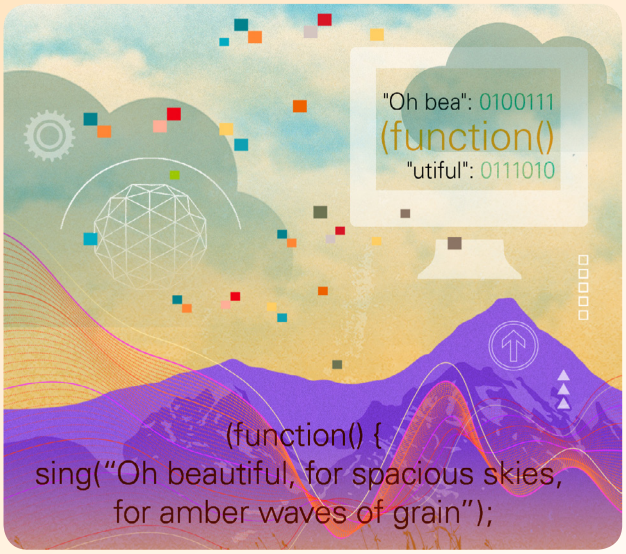
Ambassador Coding for Good

Learn how programmers write code, how video games can help people understand complex issues, and how to use data to foster positive change.

Badge 1:
Coding Basics

Badge 2:
Digital Game Design

Badge 3:
App Development


"Oh bea": 0100111
(function()
"utiful": 0111010
(function() {
sing("Oh beautiful, for spacious skies,
for amber waves of grain");

This booklet gives girls an overview of the badge requirements and badge steps for all three Ambassador Coding for Good badges. It also includes interesting background information to spark girls' interest in coding. Volunteers can access the Volunteer Toolkit (VTK) to find complete meeting plans, including detailed activity instructions and handouts.

Welcome to the world of computer coding!

When you've earned these three badges, you'll know how programmers write the code that makes the digital world work.

- You'll learn how video game makers use open-ended stories to move players through the game.
- You'll learn how people use data to help them make decisions.
- You'll learn about female leaders in the field of computer science.

Volunteers can access the Volunteer Toolkit (VTK) to find complete meeting plans, including detailed activity instructions and handouts.

Badge 1: Coding Basics

When we use computers to do schoolwork, watch a movie, or shop, we don't usually think about what makes them work. Without computer programmers and the code they write for computers, we wouldn't be able to do any of those things. In this badge, you'll learn about what programmers do and become one yourself.

Steps

1. **Learn about functions through song lyrics**
2. **Learn about loops through song patterns**
3. **Write an algorithm duet**
4. **Code a performance routine**
5. **Share your coded routine with others**

Purpose

When I've earned this badge, I'll know how to write shareable code with functions and arguments. I'll have explored how to use coding to spread a message or build community.

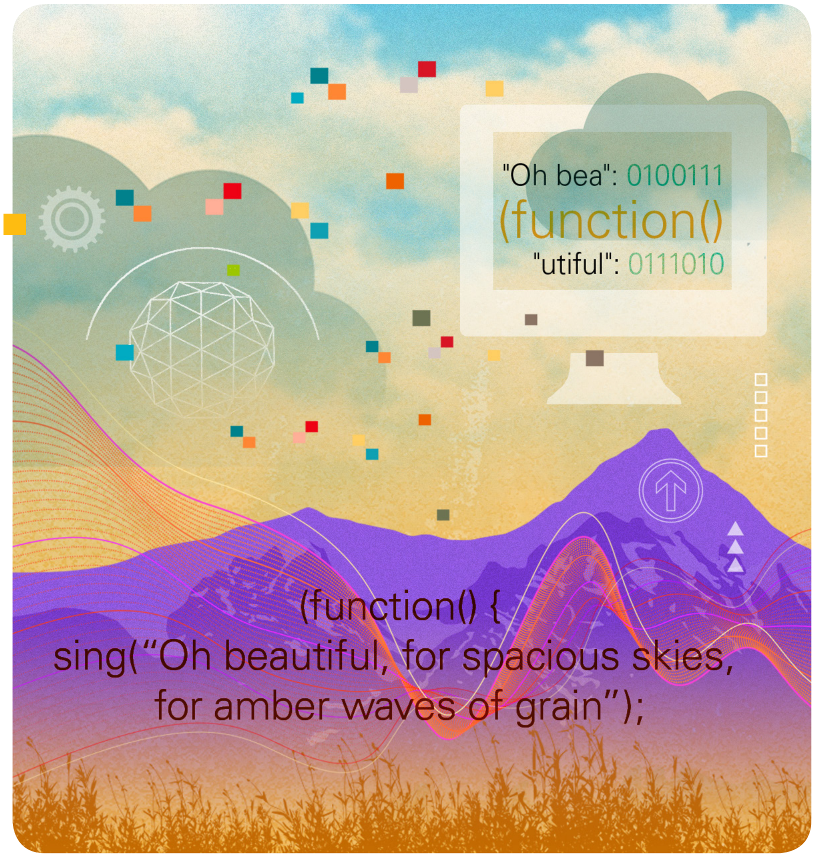
STEP 1 Learn about functions through song lyrics

Computers can fly airplanes, restart stopped hearts, and give you directions to your favorite restaurant! Programmers write the algorithms computers use to accomplish tasks. **Algorithms** are the step-by-step instructions a computer follows. The algorithms are made up of different parts like functions, arguments, and variables.

In coding, a **function** tells a computer to do something. It's similar to a verb, like sing or whistle.

You can make a function like sing() more specific by including an **argument**. An argument tells the computer what words to sing. For example, sing("Oh beautiful, for spacious skies, for amber waves of grain").

You can use the same function, sing(), with different arguments or **variables** to get your computer to sing other verses or an entirely different song.



```
(function() {
sing("Oh beautiful, for spacious skies,
for amber waves of grain");
```

WORDS TO KNOW

Algorithm a series of specific instructions. By creating a sequence of instructions that can be applied to many circumstances, you're creating an algorithm.

Argument a part of code that makes a function more specific and reusable in a number of different ways: it adds details to the function that are changeable. In many programming languages, arguments are represented as a list separated by commas inside the parentheses.

Choreographer a person who arranges dance movements for dancers to perform.

Code a series of instructions that make up a program directing a computer to do something.

Computer an electronic machine that can store and process data. A computer has hardware, which is the machine itself, and software, which is a set of instructions.

DRY a concept in programming that means "Don't Repeat Yourself."

Function one of the basic building blocks of a program. It's a type of instruction similar to a verb: a function does something. In JavaScript, as in most programming languages, it has a special form, which is the name of the function followed by '()'. For example, turnLeft() and whistle() are two examples of functions. The () tells the computer to "do" the named function. "Doing" a function is typically described as "calling" a function or a "function call."

Function declaration the process of creating a new function. This allows a coder to write reusable code.

Iteration when you repeat a process. For example, each time a program loops, the code inside the curly brackets runs.

JavaScript a computer programming language.

Loop a function that repeats a piece of code a number of times. For example, a loop using pseudocode syntax might look like this:

```
for 1...3 {
        The repeating code
        goes here
        }
```

This piece of code loops 3 times, starting at 1. Each time the program goes through an iteration, which means one looping, the code inside the braces runs.

Programmer a person who writes algorithms to create programs or code for computers.

Pseudocode a way to plan a computer program using human-friendly language. It's not actual programming, but a written description of the key elements of an algorithm or program. It's used as a quick way of thinking about a program without completely writing it out in code.

Sequence the order in which the computer performs the steps the programmer writes.

Software the end product of written computer code.

Syntax rules for how a program is written. These rules have a purpose similar to written grammar: it's a standard format that the computer understands. In programming, the syntax is more specific and detailed, and needs to be exactly correct for a computer to know what to do. For that reason, programmers often use pseudocode to help them flesh out ideas without the burden of being too exact.

Variable in coding, a variable holds or "stores" information. This makes it easy to reuse information that might be used many times.

Whiteboarding the process of writing or reading code on a whiteboard or in other unplugged ways. It's used often as a way of understanding code without the assistance of a computer.

STEP 2 Learn about loops through song patterns

Computers were invented to do repetitive tasks, and they're really good at it! Loops in a program tell the computer to repeat an action. For example, a computer programmer might use a loop to tell a computer to repeat a math calculation using different sets of data.

If you were writing a song in computer code, lyrics that repeat could be written in a loop. The chorus in a song is a loop, because you repeat it. Verses aren't loops because they don't repeat, and the words for verses are different.

Programmers like to follow the concept of DRY—Don't Repeat Yourself! Loops make code more efficient. They let the computer do the repeating, instead of the programmers!

Remember:

D

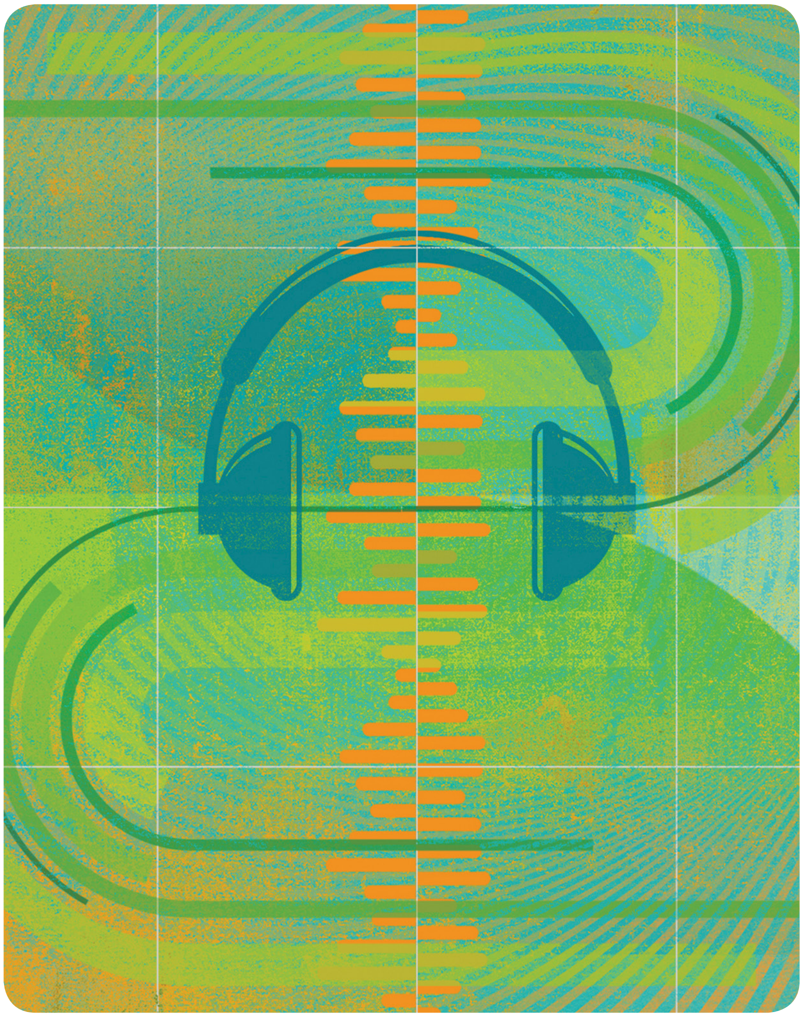
DON'T

R

REPEAT

Y

YOURSELF



STEP 3 Write an algorithm duet

Two heads are better than one. When you're first planning a new project with others, you work together to put all of your ideas down on paper. They might not be the best ideas or the ones that you use in your final project, but they're a good starting point.

Programmers write code in much the same way. They often work in teams to write programs. Programmers often work in teams to write programs. Any program will be revised many times.

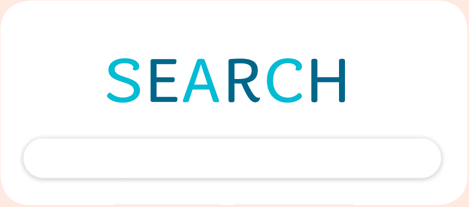
Collaboration also allows programmers to share ideas and inspire each other. Programmers build on their teammates' ideas, often creating better code than if they wrote it alone. Sometimes songwriters and musicians collaborate, too.

What are the benefits of working together on a creative project? Can you think of any challenges to collaborating or drawbacks? What makes a good collaborative team?

Computer Pioneer: KAREN SPARCK JONES

Karen Sparck Jones was a self-taught programmer who taught computers to understand human language. Ms. Jones combined linguistics, or the study of language, and statistics to create algorithms that allowed computers to recognize relationships between words. Her work created the foundation for search engines like Google. Ms. Jones was also an advocate for women in the field of computers and mentored a generation of programmers.

> "Computing is too important to be left to men."

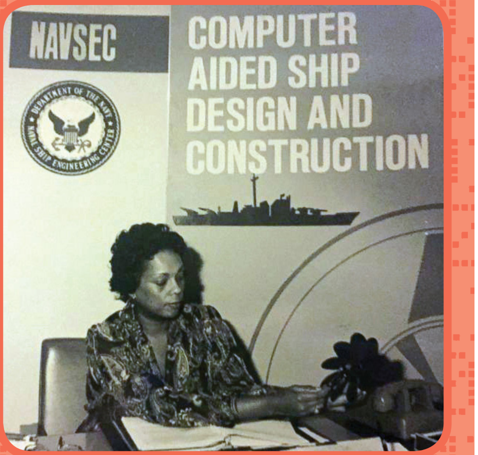


Computer-Assisted Design

People use computers to design all kinds of things: cars, houses, clothes, toys. Programmers write the code computers use in design. You could have a career creating computer design programs or using them.

Raye Montague did both working for the Navy! Around 1970, she was assigned a project by her boss: create a computer program to design warships. Ms. Montague programmed a computer to do just that. Before she created this program, it took about two years to design a ship. Her program made it possible to design a ship in less than 24 hours.

Her program revolutionized ship design for the Navy and became central to ship and submarine design. She received the Navy's Meritorious Civilian Service award in 1972 in honor of her work. Ms. Montague worked for the Navy for 33 years.

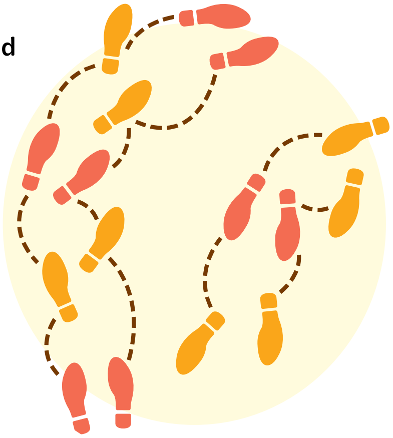

NAVSEC
DEPARTMENT OF THE NAVY
NAVAL SHIP ENGINEERING CENTER
COMPUTER AIDED SHIP DESIGN AND CONSTRUCTION

STEP 4 Code a performance routine

Create a dance, step-by-step! Just like programmers give specific step-by-step instructions to a computer, a choreographer creates specific step-by-step instructions for dancers.

The similarity between coding and choreography doesn't end there. When a choreographer creates a dance, she

- uses a special language that dancers understand (Many names of dance moves are in French. Some dance moves have unusual names like sugar or shimmy.)
- writes down the steps in sequence
- uses a special syntax to indicate repeating steps or variation
- might write the dance out in words, like pseudocode, while she's figuring it out



When she's finished, she might put it into a special type of dance notation that looks like a flow chart or drawing to document her creation so it can be shared with others.

STEP 5 Share your coded routine with others

What's the big dance craze today? In the 1920s, everybody was doing the Charleston. In the 1970s, it was the Hustle. Some famous dances have been handed down for hundreds of years. Some are taught from one dancer to another, but others have been written down.

Imagine a dancer hasn't seen a dance and was trying to recreate it based only on a set of written notes from a choreographer—it would be a lot like a computer running a program. The dancer could only do what was written down. The notes would have to be very detailed and specific for the dancer to recreate the dance accurately.

Since a computer can't guess or make assumptions about code, programmers share their code with their colleagues to make sure it's clear and understandable. One way programmers gather feedback is by using a process called **whiteboarding** where they write their code on a whiteboard and ask others to look for places that are confusing.

Having other people look at your code to find and fix errors, improve the user experience, or clarify instructions is an important step in writing good code.

Now that I've earned this badge, I can give service by:

- Teaching a group of middle schoolers how to do my dance routine by talking them through the coding that's involved.
- Interviewing professionals who use computer-assisted design about their jobs and sharing what I've learned with my troop.
- Making a video about the power of collaboration that highlights whiteboarding and how teams can use it outside the field of computers.

I'm inspired to:

Badge 2: Digital Game Design

When you play a video game, you enjoy the end product of a many-step process. Game makers have to create every aspect of the game: the scenario, challenges, goals, characters, and every possible choice players could make. It's a complex and creative process that combines imagination and a strong understanding of computer programming and design.

Steps

1. **Brainstorm game "for good" scenarios**
2. **Create a G.I.R.L. avatar for your game**
3. **Learn about decision trees in game design**
4. **Design your game**
5. **Playtest and iterate your game**

Purpose

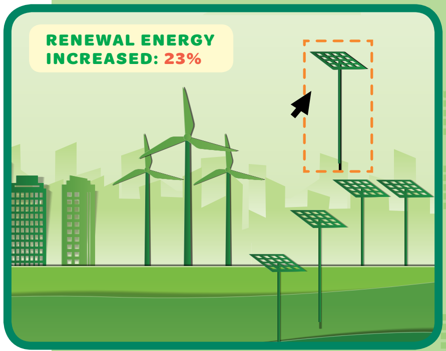
When I've earned this badge, I'll know how video games use conditionals to give players choices and how video games can help people understand the world and its issues.

STEP 1 Brainstorm game "for good" scenarios

Can a video game change the world? Sure! Some games are just entertaining, but others build some aspect of positive change into their story or rewards. Games can teach people about important issues like poverty experienced in developing nations or the need for conservation of the environment. Games can also contribute to scientific research or help relief organizations raise money.

Game makers create the worlds that their characters inhabit. That means they create **scenarios** that include the setting, plot, and sequence of events. The scenarios reflect the **game mechanics**—or the rules and what the characters need to do to reach a goal.

What kind of scenario could you create for a game that promotes positive change? How could the goal of a game impact the setting, plot, or sequence of events? What kind of challenges could characters face and how can the challenges reflect the positive message you're trying to send?



WORDS TO KNOW

Avatar an electronic image that represents a person or character. Avatars can be manipulated by a computer user, like the player of a video game.

Condition a type of statement or test which will result in the condition being either true or false. They are used in the 'decision-making' part of an IF-ELSE statement.

Consequence in decision trees, a consequence refers to the result of a decision that has been made.

Decision tree a tool often used in the organization of many video games. It has a flowchart, or tree structure, that helps game developers design the structure and logic of the player's choices and consequences.

Game mechanics the instructions given to the computer on how the game is played. They're specific to the type of game: for example, in chess, all the moves relate to the game pieces. In video games, the rules of the world created by the game's designers are game mechanics. This can include how avatars move and how players beat a level.

IF-ELSE statement tests whether a condition is true and then runs one piece of code if the condition is true, or another if it's false. They're used by computers to make decisions. This is how the code looks in JavaScript:

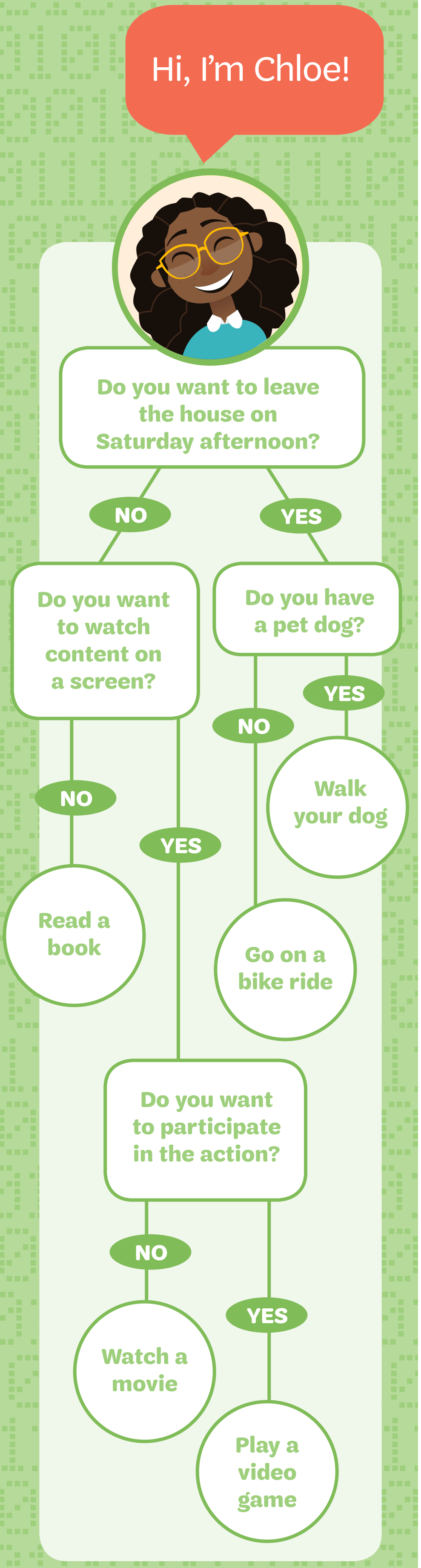
```
if (condition to be
        tested goes here) {
                this code runs if
                condition is true
} else {
        This code runs if
        condition is false
}
```

Narrative the story in a video game. It can have many different paths that are created by players making choices and facing consequences.

Node one element of a decision tree. This is the part of the decision tree where the question lives. The first node of the decision tree is called the **root node**. The nodes that come after the decisions are called **child nodes**. Nodes that don't have children are called **leaves** or **leaf nodes** (like with real trees, the leaves are at the end of the branches). In decision trees for game design, leaf nodes represent the end, or culmination, of one possible game. Trees can have multiple levels of child nodes and many leaves.

Playtest playing a newly developed game to test it for flaws and to identify possible improvements.

Scenarios the details of a situation, including the settings and sequences of events for a game, scene, or plot. It's part of the setup in many types of games.


Hi, I'm Chloe!
Do you want to leave the house on Saturday afternoon?
NO
YES
Do you want to watch content on a screen?
Do you have a pet dog?
YES
NO
Walk your dog
NO
YES
Read a book
Go on a bike ride
Do you want to participate in the action?
NO
YES
Watch a movie
Play a video game

STEP 2 Create a G.I.R.L. avatar for your game

Once you have a scenario for your game, you need a character to play in it. Game makers create each of the characters in their games. They might allow the players to customize their characters a bit by changing the way they look or choosing different traits to emphasize. The main personality of the characters, though, is usually determined by the game makers. They create characters by designing their look and sound, providing a back story, and creating the different situations where they makes choices.

What would a G.I.R.L. character be like? How could you show her G.I.R.L. qualities through your design choices?

G.I.R.L.

go-getter / innovator / risk-taker / leader

STEP 3 Learn about decision trees in game design

Every time you make a choice, you take a step down a certain path. Some choices are more important than others. Where you choose to go to college or work has more impact on your future path than what you eat for breakfast, but even breakfast choices have consequences.

Game makers design choices for players with **decision trees**. With every choice a character makes, the story changes and moves forward. Every choice has a **consequence**. That means that each decision causes some kind of result or effect. Games with decision trees let the players have some freedom to shape the story, making them fun to play.

To allow players to make choices in a game, programmers use **conditionals** in their program. They're the commands that let the computer understand decisions. A common conditional is the **IF-ELSE statement**. It tells the computer IF ____is true, do ____. ELSE (meaning if not), then do ____. For example, if the player clicks on the door, open the door and let the character walk through. Else, open the trap door in the floor and let the character fall through the floor below.

STEP

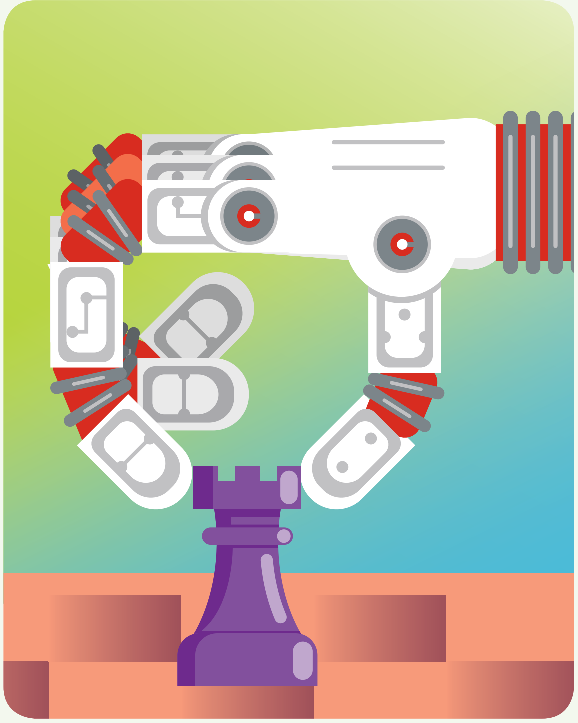
4 Design your game

What makes a game fun to play? When game makers design a story-based game, they start with a problem or challenge for characters to solve. They build their world around the problem, creating scenarios where their characters will make choices and face the consequences of their decisions. Each choice the player makes for her character will move the character and the story in a new direction.

The possibilities for choices that players can make are limited only by the programmer's imagination. The type of choices that make the game the most interesting are ones that are equally good or bad, or that have uncertain consequences.

AI and Game Design

It used to be that computers learning from experience was just something you'd see in movies like *2001: A Space Odyssey* or *WarGames*. But now AI is a real thing. Artificial intelligence, or AI, describes any machine that can assess its environment and take steps to achieve a goal. Computers that can understand human speech or self-driving ("autonomously operating") cars are examples of current AI technology. Video game makers are also starting to incorporate AI to make their video games more interesting.



For example, AlphaZero, a machine learning algorithm (or computer using AI), mastered three games: chess, Japanese chess, and Go. Starting with only the basic rules, AlphaZero played millions of games against itself and learned from its mistakes. Garry Kasparov, a chess expert or "master," commented that by discovering the principles of chess on its own, AlphaZero developed a style of play that "reflects the truth" about the game rather than "the priorities and prejudices of programmers."

Programmers wrote the algorithm that told AlphaZero how to play the games and how to learn from mistakes, but AlphaZero was then able to create its own style of play—it changed its algorithms based on what it had learned.

Playing For Peace

When most people think about video games, they imagine people fighting or blowing things up. There's a movement, though, to create games that teach and promote peace.

For example, students at Carnegie Mellon University created PeaceMaker, a simulation game about trying to resolve the Israeli-Palestinian conflict.

The United Nations' Economic and Social Council (UNESCO), has also created a competition challenging game makers to create games related to peace and sustainability.

In **World Rescue**, kids work together to solve global problems like disease, drought, or pollution.

In **Cantor's World**, adults learn how different government policy choices, like investing money or imposing regulations on businesses, affect the economy and sustainability. The choices players make have consequences for the environment and for people's well-being.

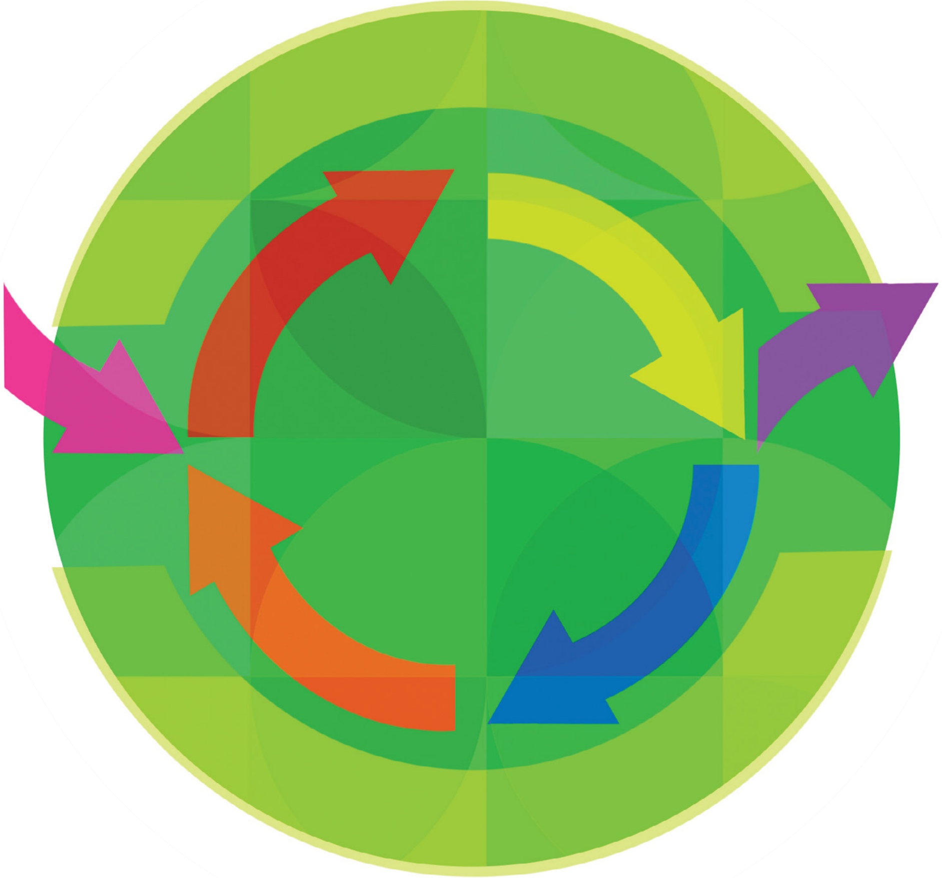
What other situations can you think of where you could create a game about peace or sustainability?

STEP 5 Playtest and iterate your game

In cooking, people sometimes say, "The proof is in the pudding." That means you only know how what you cooked tastes when you finally eat it. In video games, the proof is in the playing.

Game makers often have other programmers play their games and provide feedback during the development process to see if they work and are fun. They call this process **playtesting**. The game's developers then make changes based on the feedback. Each time they revise their game and have it playtested again is called an **iteration**.

This create, test, and revise process is used in all kinds of design, not just video game creation. Testing and iterating is an important part of good design because it lets you fix any problems, and possibly include better ideas than you had when you first started developing your creation.



Now that I've earned this badge, I can give service by:

- Inviting other people to play my game and sharing what I've learned about game design, conditionals, and open-ended stories.
- Starting a video gaming branch of my school's computer club that focuses on learning more about digital games and supporting each other.
- Researching the role of women in game design and creating a presentation, a video, or a social media post to share what I learned.

I'm inspired to:

Badge 3: App Development

When you have a problem, wouldn't it be great to have a handy tool that could help you solve it? There's an app for that. Or there can be, because you can design it!

Data can help you solve problems, but it needs to be organized and understandable to be useful. Apps can do all of that: gather data, organize it, and present it in an understandable way.

Steps

1. **Learn to code data objects**
2. **Create a data visualization**
3. **Design a data collection plan**
4. **Analyze your leadership data**
5. **Develop an app based on your data**

Purpose

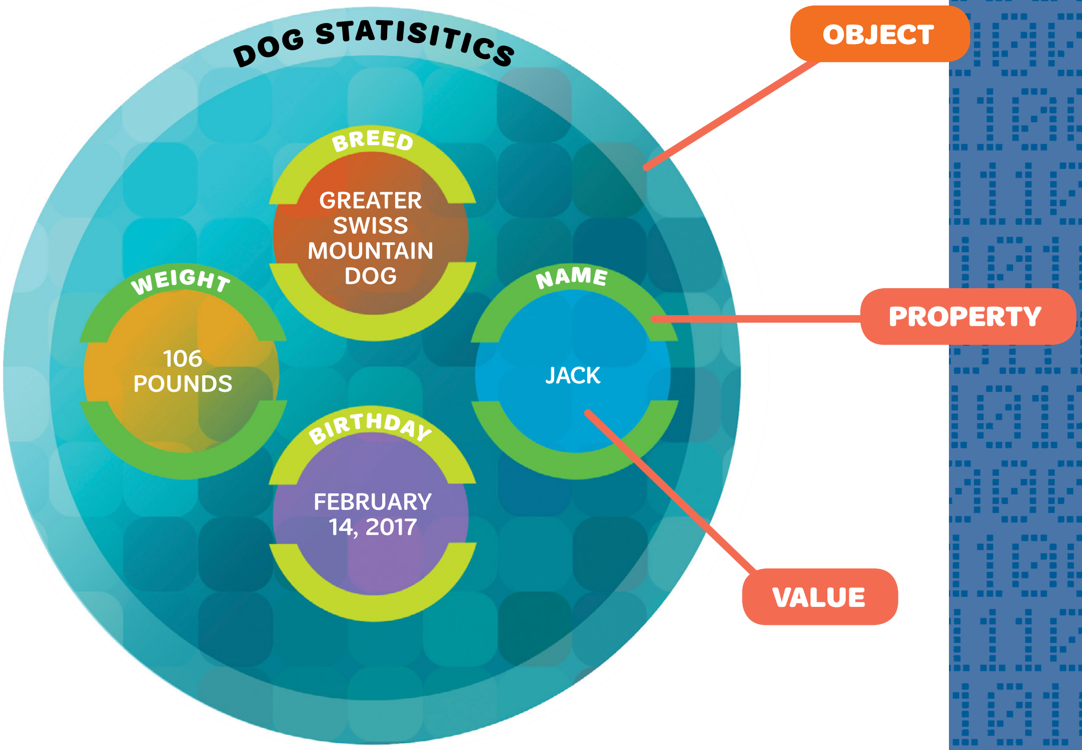
When you've earned this badge, you'll understand how to create data objects and how to develop apps that collect data that will help leaders change the world.

STEP 1 Learn to code data objects

To harness the power of data, first you have to organize it. Data are types of information gathered together for analysis. In coding, data can be organized into groups called **objects**. Inside an object, you have **properties**, like categories, and **values**, for specific things that would be in those categories.

For example, you could have an object organizing data about your dog. “Name” is a property and “Jack” is a value.

```
dog statistics = {
        breed: “Greater Swiss Mountain Dog”
        name: “Jack”
        weight: “106 pounds”
        birthday: “February 14, 2017”
}
```



Objects let you group different kinds of data about a topic together. You label the data in objects like name, age, and address using properties. The data can be in any order. For example, if you had a digital map of coffee shops, each pin would have an object with data about each shop. Properties might include the shop’s name, address, and hours of operation.

WORDS TO KNOW

App stands for application, used to refer to self-contained software that a user interacts with on different devices. Apps can be used for different purposes like organizing information (such as research notes or to-do lists), providing a service (such as searching for flight information or shopping online), or providing entertainment (such as playing a game or a video).

Big data very, very large datasets that contain huge quantities of information. People need incredible computational power to make sense of big data and make it useful.

Data any set of facts or statistics collected and analyzed or used for reference. Data can be in many forms and include information like information on location (such as GPS coordinates, street addresses, or zip codes), biographical information (such as birthdays or social network profiles), or even images (such as flags or photographs).

Data visualization a way data scientists, computer programmers, designers, and others communicate information clearly and efficiently. Data visualization uses statistical graphics, plots, information graphics, and other tools. Effective visualization helps users analyze and think about data. It makes complex data more accessible, understandable, and usable.

Empathy the ability to understand how someone feels.

Leading question a question that prompts a particular answer and will likely result in skewed answers. For example, "Since the lunch food is unhealthy, how likely are you to buy lunch outside of school?" is a leading question because it implies that you SHOULD buy your lunch outside of school because the food is unhealthy.

Object a way of storing lots of different types of data. In most programming languages, objects are represented with curly braces **{}**, with the content of the object between them. Objects are based on the idea of **properties** and **values**. When you code an object, each property-value pair is separated with a comma. Think of objects as being like a dictionary: a word to look up and there's a definition of it. Properties are the word to look up, and values are the definition. For example:

```
dictionary = {
   apple: "A tasty fruit.",
   sun: "The ultimate power
source of the solar system",
   zebra: "A type of equid with
black and white stripes"
}
```

In this case, "apple" is a property, and "A tasty fruit" is the value.

Objects can also store other types of data. For example, this could be an object that describes Juliette Gordon Low:

```
juliette = {
   name: "Juliette Gordon Low",
   birthday: "October 31",
   born: 1860,
   died: 1927,
   fact: "founder of GSUSA"
}
```

Pitch a business presentation seeking support from people to invest in or buy a new product. It can be an email, a letter, or even a conversation. Sometimes the presentation is called a "sales pitch," where the goal is to get a user to buy a product.

Prototype a first version of a product which is built to be tested so that changes can be made before production.

User-centered design when programmers involve their users at multiple stages of the product design process. By incorporating the users' needs, concerns, and feedback into their design, programmers can create a better product that solves their users' problem and takes into account what's most important to them.

User interface the visual elements of a program through which a user controls or communicates with the application. Often abbreviated UI.

STEP

2 Create a data visualization

Computers are much better at analyzing big sets of data than people are. That's where data visualization is useful. **Data visualization** is a visual or graphic representation of data that makes it easier to understand and use.

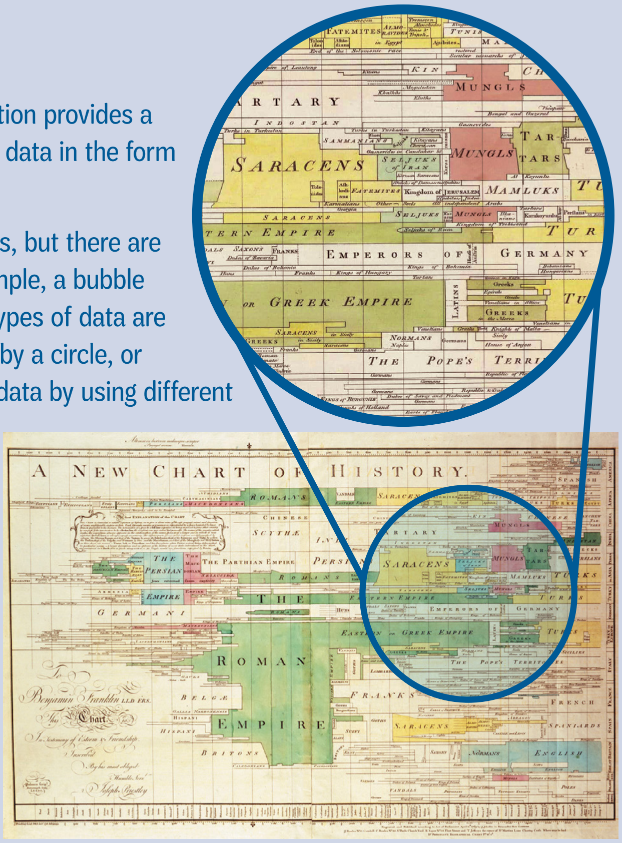
Apps often collect data, like the number of steps you've taken in a day—and then present it to the user in a useful way. The app developers have lots of different visualization styles to choose from, so they need to pick the one best suited to displaying their data in the most understandable way. Sometimes a specialized chart will work best. Other times, a map or timeline might work better. It all depends on the kind of data the app developers are trying to share with the user.

For example, streamgraphs show changes in different categories of data over time, when there are lots of categories starting and stopping at different times. One of the most famous streamgraphs was used in a New York Times article about how much money different movies made over a 20-year period.

Seeing Is Understanding

People's eyes are drawn to colors and patterns, so data visualization provides a visual interpretation of data that's easier to understand than raw data in the form of a spreadsheet or list.

Charts, graphs, and tables are familiar kinds of data visualizations, but there are many variations that can display complex kinds of data. For example, a bubble chart contains three dimensions or types of data. The first two types of data are represented using x and y locations, but the third is represented by a circle, or bubble, that varies in size. You can even convey a fourth kind of data by using different colors for your bubbles.



Maps can also show more than geography. When you combine them with other data, they can show information about population, economic development, voting trends, epidemics, and more.

Calendars, clocks, and timelines help users see their data in the context of time. In 1786, a man named Joseph Priestley created "A New Chart of History" that showed a timeline of events in history across 106 locations. The user could see if important historical events around the world had happened at the same time or in the same place. Priestley used color, size, and location on his timeline to present multiple types of data. Today, app developers design digital timelines and other data visualizations to help users see how several types of data are related.

How Can I Help?

Charities and non-governmental organizations work to make positive change in our world, but they need help to accomplish their goals. Many apps are available now to support the work of charities.

- **My Life as a Refugee** was created by the United Nations Refugee Agency, UNHCR, to build awareness about the challenges refugees face as they try to reach safety and establish lives in new places.
- **VolunteerMatch** lets people find volunteer opportunities by location.
- **CharityMiles** allows users to earn money for their favorite charity by tracking how much they run, walk, or bike.
- **Budge** lets users set up a challenge with friends and family, where the loser has to pay a donation to a charity. It's a fun way to motivate people toward a goal and support a charity.
- **DonorReminder** helps blood donors keep track of their donations and reminds them when it's time to make another donation. Every 2 seconds, someone in the US needs a blood donation, so this app saves lives!

STEP 3 Design a data collection plan

How does an app designer choose which data to collect? She starts by asking potential users what kind of data they want! Then, she makes a plan to collect the data so she can organize, analyze, and present it in a useful way.

One way to collect data is to interview people. Another way would be to have people log information. It's important to organize the data as it's collected so it's easier to analyze.

Often data gets **quantified** to make it easier to analyze. That means, for example, that answers to a survey question may get turned into numbers. You might ask, "on a scale of one to five, with one being the most important and five being the least, how would you rate these leadership skills?"

The kind of data you decide to look for will shape the way you gather it.

STEP

4 Analyze leadership data

Now that you have data, what are you going to do with it?
You need to organize it and then analyze it!

For example, you might:

- **Look for patterns and trends, or a lack of them, to help you understand the big picture.**
- **Look for unusual or uncommon answers that could point out important exceptions to bigger patterns.**
- **Think about whether you have enough information to draw conclusions.**

If you're making an app for one person, then her interview answers are the only ones you need. But if you're making an app to be used by lots of people, then you need to interview and gather feedback from a lot of potential users to get an idea of what the app should do.

Using Data To Solve Problems

Everybody needs help sometimes. Collecting and analyzing data can give decision-makers the information they need to make smart choices. Big data, or super large sets of data that need very strong computers to analyze them, can provide insights that make a big difference!

For example:

- United Parcel Service (UPS) uses sensor data from its delivery trucks to know when to replace parts or do maintenance, preventing costly breakdowns.
- In Rio de Janeiro, government officials use weather data to predict when dangerous landslides might happen and coordinate emergency responses.
- Cities like Memphis, Ft. Lauderdale, and Detroit use data to predict where and when crimes might happen.
- Researchers are using genetic data collected by 23andMe from more than 1 million people to look for genetic links to diseases like depression.

Computers make problem solving with data possible because they can organize, analyze, and find patterns in data much more quickly than people can.

STEP 5 Develop an app based on your data

You've got the data, now run with it!

Once app developers know what their users want, they can use that information to plan what the app will do and look like. Their plan might include:

- The name and focus of the app
- The kinds of data it will collect and how the data will be collectd
- How the app will use data visualization
- Any other features the app might have like communication tools, ways to take notes or manage tasks, or search functions.

App developers might make a **paper prototype** which maps out the different features, screens, and data visualizations on paper. It's especially helpful to draw the **user interface**, or visual parts the user uses to control the app, like the menus, icons, buttons, links, and the landing page. Prototyping their app and interface lets the designers see how the app will work for the user, before they spend time coding.

Once the program is coded, the developers will test the app, ask for feedback, and improve its design. Once the app is ready to go, the developers need to market it to potential investors or users. They'll create a marketing campaign with pitches for different audiences and demonstrate how their app works.

Now that I've earned this badge, I can give service by:

- Researching and making a presentation about how government leaders could make better use of data to guide policy decisions and solve problems.
- Creating and sharing data visualizations to raise awareness about issues that are important in my community.
- Hosting a panel discussion of app development professionals to talk abut their experiences and what they see as the future of app development.

I'm inspired to:

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