The Connection Game:
The Shape of Change

The text of
Lesson 9: The Connection Game
From the books

The Shape of Change

and

The Shape of Change: Stocks and Flows

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The Shape of Change

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Introduction

In this activity, students play a game in which their movements around the room depend on the movements of other players. Even a small change in position by one person can cause the whole team to move about. Diagramming the game afterwards introduces the concept that parts of a system are interconnected and changes to one element can cause far reaching effects. Through their own actions, students become aware of the concept of complexity in an apparently simple game.

The Connection Game is based on the Triangle Game developed by Meadows and Booth-Sweeney.[1]

Materials

- Large open space in which to play the game
- Easel pad or display board
- A large number card for each student

How It Works

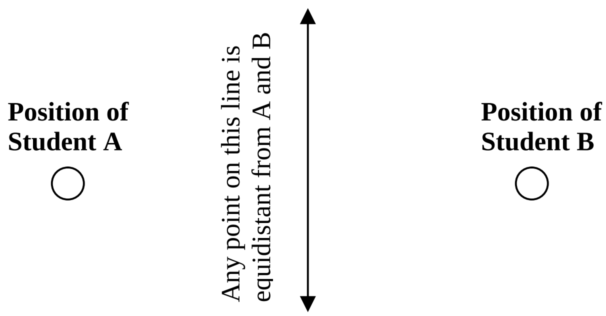
Most things are not as simple as they seem. For example, many times we think in terms of simple cause and effect: if we do action A, then consequence B will result. In reality, causes and effects are interrelated in a complex manner, which can make them difficult to understand. So, action A will probably have a range of consequences, causing C and D as well as B. B creates its own set of consequences as well, some of which may be delayed and some of which will be unintended. Now, instead of a simple linear cause and effect chain, we see an intricate web of connections.

Here's an example. Removing a "pest" from the environment may seem like a good idea. But what are the effects on other organisms? What will happen to the predators and prey of the removed pest, and what populations will increase to fill the niche left empty?

> Life is full of webs of connections.
> The Connection Game gives students direct experience with complexity.

Procedure

1. Define "equidistant." Demonstrate by asking two student volunteers to stand about 8 feet apart. Ask the class to suggest where the teacher should stand to be equidistant, or equally distant, from the two students. Using student suggestions, move to a point where the teacher is equidistant from the two students – students usually suggest the midpoint on the line between them. Ask the class for other suggestions for places to stand equidistant from the two students. Repeat this until students understand the concept clearly.



2. Ask students to stand in a large circle, leaving two or three feet of space between them. The game works best with 10 – 15 players but can be played with more or fewer. Space can become a problem indoors if the team is too large. In that case, split up the class and play multiple games with different teams.

3. Distribute number cards to students in order around the circle. The cards should be visible to all players.

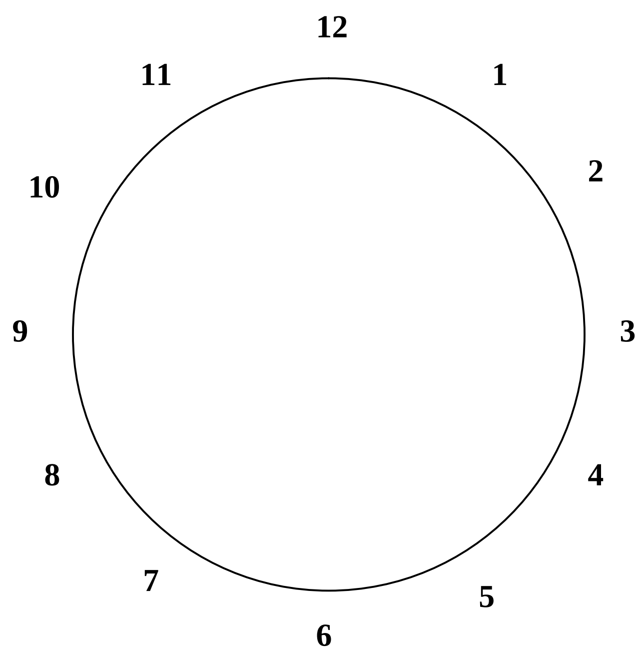
4. Tell students they are going to play a game. They are all on the same team and have a common goal.

Connection Game Rules

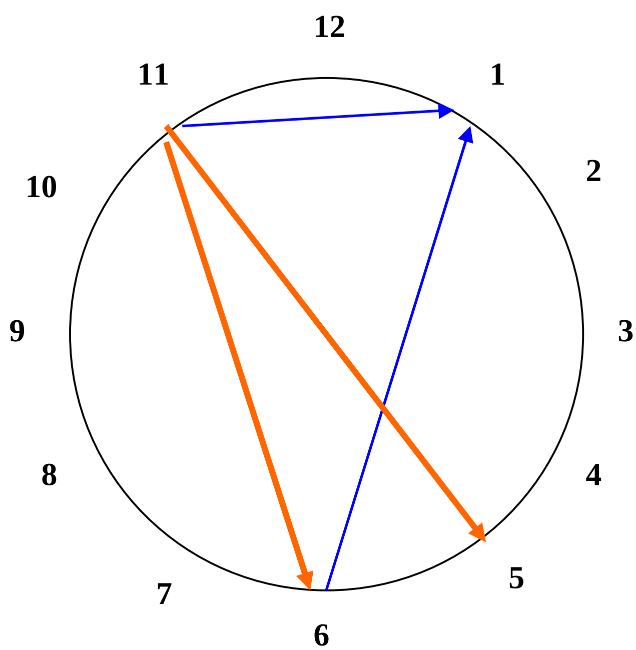
1. Look around the circle and randomly choose the numbers of two other players. *This is secret! Do not tell anyone what numbers you have chosen.* Remember your position in the circle and the positions of your chosen numbers.
2. When the teacher gives a signal, move to a point equidistant from the other two players whose numbers you have chosen. *Do this with no talking.*
3. The game continues until all players are equidistant from the two others they are watching, and movement stops – a state of equilibrium.
4. The goal is to achieve equilibrium as quickly as possible.

Avoid having students concentrate on who chooses whom. The emphasis in the game should be on the way a change or disturbance to a web of connected elements causes ripples of disruption to spread through the system. Urge students to choose randomly when they select players to track during the game. The teacher may suggest everyone choose a boy and a girl, or choose based on numbers held by players, or even to choose someone who may not be a best friend. Otherwise, if one of the players in the game is not chosen to be observed by anyone, his or her feelings might be hurt.

5. It takes only a few minutes for the students to find equilibrium. After they do, draw a large circle on the board or easel with numbers around the edge for all the students, as shown below.



6. Using different colors for each student (until you have to repeat colors), have players draw arrows FROM the numbers they watched TO their own number on the diagram, as shown on the partially completed diagram below. This will indicate which numbers caused other numbers to move.



Notice that Student 1 tried to stay equidistant from 11 and 6, while Student 11 tried to stay equidistant from 5 and 6. Therefore, during the game, movement by 5 caused 11 to move, which then caused 1 to move, even though 5 was not a marker for 1. And, this is only a partial diagram! (Don't worry! This is concept becomes obvious as the game is played.)

5. After all students have drawn their arrows, choose two or three students to trace the connections that caused them to move during the game. Students follow a trail of arrows from their number and tell the story: "I moved when 8 moved, who moved when 12 moved, who moved when 3 moved, etc."

Students are surprised to see the complexity when all their arrows are drawn.

Bringing the Lesson Home

Use the diagram to focus a discussion on what happened in the game.

? **What happened when you tried to stay equidistant from your two numbers?**

Everyone started moving at once. Just when students thought they were in the right spot, one of their numbers would move and they would have to move again. Finally the movement settled down.[2]

? **Was it difficult to achieve the goal of equilibrium? Why or why not?**

Most students express surprise that they were able to reach equilibrium. The movement is so chaotic and complex that it seems impossible. Groups are generally able to settle down in a few minutes.

? **What strategy did you find most effective? If you played again, what would you do differently?**

Some players find staying back helps. If the circle collapses, there isn't much space to maneuver. Other players may mention moving slowly. This is a case where answers truly will vary.

? **How did one person's change in position affect others in the group?**

The arrows create a complicated picture but you can trace connections by following the lines with a finger or pointer. When someone moved to be equidistant from two other players, that caused other players to adjust their positions. Change rippled through the group.

? **More arrows are clustered at some numbers. What effect did that have on the game?**

Some numbers will have more connections than others. Those players would have caused more movement when they moved since many players were tracking them. Some numbers might have no arrows out. That means those players could move without affecting the movement of others. All the players in the game are connected in some way.

? **Can you think of an example of one behavior causing many other unexpected things to change?**

- *Eradicating a pest upsets the balance between predators and prey, affecting other animals and plants in the system, causing new problems.*
- *You stay up late to finish homework, but the next day you are tired, so you don't do very well on the test, so you have to stay for extra help, so you miss the bus, so you get home late, so you don't have enough time to finish homework again.*

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[1] Linda Booth Sweeney and Dennis Meadows, 2001, *The New Systems Thinking Playbook*, Institute for Policy and Social Science Research, UNH, Durham. This book presents 30 engaging activities demonstrating principles of systems. Players learn by doing.

[2] The Connection Game is a fun classroom activity that lets students play with complexity and change within a system. It is an example of agent-based simulation: the behavior is caused by individual agents following a simple rule. This approach is different from system dynamics which traces behavior changes to the underlying feedback structure of the system. Many problems can be studied in either way.

The Shape of Change

In Lesson 9 of ***The Shape of Change***, students moved around the classroom trying to maintain an equal distance from two students who were also moving around the room tracking two other students. A small change in the position of one person caused everyone else to move. See Pages 97-102 in ***The Shape of Change*** for the complete lesson.

The Connection Game

The Connection Game is a precursor to the next two lessons in ***The Shape of Change*** on drawing causal loop diagrams using connection circles. The game is just an engaging way to experience the complexity of a web of interdependencies. There are no stocks and flows to draw for this lesson.

Connection to Characteristics of Complex Systems Project

Lesson Title:
Shape of Change, Lesson 9: The Connection Game, including Stocks and Flows

Overview:
Students kinesthetically experience an interdependent system of cause-and-effect relationships.

Related Characteristic(s) of Complex Systems:

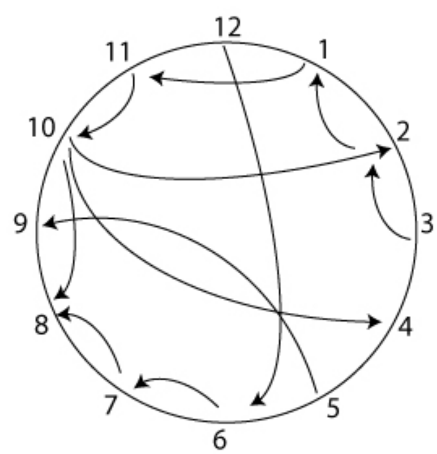
- Action is often ineffective due to application of low-leverage policies.
- High-leverage policies are difficult to apply correctly.

Ideas and Examples for Connecting to the Characteristic:
Extend the lesson when the group comes to equilibrium. Move one person out of position and then instruct the group to make sure they are still equidistant from their two chosen numbers. If they are not, the whole group must begin moving again. If they are, no one needs to move.

Discuss the concept of ineffective vs. effective action (leverage) in terms of which number (person) causes the system to move the most. Whoever causes the most movement has the most influence on the system as a whole. Discuss:

- Is it obvious from looking at the group of interconnected people, who has the most leverage/who will create the most movement throughout the system when he/she changes position? Why or why not.
- What's an example of a real-world system with some parts of the system having a greater influence than others?
- How does the experience connect to creating desired change in a system?
- How can we know whether an action is effective or ineffective in the long-term?

Once the debrief diagram is created, it becomes even more evident who (which number) has the most direct influence on the system. Whichever number has the greatest number of arrows coming out from it has the greatest influence (the highest leverage).



Of course this influence cascades based on who influences that person, and so on. In the example diagram, number 10 influences the most other numbers, but 10 is influenced by 11, which is influenced by 1 and so on.

Complex systems feature many connections between individual parts, and it is difficult in real life to identify which part has the most influence. If that part is actually identified correctly, it is often difficult to understand how to influence that part to bring about desired change in the system as a whole. For example, to reach a goal of having a group of interconnected people "settle" into a particular pattern, the "high-leverage person" would need to

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be “placed” in a particular position to create that specific result. The more interconnections that exist, the more difficult this becomes.
Resources: *Shape of Change*. Rob Quaden and Alan Ticotsky Optional Article: “Don't Throw Back Those Baby Fish – Should fish only be caught after they've matured and reproduced, or does that harm the ecosystem?” Brendan Borrell. 2013. Discover Magazine. http://discovermagazine.com/2013/march/8-baby-fish#.UbcrD_nCaSo

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