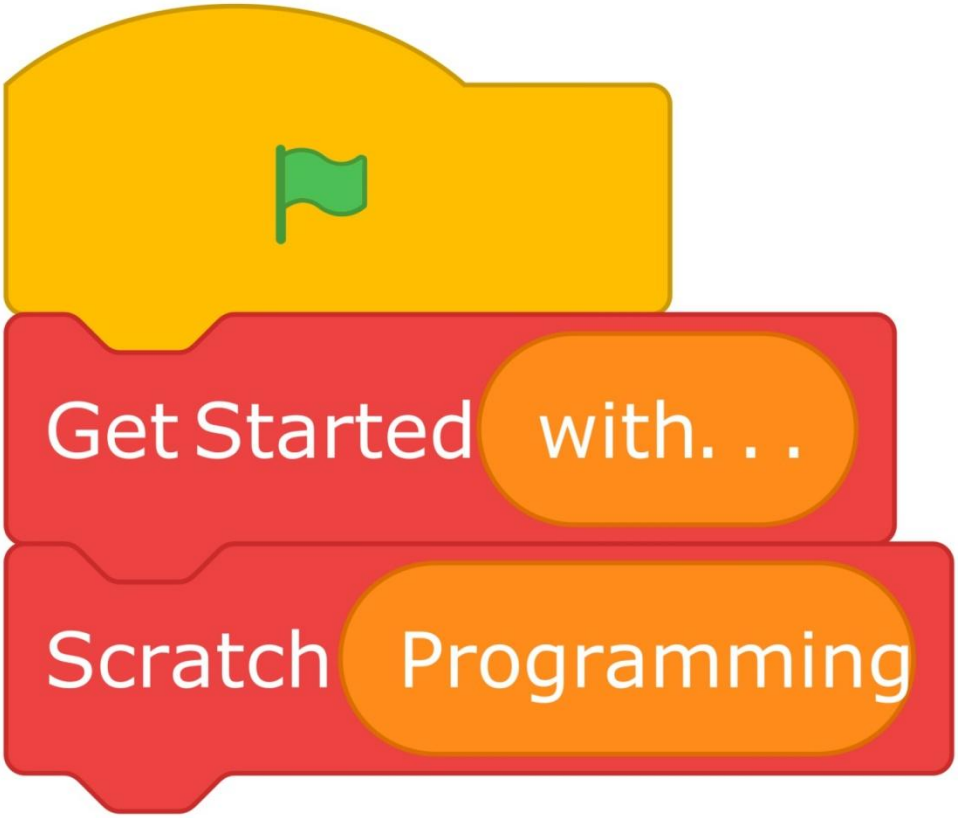

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Scratch on!

Getting Started with Scratch Programming

by Gary Grosso

Scratch is a project of the Lifelong Kindergarten Group at the MIT Media Lab

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Fonts used may include:

Calibri	Microsoft Corporation
Black boys on mopeds	Jakob Fischer at www.pizzadude.dk
Witches Magic	SpideRaYsfoNtS
a little sunshine☼	Bythebutterfly

Getting Started with Scratch Programming

Scratch is a project of the Lifelong Kindergarten Group at the MIT Media Lab. It is provided free of charge[1].

Scratch Versions

On January 2, 2019, Scratch 3 was released by the MIT Scratch Team. As of this writing (April 2019), most books (and many Internet resources) that you are likely to find are still based on Scratch 2, or the version before that, Scratch 1.4[2].

Online or Offline?

If you are planning to use Scratch for the first time, you should decide whether you want to run it online (in a web browser, and connected to the Internet) or offline (as a stand-alone application on your computer). You can always change your mind later. In this guide, when it matters, you will see Online and Offline.

Note that at this time you can't create Scratch projects with a phone. And tablets have some limitations[3], so a computer is best, but I would encourage you to get started on a tablet if that's all that you have.

Online

- Requires an Internet connection, and creating an account, which requires an email address.
- Allows you to see Scratch projects made by others, and share your projects so others can see them. You can make copies of projects and make changes in your copy. And people can comment on each others' projects. Being part of the Scratch community can be a big plus.
- Scratch runs in most current web browsers on desktops, laptops and tablets. (Chrome, Edge, Firefox, and Safari, but *not* Internet Explorer.) So it matters less what computer you have.

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[1] For more information, go to scratch.mit.edu/about.

[2] These books and articles may still be useful. Just don't get confused when you see differences between what these tell you and what you actually see when you run Scratch. The concepts are the same; layout and various features have changed.

[3] Many Scratch projects use key presses to trigger certain actions. For example, many Scratch games use the arrow keys. Since the "keyboard" on a tablet only appears when you have your cursor in a text box, there is no way to type a key during a game.

Offline

- Requires no Internet connection so you can take it anywhere.
- You don't get to be part of the Scratch community. But you can upload your projects later.
- At scratch.mit.edu/download, it says offline Scratch ("Scratch Desktop") requires Windows 10 or macOS 10.13. I have had no problem running it on Windows 7, and looking online I see I am not alone.

Getting Started Online

1. Go to scratch.mit.edu.
2. Click "Join Scratch".
3. Choose a user name and password.
4. Supply birth month and year, and country.
5. Supply an email address. If you don't have one, you can ask someone you know who has one. Messages to this email are rare, such as a notification when you change your password.

Getting Started Offline

1. This assumes your device is running a suitable version of Windows or macOS[4].
2. Go to scratch.mit.edu/download and make sure the correct Operating System (OS) is selected.
3. Follow the instructions to download and install Scratch Desktop.

Let's Get Started

[4] I can verify Scratch 3 Desktop will not run in a Linux or Android OS. If you need to run offline on these devices, look into Scratch 2 – or consider getting an inexpensive used laptop. Suitable refurbished laptops running Windows 10 can often be found for under $100, e.g., at newegg.com.

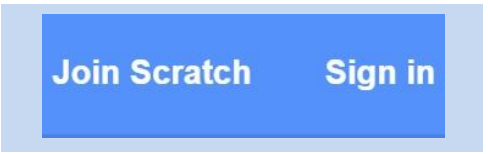
Create

Let's start by making the simplest of projects. It is a tradition in computer programming to begin any new language with a "Hello World" program.

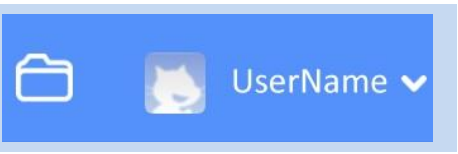
Online

If you haven't yet signed up at scratch.mit.edu, do so now, as described previously in Getting Started Online.

Look near the top right of your browser window for one of these:



Click "Sign In" and enter your user name and password.



You are already signed in. Continue.

Once signed in, look left from your user name, and click "Create".

Offline

From installing Scratch Desktop, you will probably have a desktop shortcut or icon from which you can run Scratch. On Windows, it may look like the picture to the right. Start the application.

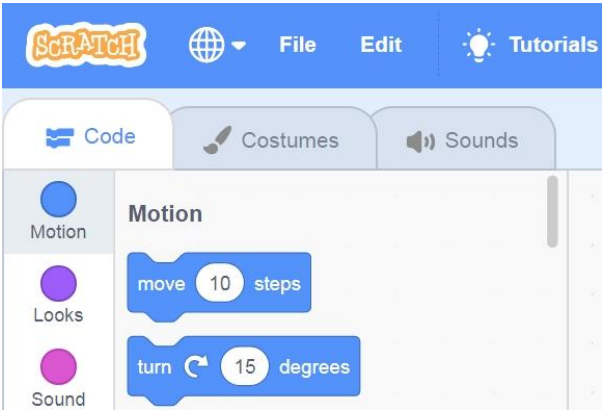
Since there is no way to "Explore" other Scratchers' projects offline, Scratch Desktop is always in "Create" mode.

Hello

☼Scratch☼

Say Hello!

1. I recommend making Scratch fill your entire screen. Scratch has a few different areas, and there is a lot going on, so it helps to make it as big as possible.
2. Scratch starts with the Code tab enabled, but make sure that's what you have before going to the next step. The upper left corner of Scratch should look like this:



This shows 3 tabs: Code, Costumes, and Sounds, with the Code tab selected. Below the tabs is a portion of the "Block Palette" area. On the left is a vertical "block category" area with the Motion category selected[5].

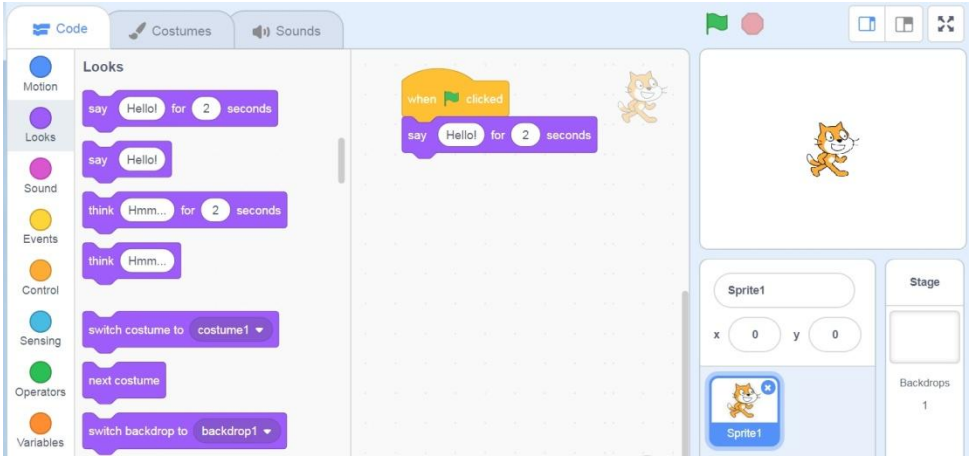
3. The different block categories are color-coded. The fourth category is "Events". Clicking the "Events" button will scroll the Block Palette down to the Events category.
4. The first block in the Events category is "when [green flag] clicked" (shown at right). Drag this block from the Block Palette to the blank pane to the right (the Script Area), as shown below.

[5] There is a good description of the Scratch "user interface" at: learn.adafruit.com/guide-to-scratch-3/user-interface

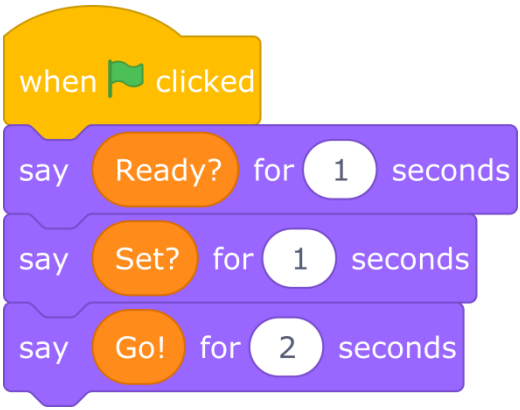
5. Now click on the “Looks” button to scroll to the Looks category, and drag this block: 

   and place it right below “when [green flag] clicked” so that they lock together like puzzle pieces. They should look like this:

   The overall layout should now look something like this:



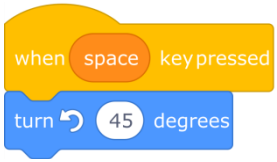
6. Click the green flag and Scratch Cat says “Hello!” for 2 seconds.
7. Try changing what Scratch Cat says and for how long. Stack another “Say ... for ... seconds” block on the bottom so Scratch Cat says one thing after another.



Move

1. Start a new project by clicking the File menu and clicking New.
2. Select the Events category, and drag the “when [space] key pressed” block into the Script Area.
3. Now select the Motion category.
4. Drag the “turn ↻ degrees” block into the Script Area.
5. Change “15” to “45”.
6. Tap the space key.

   If you tap it 7 more times, Scratch Cat will be back on his feet.



7. Let’s make him do a complete back flip each time you press the space key. Select the Control category, and drag the “Repeat [10]” block to the Script Area. Drag it so it wraps around the “turn” block as shown.

   Try pressing the space key. Scratch Cat does a back flip. Go, Scratch Cat!
8. Scratch Cat moves so fast it’s hard to tell if he’s really flipping. And it would be nice if he landed on his feet. Change 10 to 18 and 45 to 20. Since 18 times 20 is 360, he will make one complete turn. To start (and end) with him standing up, select the Motion category and drag “point in direction [90]” to just below “when [space] key pressed”.

   Now Scratch Cat does a smooth 360 degree back flip, starting and ending on his feet[6].

[6] The “repeat” block is what programmers call a loop. And “point in direction” at the top of your script? That’s called initialization. Or if that’s hard to say, set-up.

Saving Your Work

This seems like a good time to talk about saving your work. Actually, any time you are doing computer programming, you should:

a. Save your work frequently in case there is any sort of system failure.
b. When things are mostly working and you are about to make changes, copy your project in case you want to get back to the way things were before your changes. You can do this by saving it with a new name.

How you save depends on whether you are working online or offline.

Online

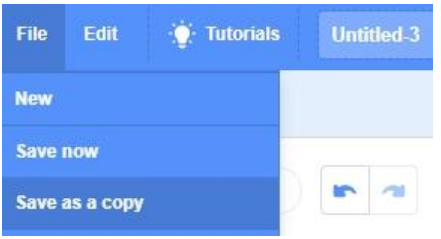
Scratch online frequently auto-saves your work without you having to do anything, and prompts you if you try to leave the page with unsaved changes. However it never hurts to tell it to save. Look for "Save Now" in the upper right:

If you don't see "Save Now" there, then there are no unsaved changes.

By the way, that folder icon to the right of "Save Now"? That's "My Stuff" where you can see all your work. And that hazy Scratch Cat image is the default profile picture – which you can customize.

To save a *copy* of your project, use File > Save as a copy.

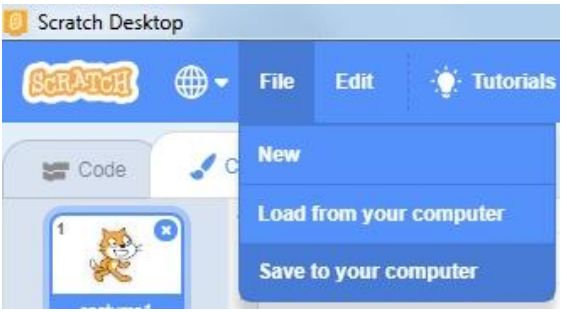
You can also edit the *name* of your project ("Untitled-3" in the image at right). But it's important to know that this will not create a copy! It only changes the name of your project.



Offline

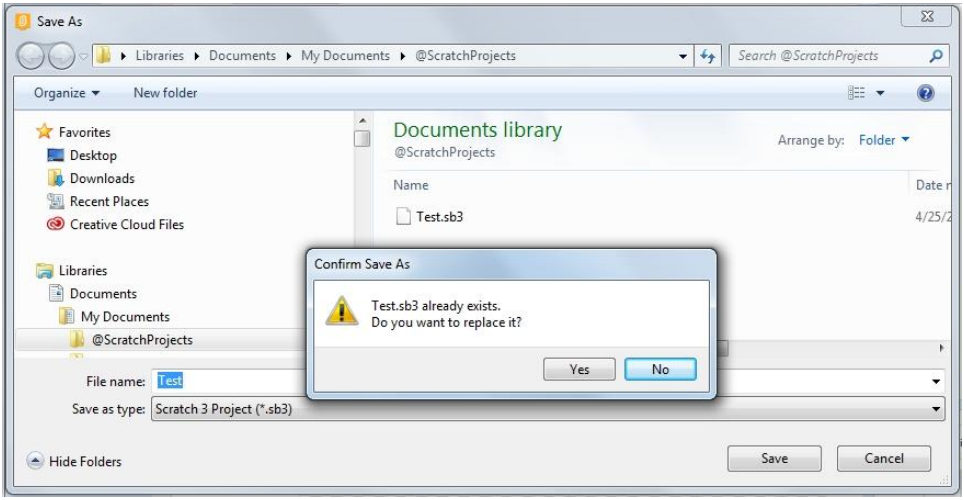
You can save your work with File > Save to your computer.

The name you give will automatically have ".sb3" added to it. It's OK if you provide ".sb3". Just don't provide something *else*. That could make the file unusable.



Saving Your Work *Offline*, continued

When you use “Save to your computer” it is always a “Save As”. So if you want to save to the same filename you used before, you will be prompted:



Just click “Yes” unless you want to give a new name[7].

Notice in the image above that I have created a special folder just for my Scratch Projects. That will help you find them, and help you keep organized.

You may also notice I used an at sign (@) for the first character of my folder name. That’s just a trick to make it sort before “A” – that’s entirely optional.

Finally, Scratch Desktop will often ask you “Leave Scratch?” when you go to quit even when you just saved your work. Just be sure you really saved it, and click “Leave”.

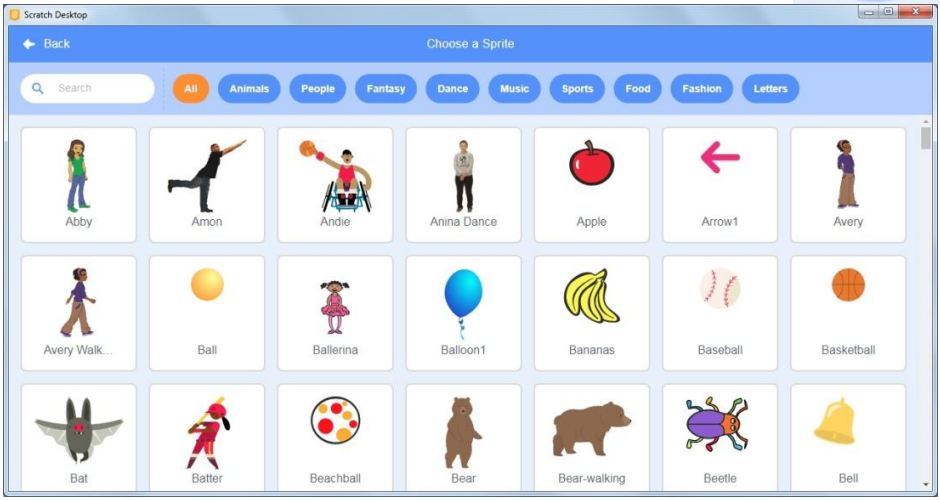
[7] Remember, saving to a new name is a good way of making a copy now and then in case something stops working and you want to go back to an earlier version to see what you changed.

New Sprite, New Looks, New Action

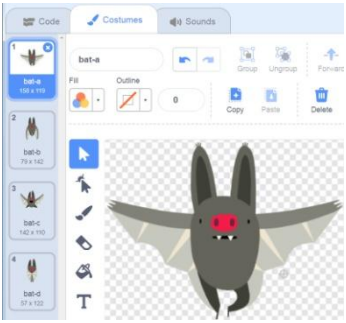
1. Start a new project with File > New. (Click the File menu, then New.)
2. Time to give Scratch Cat[8] a rest. The place where you've seen your project play out is called the Stage Area. Below the Stage Area is the Sprite Info Pane. In the Sprite Info Pane is a "thumbnail" (small image) of Scratch Cat. Click the "X" in the upper right corner of the thumbnail, and Scratch Cat (in this case, Sprite1) disappears.

WARNING: When you delete a sprite, you also delete its code!

3. In the bottom right of the Sprite Info Pane is the New Sprite icon. Click this icon – or point at it and select Choose a Sprite – this will switch your view to the "Choose a Sprite" dialog, as shown below.



4. I encourage you to explore here, but for now, I'd like you to pick the Bat sprite which you can see at the lower left of the above image.
5. So far we've been working in the Code tab, but now select the Costumes tab. Down the left side, instead of code block categories, you have 4 different costumes for this one sprite. A sprite might have just one costume, or it could have dozens. And you can modify each costume. For now, we are going to have a look at *switching* costumes.



[8] Scratch Cat is the mascot of Scratch and the default sprite when opening a new Scratch project. If you're curious, see en.scratch-wiki.info/wiki/Scratch_Cat for more info.

6. Switch back to the Code tab – we were only having a look around at costumes this time. From Events, get "when [green flag] clicked"; from Control, get "repeat [10]"; and from Looks, get "next costume".

   Your "Script Area" should look like the image to the right. Click the green flag and watch. Animation!

7. "Bat" is moving a little *too* fast. From the Control category, drag a "wait [1] seconds" block, and insert it at the top of your "repeat [10]" loop, just before "next costume".

   A whole second is too long. Change it to "0.1" seconds and try that out. Next let's make it look like "Bat" is coming at us.

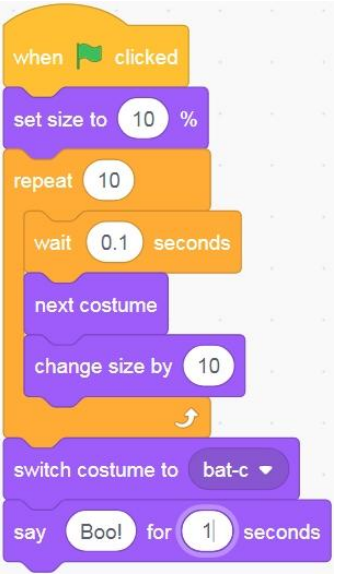
8. In order to start out small and get larger, and say something at the end, we'll get 4 blocks all from the Looks category.

a. Insert "set size to [100]%" before your repeat loop, and change 100 to 10.

b. Insert "change size by [10]" at the bottom of the repeat loop.

c. After the repeat loop, insert "switch costume to [bat-a]" and change it to switch to [bat-c] by clicking the down-triangle and selecting from the list.

d. Finally add a "say [] for [] seconds" block at the end. I chose to say "Boo!" for 1 second.



This would be a good time to make sure your work is saved.

9. Click the green flag and enjoy your animation. You've learned a lot!

Sound

Let's add some sound to your Bat animation. First, let's go over how to open it.

If you still have the Bat animation project open, do the following:

Online

If it still says Untitled-something at the top of the page, give it a more meaningful name, such as "Bat" by clicking inside the title box, backspacing or deleting away the "Untitled" name, typing in your new name, and hitting Enter.

If it doesn't say "Save Now" in the upper right, drag any block in your Script Area just the tiniest bit (without actually changing anything), and "Save Now" should appear. Click on "Save Now" and it should briefly say "Project Saved".

Offline

Click File, then Save to your computer. Give a new name, or say Yes to replacing the file. To really prove to yourself you can open a file, close Scratch Desktop.

To open your saved file:

Online

If not already there, go to scratch.mit.edu.

Now click on the My Stuff[9] folder –  – and you should see your project(s) listed. You can click on the thumbnail image or the title and then click "See Inside", or click on the See Inside button from My Stuff to go directly to work.

Offline

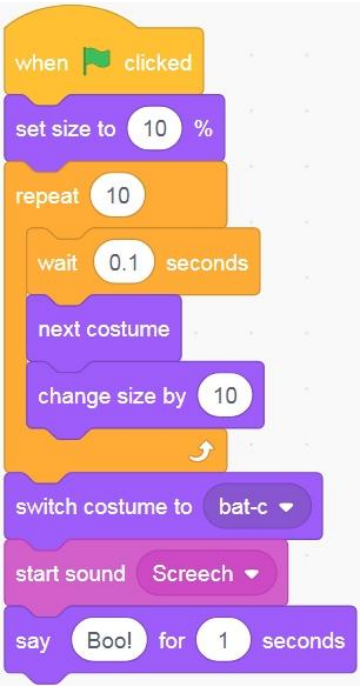
Open Scratch Desktop. Click File > Load from your computer, select your saved file, and click Open. I assume you are now in your Bat animation project.

Now let's add some sound!

1. Switch to the Sounds tab. It's a lot like the Costumes tab view, except instead of an image the main area has a "waveform". And down the left side, instead of different costumes, you can have different sounds. And in the bottom left there is the "Choose a Sound" icon, as shown at right.

[9] The My Stuff icon may also look like this: 

2. The Bat sprite comes with the Owl sound – don't ask me why. So we'll get some good practice by changing it to a screech (or something else if you'd like). You might want to make sure your volume is on, but not too loud, and click "Choose a Sound" icon. This will put you in the Choose a Sound dialog, which is a lot like the Choose a Costume dialog.
3. Click the "Animals" button near the top. This will reduce the number of choices. Just point at a square to hear its sound. If you want the Screech sound, it is the first one that starts with "S". (They are arranged alphabetically.)
4. Clicking on a square (instead of just pointing at it) will choose it and return you to the Sounds Pane.
5. To use the sound, select the Code tab, select the Sound category, and drag the "start sound" block to your Script Pane. Since you want the sound to happen at the same time as the "Boo!" (or whatever you chose to "say"), you want to drag it to *before* the "say" block.



If you want to play an entire sound before your code continues to the next thing it does, use the "play sound [] until done" block instead.

If you want background sounds to start when your project starts, drag a separate "when [green flag] clicked" block from the Events category and put your "play sound [] until done" block on it.

And if you want it to repeat endlessly, put it in a "forever" block from the Control category.

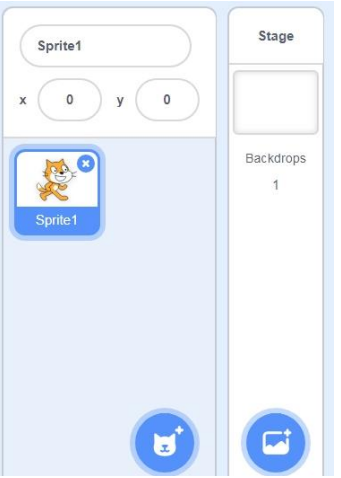
Backdrops

So far we have been working with a plain white background on our "Stage". But Scratch can also supply what is called a "Backdrop". The stage is a bit like a special sprite that fills the display area and stays behind your other sprites.

(You can have more than one sprite, but only one stage.)

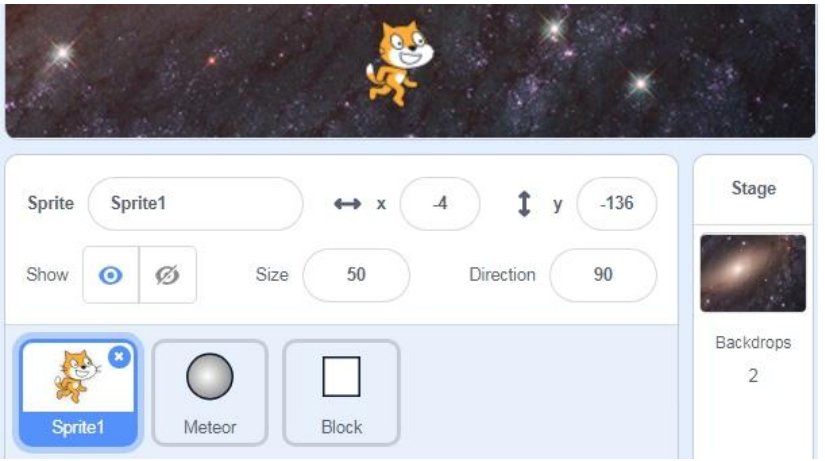
Just as a sprite can one or more costumes, the stage can have one or more backdrops, so you can switch from one backdrop to another in your code.

1. Start a new project with File > New.
2. Below the Stage Area, to the right of the Sprite Info Pane, there is a narrow “Stage Info Pane”. Clicking anywhere in this pane will switch to it, and will change your Costumes tab to a Backdrops tab. (Try it.) You have to click on a particular sprite thumbnail to go back. You can click back and forth to see how this works.
3. With the Stage Info Pane selected, you can select the Backdrops tab to see all your backdrops.

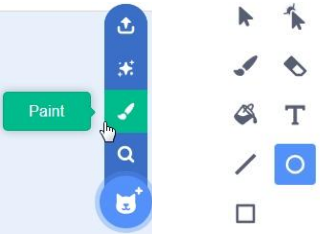


One More Project, a first game

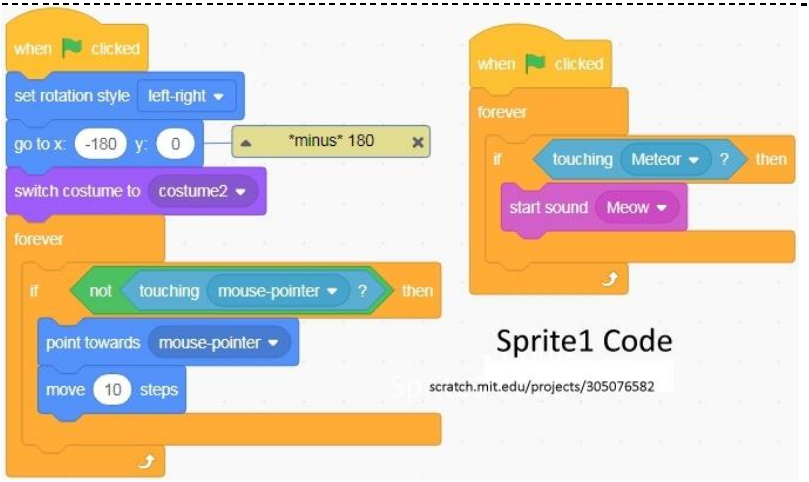
1. This will be a challenge as it uses some new code groups and concepts, but you can do it! Work carefully, and be brave!
2. A backdrop is optional, but I used Galaxy.
3. Set the Size of Sprite1 to 50. The x, y, and Direction don’t matter.

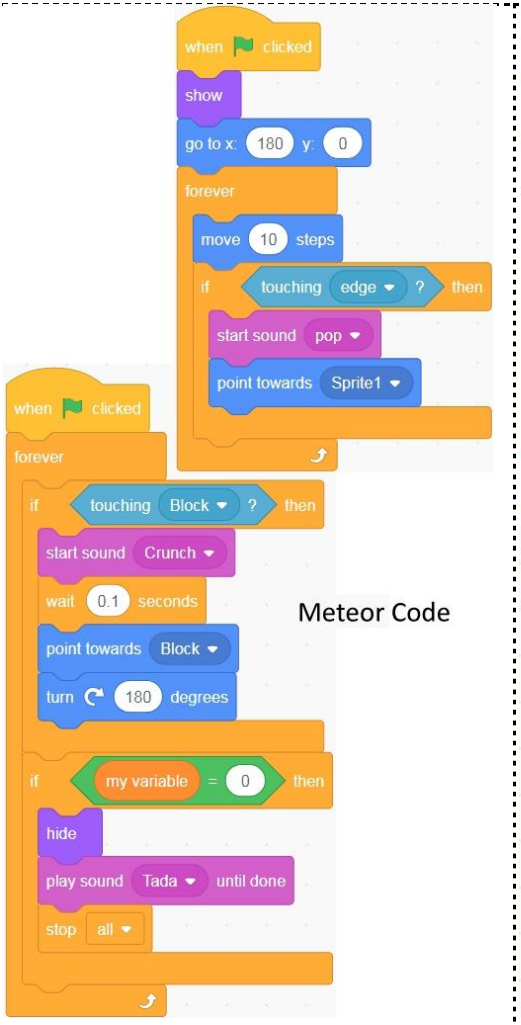


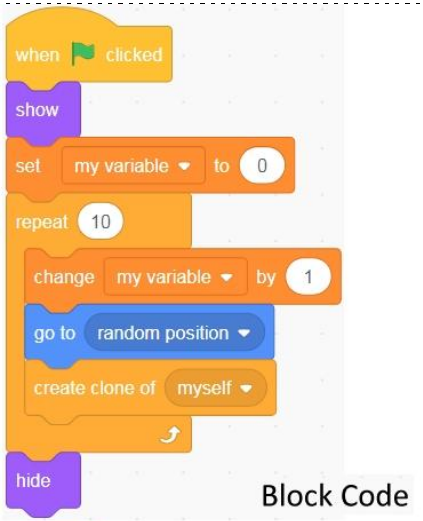
4. Create a new sprite by selecting Paint (see right).
5. Select Costumes tab.
6. Create a small white circle (see far right).
7. In the Sprite Info Area, name it Meteor.

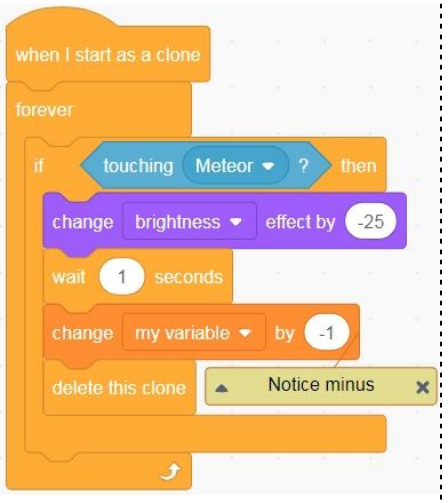


8. Create another new sprite by selecting Paint, select the Costumes tab, create a small square, and name it Block.
9. Code for the 3 sprites is on the following page.


when clicked
set rotation style left-right
go to x: -180 y: 0
minus 180
switch costume to costume2
forever
if not touching mouse-pointer ? then
point towards mouse-pointer
move 10 steps
when clicked
forever
if touching Meteor ? then
start sound Meow
Sprite1 Code
scratch.mit.edu/projects/305076582


when clicked
show
go to x: 180 y: 0
forever
move 10 steps
if touching edge ? then
start sound pop
point towards Sprite1
when clicked
forever
if touching Block ? then
start sound Crunch
wait 0.1 seconds
point towards Block
turn 180 degrees
if my variable = 0 then
hide
play sound Tada until done
stop all
Meteor Code


when clicked
show
set my variable to 0
repeat 10
change my variable by 1
go to random position
create clone of myself
hide
Block Code


when I start as a clone
forever
if touching Meteor ? then
change brightness effect by -25
wait 1 seconds
change my variable by -1
delete this clone
Notice minus