems Dynamics Institute, we are engaged in an on-going praxis cycle of learning and action. This project, like all of our projects, sparks many questions for future inquiry. In particular we wonder:

- Which traditional methods of evaluation have been or might be adapted to work within the assumptions of complex human systems dynamics?
- What will happen to youth in The Future Foundation's region over time? Will the patterns established during the Summit persist and continue to support systems that support children and youth?
- What individual learning and performance improvement resulted from this intervention and, more broadly, what is the relationship between attractor patterns for the whole system and those that affect subsystems or individuals?
- What are the most effective ways to integrate the principles and metaphors of nonlinear dynamics with theory and practice of performance evaluation and management?

Our future research and consulting projects will continue to respond to and generate questions as we work with others to build a system of theory and practice that articulates the complex dynamics of human systems.

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