Youth Handouts and Worksheets for:

SCRIPT CHANGERS
DIGITAL STORYTELLING WITH SCRATCH

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foreword by Linda Booth Sweeney
Overview & Explanation

For your convenience, we have gathered together here all handouts and worksheets useful for supporting the activities found in *Script Changers*. See the Design Challenges within the book for detailed information on how these materials may be used. On the following pages you will find printable copies of all worksheets and handouts identified within the book. The worksheet headings and page numbers match the same within *Script Changers*.

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**APPENDIX A: pages 225-263**

GLOSSARY OF KEY TERMS

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Design Challenge Two

Systems, Systems Everywhere! Diving into Systems
DESIGN CHALLENGE 2, PART 2

FINDING SYSTEMS IN OUR COMMUNITY

1. What goal of your community are you addressing?

2. What are the different parts of your community (the elements) that interconnect in order to achieve that goal?

3. How do those elements interact with one another in order to achieve that goal? Describe in words and pictures. Consider using a connection-circle diagram to illustrate the interconnections.

4. What would happen to the goal if one of the elements disappeared? Give one example.
DESIGN CHALLENGE 2, PART 3

TELLING STORIES ABOUT SYSTEMS: KEY QUESTIONS

As you draft and create your stories, keep these questions in mind to make sure that you’re thinking about things from a systems perspective:

- What’s the problem or issue you’re concerned with?

- What are the “big trends” associated with the issue? How has the issue changed over time?

- What are the key elements of the system? How are they connected to one another?

- What would the community look like if the problem was solved?

- What kinds of changes would make that solution possible?
DESIGN CHALLENGE 2, PART 3

MISSION: COMMUNITY MEMBER INTERVIEW

Name: ____________________
Date: ____________________

Instructions: Your mission is to go into your community and talk to people to find out more about it and what people think might need changing. Interview a member of your community (this could be parent, a local shopkeeper, a neighbor, etc.), focusing on these five questions. Use the back (or a separate sheet of paper) if you need more room for notes.

NAME AND TITLE OF THE COMMUNITY MEMBER YOU INTERVIEWED:

- How has the community changed over time in positive ways?

- How has the community changed over time in negative ways?

- What are the most important parts (elements) of the community, and how are these parts connected to one another?

- What are good goals for the community, or the purposes that it should serve?

- What are the most important issues, challenges, or opportunities facing this community?
Design Challenge Three

It's All About Perspective: Thinking Below the Waterline... And Across the Table
**CHALLENGE 3, PART 2:**
**STAKEHOLDER SKIT PLANNING**

In order to create a short skit about various perspectives on a community issue, take a moment to “get inside the head” of your particular stakeholder. Consider how you can use your research to teach the audience (a) something about the systemic nature of the issue and (b) the role your stakeholder has in it.

1. What is the community issue being addressed in your skit?

2. Which stakeholder are you representing?

3. What is your stakeholder’s general relationship to the issue? What’s that person or entity’s “stake” in it?

4. From your stakeholder’s perspective, what is the root cause of the issue?

5. From your stakeholder’s perspective, what are some good next steps to either help solve the issue or make sure things stay exactly as they are?

6. Where and when will your skit take place (present-day or as an event in the past that laid the foundation for the current community issue)?

7. Besides the main stakeholder, what other characters will appear in your skit? Why are you including them?

8. What does your stakeholder think about some of the other characters?

9. What events will happen in your skit? How will your stakeholder or the other characters react to them? What do their reactions tell the audience about the issue and each character?

10. On the back of this paper, draft your script: a short dialogue and actions that will take place during the beginning, middle, and end of the skit as well as who is playing what role.
DESIGN CHALLENGE 3, PART 4

THE ICEBERG
Looking below the Waterline

WE CAN BE

EVENTS
Reactive & Responsive

PATTERNS OF BEHAVIOR
Adaptive & Proactive

SYSTEM STRUCTURE AND MENTAL MODELS
Creative & Transformative

MORE LEVERAGE
Design Challenge Four

Out of Control: Reinforcing Feedback
**DESIGN CHALLENGE 4, PART 1**

**CONNECTION CIRCLE**

Use the circle below to map connections within the system.

1. First, list the important elements of the system around the outside of the circle. Keep in mind that your elements should be things that increase or decrease over time in the system.

2. Then use arrows to start mapping the connections between the elements in terms of one causing another to increase or decrease. Remember to:
   a. Use arrows to indicate the “direction” of the relationship (which element is causing, which element is being affected).
   b. Use plus (+) and minus (–) signs near the heads of the arrows to indicate whether the relationship is causing an increase or decrease in the affected element.
WHY DON’T HOMELESS PEOPLE JUST GET JOBS AND STOP BEING HOMELESS?
IT SEEMS LIKE IT WOULD BE EASY, JUST GET A JOB AND GET OFF THE STREET, RIGHT?

By Kylyssa Shay, Yahoo! Contributor Network

Many people believe that homelessness is a choice, that all a person needs to do is get a job to stop being homeless. The fact is that it isn’t that simple, either to get a job when homeless or to get out of homelessness even with a job. For one thing, getting a job while homeless presents a set of difficulties a homed person might not suspect. For another, a job isn’t always enough to get a person off the street.

Unemployment rates are high and jobs are scarce. Even for those who have homes, it’s hard to find a job. As to why homeless people have more difficulty getting jobs, there are multiple reasons.

Many people become homeless due to unemployment or illness, both of which create gaps in job history many employers find unacceptable. Homeless people lack regular addresses and may not even have cell phones, making them too much trouble for prospective employers to contact. Homelessness makes staying clean and tidy enough for job interviews nearly impossible. Transportation is also a major issue for homeless people. Many job listings specify: “dependable transportation required.” While some homeless people have cars, not all of them do.

In some areas, homelessness itself is illegal, resulting in jail time and a criminal record, which tends to look bad on a job application. Even without a criminal record, the stereotype of homeless people as drug-using criminals prevents many employers from even considering anyone they suspect might be homeless.

On top of those problems, there’s another barrier to employment that many homeless people face when looking for work—credit checks. Many employers perform credit checks now in their employee-screening process. As you can imagine, not having an address or recent income, and probably having past evictions and medical bankruptcies or past-due bills on your record, destroys your credit rating.

That covers reasons why homeless people who are capable of working may not have jobs—there are also those who are not able to hold a job due to illness, mental or physical.

Many homeless people are physically disabled by illness or age. That’s right, some homeless people are senior citizens whom someone ought to be caring for, and others are very sick people unable to support themselves.
Then there is another category, a surprisingly large one—employed homeless people, often called the working poor. Anywhere from one-third to one-half of homeless Americans have jobs. They simply do not earn enough to get off the streets due to excessive debts such as medical bills, student loans, alimony or child support, or due to the lack of a living wage.

**MY STORY—FALL, 2001**

By Anonymous

My story is simple, but you won’t like it. I had a job and I made $9 an hour. But one-third of what I had went to the childcare center and nearly half went to rent. The rest went to food and regular bills. I got five kids. I got no other money. You can’t make it on that. It’s just plain and simple. I got skills. I went to school and learned to be a cook. I work good restaurants. I did what I was supposed to do. You just can’t have kids and make it on $9 an hour. When my daughter got pneumonia I had insurance, but the co-pay was high and the hospital wanted me to pay out $300 a month. I couldn’t give them but $20 or $30 and they took me to court. Then my boyfriend got married and wanted to get custody of my kids. I had to fight him in court. I paid $200 a month for a lawyer and he didn’t do nothin’. I had to get all the witnesses and do all the legwork. Then my car needed a new exhaust. And that was $1,000. Comes a point where something’s gotta give. With the car—I had to have that to work. The lawyer wouldn’t stop getting after me for the money I owed him. There’s just no way. I fell behind a little on my rent and got kicked out. Ain’t no way you can do it. You figure the math. They tell you, you got a skill and you be making $9 an hour. You can pay your bills—*just* pay your bills. Then anything come up and you’re flat. You can’t do it.

They say here that they will help me, and they do. But I can’t just convince them of the obvious. I’m off the streets now, but I’ll be back. Ain’t no way you can do it. I could do like these other women and sell a little pot, but I ain’t raising my kids in that environment. So I do it the way they say. Ain’t no way it can work. Do the math.

I’m trying now to find a job that will pay me just a little more, but so far no good. The good salad and grill jobs are way out by Waukesha. Then I’d have to have a better car and spend hours traveling and my daycare wouldn’t keep the kids that late. I don’t know what the solution is. I feel like it’s just no use. All I can do is get me some boyfriend that will bring a little money into the house. But then I have to feed him too.
MISSION: COMMUNITY MEMBER INTERVIEW

Name: ____________________
Date: _____________________

Instructions: Your mission is to go into your community and talk to people to find out more about it, and to inquire what people think might need changing. Interview a member of your community (this could be parent, a local shopkeeper, a neighbor, etc.) about the five things below. Record your answers on this sheet, and use the back (or a separate sheet of paper) if you need more room.

Community member you interviewed: ____________________

How has the community changed over time in positive ways?

How has the community changed over time in negative ways?

What are the most important parts (elements) of the community, and how do they interact with one another?

What do you think are good goals for the community, or the purposes that it should serve?

What are the most important issues, challenges, or opportunities facing our community?
DESIGN CHALLENGE 4, PART 2

CONNECTION CIRCLES

Use the circle below to map connections within the system.

1. First, list the important elements of the system around the outside of the circle. Keep in mind that your elements should be things that increase or decrease over time in the system.

2. Then, use arrows to start mapping the connections between the elements in terms of one causing another to increase or decrease. Remember to:

   a. Use arrow to indicate the “direction” of the relationship (which element is causing, which element is being affected).

   b. Use plus (+) and minus (-) signs near the heads of the arrows to indicate whether the relationship is causing an increase or decrease in the affected element.
REINFORCING FEEDBACK LOOP EXAMPLES

Reinforcing feedback loops are circular cause and effect processes that create growth, such as in escalation cycles, or decay, such in resource drain cycles. Reinforcing feedback loops are important to understand because they’re the engines of growth or decline and are often at the heart of that are described as “out of control,” experiencing a “snowball effect” or are “out of balance.” Reinforcing feedback loops rarely occur in isolation—often when you find them you’ll also find balancing feedback loops.

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<td>A <em>vicious cycle</em> is a reinforcing feedback loop that causes a negative (bad) outcome in terms of the perceived goal of the system. (<em>Note:</em> Don’t forget that sometimes reinforcing feedback loops can be considered good, depending on where you stand in relation to a system. In that case they aren’t vicious.)</td>
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Diagram of Overeating Example

**Examples**

**Overeating**
Gerald wants to lose weight and is under the impression that if he only eats twice a day (instead of three) he will lose weight. Unfortunately, when Gerald skips breakfast he experiences an increased feeling of hunger at lunch. As a result, Gerald eats more than he should at lunch, taking in more than his body actually needs between lunch and dinner. This causes Gerald to slowly gain weight, which leads him to think that he needs to continue to skip meals, starting the cycle over again.

Diagram of Peer Influence Example

**Peer Influence**
Tiffany just got an iPod as a gift for her birthday and she brings it to school to show her friend Jayden. After Jayden sees Tiffany’s iPod, he tries to convince his parents that he needs one, despite having a working CD player. As a result, on Jayden’s birthday his parents buy him an iPod that comes with more memory than Tiffany’s iPod. When Tiffany’s parent’s bought hers, iPods came with 2 gigabytes of memory, but when Jayden’s parents buy his, most iPods come with 10 gigabytes of memory. After learning that Jayden’s iPod has so much more memory, Tiffany tries to convince her parents that she needs an iPod with more memory.
**Virtuous Cycles**

**Definition**
A *virtuous cycle* is a reinforcing feedback loop that causes a positive (good) outcome in terms the perceived goal of the system. (*Note: Don’t forget that sometimes reinforcing feedback loops can be considered bad, depending on where you stand in relation to a system. In that case they aren’t virtuous.*)

**Examples**

**Student Leaders**
Mr. Johnson, a high school principal, notices that his more popular students have begun to speak out against bullying when they witness it. He also notices that more students are beginning to look down upon casual bullying. This has led to less acts of bullying observed among students, which the popular students take as feedback that their words have an effect, which in turn further encourages his popular students to increase their efforts to speak out against bullying.

**Saving Money**
Every two weeks, Connie puts some of the money from her paycheck into the bank. Over time, the money she invests grows interest, which increases the total amount of money in her bank account. Connie notices that the more money she invests, the greater amount of interest she earns. This encourages Connie to put as large a portion of her paycheck as possible into her account.
DESIGN CHALLENGE 4, PART 3

FEEDBACK FORM: REINFORCING LOOPS PROJECT

Designer’s name: ______________________ Consultant’s name: ____________________

Circle a number in each category to give the designer your feedback on their project.

Interest: How interesting is the story?
1............................2............................3............................4............................5
A bit boring                       Fascinating!

Plot: How well does the story hold together?
1............................2............................3............................4............................5
It’s confusing                      I completely understand

Feedback: How well does the story demonstrate a reinforcing feedback loop?
1............................2............................3............................4............................5
Not Well                           Very well

Type of Reinforcing Feedback: Is this story about a vicious or virtuous cycle? (circle one)

           Vicious                         Virtuous

Describe the reinforcing feedback loop that is being shown in the story. What are the elements of the feedback loop and how do they work together?

What suggestions do you have to improve the story?

What suggestions do you have to help the story illustrate a reinforcing feedback loop more clearly?
**DESIGN CHALLENGE 4, PART 3**

Name: ___________________   Date: ____________________   Topic:____________________

Working Title: ________________________________________________________________

**SCRATCH PROJECT STORYBOARD**

**SCENE#**

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Use as many copies of this storyboard as needed to plan your story.
Design Challenge
Five

Out of Balance:
Balancing Feedback
And Leverage Points
DESIGN CHALLENGE 5, PART 1

CONNECTION CIRCLE

Use the circle below to map connections within the system.

1. First, list the important elements of the system around the outside of the circle. Keep in mind that your elements should be things that increase or decrease over time in the system.

2. Then, use arrows to start mapping the connections between the elements in terms of one causing another to increase or decrease. Remember to:
   a. Use arrows to indicate the “direction” of the relationship (which element is causing, which element is being affected).
   b. Use plus (+) and minus (-) signs near the heads of the arrows to indicate whether the relationship is causing an increase or decrease in the affected element.
DESIGN CHALLENGE 5, PART 2

CONNECTION CIRCLE

Use the circle below to map connections within the system.

1. First, list the important elements of the system around the outside of the circle. Keep in mind that your elements should be things that increase or decrease over time in the system.

2. Then, use arrows to start mapping the connections between the elements in terms of one causing another to increase or decrease. Remember to:
   a. Use arrows to indicate the “direction” of the relationship (which element is causing, which element is being affected).
   b. Use plus (+) and minus (-) signs near the heads of the arrows to indicate whether the relationship is causing an increase or decrease in the affected element.
Balancing feedback loops generate actions aimed at creating or preserving a desired state. Generally speaking, balancing feedback processes keep systems stable. They can be referred to as “self-limiting,” which makes them the opposite of reinforcing feedback loops).

### Examples

**Hunger**

Shannon is hungry so she eats. When Shannon eats her feeling of hunger decreases, which causes her to stop eating. Eventually, Shannon’s body uses up the energy from her food intake and will require more, causing her to be hungry again.

**A Flushing Toilet**

When you flush a toilet the water level drops, which activates the mechanism in the back reservoir to fill up with water. The back reservoir stops filling up with water once the level returns to normal.

**Itching and Scratching**

When your skin itches, you scratch it to relieve the itchy feeling. Once the itchy feeling subsides you stop scratching, until the itch returns.
DESIGN CHALLENGE 5, PART 3

FINDING BALANCE IN OUR COMMUNITY

This handout will help you identify balancing feedback loops within your community.

Think of two examples of successful balancing loops that you see in your own community that help it meet a goal.

What are the elements of the balancing loop in those examples, and how do they work together?

Think of two examples of fixes that have failed in your community.

Using what you know about systems and feedback loops, can you explain why those fixes might have failed?
Design Challenge
Six

Make a Change!
Leverage Points and
Unintended Consequences
DESIGN CHALLENGE 6, PART 1

FINDING LEVERAGE IN THE LORAX

In your group, think of two solutions that you could offer to solve the problem in The Lorax. Explain how your solutions would change one thing but impact the entire system. Then think about a potential unintended outcome that could result from each change.

SOLUTION 1

What one thing would you recommend to change in the system described in The Lorax?

Why might that change impact the entire system?

What is a possible unintended consequence that could arise from this change?

SOLUTION 2

What one thing would you recommend to change in the system described in The Lorax?

Why might that change impact the entire system?

What is a possible unintended consequence that could arise from this change?
DESIGN CHALLENGE 6, PART 1

CONNECTION CIRCLE

Use the circle below to map connections within the system.

1. First, list the important elements of the system around the outside of the circle. Keep in mind that your elements should be things that increase or decrease over time in the system.

2. Use arrows to start mapping the connections between the elements in terms of one causing another to increase or decrease. Remember to:
   
a. Use arrows to indicate the “direction” of the relationship (which element is causing, which element is being affected).

b. Use plus (+) and minus (-) signs near the heads of the arrows to indicate whether the relationship is causing an increase or decrease in the affected element.
# DESIGN CHALLENGE 6, PART 2

Name: ___________________   Date: ___________________   Topic: ___________________

Working Title: ________________________________________________________________

## SCRATCH PROJECT STORYBOARD

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Use as many copies of this storyboard as needed to plan your story.
DESIGN CHALLENGE 6, PART 2

TELLING STORIES ABOUT SYSTEMS: KEY QUESTIONS

As you draft and create your stories, keep these questions in mind to make sure that you’re thinking about things from a systems perspective:

What’s the problem or issue you’re concerned with?

What are the “big trends” associated with the issue? How has the issue changed over time?

What are the key elements of the system? How are they connected to one another?

What would the community look like if the problem was solved?

What kinds of changes would make that solution possible?
Appendix A

Glossary of Key Terms
Identifying a system. Conceptual understanding that a system is a collection of parts, or elements, which interconnect to function as a whole. The “whole” of the system is always more than simply “the sum of its parts,” because the way that the elements are set up, called a system’s structure, determines the interactions among the elements. These interactions actually change the ways particular elements behave in a system. Systems are characterized by circular (rather than linear) patterns of cause and effect.

Identify the way a system is functioning. The function of a system describes the overall behavior of the system—what it is doing or where it’s going over time. A system’s function might emerge naturally based on interconnections among elements, or it might be the result of an intentional design (in which case, we might also call refer to the function of a system as its goal). Regardless, the function of a system is the result of the dynamics that occur among elements’ interconnected behaviors. For example, the respiratory system in the body, when it’s working correctly, functions to keep a balance of the necessary gases inside the body and unnecessary gases in the environment surrounding it.

Distinguishing the goal of a system. The goal of the system is what a system that was intentionally designed to do. Sometimes this might be the same as the functioning of the system ... other times the goal and the function are not aligned. A given system might have multiple goals or purposes that are at play simultaneously, and come into
conflict. Being able to understand system purpose or goal gives a sense of the ideal state of a system from a particular perspective.

**Identifying elements.** Identifying the parts of a system that contribute to its functioning. *Elements* have certain qualities and/or *behaviors* that determine how they *interconnect* with other elements, as well as define their role in the system. Without being able to effectively identify the parts of a system, it’s hard to understand how a system is actually *functioning* and how it might be changed. *For example, a neighborhood is made up of available housing, number of people, amount of local business, levels of employment, availability of public spaces, etc.*

**Identifying behaviors.** Identifying the specific ways that *elements* act within a system, or the role that they’re playing. These behaviors are the basis of a system’s *dynamics* or *interconnections*—the ways its elements interact with other elements (like through various types of feedback loops). Being able to identify behaviors becomes important when we change systems, as often an element will look the same after the change, but its behavior will be different. *In a neighborhood, the behavior of a store is to sell goods or services, as well as employ people. In a story, each character will behave in ways created by the author. A character might be angry and will therefore act aggressively toward other characters in the story.*

**Identifying interconnections.** Identifying the different ways that a system’s parts, or *elements*, interact with each other through their *behaviors*, and through those interactions, change the behaviors of other elements.

**Perceiving dynamics.** Perceiving a system’s dynamics involves looking at a higher level at how the system works. Dynamics in a system are often characterized by circles—patterns that “feed back” on one another. These are called *feedback loops.*

**Make systems visible.** When we learn to “make the system visible”—whether modeling a system on the back of a napkin, through a computer simulation, a game, a picture, a diagram, a set of mathematical computations, or a story—we can use these representations to communicate about how things work. At their best, good pictures of systems help both the creator and the “reader” or “audience” to understand not only the parts of the system (the elements), but also, how those elements work together to produce a whole. *For example, a map is a visual model of a certain area. Different maps will include or leave out different details about that area, depending on their purpose. A map of New York City that’s used to navigate its subway system looks very different from a map of New York City that’s used to navigate its streets by car.*
**Systems diagram.** This diagram is used to visualize the dynamics that occur between elements in a system, intended to capture how the variables interrelate. One way of diagramming a feedback loop uses an “R” with a clockwise arrow around it to indicate a reinforcing feedback loop (see below). A “B” with a counterclockwise arrow around it would indicate a balancing feedback loop, which “counts” something in a system. The plus sign indicates an increase in that amount of an element in a system, and a minus sign indicates a decrease in the amount of an element in a system. There are other ways to create systems diagrams, but the most important thing about a good systems diagram is that it not only shows the elements in a system, but is able to show the relationships between the elements through the arrows, symbols, and text. *Example of a system diagram showing the reinforcing feedback relationship between a character’s angry thoughts and feelings:*

- **Feedback loops.** Relationships between two or more elements of a system, where actions by these elements interact in a circular fashion—something that element A does affects element B, which then circles back and affects element A. There are two types of feedback loops, balancing and reinforcing.
**Reinforcing feedback loops.** Relationships where two or more elements of a system cause each other to increase, such as in escalation cycles, or decrease, such in resource drain cycles, in a way that’s “out of control” or creates a “snowball effect.” Reinforcing loops encourage a system to reproduce certain behaviors, though these behaviors always “exhaust” themselves after the resources fueling the growth or diminishment run out. This is also called “limits to growth.” For example, a reinforcing loop that escalates might be a new hot shoe style—more people wear the style, which then makes more people aware of the new style and its popularity, which causes it to become even more popular.

A reinforcing feedback loop that drains or diminishes resources is a bank run—people hear that a bank won’t be able to return deposited money, and so people keeping their money at that bank withdraw it. This weakens the bank, which makes more people concerned that the bank will fail and their money will be lost, causing more withdrawals and keeping the cycle going.

There are two types of reinforcing feedback loops: vicious cycles and virtuous cycles.
**Diagrams of a reinforcing feedback loop that results in escalation (on the left) and resource drain (on the right).**

**Vicious cycle.** Reinforcing feedback loop that causes a negative outcome in terms of the goal of the system. One thing to keep in mind is that the same thing might be a vicious cycle to one person, but a virtuous cycle for another person who has different goals. *For example:* Two kids get into a disagreement while on the playground. One of them calls the other one a name, the other responds by pushing the first kid. The situation continues to escalate until they’re having a full-on fight.
Virtuous cycle. Reinforcing feedback loop that causes a positive outcome in terms the goal of the system. One thing to keep in mind is that the same thing might be a virtuous cycle to one person, but a vicious cycle for another person who has different goals. For example, a farmer plants a seed that over time becomes a plant that provides fruit that have many seeds. He then plants many of those seeds, which produces more fruit, now with many more seeds. Each round of planting produces more fruit with more seeds, creating a snowball effect.
Balancing feedback loops. Relationships where two or more elements of a system keep each other in balance, with one (or more) elements leading to increase, and one (or more) elements leading to decrease. These processes keep a system at the desired state of equilibrium, the system goal. Usually, balancing feedback processes stabilize systems by limiting or preventing certain processes from happening. Having a sense of how balancing feedback loops operate can give a person a sense of what will make a system stable. For example, when gas prices go up, this causes more people to carpool, which decreases gasoline consumption. Since there’s less demand, gasoline prices eventually go down again, causing fewer people to carpool, starting the cycle over again.

Nested systems. Systems that are a smaller part of other systems. Almost all systems are nested within larger systems. With nested systems, a larger system will affect the way that a subsystem behaves, and the subsystem will affect the way that the larger system behaves. The nature of systems as nested within one another means that it’s usually possible to zoom in or out of systems in order to see systems that are either around them (if those systems are bigger) or within them (if those systems are smaller).

Designing a system. Creating a system through engaging in an iterative design process, one that entails cycles of feedback, troubleshooting, and testing. One of the most effective means of developing systems thinking is to regularly create and iterate on the design of systems.
**Fixes that fail.** Any kind of solution to a problem that fixes the problem temporarily but fails fix it in the long term, and might even make it worse over time. Fixes that fail are often put in place quickly, usually without much reflection on what consequences they’ll have for the system. *For example, a city’s roads are congested, so the government decides to build more roads to make more room for all the cars. But people who didn’t have cars see that it’s now easier to drive around the city, so go and buy cars—with the roads remaining as congested as they were before.*

**Leverage points.** Particular places within a system where a small shift in one thing can produce big changes in everything. Leverage points are difficult to find because they often lie far away from either the problem or its obvious solution. It is because of the multitude of cause-and-effect relationships, feedback loops, and system structures that a seemingly small change can be amplified, often in unexpected ways. Not every place in a system is a leverage point—sometimes changing one thing in a system will produce only small effects that aren’t felt throughout the system. *For example, making sure that young women in developing countries get education and health services when they are very young helps to make issues like poverty less of a problem in the long run for all people in a developing country. In a mystery story a detective might look for one key piece of information that will allow him to solve the case.*

**Unintended consequences.** The unexpected result of an action taken in a system that the actor taking that original action did not want to happen. Unintended consequences are often the result of fixes that fail or someone aiming to find a leverage point in a system but not considering long-term implications to those actions. *For example, a company starts to cut down trees in order to manufacture products. As a result, many of the animals that lived in that forest have to leave to find new habitats, something that wasn’t envisioned or expected when the logging started.*

**Mental model.** An evolving set of ideas and assumptions about a system and how it works. Consciously or not, people use their mental models of how a system works when they decide how they’re going to act in a system. When someone’s mental model changes, the ways that they relate to and act within systems change with them. From a systems perspective, mental models are important because any “map” we create of a complex system is essentially a map of our mental models. The more clarified our mental models, the closer to reality (that is, the closer to representing a complex set of interconnections) the map will be.
Considering how mental models shape action in a system. The ability to consider the assumptions, ideas, and intentions that a given actor might have in relation to a system, and how these affect that actor’s behavior within the system. Mental models are often correct about what elements are included in a system, but frequently draw wrong conclusions about a system’s overall behavior. For example, throughout most of human history, people thought that disease came about spontaneously. The introduction of the germ theory of disease, the idea that many diseases are caused by microorganisms, changed people’s ideas and opened the door for most of modern medicine and the importance of hygiene. When we tell a story, we are sharing a mental model of how we understand a situation, a set of events, or characters.

Looking at a system from multiple perspectives. The ability to understand that different actors in a system will have different mental models of the system and consider each of these perspectives when engaging in action within a system. This is also called “thinking across the table.”

Considering multiple levels of perspective. The ability to move fluidly between different levels of perspective within a system, from events, to patterns to system structures, to mental models. The most visible level of a system is an event, that is to say, visible instances of elements interacting in a system. Using the metaphor of a system as an iceberg, events are “above the waterline”—they’re easy to see. When we start to think “below the waterline,” we start to see three other levels of perspective: patterns (recurring sets of events), structures (ways the elements are set up in a system which give rise to regular patterns) and mental models (which shape systems structures.) Switching between different levels of perspective when looking at a system deepens understanding of how a system operates.

Time delays. The time lag between an action in a system and the evidence of its effects. For example, there’s a long delay between the point when you plant a seed in the ground and the appearance of a fruit-bearing tree.

Time horizons. The overall period of time that you look at something in order to understand it. For example, if we only look a complex system like an economy for a short period of time, we might misunderstand how it’s behaving and miss the effects of actions taken far into the past.