Welcome to Scratch Coding Tutorial



Contents :

1. Overview
2. Getting Started
3. Basic Scripts
4. More Commands
5. Projects

An initiative of

Children's Knowledge Hub

School Education Development Mission

http://sedm.in.net

Overview

In this lesson, we will introduce you with Scratch , a **block based visual coding**, the first step to enter the world of programming.

Not clear ? Well, let us start from 0.

What is coding ? To communicate with a computer, we use instructions on what actions to perform. Such commands are framed in a language the computer understands. Here, each instruction is a code and a set of codes in a sequence to carry out a specific task is a program.

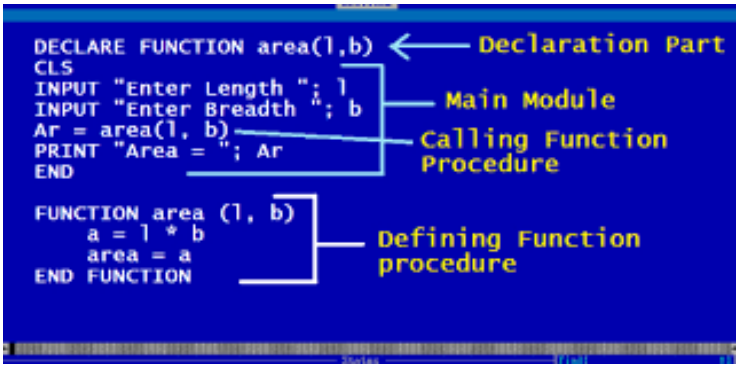
We use coding to create websites, apps, games and other technologies we interact everyday.



The best way to get children started in **computer science** is to get them involved in **coding** and writing their own code for creative activities in a fun and exciting way. It helps them to develop an appreciation of how things work.

Simple coding projects offer an excellent introduction to **problem-solving skills** at a young age. Step by step thinking to solve a problem develops sequencing skills that are foundational for later academic success and a valuable asset in any career field. It ignites to grow confidence to overcome any adversity in future life.

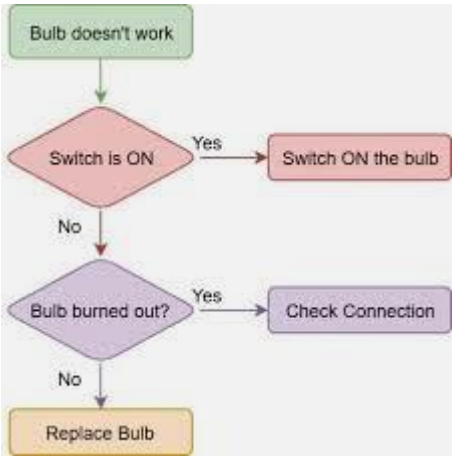
Learning code teaches **computational thinking** — the process of breaking down complicated tasks into individual steps that a computer can understand. This is a pillar of logical thinking.



Coding projects can make abstract math concepts feel more real. Using logic and calculation skills while creating something can make mathematics more engaging and fun.

When you fail and try again, you can learn from your mistakes. Coding gives children the ability to try and try again until they succeed and produce the result they are looking for.

We have different coding for different purpose. LOGO, BASIC, Python, Java, C++ are a few among them. Each has its own **syntax** (rules to frame). A machine language is a series of 0's and 1's, which is difficult to manipulate. We write codes in English-like language, which is a set of data and instructions. The step by step analysis of the process makes an **algorithm**, while a **flowchart** is a diagram created by different shapes to show the flow of data. These are **text based** coding.



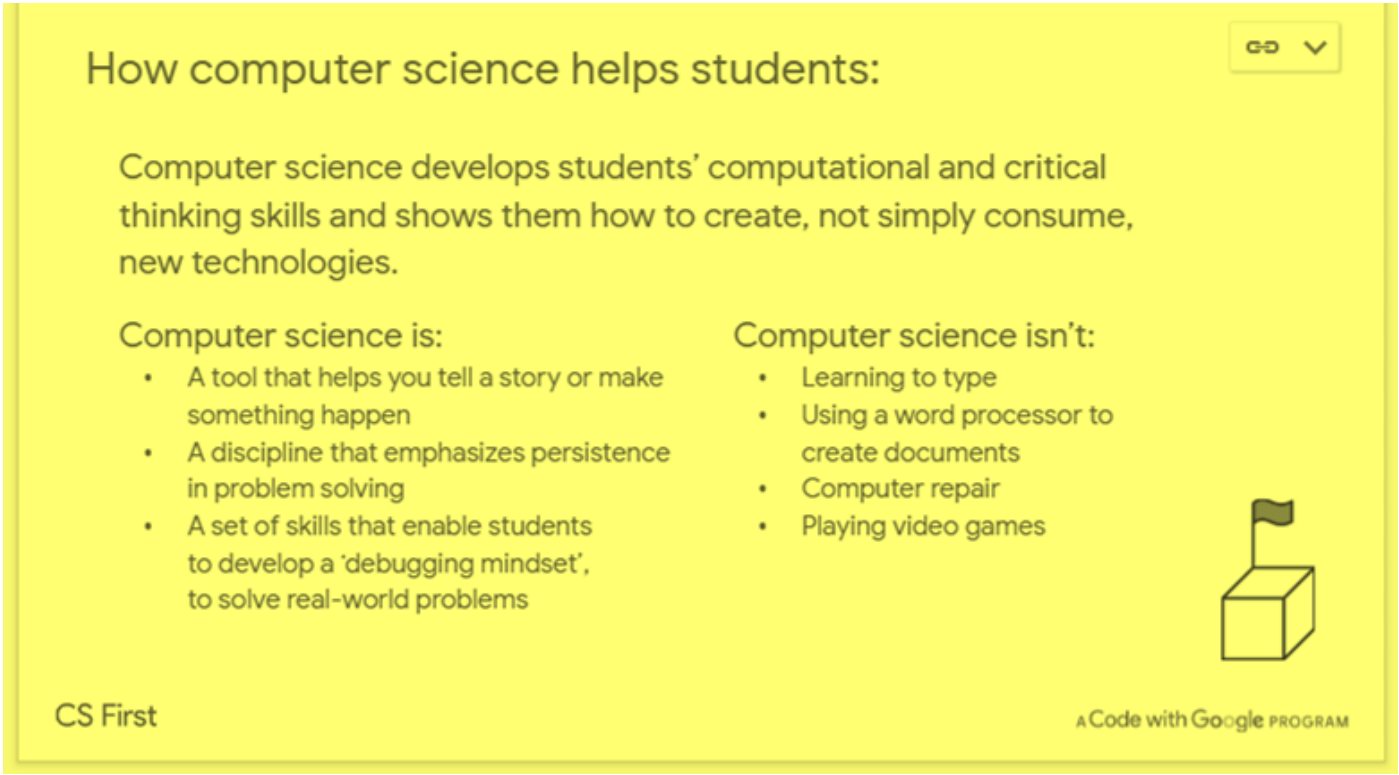


Block based coding has been introduced to make programming simpler and easier for beginners. Here instructions are already written in blocks, just drag and drop the appropriate blocks in their appropriate positions.

Text based and Block based actions

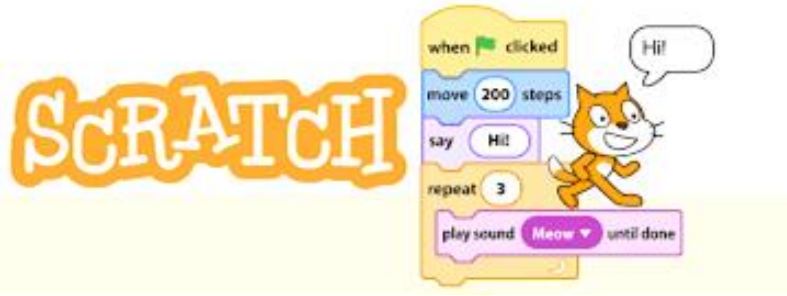


Suppose, you are in a tea shop. How can you command the vendor to serve you a cup of tea ? You can either tell him to do it or write on a piece of paper. These are text based. Any other way ? Yes, he has different cards with written instructions. You simply pick up the right card ("Please give me a cup of tea") and show him. That's all. He will serve your order.



What is Scratch ? **Scratch** is a new programming language that makes it easy to create interactive stories, games, and animations – and share your creations with others on the web.

Scratch projects are made up of characters or objects called **sprites**. You can change how a sprite looks by giving it a different **costume**.





You can give instructions to a sprite, telling it to move, run, sing or play music or react to other sprites on the **stage** (background) using various small program segments. To tell a sprite what to do, you snap together colorful graphic **blocks** into stacks, called **scripts**.

Scratch is a simple environment designed by the Kindergarten Lifelong Learning Group at **MIT Media Lab**, (scratch.mit.edu) in cooperation with Tufts University and The Playful Invention Company, launched in July 2014, to introduce some basic programming concepts in a fun and interactive manner.

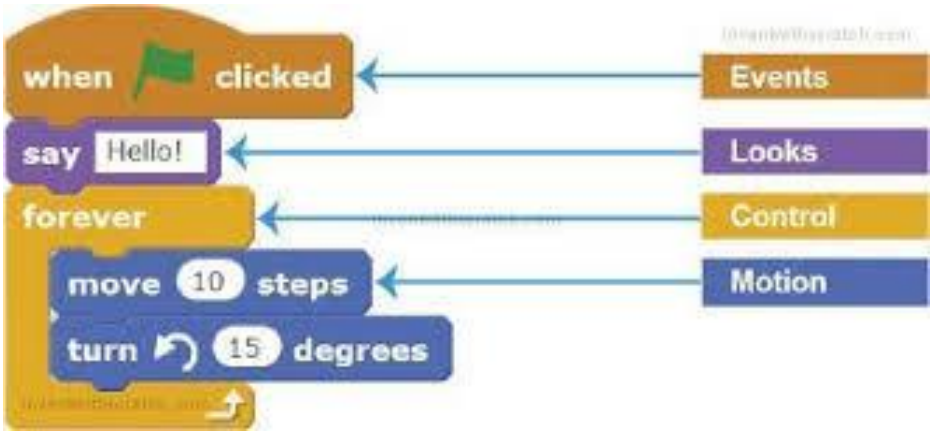
The concept is now used by millions of young people (ages 8 and up) around the world, to match young children's cognitive, personal, social, and emotional development.



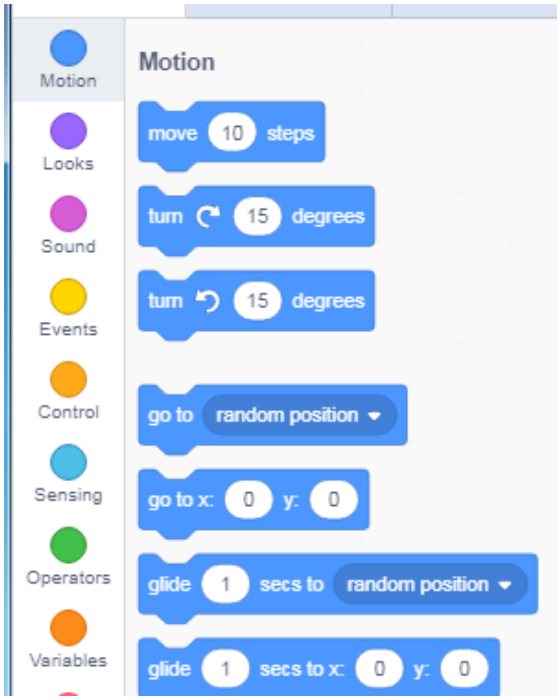
In **Scratch**, **e**ach sprite has its **own set of scripts** to control its behaviors and how it interacts with other sprites and events. You can drag a sprite anywhere in the stage and delete it by right clicking on the thumbnail of that sprite. Programming consists of snapping together individual blocks of preexisting actions to create a script.

In addition to sprites, you can add backgrounds to projects, to give them a setting and atmosphere. Each background is treated like a page in a book, and has its own set of sprites. A project can have a maximum of 4 backgrounds.

A program can be as simple as a single block or consist of multiple blocks stacked together that will run as a unit. The command blocks used for animation are as simple as start, move forward and backward, turn left or right, jump, grow, and shrink.



When you test your program, you'll watch your sprites on the Stage, in the top-right of the screen.
To make your sprites do something, you have to give them instructions that tell them precisely what to do and when. Those instructions come in the form of blocks that join together. The blocks are sorted into eight categories:



Motion: Used for moving sprites around the Stage.
Looks: Used for animating sprites, giving them speech bubbles, and changing their size and appearance.
Sound: Used for playing recordings or musical notes.
Events: Used to start a program by clicking the sprite or green flag or pressing a key or when a condition is fulfilled,
Control: Used to describe what happens when, and for making bits of your program repeat.
Sensing: Used to test whether your sprite is touching another sprite or another color, or to get information about other sprites.
Operators: Used for math, random numbers, and doing things to text. These provide various mathematical and Boolean operations, along with functions for handling strings. There are also blocks here for combining the blocks used in decision making.
Variables: Used to remember information, such as scores, timer, values, or player names.

You can find all the blocks in the **Blocks Palette** on the left of the screen. The blocks are color coded, so you can find the blocks you need more easily.
In the middle of the screen is the Scripts Area. This is where you make your lists of instructions (or 'scripts') for your sprites. To stop, click the red stop button.

Before getting started, watch a few videos to get an overall idea. The following links are suggested by **Google**'s CS First Educators' Group :

https://scratch.mit.edu/help/videos/

https://docs.google.com/presentation/d/10hc7aWqTKymM-jkiXqrtRklUg4lffEcKmjp_yrwRmJY/edit#slide=id.g5e2132fbcf_1_92

https://www.youtube.com › watch
INTRODUCTION TO SCRATCH PROGRAMMING - YouTube
18:19
Scratch is a computer **programming** language that lets you create your own interactive stories, animations ...
01-Apr-2018 · Uploaded by Kips Learner's Channel

https://www.youtube.com › watch
Scratch Tutorial 1: Make Your First Program - YouTube
12:52
In this tutorial, we learn the basics of **Scratch**. You will learn how to make your character move ... Your browser ...
29-Dec-2013 · Uploaded by Kevin Briggs

https://www.youtube.com › watch
Scratch 3.0 Tutorial #1: Make your first program - YouTube
17:55
The first in a series of tutorials covering **Scratch** 3. We start with the basics by creating an ... Your browser can ...
27-Apr-2019 · Uploaded by Kevin Briggs

https://www.youtube.com › watch
Scratch Coding A complete overview for Beginners - YouTube
21:29
If you are just getting started with **Scratch** this **video** is for you! Dive into the Computing curriculum and learn ...
20-Mar-2018 · Uploaded by Flipped Classroom Tutorials





Getting Started

Are you ready ?

First of all, download and install the **Scratch3** software. Log in *http://scratch.mit.edu/download* and select Install for Windows 7 or which one is suitable for your system software. After installed properly, simply double click the



desktop icon and the user interface or Scratch programming environment will be ready.



If you want to work online, use the Scratch project editor by going to *scratch.mit.edu* and clicking "Create".

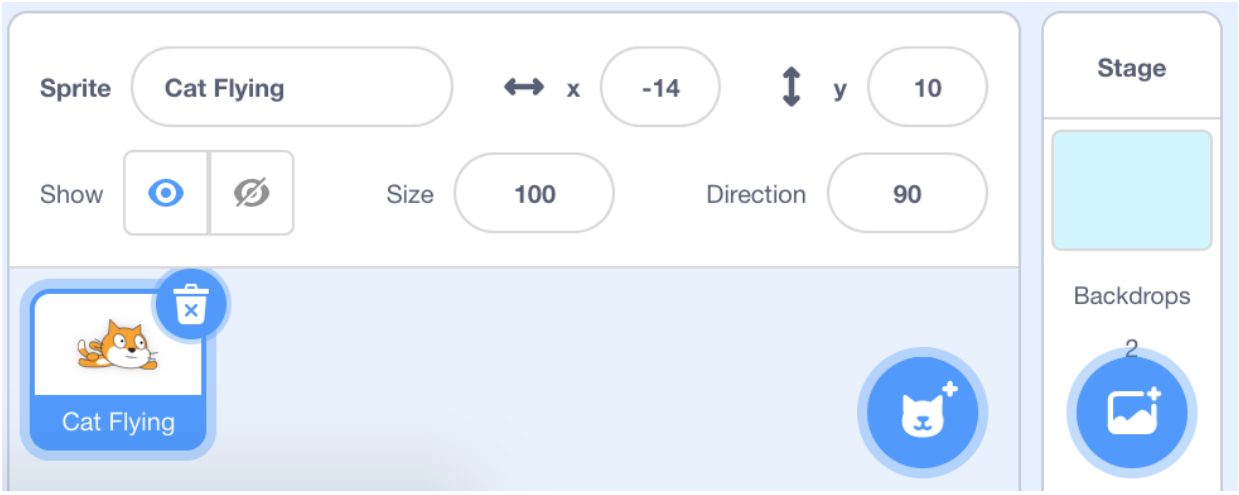
Before starting your first coding, you may go to the "Tutorial" menu and select any thumbnail. The pop up window will show you the steps one by one. Do every step yourself by dragging, dropping and joining the appropriate blocks and go forward. Try all of them sincerely to get a clear concept of how it works.

At the top left, three tabs are there :

- **Code** : Active, when you construct scripts for the sprites by joining blocks at the programming area in center A script is another name for program or method; a script tells the actor what to do.

- **Costume** : When you recolor or reshape the sprites by using Paint tools or delete or copy paste or flip horizontal / vertical a portion or the whole sprite. Select ‘Paint’ from the ‘Costume’ icon at bottom left to create your own shape. Even you can upload a picture from your computer.
- **Sound** : Different sounds can be selected from the library by clicking the ‘sound’ icon at bottom left. You can record your own voice or upload one from your computer. Make it faster or slower.

The cat is waiting for your command at the stage. The stage is at the upper right, where you see your stories, games, and animations come to life. Sprites move and interact with one another on the stage. The stage is 480 units wide and 360 units tall. It is divided into an x-y grid. The middle of the stage has an x-coordinate of 0 and a y-coordinate of 0.



Just below the stage, the size and position of the sprite is mentioned. Check the box for x-position and y-position. Drag

the sprite here and there to see how coordinates change. Default size is 100, you can increase or decrease it (expand or shrink). By right clicking the thumbnail, the sprite can be deleted. Related blocks will be disappeared automatically. At the bottom right, '**Choose a sprite**' and '**Choose a backdrop**' icons are there. Click and select your favorite one. You can paint or upload a sprite or backdrop from the right option. Also, three alignment (left, right, centre) buttons and scroll bars are there at the coding area. There are 'Green flag' to start the action (if so instructed) and red ball to stop execution.

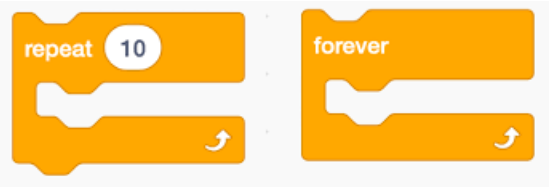
BLOCKS PALETTE and SCRIPTS AREA

To program a sprite, drag out blocks from the **Blocks Palette** to the **Scripts Area**. Create **Scripts** (programs) by snapping blocks together into stacks.
To move a stack, pick it up from the top block. If you drag out a block from the middle of a stack, all of the blocks beneath it will come along with it.
Some blocks have white editable text fields inside. To change the value, click inside the white area, delete the existing number, and type a new number. You can also drop rounded blocks inside these areas.



Some blocks have pull-down menus. Just click on the button to see the menu, then click again to make a selection.

Some stack blocks have a C-shaped “mouth” where you can insert other stack blocks.



There are variable blocks to store values of a variable. If you click in the check box, a monitor appears on the stage, displaying the current value, which updates automatically.

Click the **Presentation Mode** button to see projects at full-screen size. To exit Presentation Mode, press the Esc key.

BLOCK DESCRIPTIONS

Let us know the functions of the blocks in each of the eight color-coded categories :

Motion :

move 10 steps : Moves sprite forward or backward *(when number is negative)*
turn 15 degrees : Rotates sprite clockwise or anticlockwise
go to random position : Moves sprite in any direction
go to mouse pointer : Moves sprite to the location of the mouse-pointer
go to x 0 y 0 : Moves sprite to specified x and y position on Stage
glide 1 sec to random position : Moves sprite smoothly in any direction
glide 1 sec to x 0 y 0 : Moves sprite smoothly to a specified position over specified length of time
point in direction 90 : Points sprite in the specified direction

point towards : Points sprite towards mouse-pointer or another sprite
change x by 10 : Changes sprite's x-position by specified amount
set x to 0 : Sets sprite's x-position to specified value
change y by 10 : Changes sprite's y-position by specified amount
set y to 0 : Sets sprite's y-position to specified value
if on edge, bounce : Turns the sprite in the opposite direction when it touches the edge of the stage
sprite's x-position ranges from -240 to 240
sprite's y-position ranges from -180 to 180
sprite's direction 0=up, 90=right, 180=down, -90=left

Looks :

say Hello for 2 seconds : Displays sprite's speech bubble for specified amount of time
say Hello : Displays sprite's speech bubble with no time limit
think Hmm… for 2 seconds : Display sprite's thought bubble for specified amount of time
think Hmm… : Displays sprite's thought bubble
switch costume to : Changes sprite's appearance by switching to different Costume
next costume : Changes sprite's costume to next costume in the costume list
change color effect by 25 : Changes a visual effect on a sprite
set color effect to 0 : Sets a visual effect to a given number

clear graphic effect : Clears all graphic effects for a sprite
show : Makes sprite appear on the Stage
hide : Makes sprite disappear from the Stage
go to front layer : Moves sprite in front of all other sprites
go backward 1 layer : Moves sprite back a specified number of layers, so that it can be hidden behind other sprites

Sounds :

play sound : Starts playing selected sound, selected from pull-down menu, and immediately goes on to the next block even as sound is still playing.
play sound until done : Plays a sound and waits until it has finished playing before continuing with next block.
stop all sounds : Stops playing all sounds.

Events :

when “green flag”clicked : Runs script below when green flag is clicked
when space key pressed : Runs script below when specified key is pressed
when the sprite clicked : Runs script below when sprite is clicked
when backdrop switches to : Perform the actions when the selected backdrop appears
broadcast message : Sends a message to all sprites, then continues with the next block

when I receive message : Runs script below when it receives specified broadcast message

Controls :

wait 1 second : Waits specified number of seconds, then continues with next block
repeat 10 : Runs the blocks inside a specified number of times
for ever : Runs the blocks inside over and over
if, then : If condition is true, runs the blocks inside
if, then, else : If condition is true, runs the blocks inside the **if** portion; if not, runs the blocks inside the **else** portion
wait until : Waits until condition is true, then runs the blocks that follow
stop all : Stops all scripts in all sprites

Sensing :

touching mouse pointer : Reports true if sprite is touching specified sprite, edge, or mouse pointer. Useful for collision detection in games.
touching color : Reports true if sprite is touching specified sprite, edge, or mouse pointer. Useful for collision detection in games.
ask and wait : Asks a question on the screen and stores keyboard input in **answer**. Causes the program to wait until the **ENTER** key is pressed or checkmark is clicked.

answer : Reports keyboard input from most recent use of **ask and wait** (shared by all sprites).
mouse x : Reports the x-position of mouse pointer.

mouse y : Reports the y-position of mouse pointer.
mouse down : Reports true if mouse button is pressed.
key pressed : Reports true if specified key is pressed. Useful for controlling moving objects, such as in games.
distance to : Reports distance from the specified sprite or mouse pointer.

Operators :



Adds two numbers.



Subtracts second number from first number.



Multiplies two numbers.



Divides first number by second number.



Picks a random integer within the specified range.



Reports true if first value is less than second.



Reports true if two values are equal.

	Reports true if first value is greater than second.
	Reports true if both conditions are true.
	Reports true if either condition is true.
	Reports true if condition is false; reports false if condition is true.
	Concatenates (combines) the two strings.
	Reports the letter at the specified position in a string.
	Reports the number of letters in a string.
	Reports remainder from division of first number by second number.
	Reports closest integer to a number.

Variable :

Make a variable : Allows you to create and name a new variable You can choose whether the variable is for all sprites (global) or just for one sprite (local).
My variable : Select the check box to activate it
set my variable to 0 : Sets variable to specified number

change my variable by 1 : Changes variable by specified amount
show variable : Shows the selected variable's monitor on the stage.
hide variable : Hides the selected variable's monitor so it is not visible on the stage.

Source: ***http://scratch.mit.edu*** *REFERENCE GUIDE*



- Search sprites from different categories and bring them on the stage. Make duplicate by right clicking on its thumbnail. Delete them.
- Change backdrops and be familiar with their names.
- Drag the sprite here and there and see how coordinates change. Modify size percentage.
- See the various blocks of each category.
- Click on "Costume" tab, when the cat is on the stage. Change its color, remove a portion, make copy and paste, flip horizontal or vertical, undo, redo. Draw a color circle.
- Switch on your speaker; go to "Sound" tab and click "Choose a sound" option. Listen to the funny sounds. Make it faster or slower.

Basic Scripts

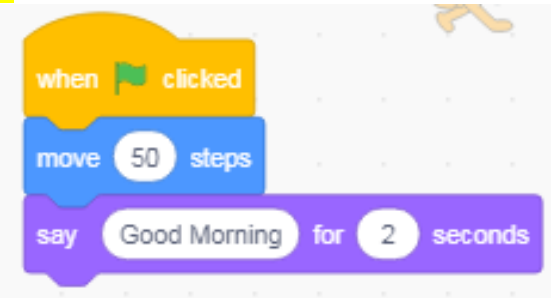
This is the right time to start our first coding.

Oh ! How exciting moment it is.

▸ Drag each instruction from the block palette to the center script area. ▸ Connect them into a single block. ▸ Edit the parameters to get the numbers you want. ▸ Run the script.

1. A cat will move and say something

Select Cat and a suitable backdrop.
Drag "when the green flag clicked" from "Events"
Drag "move 10 steps" from "Motions"
Drag "say Hello for 2 seconds" from "Looks"
Change 10 to 50 and "Hello" to "Good Morning"



Finished. Now click the green flag and watch what happens.

● You may change the steps, message and seconds several times for practice.

Do-it-yourself

Select Dog1 and change background. Place the dog at left edge. It will say "this is starting point". Then move 300 steps and stop and say "this is finishing point".

2. The cat will look towards mouse pointer or rotate





Keep the mouse pointer anywhere and press space key. Watch what happens. When you click green flag, note the direction.

● You may replace space key by left or right from the drop down options. Place mouse pointer in different position and run again to test the script. Change the angle to 45, 135, 180 and whatever you wish and watch the cat rotating.

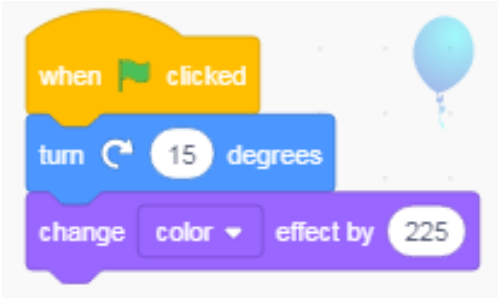
Do-it-yourself

Select Pico Walking. When you click green flag, it looks 180 degree and says "this is 180". When you press space key, it looks 0 degree and says "this is 0"

3. A balloon will rotate and change color

Select Baloon1 and Winter backdrop.

When you click green flag, it will turn right 15 degree and change color. Modify the program by changing the color effect between 25 to 200 in multiple of 25 and see different colors.



● For practice, use “turn left” block and set different degrees up to 360. Input 225 as color effect to see which color comes. Run again and again.

Do-it-yourself

Select Arrow1. When you press left arrow key, it will turn 90 degree left. When you press right arrow key, it will turn 90 degree right.

4. The sprite will move to a specific position.

Select Gobo and Arctic backdrop. Its initial position is 0,0 and it thinks something for 2 seconds. Then it will move to a new location as instructed in the script.





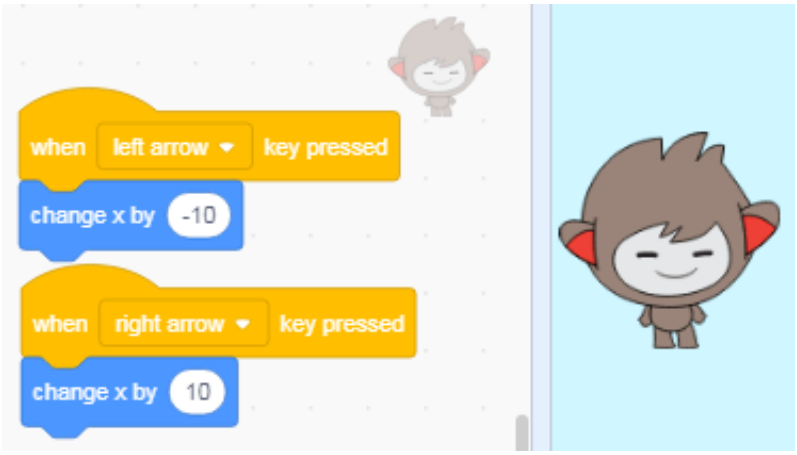
● Change the coordinates of x-axis and y-axis with positive and negative numbers and run several times. Get a clear concept about the maximum and minimum limit of the coordinate values.

Do-it-yourself

Select two sprites at a time : Ladybug2 and Apple. Under Ladybug2, (click on the thumbnail, if not active) drag go to mouse pointer and take apple from the drop down list. Run and watch where ladybug goes. Similarly, select mouse pointer and random position to understand the movement.

5. The sprite changes its coordinates

Select Nano and Savanna backdrop. When you press left arrow key, it will move a bit left and when you press right arrow key, it will move a bit right. That means it will change its x-coordinate position.



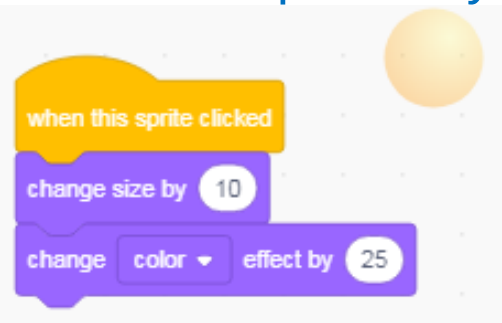
● Insert different values in x-positions (both positive and negative) and see how the gap increases or decreases. Press the key repeatedly to see Nano's non-stop moving.

Do-it-yourself

Select Duck and Pool backdrop. Make a script to move the duck upwards when you press upper arrow and it will move downwards when you press down arrow. Repeat pressing keys quickly to cover longer distance. Change the coordinate values of y-axis and run.

6. Changing size and color

Choose a sprite as you like. It may be the Ball. When you click this sprite, it will increase 10% and change its color. Click again and again to make the size bigger and bigger and watch a splash of color.

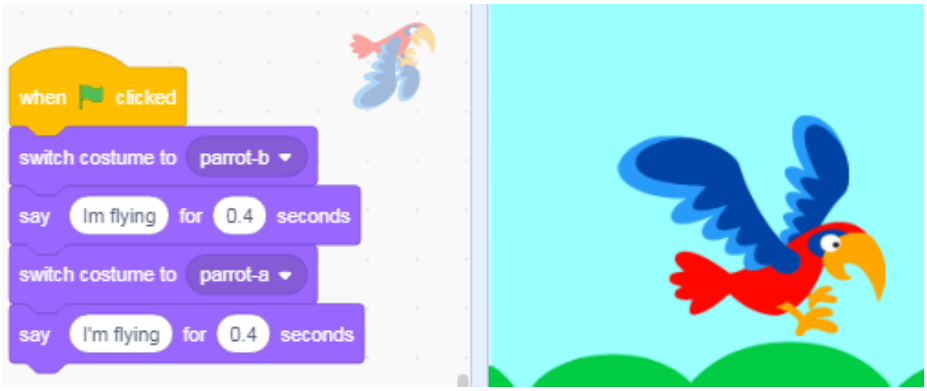


● Instead of 10, input different size percentage. Use negative number for experiment. Change color effect from 25 to 100.

Do-it-yourself Select Dog2. It says “I’m smaller”. Then it increases its size 100% and says “I’m bigger”. Bring another animal in the stage and expand or shrink their sizes.

7. Changing Costumes of the sprite

Choose Parrot and Blue Sky. Types of costumes vary depending on which sprite you select. Here Parrot has two costumes : a and b. Select the appropriate costume from the drop down option. It will move its wings and say something. Reduce time to 0.4 seconds. Run repeatedly to make the Parrot restless.



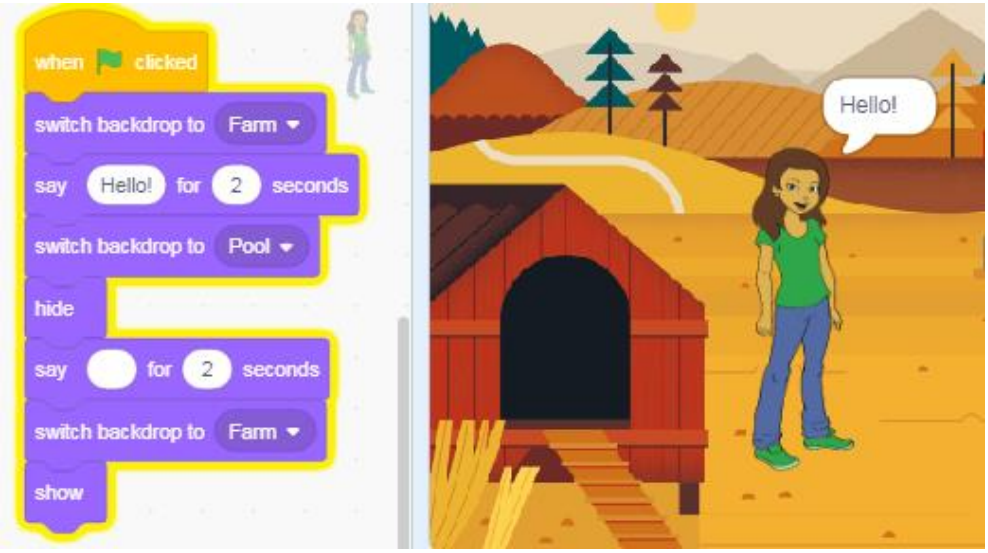
● When you drag say Hello for 2 seconds, don’t forget to decrease the gap, because 2 seconds time is too long. Input as many time limits as you wish and see the result.

Do-it-yourself Choose either the Horse or the Elephant. Both of them have two costumes. Use them one after another. Place the same

blocks switch costume to four times with a gap of 0.5 seconds. They can say or think something.

8. Changing backdrop and Show / Hide

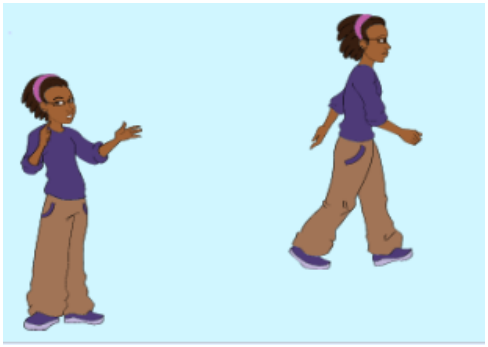
Let Abby come on the stage. Select two backdrops : Farm and Pool. Abby says “Hello” from the Farm. But when the backdrop becomes Pool, she disappears. When Farm comes again, she appears.



● Write message as you wish and make seconds more or less. You may move Abby a few steps when the Farm comes back.

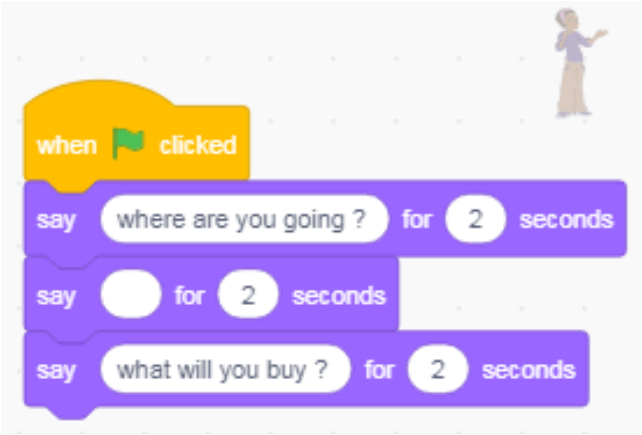
Do-it-yourself Select other sprites, two, three or four backdrops. Use other message, different time limit. Try to change costume, when other backdrop comes. Use next backdrop, previous backdrop, random backdrop from the drop down list for practice.

9. Communication between two sprites

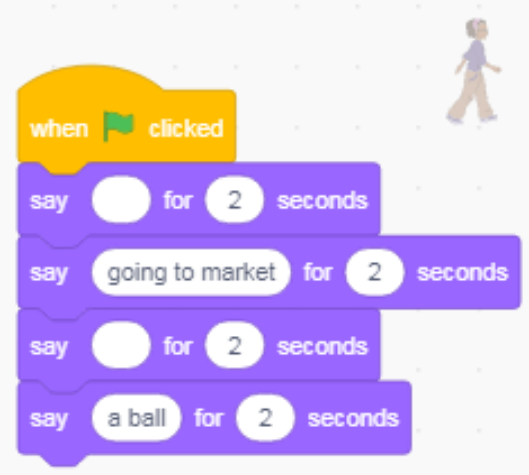


Here we create a conversation between Avery and Avery Walk. The first person asks something, the second person replies. When a bubble of message is displayed on the stage, the other sprite is silent for the same time. That means it says nothing. Snap the scripts by clicking on that sprite. When you run the programme, the incidents happen at a time.

Avery



Avery Walk



● Try to animate the actors by changing their costumes along with the dialogues. The characters can move forward a few steps when speaking. Increase or decrease 2 seconds and watch whether conversation runs smoothly.

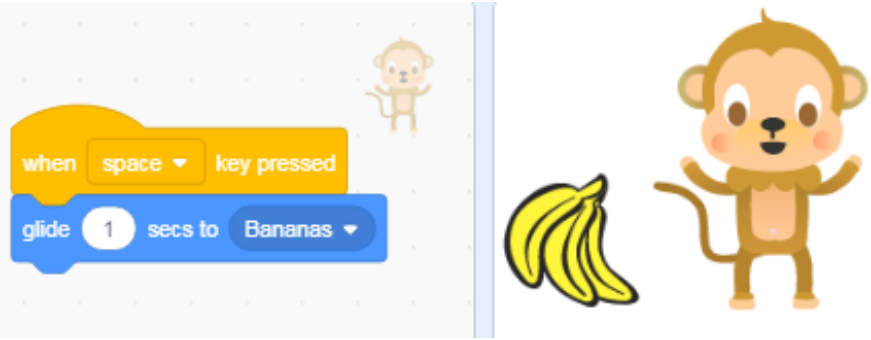
Do-it-yourself

Can you create a comic strip with two characters ? Imagine a cat and a mouse are gossiping. Prepare dialogues and snap blocks to make

script. Choose the right backdrop. Be careful that when one sprite is asking a question, other sprite is silent for the same time.

10. Moving towards an object or to random position

Select Monkey and Banana and keep them at a distance. Find a suitable backdrop. When you press space key, the Monkey will come where the Banana is. Drag glide 1 sec to random position and select Banana by clicking the down arrow.



● From the drop down list, you will also find mouse pointer and random position. Try each of them one by one. Change 1 sec to 2 or 3 seconds and note the effects.

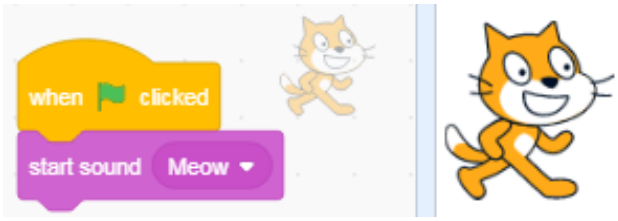


Just like this script, check the function of another similar block glide 1sec to x 0 y 0 by dragging this block, instead of the previous one. Change coordinates of x-axis, y-axis, positive or negative.

11. Play sound

Now switch on your speaker and listen to sounds of animals, people, musical instruments. If you have microphone, you can record your own voice and use it in appropriate step.

Let us test the sound effect with our Cat. Drag play sound meow and run. By default, the volume is set to 100.



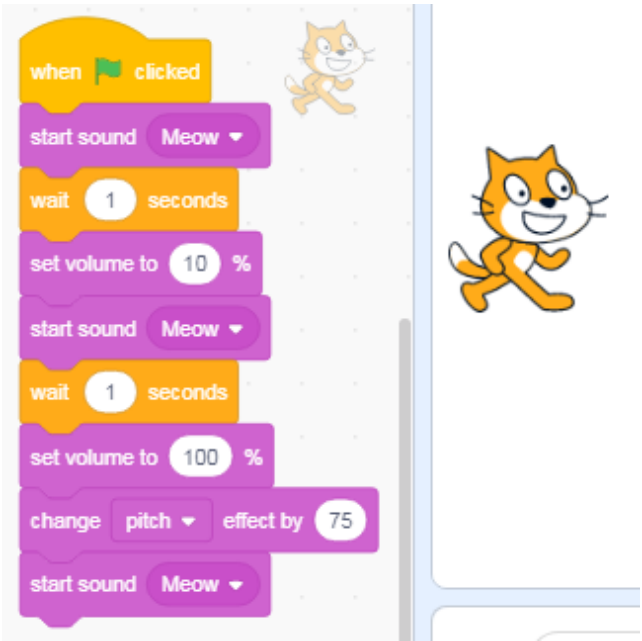
● Change volume to different level and watch the sound louder or softer.

Do-it-yourself

Bring Dog and other animals. First set volume to 100%. Then reduce the volume gradually. Run script again and again till the concept is clear to you.

12. Changing the pitch effect of the sound

To feel the difference of the pitch effect, we will use here the wait 1 second block from the Events category. Our cat will meow again, but with another pitch effect. It generates various sounds according to the number you input. The wait 1 second instruction will make the cat wait for a moment, so that we can understand the difference easily. First change volume and then change pitch effect.

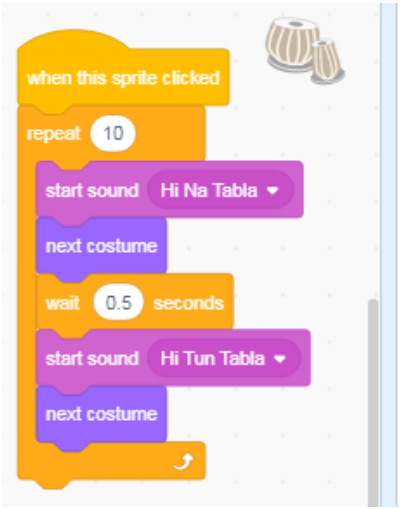


● Change pitch effect to 25, 50, 75 etc and watch what you listen. Modify 1 second to 2, 3 or 0.2, 0.3 seconds.

Do-it-yourself Apply the process for a variety of creatures. Change volume and pitch. Use wait command wherever applicable. Try to create a story and use sound just before or after the dialogue.

13. Repeating an action many times

Let us play Tabla. Select Drums Tabla from Music. Here we use repeat 10 block from Events. Activate two options of Hi Na Tabla and Hi Tun Tabla by clicking the down arrow. Wait 0.5 second between two sounds. Use next costume to animate the instruments.





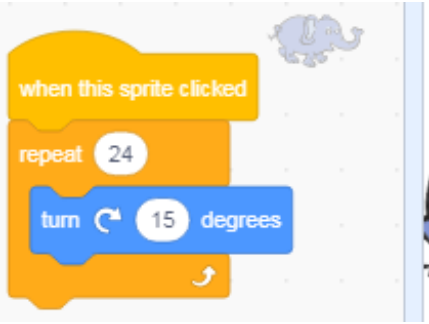
● Change times of repetition. Apply Lo Geh Tabla and Lo Gliss Tabla to see the effect. Arrange the sounds in different order and listen.

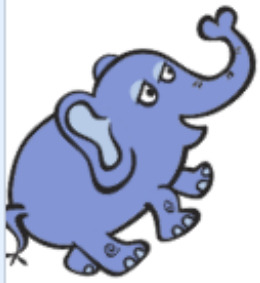
Do-it-yourself Choose Saxophone. Use all the sounds A sax to G sax, wait 0.25 seconds and try to make harmony among them. Increase times of repetition.

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https://csfirst.withgoogle.com/project/editor

14. Spinning an object

Our Elephant will tumble 360 degrees. It will turn right 15 degrees for 24 times, when you click it. It will come back to its initial position after tumbling.



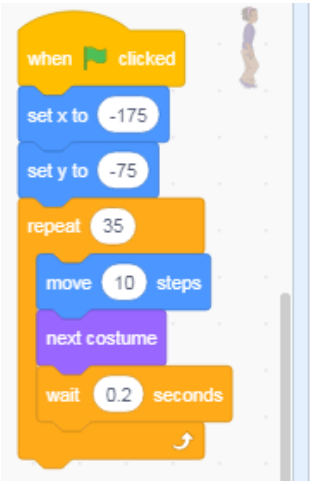


● Alter the number of repetition and degrees. Use turn left block. Use change color effect by 25 within this script. Watch the changing colors.

Do-it-yourself

Select Robot. Make it spinning. Modify the script by using next costume and wait 0.3 to realize the steps clearly. Increase repeat for a longer action.

15. Animation : A man is walking





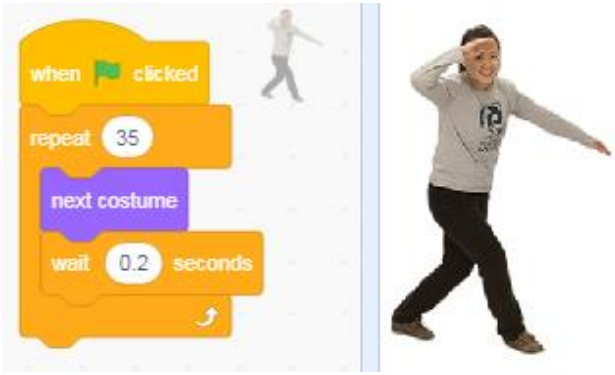
The sprite Avery Walk is standing on the stage and ready to walk, as soon as you give him signal. At first, fix his initial position to (-175, -75). He will move 10 steps, change his costume and wait 0.2 seconds. Everything will be done for 35 times. Let him walk.

● Modify repeat, move and wait parameters and note the changes every time.

Do-it-yourself Select Dragon. Make it walking with changing costume and changing color. Use repeat, wait and change color effect commands. Choose more objects for practice.

16. Animation : A dancing woman

Anina Dance will start dancing soon. She will change her appearance and wait 0.2 seconds. This activity will be repeated for 35 times.



● Set her initial position. Try to move her at the time of dancing. Change repeating and waiting time to see what happens.

Do-it-yourself Invite D-Money D and Champ99 to our stage. When you order them, they will start dancing. Increase or decrease parameters for testing.

17. Animation : Watch a girl's parade

Ballerina will move her hands and legs as per different costumes. No matter how many costumes are there, but snapping the next costume block will do it. Set a bigger size.

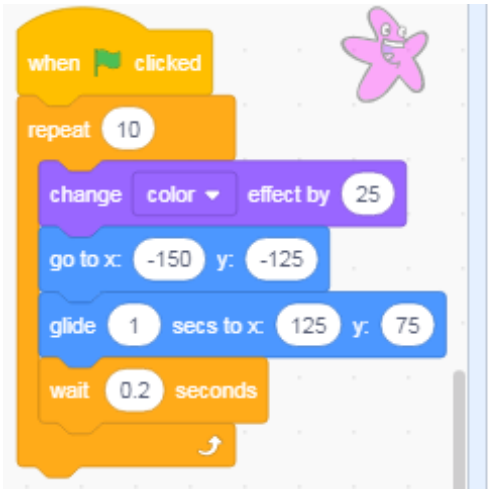


● Drag a new block. Instead of repeat block, use forever command from Control category. Watch actress's non-stop activity. To close the programme, click on the red ball.

Do-it-yourself Imagine the Cat is moving upstairs facing right, from its base. Use point in direction 45 and change costume. Repeat for 30 times. Decide which span of time for waiting is the perfect option.

18. Moving one direction to another

Let us fix our Starting position to (-150, -125). From here, the Starfish will glide to (125, 75). This action will be repeated for 10 times. To make the animation more attractive, change color effect and set a funny backdrop.





● Replace glide 1 sec to go to same coordinates and note whether anything changes. Try to understand the reason behind this.

Do-it-yourself Make the Butterfly1 flying. Choose glide 1 sec to random position and change next costume. Repeat for many times or for ever. You may change color effect.

19. Moving by repeatedly changing coordinates

The Duck will move rightward and upward. Positions of x-axis and y-axis will change equally. We have used if on edge, bounce block. That means, if it touches the end point or boundary, it will stay and not cross the limit.

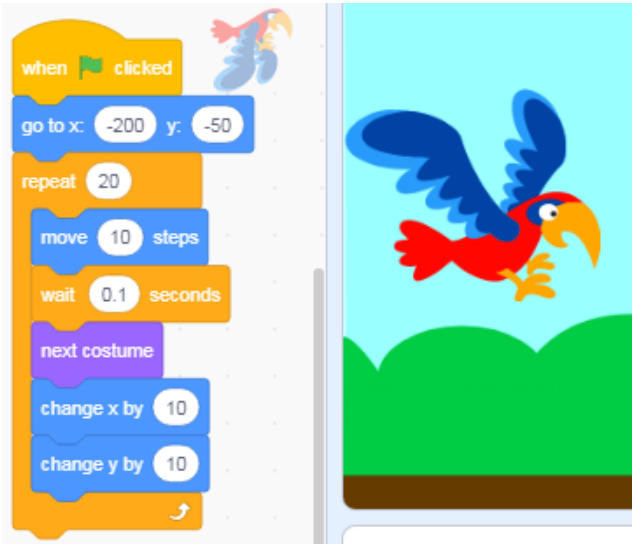


● Use point in direction and decide the perfect angle for this movement. Change the starting point and finishing point.

Do-it-yourself Flip the face of the Cat horizontal from Costume tab. Make the Cat moving backward, starting from the right edge. Try to change its costume and color effect.

20. Moving and Changing Direction

The Parrot will start flying from a fixed point and continuously change its x and y coordinates. The Parrot will change its costume and the action will be repeated for 20 times.



● Instead of next costume place switch costume to parrot-a and b in appropriate place. Flip the sprite horizontal and move it from the right edge towards left.

Do-it-yourself Encourage Hannah to move forward and bounce her ball. Use only Change x by 15 and next costume. Repeat for 20 times, waiting 0.1 second for each interval.

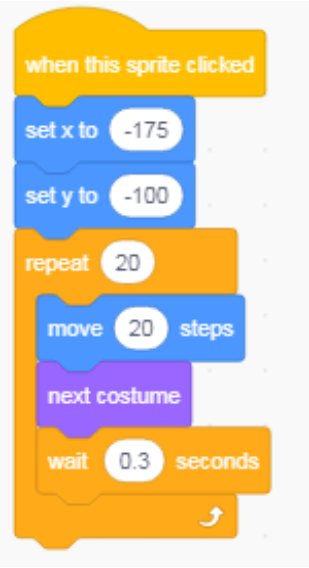


21. Jumping by moving and changing costume

Backdrop : Water Aid Sprite : Wizard-toad

Simply by using moving, waiting and applying next

costume, we can make the frog jumping.

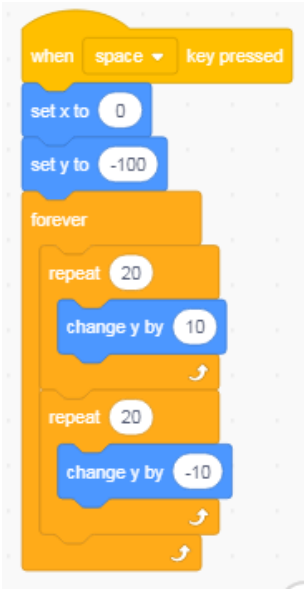


● Apply forever and if on edge bounce blocks. Set different starting position. Change number of repetition and moving steps.

Do-it-yourself

Suppose Baloon1 is at Jurassic Park. When you press space key, the color will change continuously for many times or forever. It will move here and there on the stage. Use glide to random position.

22. Jumping by repeatedly changing coordinates



We can keep a repeat command inside a forever block. Watch how the Tennis Ball will



bounce on the ground. Keep the ball at bottom edge. It will move upwards slowly. So change y position 20 times (number is positive). Then it will move downwards. So change –y position 20 times (number is negative). Both of these repetitions have to be inserted into another forever block. The tennis Ball will bounce again and again.

● Change the coordinates and number of repetition one by one. Apply color effect. Apply start sound pop within each repeat block.

Do-it-yourself Take the Cat. Flip it horizontal from Costume tab. Keep it at the right edge. Then changing x coordinate move it from left to right slowly, using wait command. Within forever, you may insert if on edge, bounce block.

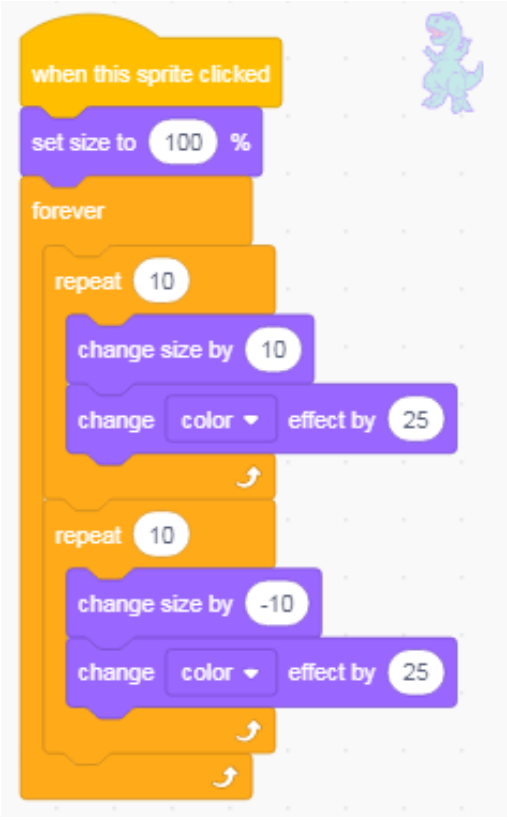
23. Making size bigger or smaller

Insert change size by 10 within a repeat command. When the number is negative, the size of the sprite will be reduced.



Let the Dinosaur5 come on the stage. It will be 10 times bigger and 10 times smaller. You may change color effect to make it funnier. It never stops.

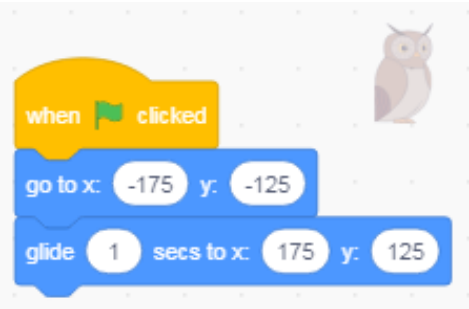
● Add sound within script. Apply play sound dance funky and bite, whatever you wish. You can make the Dinosaur move a bit left or right.



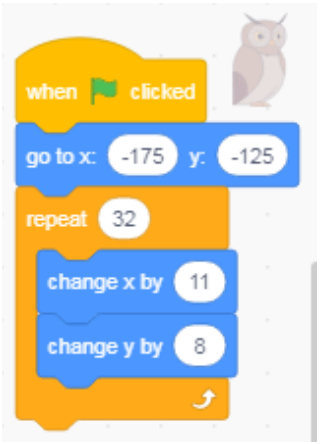
Do-it-yourself Select Gobo. Increase and decrease its size continuously. Besides this, spin it left or right repeatedly. Change color effect with it. Apply play sound pop.

24. Glide or Change coordinates

An object can glide from here to there. It may be a specific position or at random position. If it is specific, you can do it by repeatedly changing its coordinates. Order the Owl to sit



at (-175, -125) position. It can move to another position slowly (at a stretch, if go to command used) by opting glide to or change x, y coordinates. Snap the blocks accordingly.



● Create another repeat block to return the owl to its home. Insert both of the repeat blocks under a forever. For practice, you may use glide to random command to make the owl restless.



Select two or three butterflies. Activate them one by one and make scripts under them. When you click each of the butterflies, they will



start glide at random for ever. You may use sound and color effect. Even rotate or spin them.

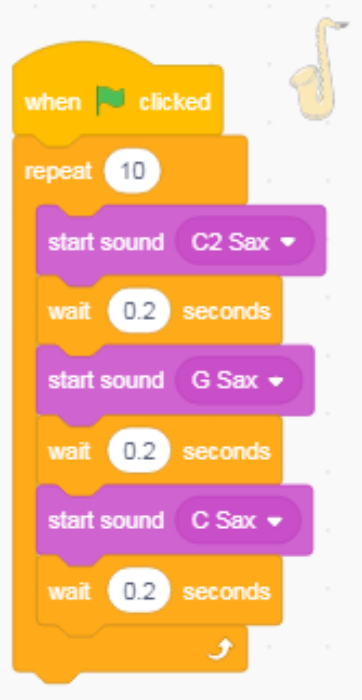
25. Create a song





Choose Saxophone. We can select different tunes from its sounds to make them a harmony, just like composing a song. Add

wait 0.2 seconds in every interval between two tunes. Repeat 10 or 20 times or play non-stop. Enjoy the music.

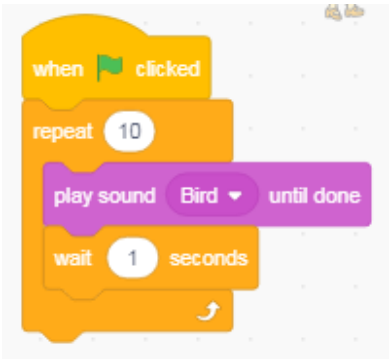


● From the drop down list, choose other tunes. Compose another song by applying them in a different sequence.

Do-it-yourself Make the Drum beat in a similar way. Select High Tom and Low Tom and wait 0.2 seconds between them. Repeat the process as many times as you wish.

26. Choose a sound

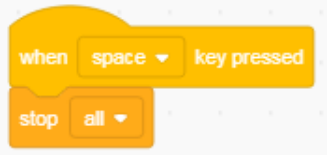
From Sound tab, we can collect many sounds. Select Bird and Crazy Laugh. Repeat 10 times or forever and apply wait a bit. You may increase or decrease volume or pitch effect.





● Select Wanda and insert the crazy laugh in the appropriate place. Try more and more. Apply them. Stop it, when you press space key.

Do-it-yourself Let the Dog bark. Listen to non-stop barking of a dog or a puppy. Change time limit of waiting.



More Commands

Now we have some basic knowledge and idea about how Scratch coding works and how we can create stories, animations and other interesting presentations by snapping blocks from different categories.

But in the Block Palette, there are three more groups, named 'Sensing', 'Operators' and 'Variables'. Before starting of our next script, let us learn something to get a clear concept.

- Just imagine a variable as a container, where we can assign an initial value and it changes automatically, as the flow of instructions goes on. Suppose, if the value of a variable named **A** increases by **2** every minute, then the new value is always **A = A+2**. Keep in mind that here **=** sign does not mean 'equals to', but the value of the right hand side is assigned into the left hand side.

if statement

This statement checks only 'True' part of the program and it comes to an end. It ignores the false part of the program.

This statement is used as :

```
if<Condition is true>
  <Perform the task>
```

if-else

It is a logical situation in which either of the two actions is to be performed depending upon certain condition. When the condition is ‘True’, it performs one set of statements otherwise, it performs another set of statements.

```
IF (condition) THEN
    Statement 1
ELSE
    Statement 2
```

A sprite can broadcast a message or sound; another sprite can reacts after receiving that message or sound. If a sprite is touched by another sprite, mouse pointer or a specific color, it can do something as per your instructions. We can capture this using a broadcast block to send a message and a when I receive block to receive the message. These are sensing activities.

We can perform many mathematical calculations and logical operations with ‘Operators’ blocks. We insert the variable value into the holes of these blocks to get a result. We can join words, text with variables, process information from user’s input, display certain message, if a particular condition is fulfilled.

27. Joining text with variable

The sprite will ask the name of user. The input will be stored in the variable answer. After pressing Enter, the sprite will say the message with name. To do this, drag say Hello! for 2 seconds and join Apple Banana. Then insert the join block inside the say block. Put your favorite message in one hole and answer variable in the other.





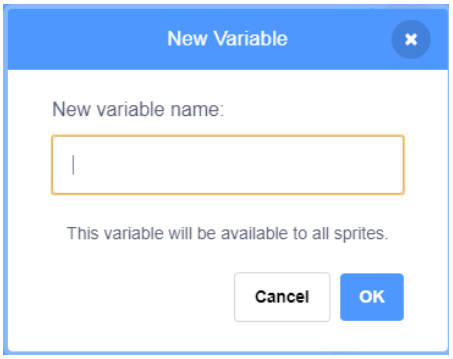
● Change the question to ask the age. The answer may be "I know your age is ……." Create a few interesting questions. The answer may be either text or number. Change Sprite, backdrop and time frame.



The cat will ask "Input angle to rotate me". By pressing Enter key, it will say "Please wait" for a moment and then turn right at that degrees.

28. Adding two fixed number

Click Make a variable and put a name, OK it. Make three variables A, B, C in this way. Bring set A to 0 and assign 18, drag another one and put 23 in B.



The adding block from Operators should be inserted in set C and the variables A and B in its two holes. By running the program, you will see the value of C at top left of the stage.



● Assign different values. Use show and hide variables and watch what happens. Bring a sprite and let it say the answer.

Do-it-yourself

Make two other variables : v1 and v2. Activate My Variable by putting a tick mark. The calculated result will be stored in this variable. Assign different values and try addition, subtraction, multiplication, division from the Operators.

29. Calculation from user's input

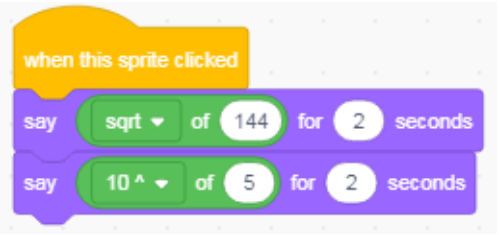
By applying simple formula, we can take input from user and show the output. Let Sam ask you to input the length of one side of a square. Your data will be stored in variable A, i.e., assign the value of answer variable into A. Multiple A by A and store it into B. Display the value of B with some text.



● Change the formula in a different way. Show the perimeter of the square. Ask the user to write the side of an equilateral triangle and display its perimeter.

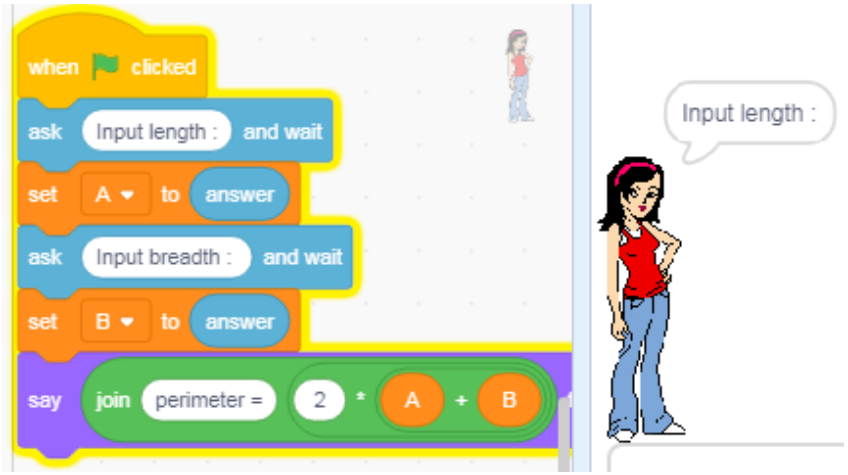
Do-it-yourself

Try the various options of calculations available here. Find the square root of a number and the value of 10 to the power something.



30. Applying simple formula

Ruby asks you to write the length and breadth of a rectangle.



You have to make the script to calculate the perimeter of that rectangle. Assign the values of answer in A and B respectively. The multiplication and addition Operators blocks have to be inserted into a join block.

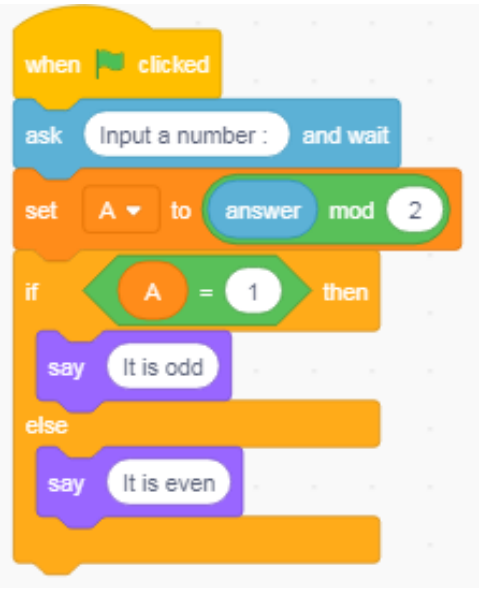
● Change sprite. Prepare a script to take two numbers from user and find the average of those two numbers. Run the same script, when there is no sprite on the stage. Result will be displayed under my variables or any other one, created by you.

Do-it-yourself Think of a program, where user will input the sum of three consecutive numbers. You have to display the numbers. Be careful to assign values in variables and inserting one join block into another one.

31. If, else condition

User's input can be checked whether a specific condition has been fulfilled or not. According to the decision, a message is displayed. For this purpose, we use if, if, else and if, else, then commands from the Control group. The received number is stored in answer variable. If it is greater than a specific number, a message will be bubbled. If not, the message will be another one. To find remainder (when we divide one by another), we use the mod command from Operators.

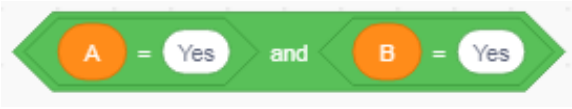




● The sprite will ask the user, “Do you neglect your study ? (Yes / No)”. If the answer is “Yes”, then say : “You are a naughty girl”. Else : “You are a good girl”.

Do-it-yourself

The sprite will ask you two questions one by one : “Can you speak in English ?” and “Do you like Math ?” If both of the answers are “Yes”, then the message : “You are eligible for admission”. Else : “Sorry, No entry”. Please remember, you have to use an and operator and two equals to conditions in its two holes in either side.



32. Nested if, else

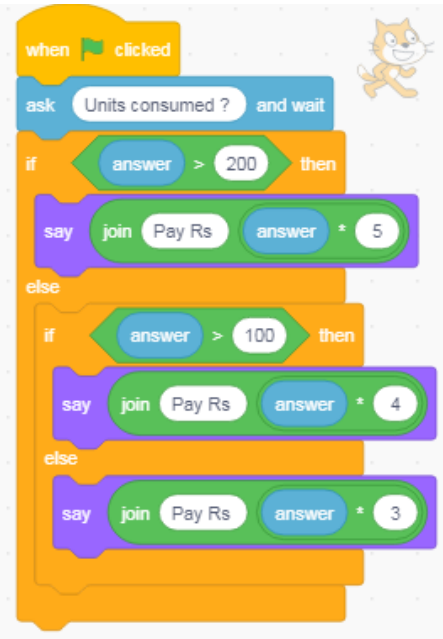
Electricity Board charges for electricity from their consumers according to the units consumed.

Units Consumed	Charges
Up to 100 units	Rs 3 per unit
> 100 and up to 200 units	Rs 4 per unit
> 200 units	Rs 5 per unit

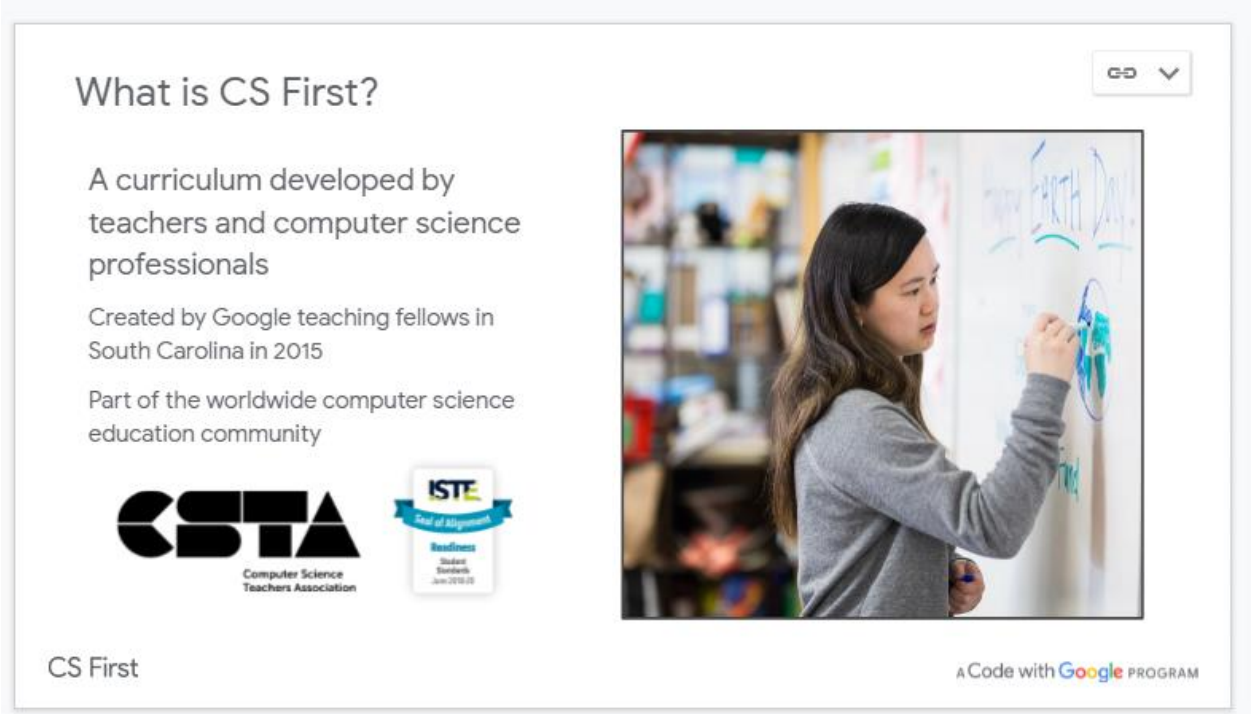
Accept reading from the user and calculate how much she has to pay.

Assign the input into answer variable. Use say block, join block and multiplication operator block to show result. Please note that another if, else block has to be inserted under the else of the first one.

● Create a script, where user will input her age. If it is >50, message is : “You are senior”. If >18, then “You are young”. Else, “You are minor”.



Do-it-yourself Make a similar program. User will tell you the marks she has obtained. If >60 : “You have secured a first division”. If >30 : “You have passed”. Else : “Sorry, you have failed”.



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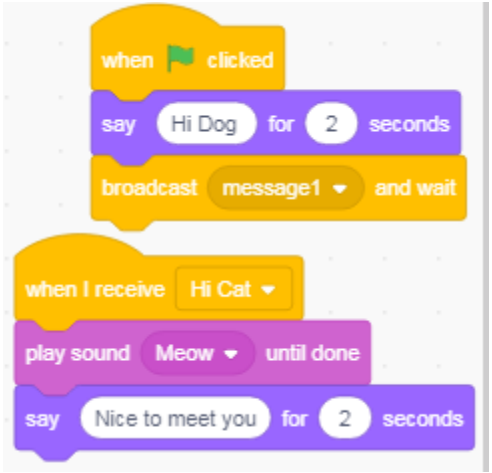
33. Communication by sending a message

A Cat met with a Dog. The Cat said “Hi Dog”. After hearing this message, the Dog said “Hi Cat”.





Receiving this message from Dog, the Cat said “Nice to meet you”. Here we use Broadcast message1 and wait block. The second sprite is activated after receiving the when I receive message1 command. You can create **new message** by giving it a name. This one will automatically appear in the drop down list. Also apply sound to make the conversation more attractive.



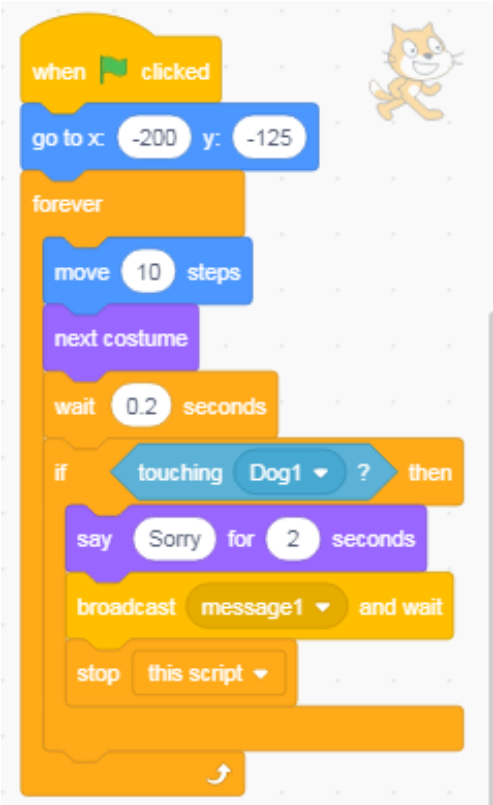


● Change sprites. Bring different sounds from Sound stock. Elaborate the conversation. Create more new messages with new names. Also imagine some funny dialogue.

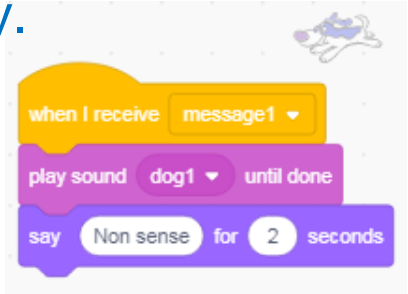
Do-it-yourself

Do another thing. Instead of say callouts, use play sound until done and then broadcast this sound as message1. When the other sprite will hear this sound it will do some acting as you order it. Continue this activity with more and more animals. Even you can **choose a sound** or apply recorded sound.

34. Touching Behavior



The Cat was roaming and suddenly knocked by a sitting Dog. Cat said "Sorry". The dog barked and passed a comment "Non sense". Here we use touching Dog1 block and broadcast a message to another sprite. After receiving this signal, the second sprite acts accordingly.



● Instead of touching Dog1, select mouse pointer and edge and watch what happens. Keep the mouse pointer anywhere on the way of the moving Cat. Create new message. Change dialogues. Make the Cat hidden at last moment.



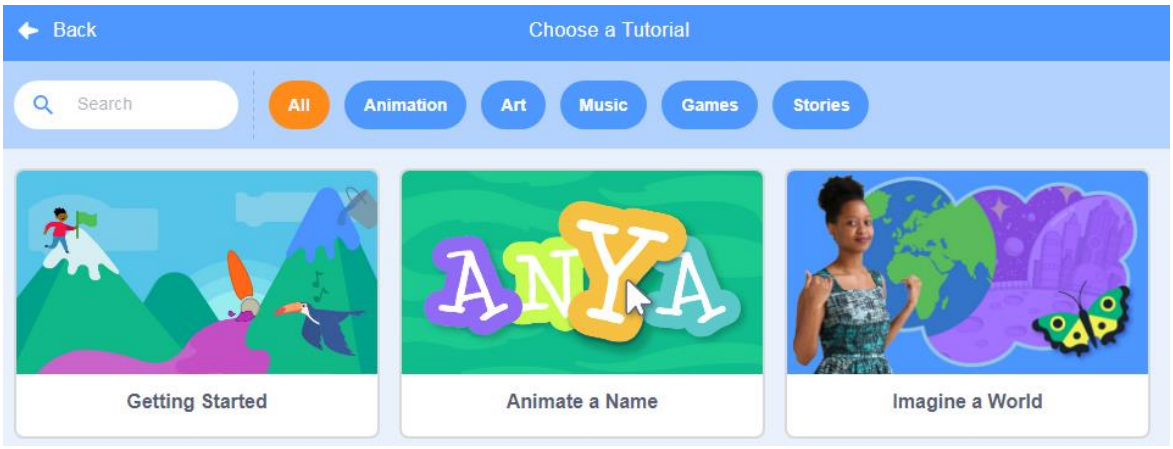
Select the Balloon1 and the Chick. The Balloon will glide 1 sec to random position for ever. But when it will be touched by the Chick, It will be vanished with a pop sound. Use If touching Chick then block. Place the Chick anywhere on the stage. Keep show at the top.





Projects

This is the final part of our learning. Go to *scratch.mit.edu* and study the creative examples sincerely. Imagine something innovative and start developing your idea.



You can modify characters in the paint editor, add your own voice and sound, even insert photo of yourself -- then use the programming blocks to make your characters come to life. Try the last three projects yourself.

Exercises



- Our Cat is ready to solve your problem. You want to deposit some money in a Bank. Tell it the Principal, Rate of Interest provided by the bank and for how many years. It will display the total interest you get.

Hint : Interest paid = P*R*T/100. Assign data into A, B, C. Then A*B*C into D and D/100 into **my variable**. Use say and join blocks to display message.

- Accept the adjoining sides of the right angle of a right-angled triangle. Then calculate its hypotenuse and show it to user.

Hint : If input is A and B, assign the value of A*A into C and B*B into D. Then use the square root operator with C+D.

- From the above program, find the area and perimeter of the right-angled triangle.

Hint : Area = $\frac{1}{2}$ x Base x Perpendicular

- Accept the temperature of a patient in Celsius scale and convert into Fahrenheit. If the temperature is more than 98^{o}F, display : “Fever” ; otherwise “Normal”.

Hint : You know the formula : F = (9*C/5 + 32). If the input is A, then assign A/5 into B, B*9 into C, C+32 into D. D is the answer. Use if, else block to display message.
[Yes, computer also follows BODMAS rule just like you do.]

- Accept the sides of a triangle from user. If all sides are equal, display : “It is an equilateral triangle”. Otherwise : “It is either an Isosceles or a Scalene triangle”.

Hint : Let the numbers are assigned into A, B and C respectively. Take an and operator and insert two equals to operators in its two holes in either side.

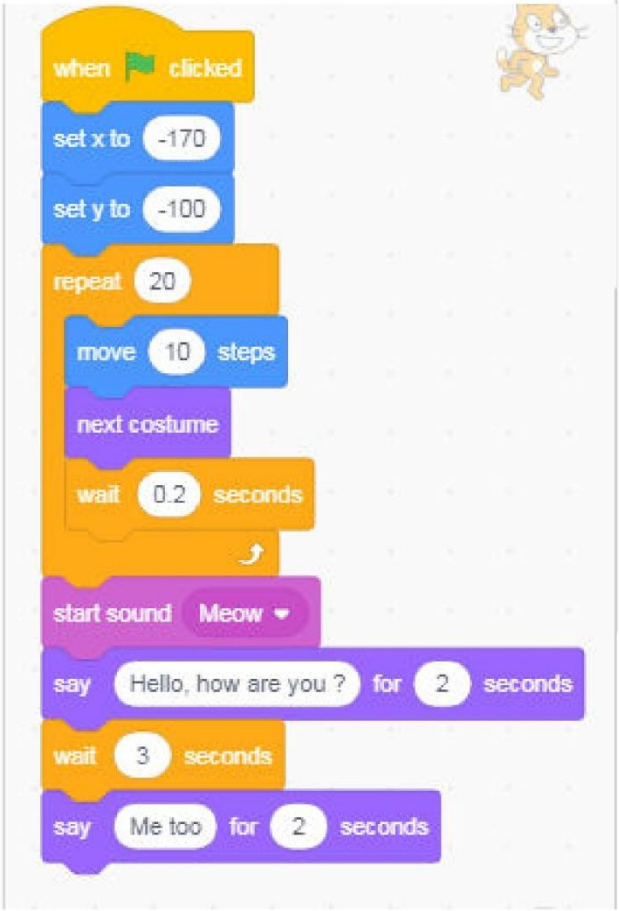


Story of a cat and penguin

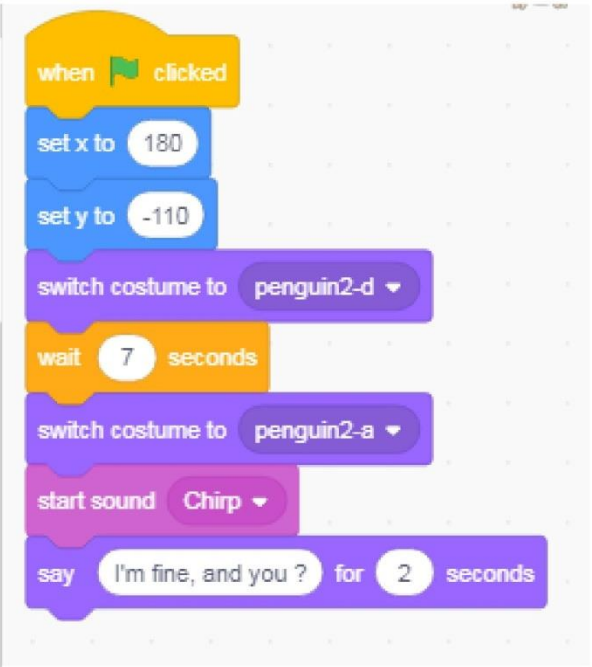
A cat went out for a morning walk and met with a penguin. With a mew sound, the cat asked, “Hello, how are you ?” The penguin turned at him and popped chirp sound, replied, “I’m fine. And you ?” The cat said, “me, too”.



Cat :



Penguin :



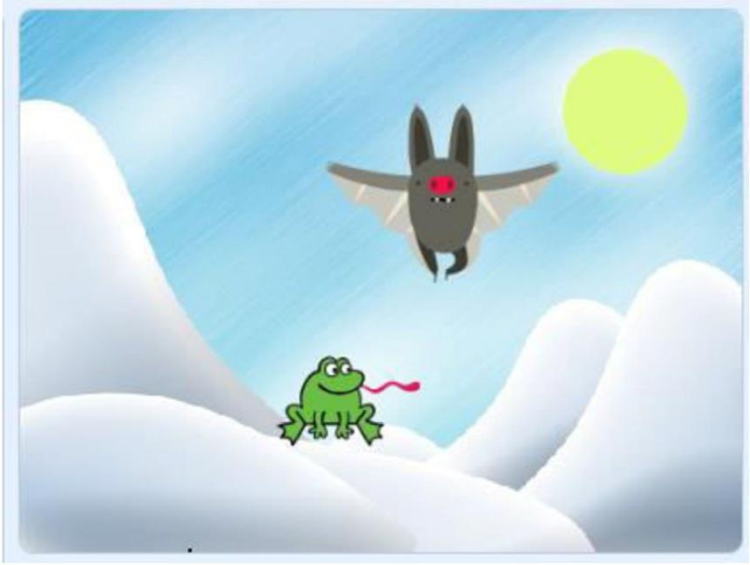
Note :

Select “Jungle” backdrop.

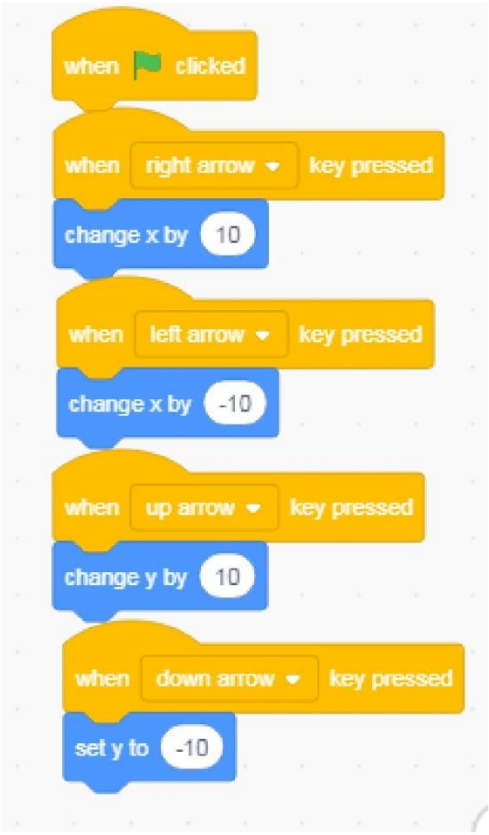
Increase the size of cat to 150%.

Save the frog Game

A frog is sitting idly. A bat is flying around the frog to catch it. You are trying to protect the frog by moving it left, right, upward and downward by pressing arrow keys. When the bat will catch the frog, the game will be over.



Frog :



Bat :



Note :

Select “Slopes” backdrop.

Drag the frog to its initial position.

Butterfly Catching Game

Seven butterflies are flying over flowers. You have to catch as many butterflies as you can within 60 seconds by clicking mouse. When you click, a sound will pop and the sprite will disappear. Variable will show you the number of butterflies you caught.





Note :

Select “Flowers” backdrop.

Activate the My Variable check box.

After creating code for one sprite, simply duplicate the same by right clicking over the sprite icon.
You may increase or decrease the number of butterflies.