Living and Working in Complex Adaptive Systems
by Royce Holladay

How is it that the various groups I belong to have such similar characteristics, no matter how different they are? I am on teams at work; I play tennis and golf with different groups of friends; I belong to a community action group to fix up our neighborhood; and my extended family gets together one weekend each month. You would think that groups with these disparate purposes and origins would feel more different than they do. How can this many groups—generally disconnected from each other—behave in ways that are so similar? And is there anything I can do about that when things are happening that I don’t like?

Every group that comes together—for work or play or just to live a day-to-day existence—has its own way of interacting and its own “rules” and expectations for how people relate to each other. At the same time, though, these variable groups tend to respond to challenges and new information in similar ways. Dynamics of the group interactions might shift a bit when someone new comes along, but soon interactions and routines settle into patterns that might be slightly changed, but are essentially the same as before the disruption. Rarely something really important might happen to cause significant changes in the group.

At the same time, in each of these groups, when someone new joins in, it’s pretty obvious in a relatively short time, whether or not they are going to “fit” in the group. A new person steps in and learns the patterns, choosing to participate and engage like everyone else. Or a new person may step in and learn the patterns and choose to either fight the pattern or leave. Rarely will one person—even a new CEO—be able to shift system-wide patterns significantly.

How can these disparate groups end up behaving in such similar ways? It’s because they are all complex adaptive systems (CAS)—dynamical, self-organizing and continually changing. The definition of a CAS holds the answer to that question. A CAS is “a group of semi-autonomous agents that interact in interdependent and unpredictable ways such that they create system-wide patterns. These patterns, over time, reinforce future behavior of the agents in the system.”

Let’s break this definition down:

- **Semi-autonomous agents** refers to the parts of the system—in a human CAS, agents are the people who make up the various teams, committees, and families. Each group operates within some constraints—rules, agreements, and expectations that govern their behavior. At the same time, however, they are free to make their own choices about how they interact with each other.

- The members of the group are **interdependent** with each other. Their actions have an impact on other members of the group. This is easy to see in a family or a small work team. If someone is having a bad day or is performing extraordinarily well, the other members of the team generally respond in direct and immediate ways. While it
may be more difficult to see, this is true even in large groups where the members may not even know about each other. In a community, for instance, when one individual or small sub-group behaves outside the norms and expectations, ripples of reaction carry across the whole.

- Because these agents are free to choose, their behaviors are unpredictable. Individuals are influenced by a number of factors we cannot know or predict at any given point in time. While you can anticipate patterns of action, you cannot predict what any one agent will be doing at any particular moment. For instance, you may know how one of your family members might respond to an event, in general, but you have no way to predict exact reactions at any specific point in time.

- The people in a CAS interact in ways that generate system-wide patterns. We may see these patterns as the culture or climate of an organization or a group. When people interact in ways that respect diversity and innovation, for instance, you will probably see patterns of trust and openness and exploration of new ideas. In a family you see it in the ways members of the family act toward each other or how they react to challenges or surprises, for example. In a community, these patterns form the traditions and rituals that characterize the group.

- As system-wide patterns emerge, they influence (reinforce) behavior of the agents in the system. Over time, the pattern becomes stronger and stronger, and people behave according to the pattern. For instance, when the prevailing patterns in an organization are about respect and diversity, then the climate is one of acceptance and trust. These patterns become formalized as rules or regulations, awards and recognitions that amplify (positively reinforce) individual behaviors that contribute to the patterns of respect. At the same time, those behaviors that do not contribute to patterns of respect are damped (negatively reinforced), in an attempt to make the behavior disappear.

So think about how the groups you belong to are made up of people who influence and depend on each other. Then think about the general patterns or expectations that help people know how to belong in that group. What do those rules or expectations say about who has power? How people should behave? What “work” gets done? How new people are welcomed (or not) into the group? The patterns that are established by any single group of people are what make it unique. The way those patterns emerge are what make the experience of being part of any group similar, regardless of its purpose, makeup, or size.

Sometimes we feel as though we are at the mercy of the “mood” or culture of the groups we are a part of. If we understand how these groups behave as complex adaptive systems, we can recognize that there are options for us to work with the other members of the group to try to change the system-wide patterns. In our families and teams we can talk with the other members and make agreements about how we want to interact—then find ways to recognize and celebrate when people behave that way. In communities, we can work with others to create new traditions and expectations. Even at the regional or national levels, we can participate in political systems or activist groups to bring about widespread change.

We see people taking this level of responsibility and action every day in many ways. Parents try to shape the behavior of their children. Community leaders try to make their neighborhoods safer or cleaner or more prosperous. Almost every week we see news items about people changing the political realities where they live. Whether they realize it or not, the individuals who are taking these actions are working to shift the emergent patterns in the complex adaptive systems in their lives.
So that’s what makes the different groups I am in feel so similar, even in the face of their differences. That’s what it is to be a part of a complex adaptive system. The actions I take on a small scale can make a difference on a larger scale. Actions of others have an impact on me in ways I may not know immediately—if ever. I am influenced by the existing patterns of interaction and decision making that constrain me—even as I have opportunities to create new patterns.
Complex Adaptive System

A collection of individual agents who have the freedom to act in unpredictable ways, and whose actions are interconnected such that they produce system-wide patterns.

1. Agents interact
2. System-wide patterns emerge
3. Those system-wide patterns, in turn, influence the behaviors of the agents