

CS4HS
ECS : Scratch Programming
Summer 2017

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Unit 4 : Introduction to Programming

- ECS pedagogical approach overview
- Getting Started with Scratch
- Dialogues between sprites
- Methods of moving sprites
- Event-driven programming
- Broadcasting through role play
- Variables

Unit 4 : Intro. to Programming (Con't)

- Conditionals
 - The if block
- And, Or and randomness
- Creating a timer
- Games
 - Monkey Game
 - Pinball Game

ECS Lesson Strategies

- Journaling
- KWL chart (Know, Want to Learn, Learned)
- Collaborative work (we will work in pairs)
- Charting
- Mapping

Journal Entry

How do you think programs like Microsoft Word, Internet Explorer and Windows are made ?

KWL Chart

Know	Want to learn	Learned

What is Scratch ?

- “Scratch is a programming language and online community where you can create your own interactive stories, games, and animations -- and share your creations with others around the world.

(<https://scratch.mit.edu/>)

What is Scratch ? (con't.)

- Young people learn to think creatively, reason systematically, and work collaboratively when designing and programming Scratch projects.

Where to access Scratch

- **Scratch is a free program that can accessed online**
- **Scratch can also be downloaded**

Do either at : <https://scratch.mit.edu/>

How to access Scratch online

➤ Create an account :

[Create](#)[Explore](#)[Discuss](#)[About](#)[Help](#)[Join Scratch](#)[Sign in](#)

Create stories, games, and animations
Share with others around the world



A creative learning community with **23,508,508** projects shared

Animations

Two kinds of animations:

➤ **Movie**

- Passive user watches the animation

➤ **Interactive**

- Active user clicks on mouse, types a key on keyboard ...
- Actions of user are called **events**

A simple story

🌍 A dancer would like to show off his skills by jumping up and dancing in mid-air. When he lands back on the ground he asks “Whoa, how was that ?”

- Nouns are characters/objects (sprites)
- Verbs are actions/methods (scripts)

Step 1: Designing a digital story

- 🌐 Determine the characters or objects needed in the story
- 🌐 How are objects going to interact ?
- 🌐 Determine the correct sequence of actions the objects must perform

Step 2 : Writing an Algorithm

Dancer moves up in mid-air

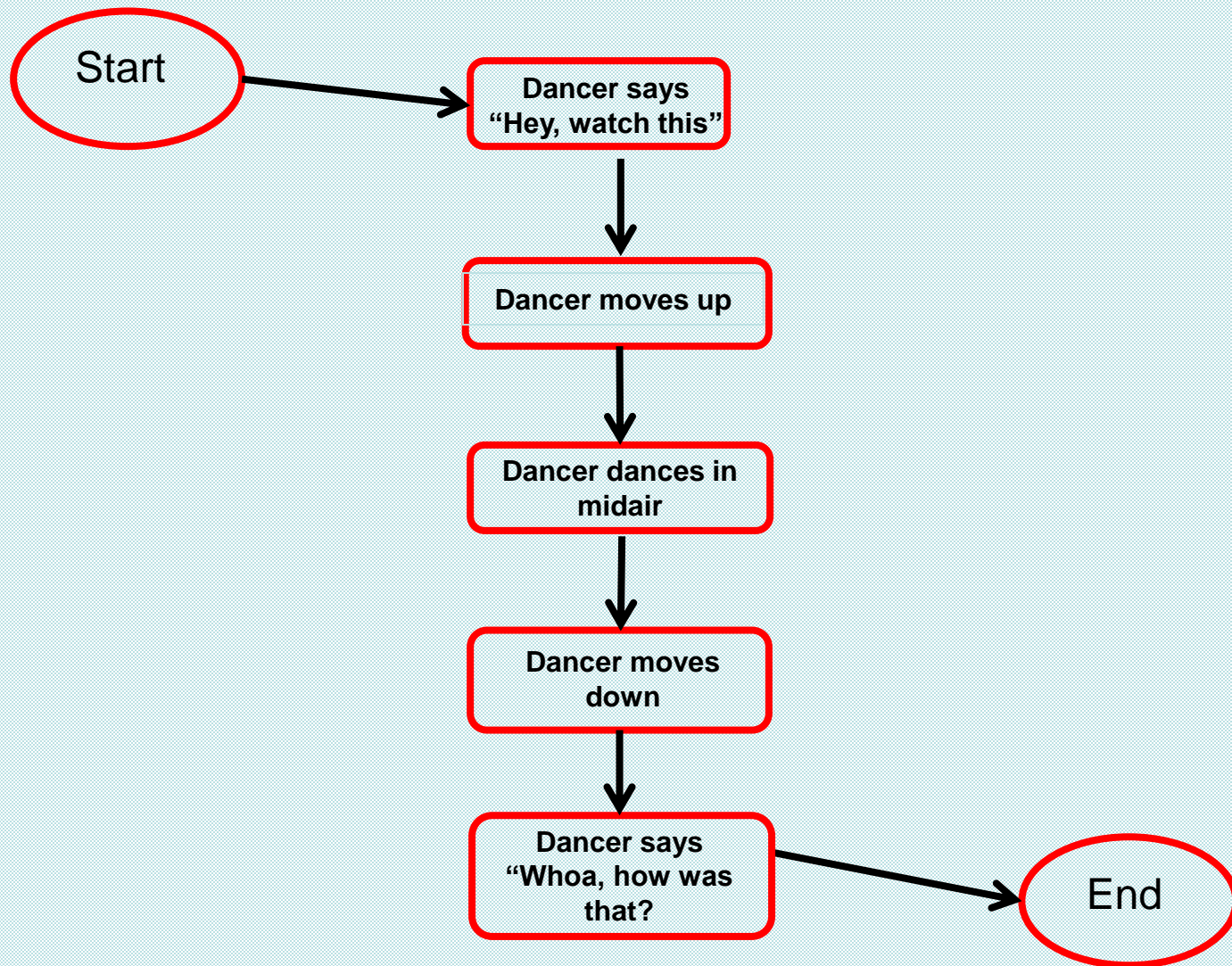
Dancer does a dance

Dancer moves down to ground

Dancer says “ Whoa,how was that ?”

This is also called pseudocode

Flowchart

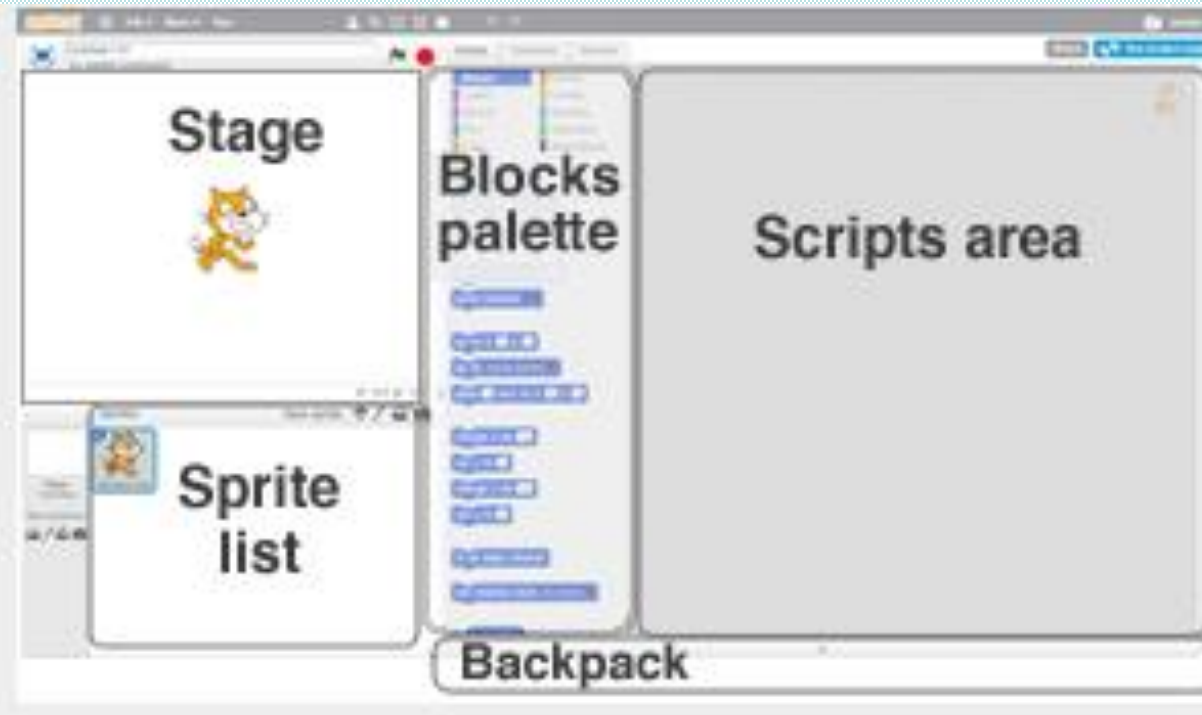


Step 3 : Translate algorithm

- The algorithm or pseudocode or flowchart needs to be translated into a Scratch program by using the Scratch script blocks.
- The script blocks are dragged into the “Scripts area”.

The Scratch Project Editor

Main areas of the Project editor :



The Scratch Project Editor

Scratch

File Edit Tips About

Project 1
by arbuticg (unshared)

Scripts Costumes Sounds

Motion Looks Sound Pen Data Events Control Sensing Operators More Blocks

when green flag clicked

switch costume to champ99-b

say Hey, watch this. for 1.5 secs

go to x: -12 y: -23

change y by 75

repeat 6

next costume

wait 0.2 secs

change y by -75

next costume

say Whoa, how was that? for 4 secs

play sound pop

play sound pop until done

stop all sounds

play drum 1 for 0.25 beats

rest for 0.25 beats

play note 60 for 0.5 beats

set instrument to 1

change volume by -10

set volume to 100 %

volume

change tempo by 20

set tempo to 60 bpm

tempo

Sprites

New sprite: [icon] [icon] [icon]

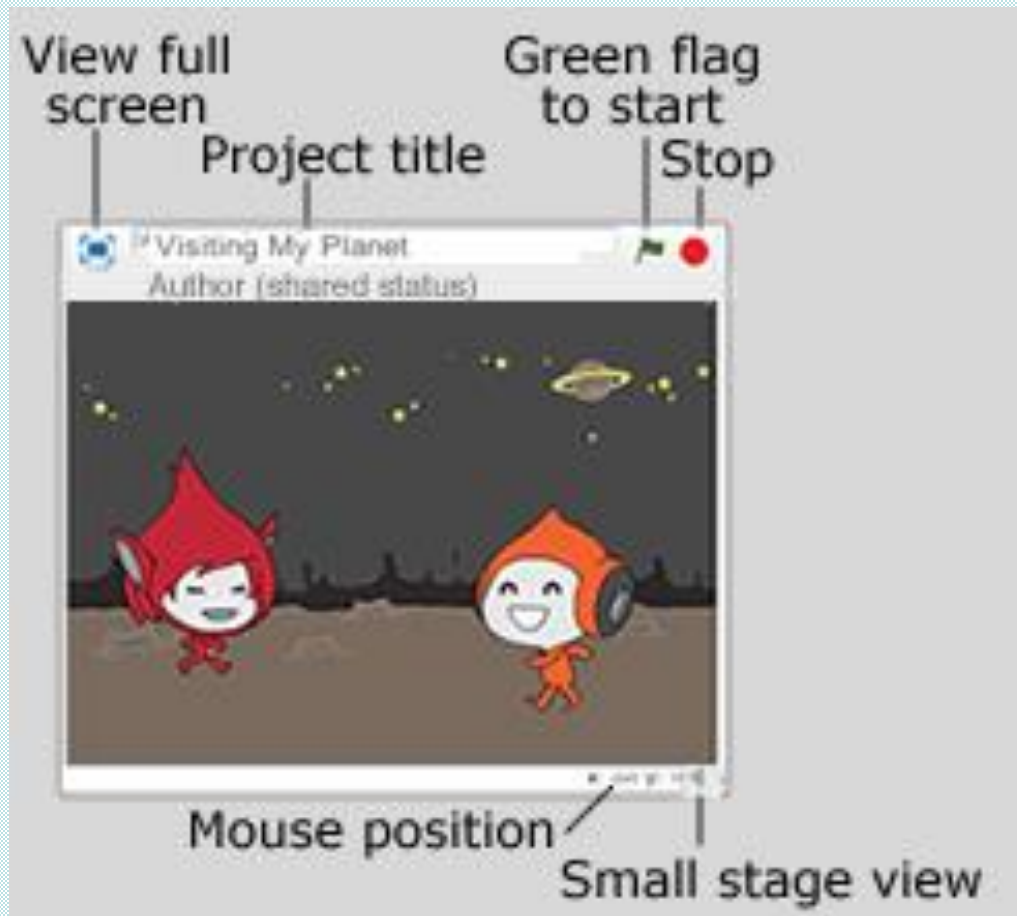
Stage 1 backdrop

New backdrop: [icon] [icon] [icon]

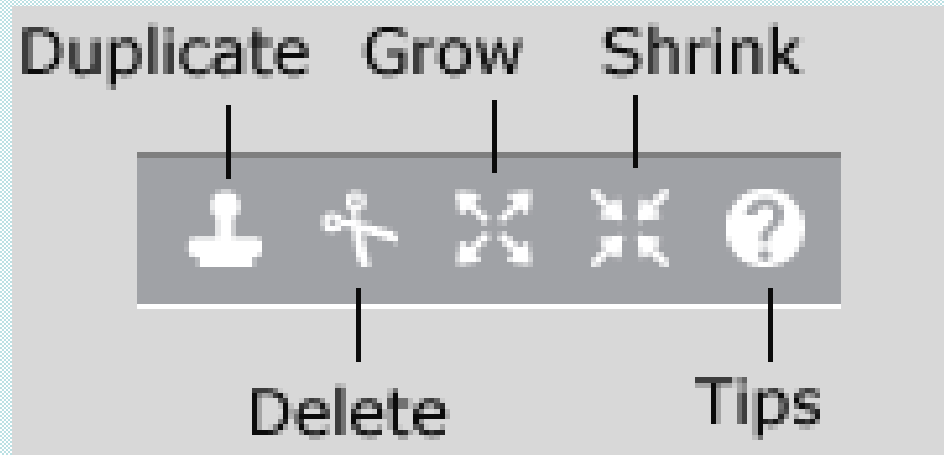
Champ99

X: 2 Y: 61

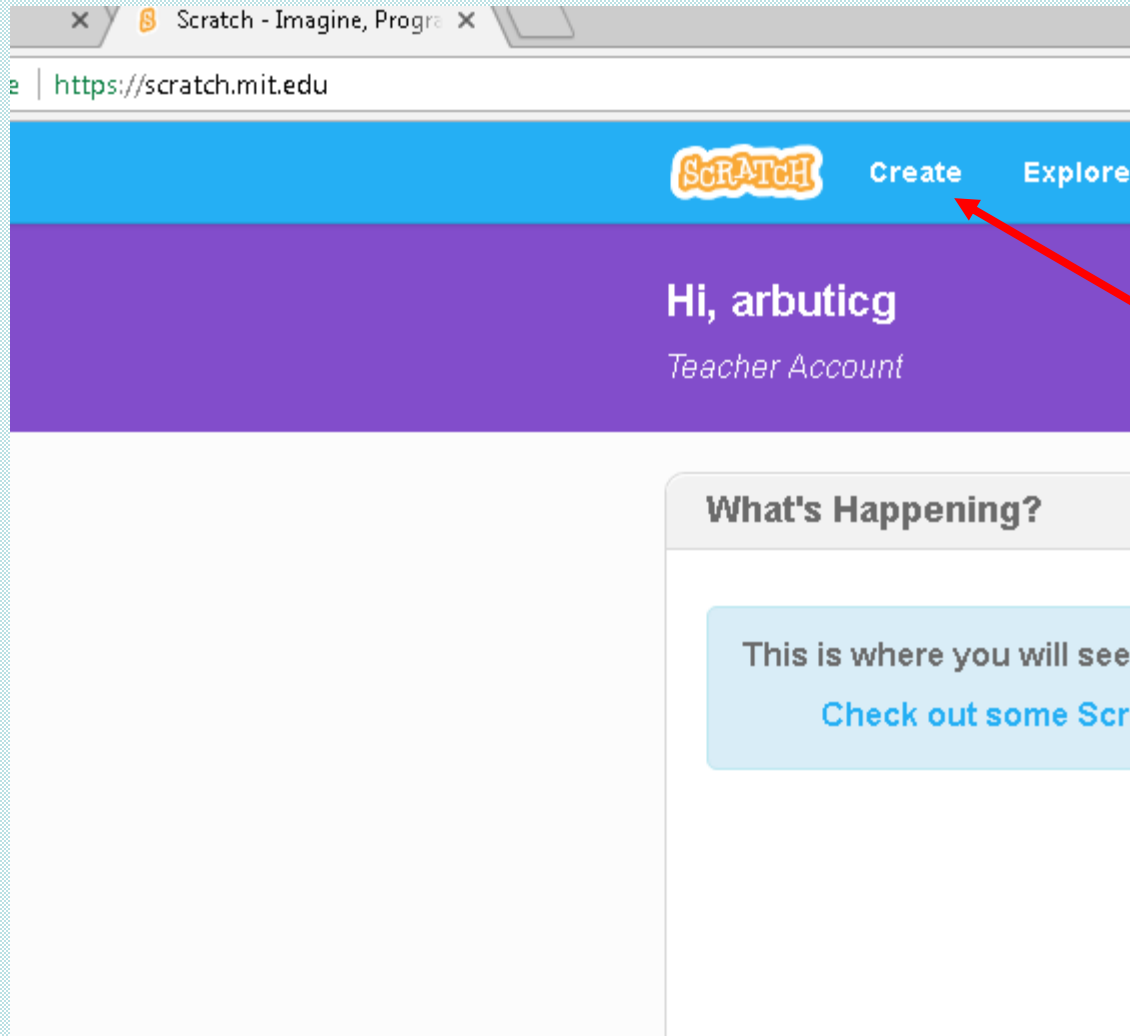
The Stage Area



The Curser Tools

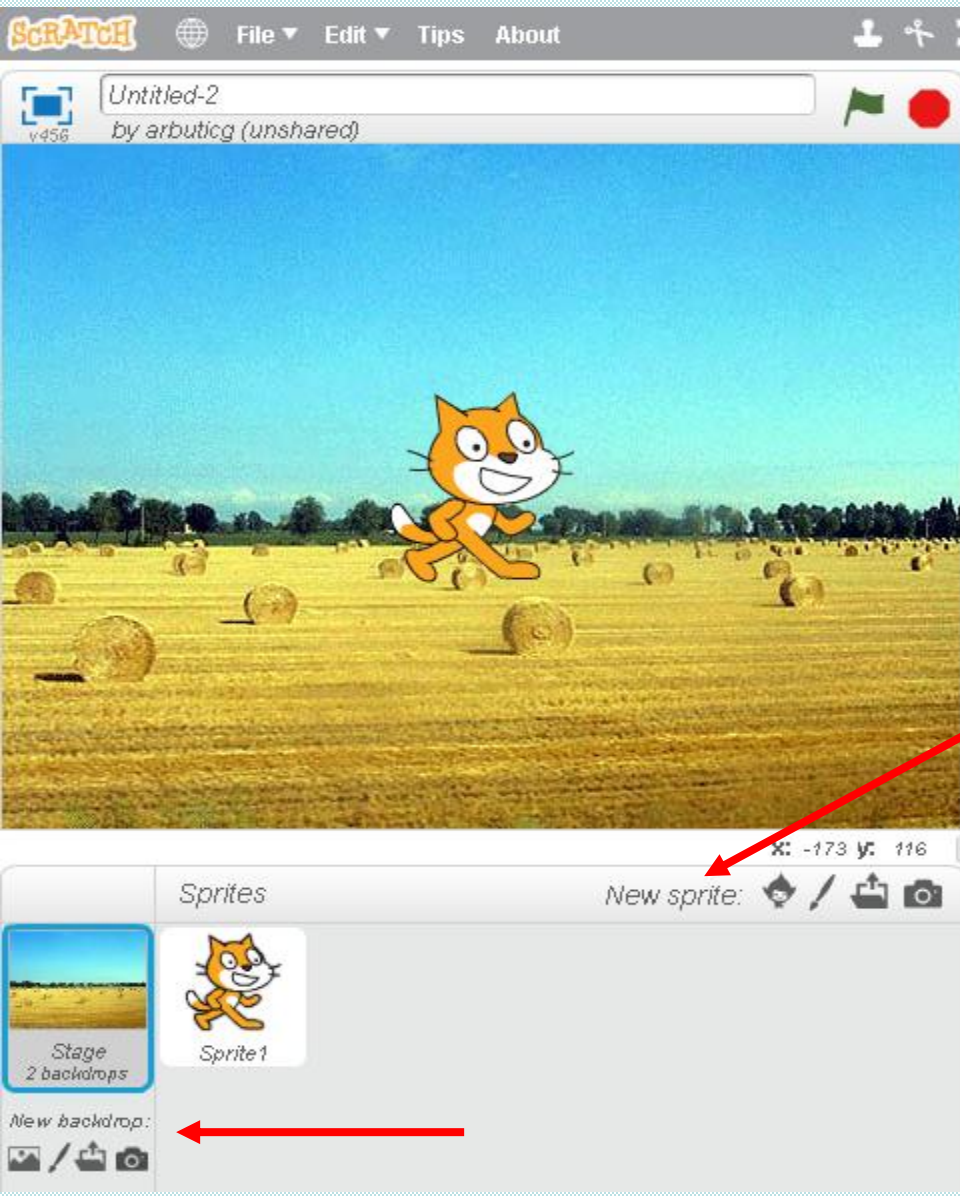


Getting Started



Chose Create

Adding sprites and changing backdrops



Sprites

➤ A “**sprite**” is :

An object in **Scratch** which performs actions controlled by scripts

➤ How is a sprite unique?

- has a name
- has properties:
 - costumes, width, height, color, location, size
- can perform scripts :
 - “scripts” blocks determine how sprites interact with each other and the backdrop

Demo: Saving a project

- Writing and testing an animation is an intense load on the computing system – a crash can occur.

➤ **Best solution:**

 **save your project every 15 minutes**

 **(Or at least every half hour)**

 **also save to a backup system**

(for example, a thumb drive)

Another story

Create an underwater scene where a fish and a crab see a scubadiver swim by. The creatures don't know what to make of the human and the fish says "Hmm...that's a funny looking fish". The crab agrees and says "For sure, goofy looking". As the scubadiver leaves, the fish is relieved and says "Good, it's gone".

Algorithm/ pseudocode:

- Scubadiver starts swimming across the screen
- Fish says “Hmm...that’s a funny looking fish”
- Crab says “For sure, goofy looking”
- Scubadiver swims off screen
- Fish says “Good, it’s gone”

Create initial scene

- Three sprites – Fish1, Crab and Diver2 from the Underwater Theme Library
- Use mouse to position scubadiver on left and the fish and crab along the bottom.
- Choose an appropriate backdrop from the Underwater Backdrop library

Dialogues

Note that in the underwater example, the fish and crab were saying things to each other. This is known as a 'dialogue'

Why did the scripts contain `wait _ secs` blocks ?

Methods to Move Sprites

Under the Motion script :

➤ Move block



➤ 'Go to' block



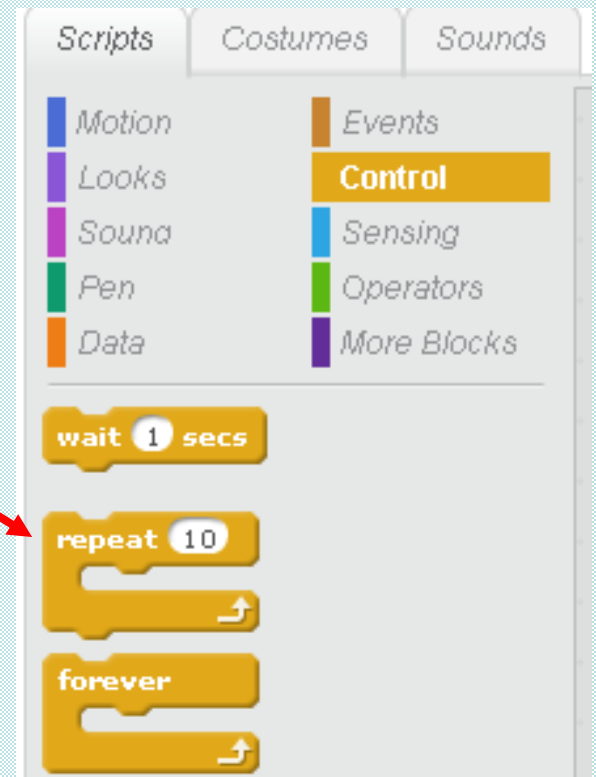
➤ Glide block



Repetition

- In many kinds of animations, especially simulations and games, some actions happen again and again.

- A repeat block is a way to write repetitive code



Repetition

Script from baseball.sp :



Hands-On Assignment

- ❖ Do assignment 1

KWL Chart


Know	Want to learn	Learned

Hands-On Assignment

- ❖ Do assignment 2

Concepts seen in first projects

- Script **blocks** may have **arguments**

 Examples: for the **say** block, the arguments we used are what is said and for how long :



Question : What argument did the **move** block use ?

- Scripts for multiple sprites can begin with :



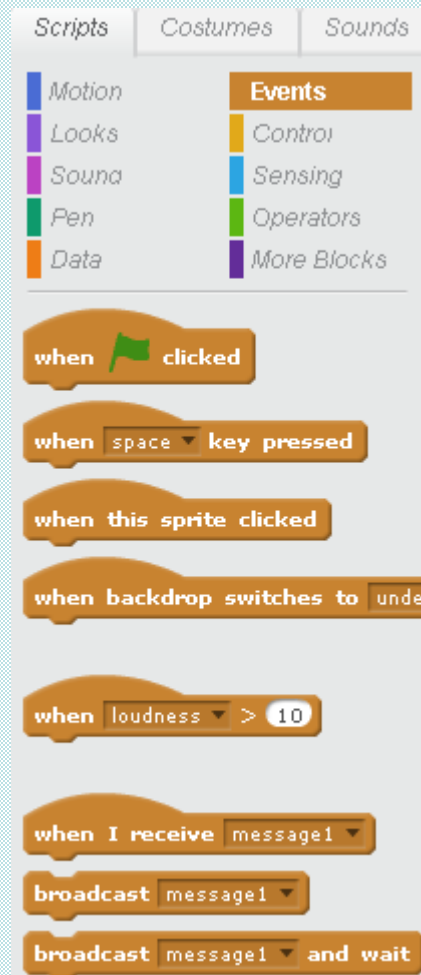
Testing

- 🌐 An important step in creating a program is to run it – to be sure it does what you expect it to do.
- 🌐 We recommend that you use an **incremental development** process:
 - 💡 drag a few blocks and then run it
 - 💡 drag a few more blocks and run it
 - 💡 drag a few more blocks and run it...
- 🎥 This process allows you to find any problems and fix them as you go along.

Event Based Programming

- **Event based programming** is programming in which the code is based on events such as the mouse moving or a key being pressed.
- Scripts are triggered when the event occurs

Event Blocks



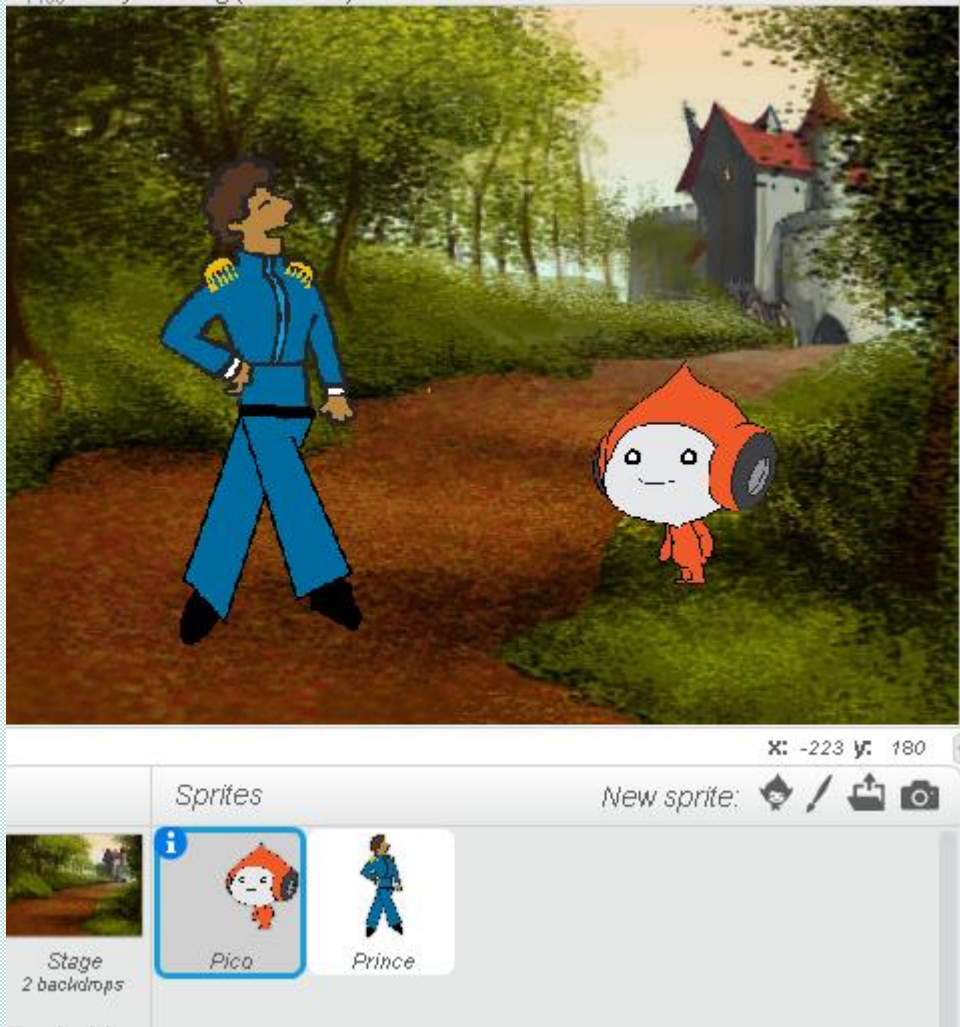
Hands-On Assignment

- ❖ Do assignment 3

Broadcasting

- **Broadcasts** are similar to events which trigger specific scripts.
- Sent with Broadcast () and Broadcast () And Wait, and are received by the hat block When I Receive ().
- Useful in games and animations.

Broadcasting Example 1

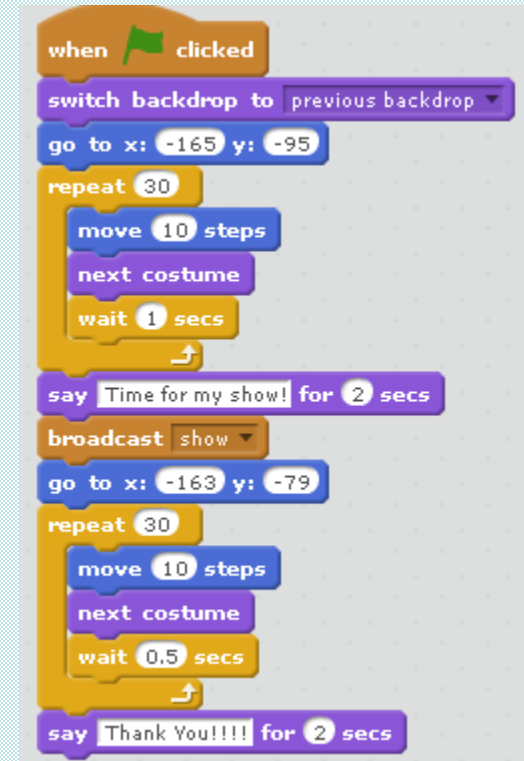
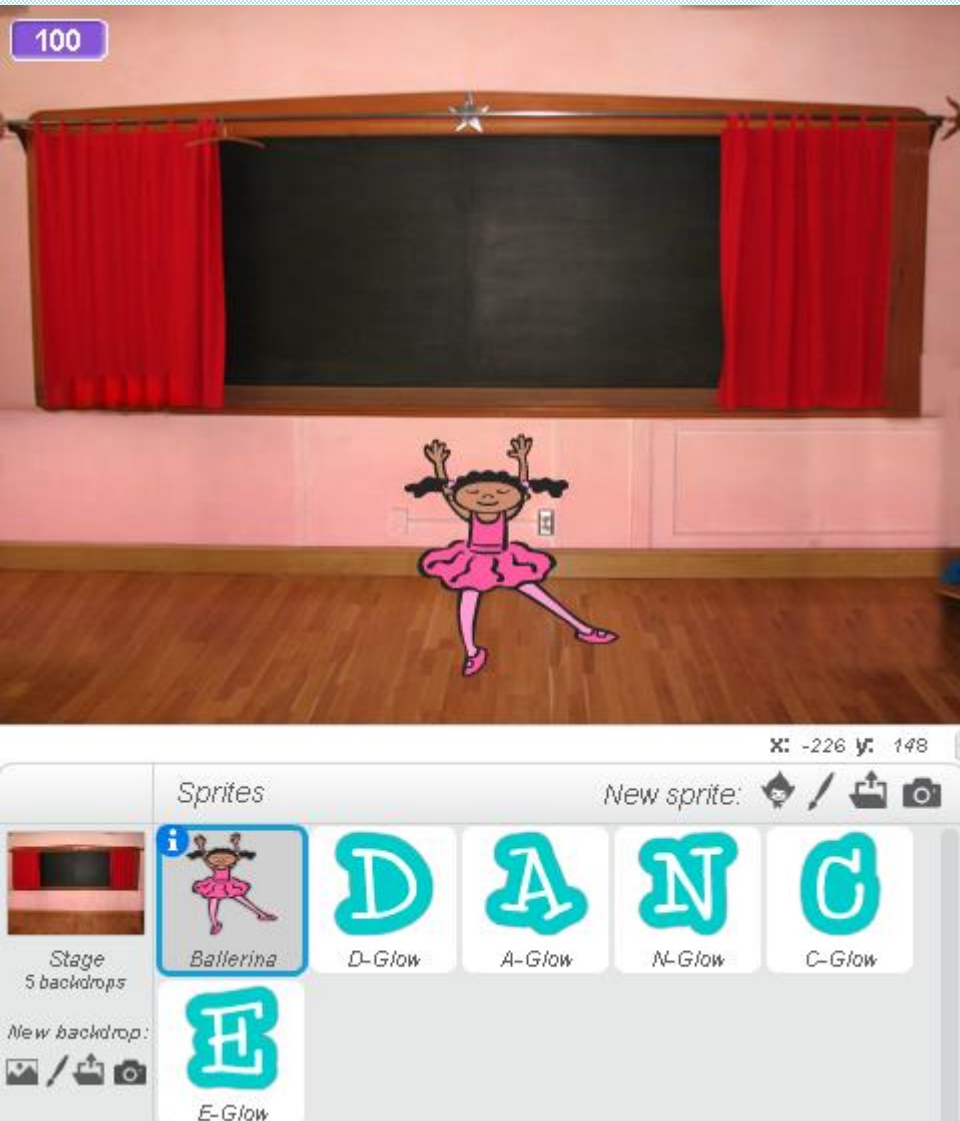


```
when green flag clicked
switch costume to prince
broadcast message1
go to x: -94 y: -10
think I am the greatest! for 2 secs
repeat 5
  wait 0.4 secs
  move 10 steps
  switch costume to prince2
  wait 0.4 secs
  move 10 steps
  switch costume to prince
wait 1 secs
broadcast ha
```

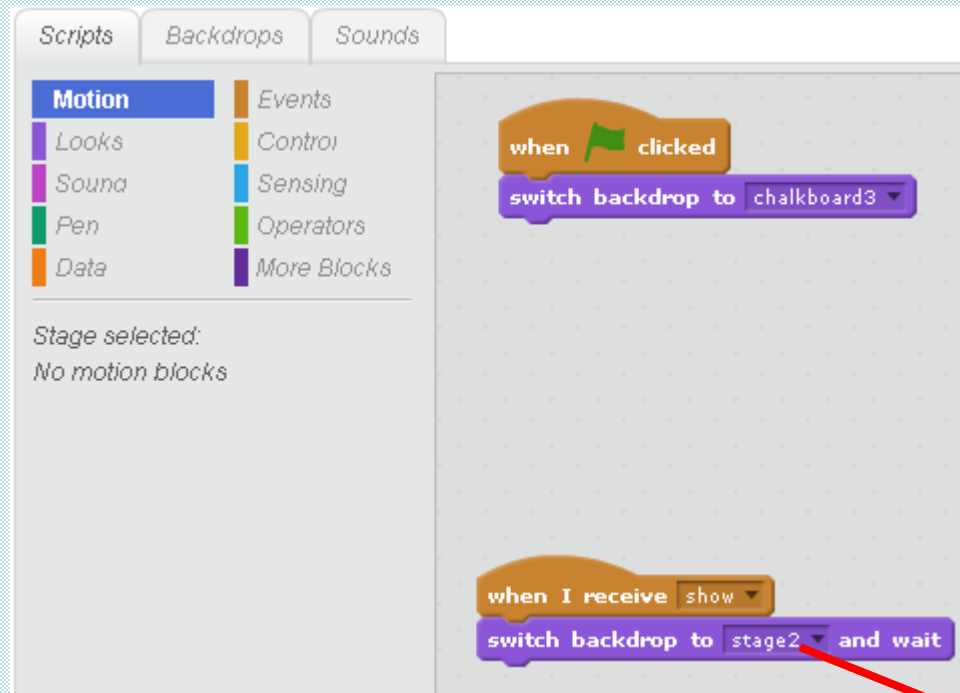
```
when I receive ha
wait 1 secs
say Hello! Who are you? for 2 secs
wait 0.5 secs
broadcast intro and wait
```

Pico

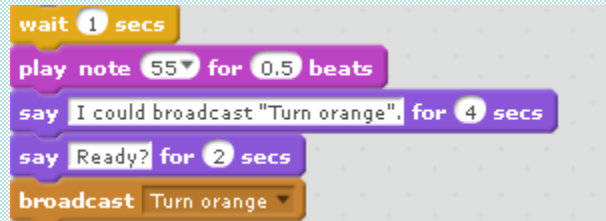
Broadcasting Example 2



Broadcasting Example 2 (con't)



Broadcasting Example 3



Hands-On Assignment

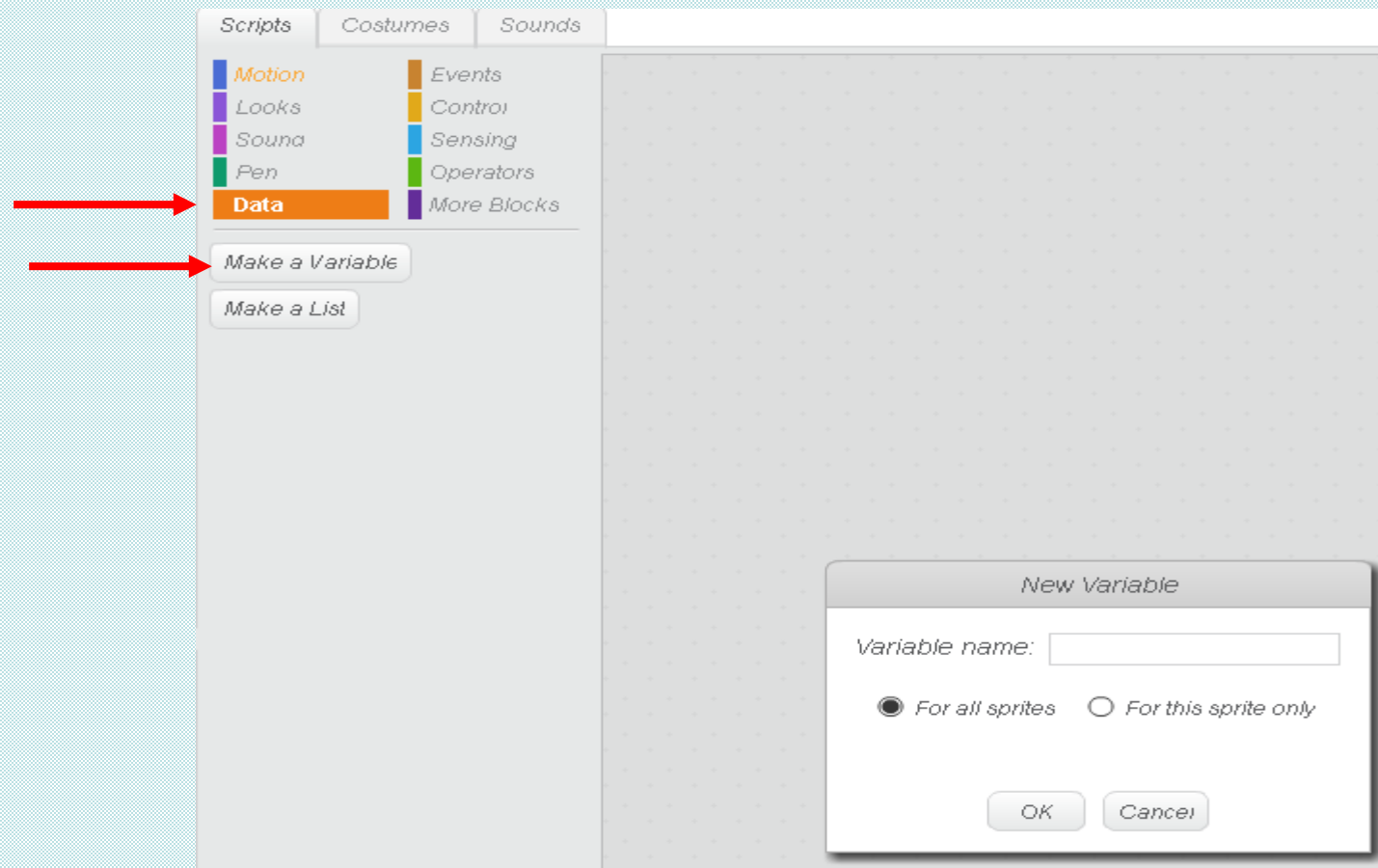
- ❖ Do assignment 4

Variables

- A variable is a changeable value recorded in Scratch's memory.
- Variables can only hold one value at a time, unlike lists
- These values can be either numbers or strings — any text.

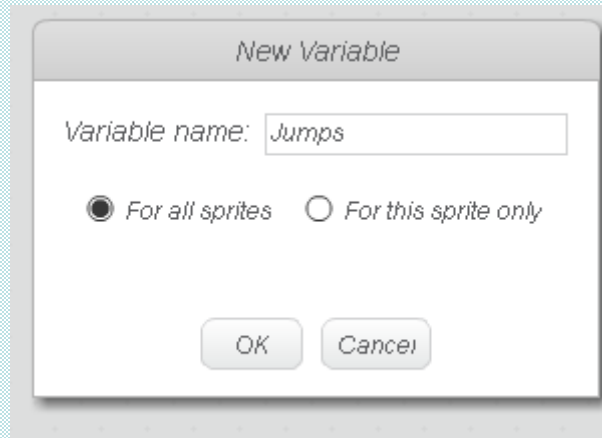
Creating a Variable in Scratch

- Go to the Data Block and click on Make a Variable :

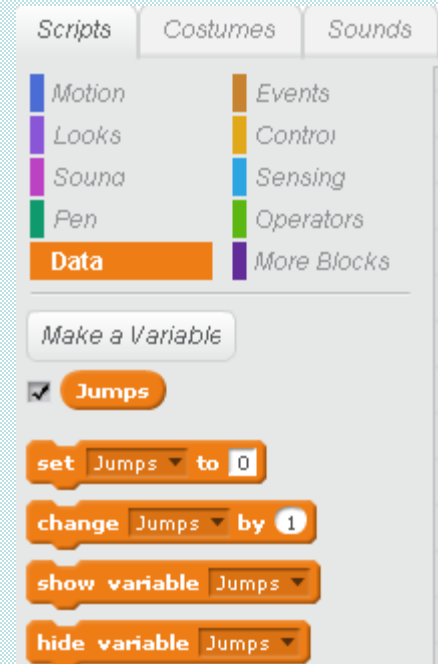


Creating a Variable in Scratch

- Provide a name for the variable :



- Click ok and see :



Variable Example

Scratch

File Edit Tips About

variable example.sb
by arbuticg (unshared)

Good Nutrition Points 0

Click on food to eat it.

when this sprite clicked
change Good Nutrition Points by 2

Scripts
Motion Looks Sound Pen Data Events Control Sensing Operators More Blocks

Make a Variable

Good Nutrition Points

set Good Nutrition Points to 0

change Good Nutrition Points by

show variable Good Nutrition Points

hide variable Good Nutrition Points

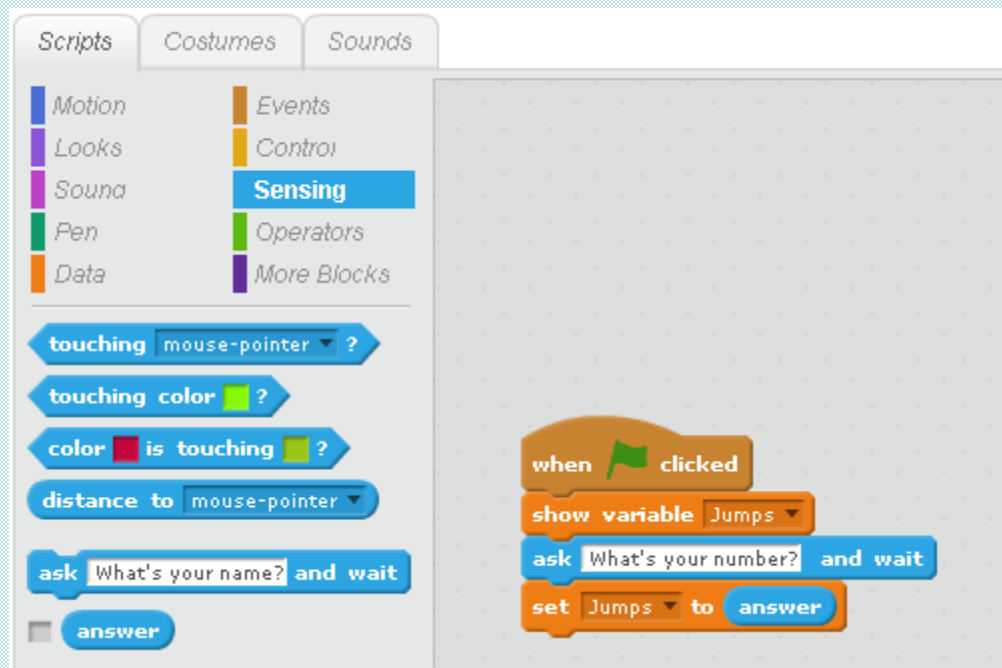
Make a List

Sprites
New sprite: Sprite2 Sprite4 Fruit Platter Donut Cake

Stage
1 backdrop

User input

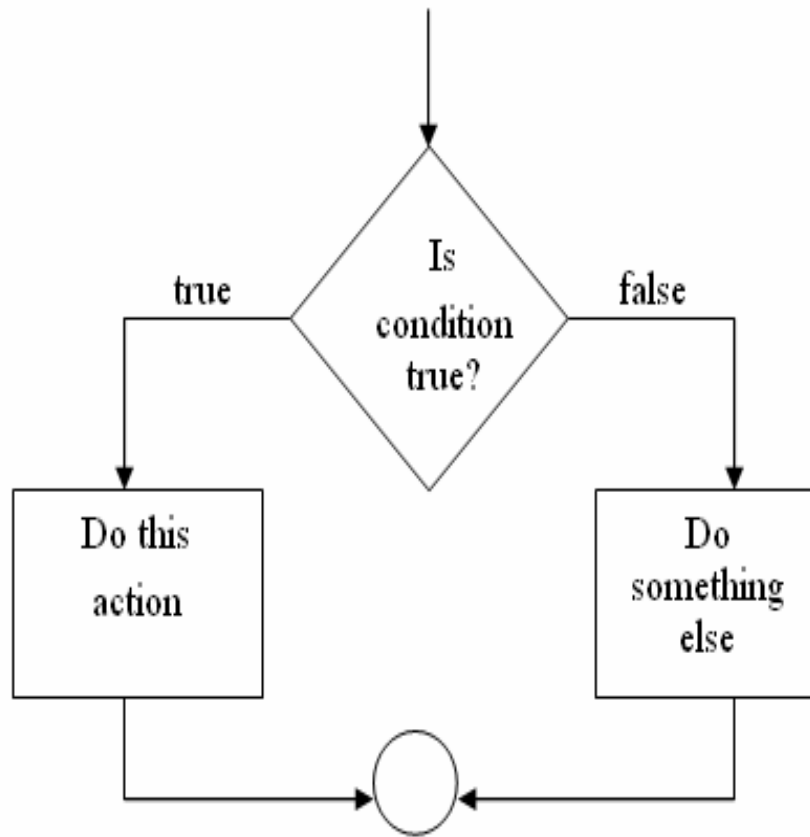
- Use of the **answer** and **ask** and **wait** blocks :



Thinking About More Advanced Projects

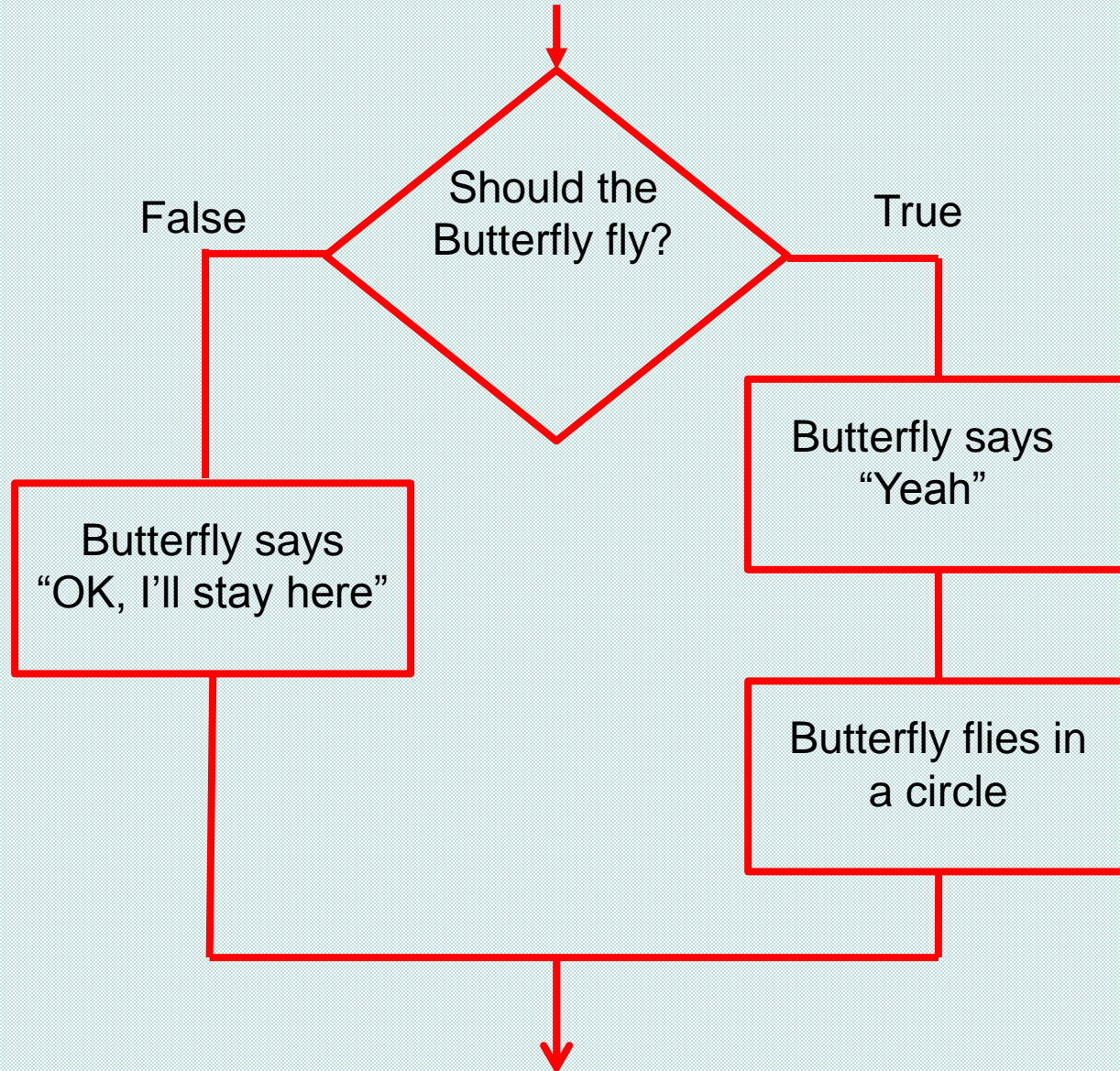
- To build more advanced projects, you will need to write code that involves **conditionals**
- We control the execution of the animation with the **if/else** structure and logical expressions

If/Else

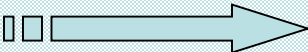



In Scratch, a logical expression is used as the condition in an ***If/Else*** control structure.

If/Else



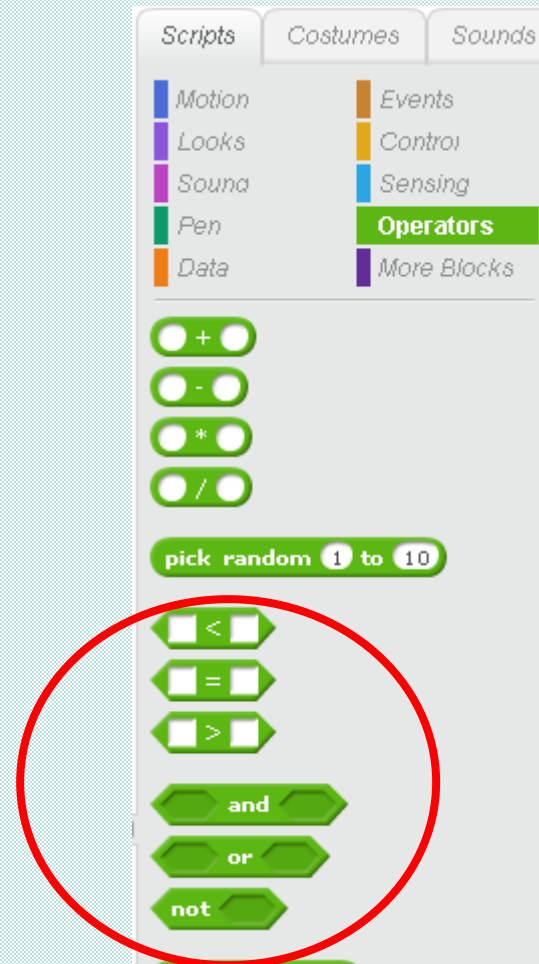
Logical Expressions

- A **decision** is made based on current **conditions**
- A condition is checked in a **logical expression** that evaluates to *true* or *false* (Boolean) value
 - car on road  *true*
 - car over finish line  *false*

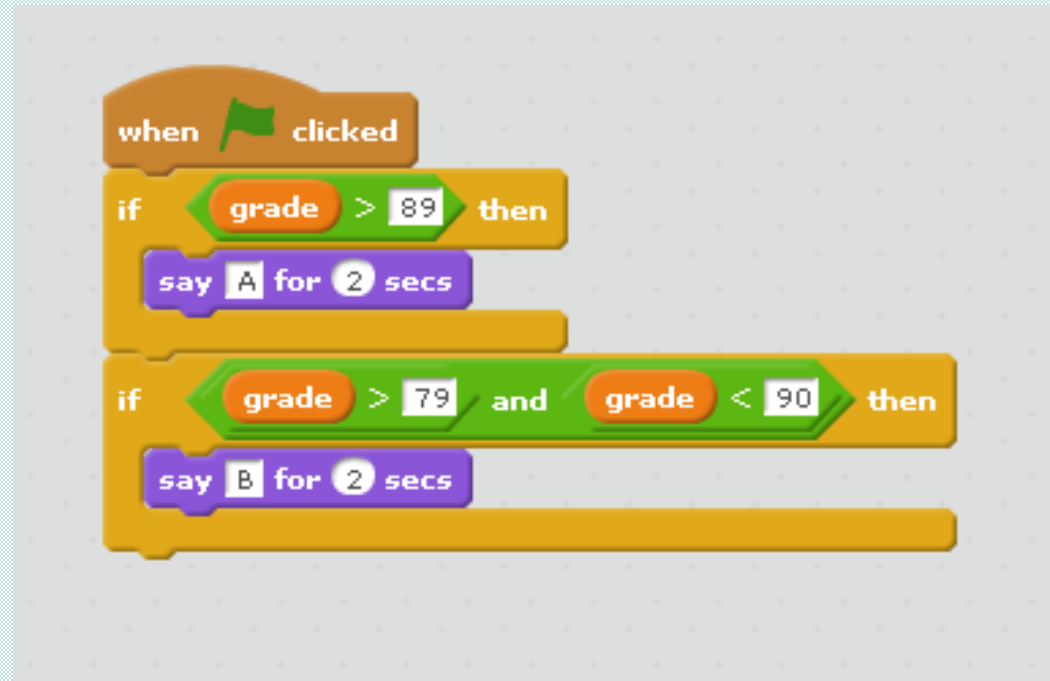
Logical Expressions (Con't)

- Logical expressions can be more complex
- Is your grade greater than 85 ?
- Are you a girl AND wearing blue ?
- Are you a boy OR wearing blue ?

Logical Expressions (Con't)





Logical Expressions Example



Hands-On Assignment

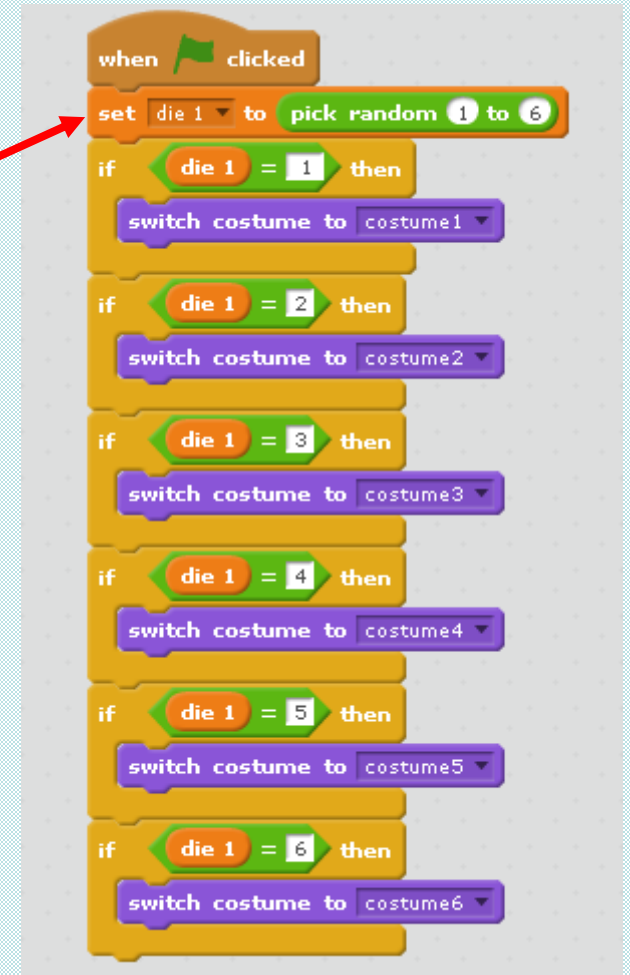
- ❖ Do assignment 5

Randomness

- **Randomness** can be defined as the lack of pattern or predictability in events
- Random numbers can be generated in Scratch using :
A green Scratch block with the text 'pick random' followed by a white circle containing the number '1', the word 'to', and another white circle containing the number '10'.
- It is found under A green Scratch category block with the word 'Operators' in white text.

Randomness Example




Sets the variable die 1 to a random number between 1 and 6



Hands-On Assignment

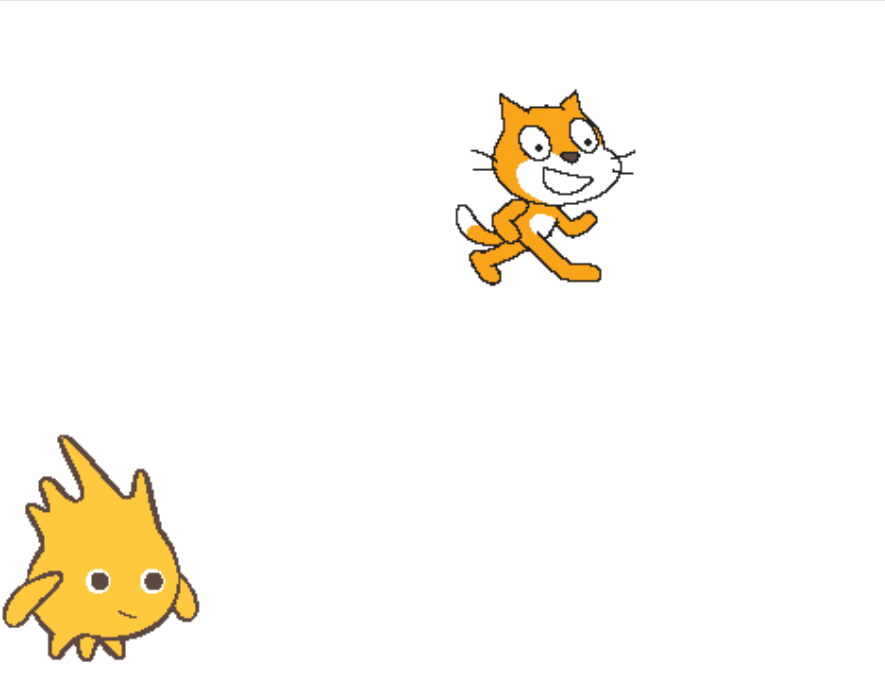
 Do assignment 6

The Timer (block)

- The  block is found under 
- The block starts at 0 when Scratch is launched and increases gradually; every second it will have increased by 1
- Usually used with the  block at beginning of project so it holds the correct time

Timer Example

Timer Example 1
by arbuticg (unshared)



Scripts

- Motion
- Looks
- Sound
- Pen
- Data
- Events
- Control
- Sensing**
- Operators
- More Blocks

touching mouse-pointer ?

touching color ?

color is touching ?

distance to mouse-pointer

ask What's your name? and wait

answer

key space pressed?

mouse down?

mouse x

mouse y

loudness

video motion on this sprite

when clicked

reset timer

wait until touching Gobo ?

say join Seconds to Gobo: timer for 4 secs


when clicked

forever

go to x: mouse x y: mouse y

Sprites

New sprite:

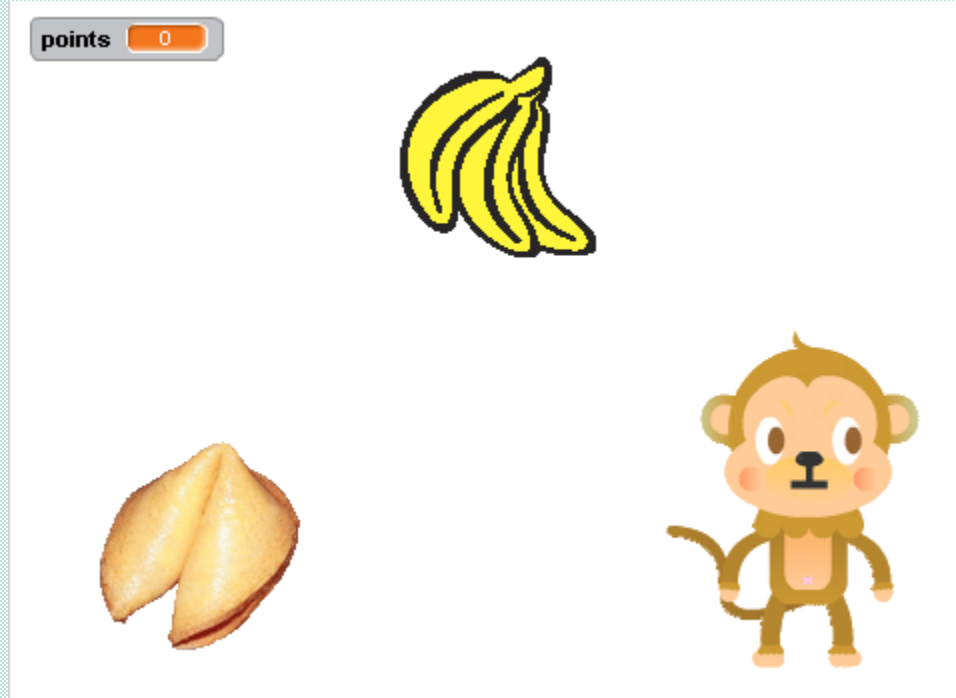


Hands-On Assignment

- 🌐 Do assignment 7 (Timer Project)

Monkey Game

- The objective is to move the monkey using the arrow keys until it touches a piece of food



Monkey Game (Con't)

Part of Monkey script :

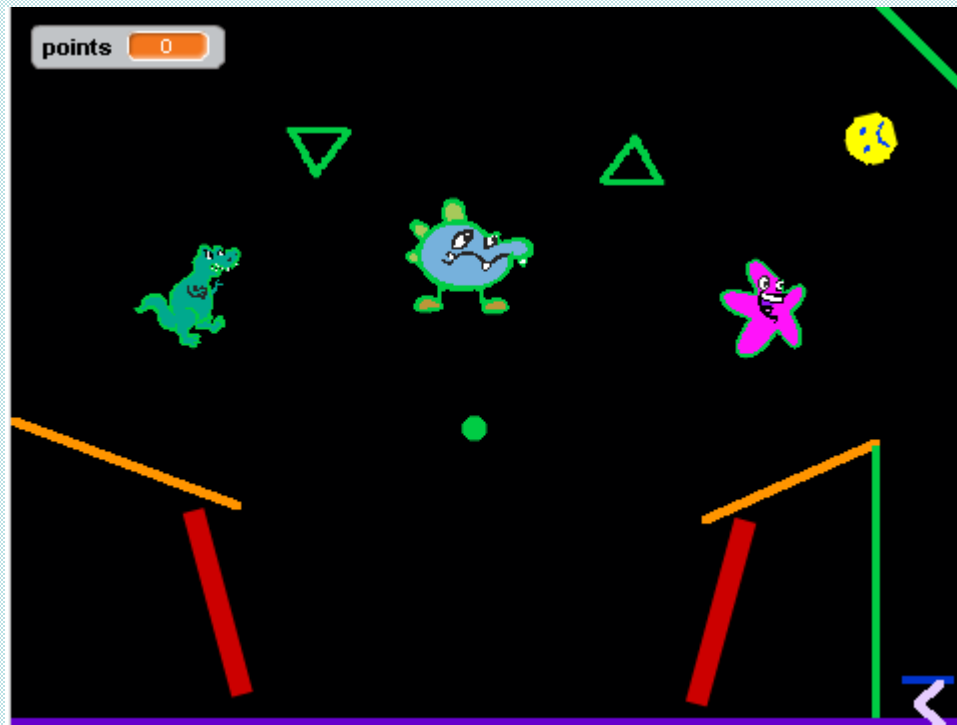


Bananas script :





Pinball Game

- Points are achieved when the yellow ball bounces off one of the sprites in the upper part of the screen.



Team Project

-  Working with your partner, develop a scratch project. In addition, prepare a lesson plan which can be used to teach the concepts illustrated in the project.
-  This will be presented to the CS4HS attendees on Friday