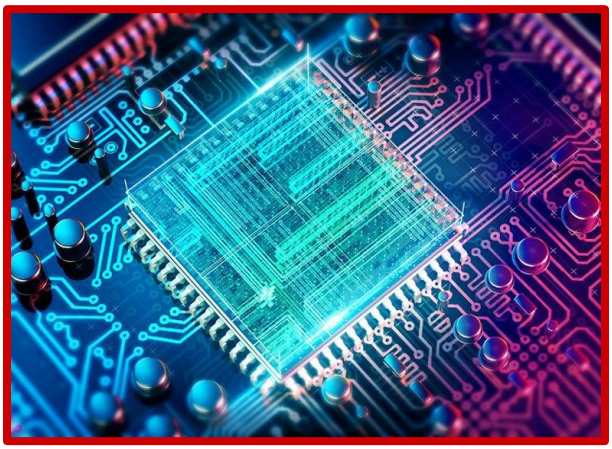
Northeastern University
College of Engineering

Weekly STEM Newsletter 6 (April 24 - May 1, 2020)

Electrical/Computer Engineering and Computer Science

Introduction



When you think of computers, you might picture a laptop, or a desktop computer, but there are so many more computers around us than you think. A computer is a device that follows instructions, known as programs, to complete certain tasks. A television, traffic light, cellphone, and even a calculator, are all examples of computers. Computer Engineering is a branch of engineering that works with both developing hardware and software. Hardware is the physical parts of a computer and the Software is a collection of programs that run on the Hardware. Electrical Engineering, on the other hand, works more on electrical systems and hardware, specializing in designing and working on systems that use electricity, electronics, and electromagnetism. Computer Science focuses more on the software aspect, which involves writing instructions that perform certain tasks on data, which is the definition of programming. To simplify the above, when thinking about electric devices, Electrical Engineers focus on the hardware, Computer Scientists focus on the Software, and Computer Engineers think about both and tie the two together.

Northeastern Connections

At Northeastern, Electrical Engineering and Computer Engineering (ECE) are offered in the College of Engineering. Computer Science is offered in the specialized Khoury College of Computer Science that includes other majors such as Cybersecurity and Data Science. A unique part of the Northeastern curriculum is the combined major aspect. A major is the area you choose to specialize in, therefore a combined major allows you to have two areas to specialize in. This means you can do Electrical and Computer Engineering, Computer Science and Computer Engineering, or any of them on their own!

Anya Anya, a combined Electrical and Computer Engineer, decided to share his experiences at Northeastern with his combined degree, “I chose electrical and computer engineering because I am very into software, hands-on creations, and electronics developments . I am also very good at coding and robotics are a passion of mine. I hope to be able to create a new wave of technology for everyone in the world to use. Hopefully I can be a benefit to Northeastern, my peers, and society in general. Computer engineers implement and make computer devices that are more mobile and more widely available to everyone. I want to develop something or be part of that development.”

Northeastern also has many Computer Science, Electrical Engineering, and Computer Engineering clubs to take part in such as Code 4 Community, FirstByte, Northeastern Robotics, NUTRONS, and IEEE.

Do Now

Electrical and Computer Engineers must understand physics, more specifically, the science behind electricity. Here’s a simple activity to do to start thinking about electricity!

This activity just involves a plastic comb/rod, a cloth, and a water faucet. Build up static electricity on the comb by rubbing it with the cloth (only rub it in one direction). Then run the faucet and place the charged comb next to it. What happens to the water?

Why does this happen? When we rub the comb with the cloth, the electrons in the comb get transferred to the cloth, leaving the comb with a positive charge. Or the electrons in the cloth are transferred to the comb, leaving the comb with a negative charge (we cannot be sure of the exact movement of electrons, but we do know that the comb is left with a charge). The water has a mix of positive and negative charges, so the charged comb attracts the opposite charges of the water to it, making it bend (if the comb is negative, the positive charges of the water are attracted, and vice versa). This is an important concept

when thinking of electricity. Electricity has different charged particles and components interacting, and it is the basis of the subjects we look at in this Newsletter.

Activity

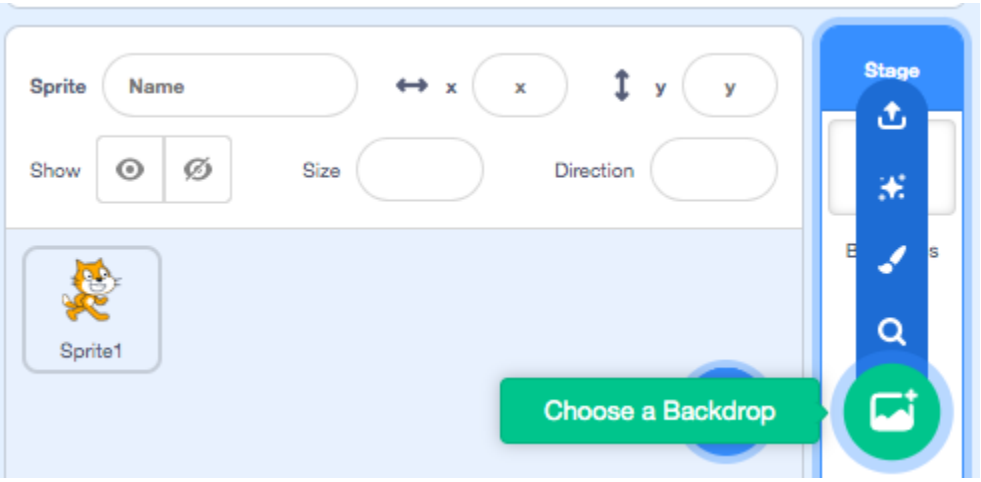
For this week's activity, all you need is a computer connected to the internet!
You'll be programming the popular 2013 game "Flappy Bird", on a website called "Scratch" that uses block programming. "Flappy Bird" is a game that involves a bird that flies through pipes and the game ends once it hits a pipe or the ground. Game Development uses elements of Computer Science to implement the logic of a game someone has in mind. You must give the computer the set of instructions for the game you are making in the form of code.

Materials Needed:

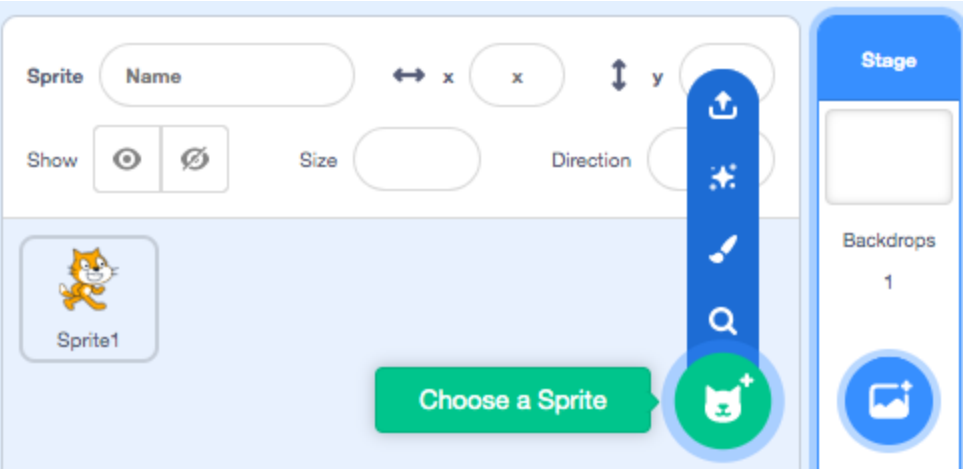
- Computer with internet connection

Steps:

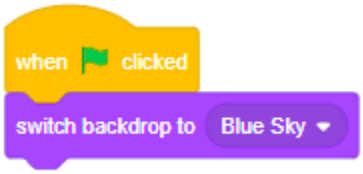
1. Open up "Scratch" on your computer using this link: https://scratch.mit.edu/
2. Click "Start Creating" to open a new project on the website
3. Select the bottom right corner of the Screen "Choose a Backdrop" for your background, and choose the "Blue Sky".



4. Select the image of the cat next to the background image to "Choose a Sprite". This will be the character in your game and choose the "parrot". You may delete the "Sprite1" cat if you wish.



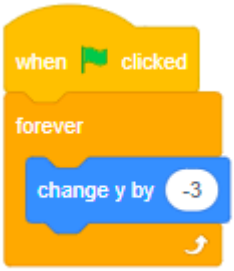
5. Change the size of the parrot to 25% of its original size, change the '100' to '25' in the "Size" bubble.
6. Now that we have a setting and a character, we can begin coding!
7. Select the "Blue Sky", then drag and drop these blocks into the "Code" window. The green flag indicates that the game is running. This means that when the game is running, the background will always appear.



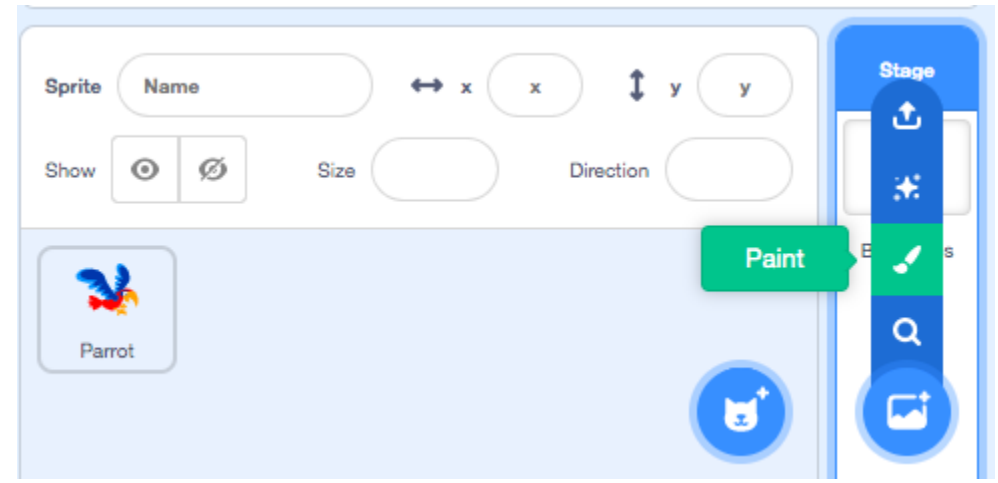
8. Select the parrot sprite, then drag and drop these blocks to animate the parrot's wing flapping in the "Code" window. This means that when the game is running (green flag) the two images of the parrot will switch to the "next costume" every 0.5 seconds. The "forever" block is a loop!

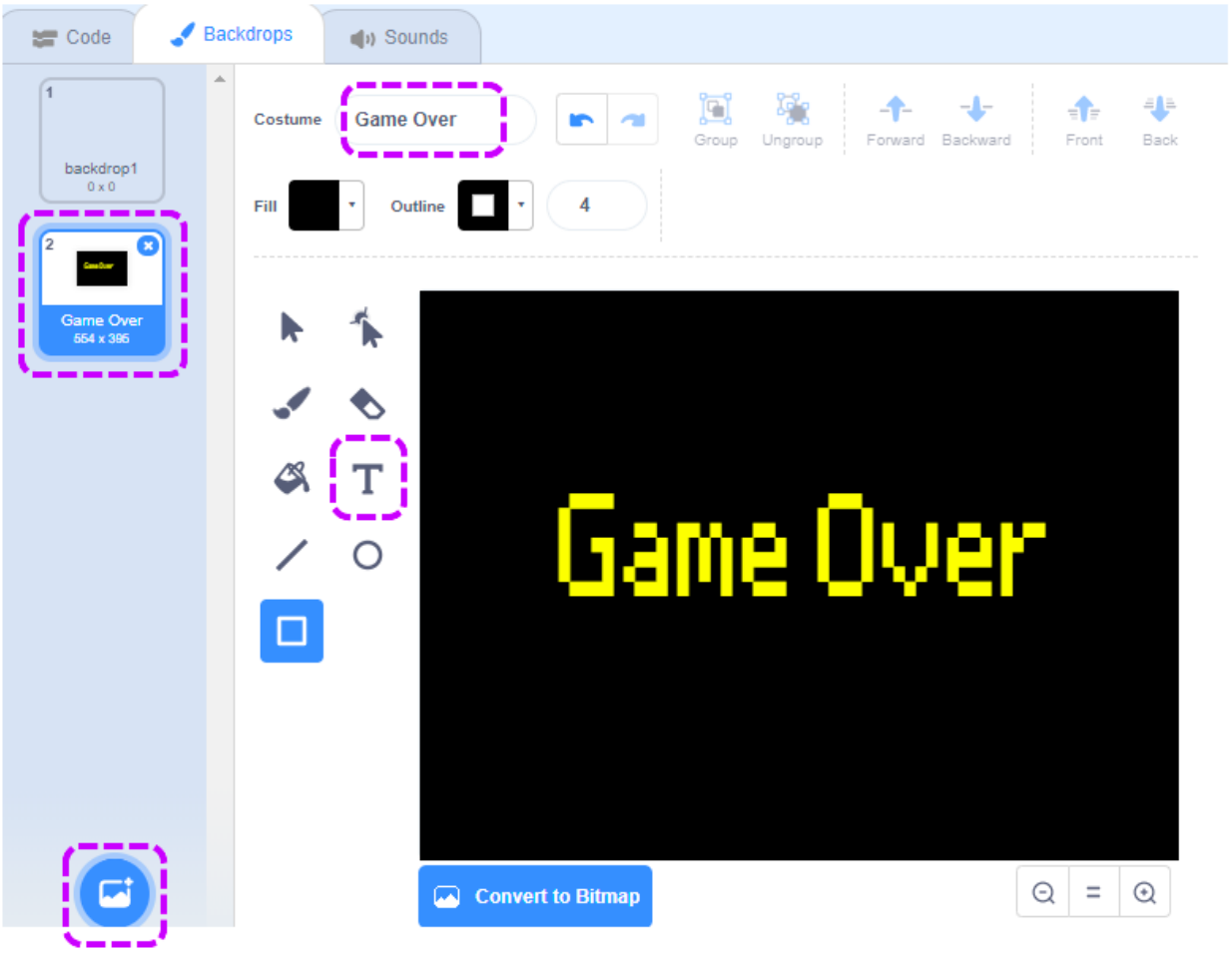
9. We should also insert these blocks. This means that **if** the space bar is pressed, the parrot should fly. This is why we only update its vertical position (y - axis).

10. We can add the element of gravity to our game. We insert the blocks below in the "Code" window. This means that as long as the game is running (green flag), the character's vertical position will decrease by three.

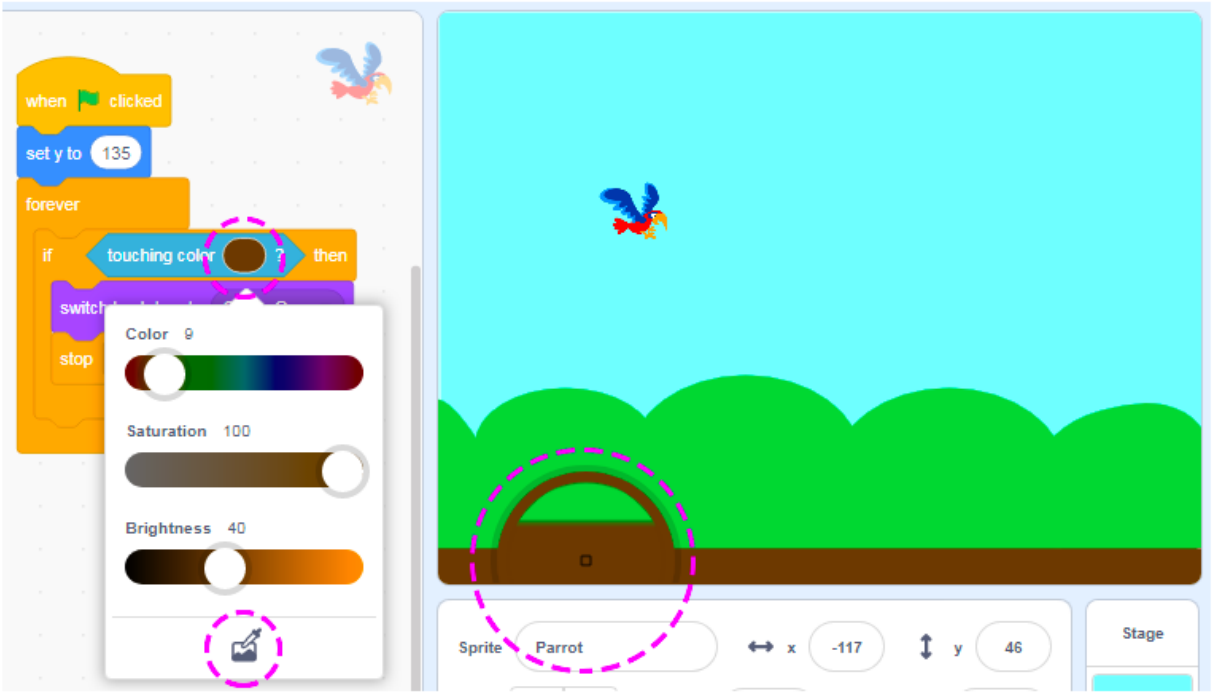


11. Now that our parrot can move when the spacebar is pressed and gravity acts on it, it is time to think about the conditions of when our game should end. Select the bottom right of the screen, then select "paint" to make a new backdrop with the words "Game Over" or you can select an image from the gallery (similar to how we selected ("Blue Sky"):

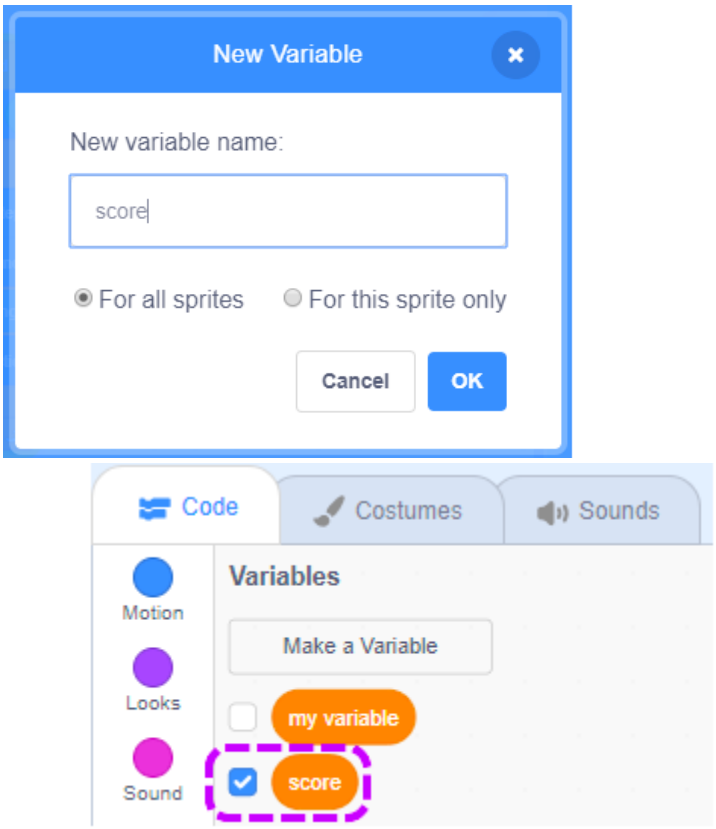




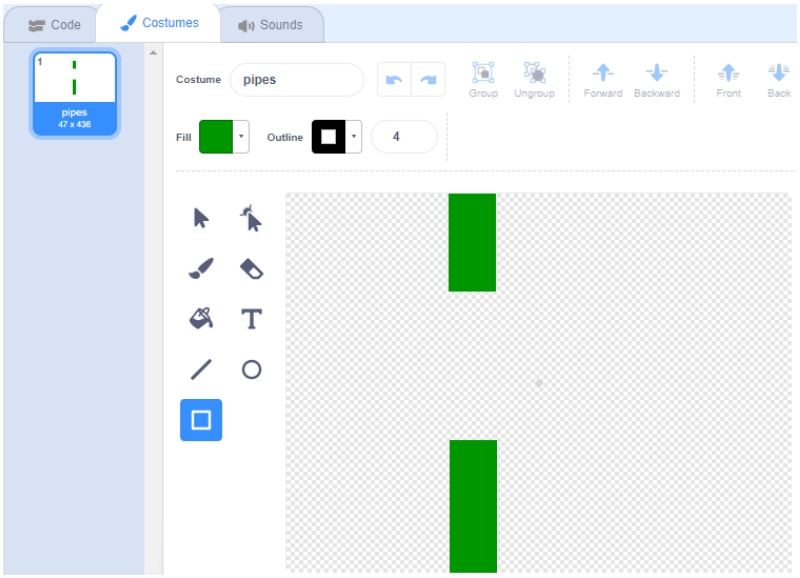
12. Now we must add the condition that ends the game to display our new backdrop. After selecting the parrot sprite, we add the following blocks to the “Code” Window. This means that when the game is running (green flag), the parrot should initially be in at 135 on the y axis. The loop below means that it should constantly check if it is touching that specific color (the color of the ground in the game), and if it does, “Game Over” should be displayed and the game should end.



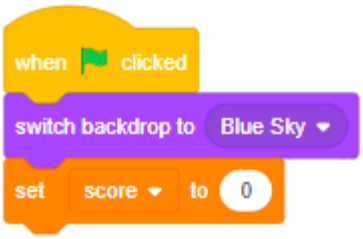
13. Now we will find out how to keep score. In the original “Flappy Bird”, the score increases every time the bird flies through a pipe. The score will be stored in a **variable.** A variable keeps track of information, and in this case that is the score. To create a variable in scratch we select the orange circle on the left tab with the label “variable”, then we click “make a variable”. The variable should be called “score” and be used “for all sprites”. Then select the box next to “score”.



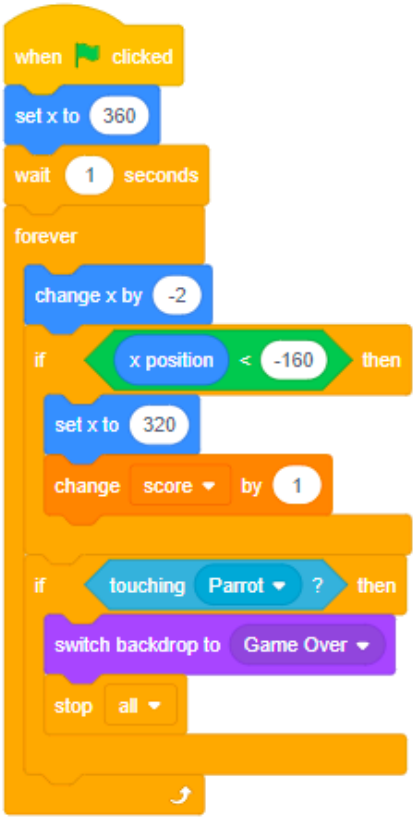
14. Now to add the pipes, we must create a new sprite. Similar to how we created the "Game Over" backdrop, we select the "paint" part of "New Sprite". Then paint the pipes:



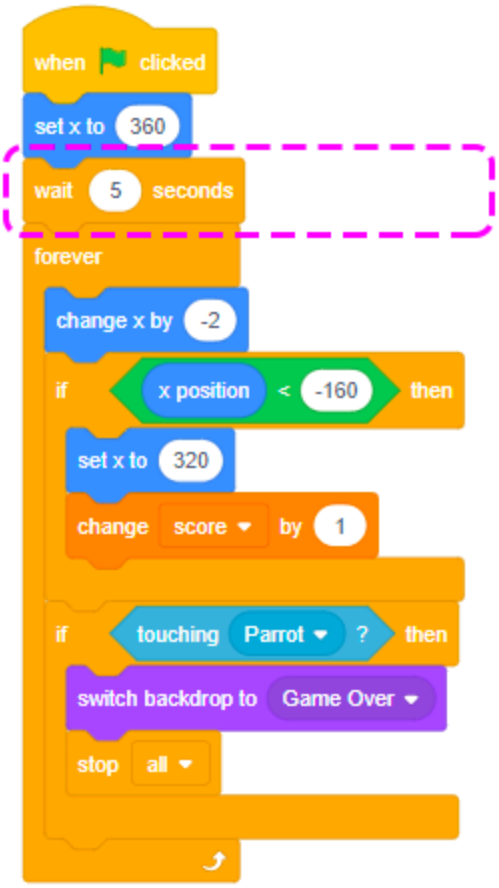
15. Select the parrot sprite then add the blocks below to the "Code" window. This means that when the game starts, the score should be 0.



16. Select the pipes sprite and add the blocks below to its code window. This means that when the game is running, this sprite should be at this specific position (x value of 360). As time passes by, the pipe's position moves to the left (as seen by "change x by -2). After the pipe is off the screen, it resets its position to the right of the screen and it increases the score by 1. If the pipe touches the parrot, "Game over" appears and the game stops.



17. You can then add a second pair of pipes with a different gap (this can make your game harder). This is done by creating another sprite. Then select your new set of pipes and add the code below. This is almost identical to the code from the previous step, but these pipes appear after the first set.



18. And that's all! Press the green flag to play your game!

Website Reference: https://www.101computing.net/flappy-bird-using-scratch/

Discussion Questions:

- How does the program know when to end the game?
- Can you identify where we used loops in the game?
- Can you identify the "if statements" in our code and what they might mean?
- What other conditions could you add to this game?
- What are the uses of programming?

Share Your Results

We'd love to know how the activity and/or the "do now" turned out! What worked and what didn't work? Please share with us something you learned and/or send us pictures of your game! Email us at stem@northeastern.edu.

Related links/Extensions

Learn different programming languages: https://www.codecademy.com/

Weekly coding activities on this website to try: https://code.org/break

"Think like a Coder" Series: https://www.youtube.com/watch?v=KFVdHDMcepw&list=PLJicmE8fK0EgogMqDYMgcADT1j5b911or&t=0s&ab_channel=TED-Ed

To create games and animations using "scratch" code: https://scratch.mit.edu/

For girls interested in coding/programming: https://girlswhocode.com/

Robotics/Electrical Engineering projects: https://researchparent.com/learn/technology-engineering/electrical-engineering/

Crash Course on Computer Science: https://www.youtube.com/playlist?list=PL8dPuuaLjXtNlUrzyH5r6jN9ulIgZBpdo

Crash Course on Artificial Intelligence: https://www.youtube.com/playlist?list=PL8dPuuaLjXtO65LeD2p4_Sb5XQ51par_b