CODING WITH KIDS

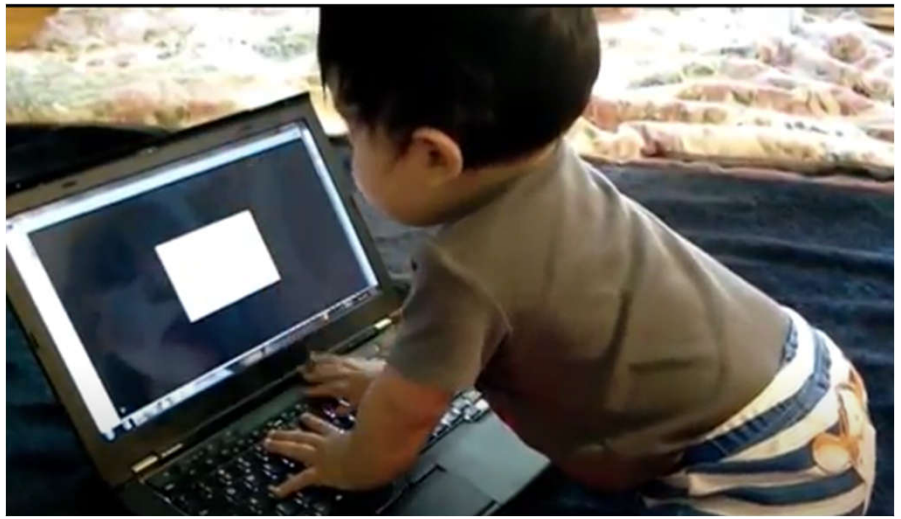
Fatemeh Jafargholi – July 20, 2022

ME

- Mom of 2 boys (8 and 6)
- Dev team lead at Moody's Analytics
- 14+ years coding with C++
  - A backend programmer

OBJECTIVES

- Encourage you to code with kids!
- Caution you about a few things
- Ideas on how to start

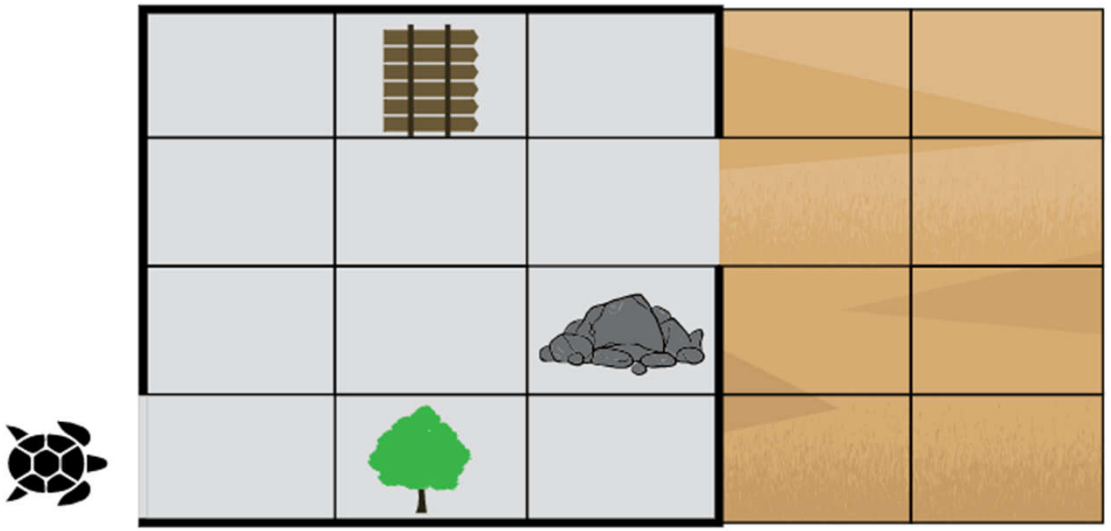


WHY BOTHER?

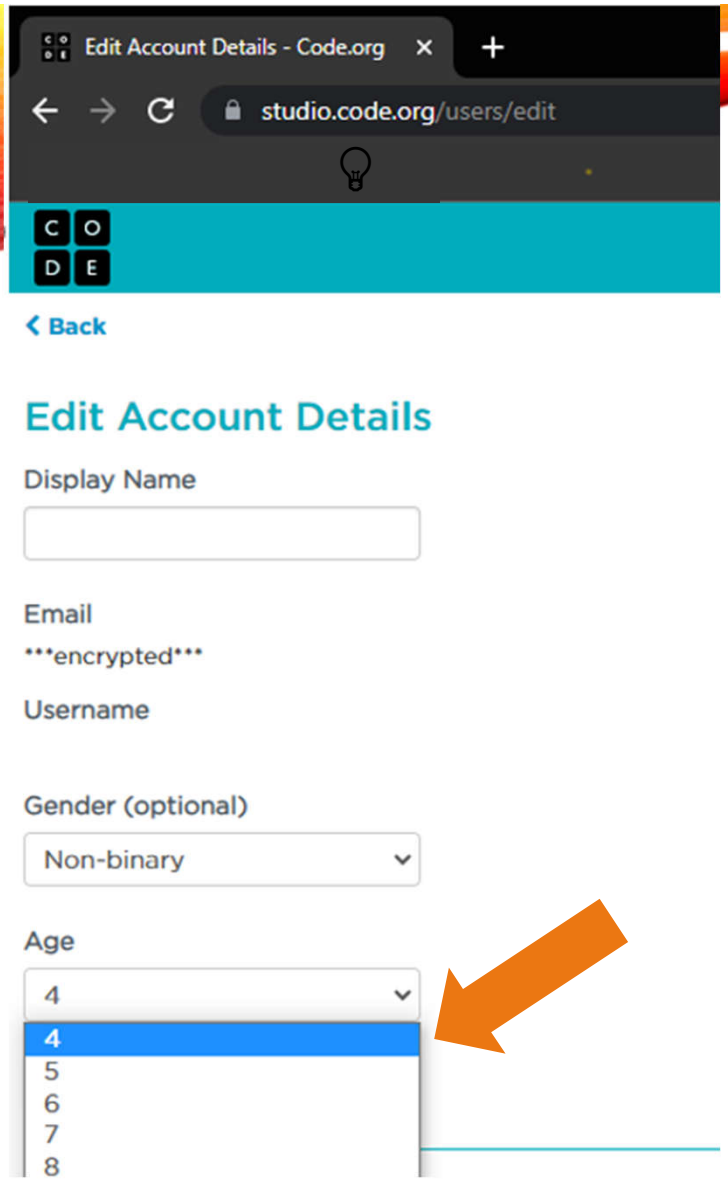
- Give them a tool to
  - Express themselves
  - Enable their creativity
- Build confidence
- Foster a logical mindset
- A bonding activity
- School support
  - Ontario starts coding in grade 1

Only if they enjoy it too.

GRADE 1 - ONTARIO



https://www.dcp.edu.gov.on.ca/en/curriculum/elementary-mathematics/grades/g1-math/strand-c/c3



HOW EARLY?

A 1.5 yro baby can handle a touch screen
A 3-year-old can play coding card games
A 4-year-old can do block-based coding
A 6-year-old can type (slow though)
A 9-year-old can code in python and find solutions online

All kids have ideas about what their app should do!

HOW TO START

Under 3

- Maybe too early!
- Could try “cause and effect” type of apps!

HOW TO START

3 and above

- Board games that require "writing" instructions (~$30)
- Build your own board game
  - A cardboard board
  - A bunch of direction/instruction cards
    - Individual instructions and a named group of instructions (make a function!)
  - Begin and Goal and Obstacles!

HOW TO START

6 and above

- Have them design a treasure hunt for you!

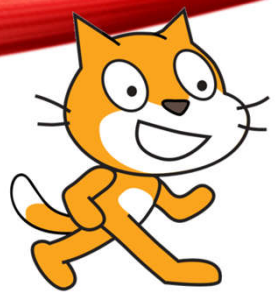
HOW TO START

7 and above

Eat<cup> (milk, 1)
Eat<cube> (cheese, 3)
Eat<count> (broccoli, 3)

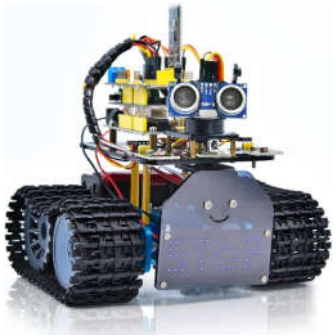
MayI<Minute>(playMore, 5)
MayI<Count> (eatChocolate, 2)
MayI<Count> (buyTickets, 4)

HOW TO START



4 and above

- Blocked-based coding



5 and above

- Robot toys that follow instructions
  - After they learn blocked-based coding
  - Though definitely NOT cheap

6 and above

- Arduino

ARDUINO

HOW TO START

```
for (i=1 to 5) {
   Spin (Mom)
}

While (My hand is up) {
   Spin (Mom)
}
```

Give them new terminology

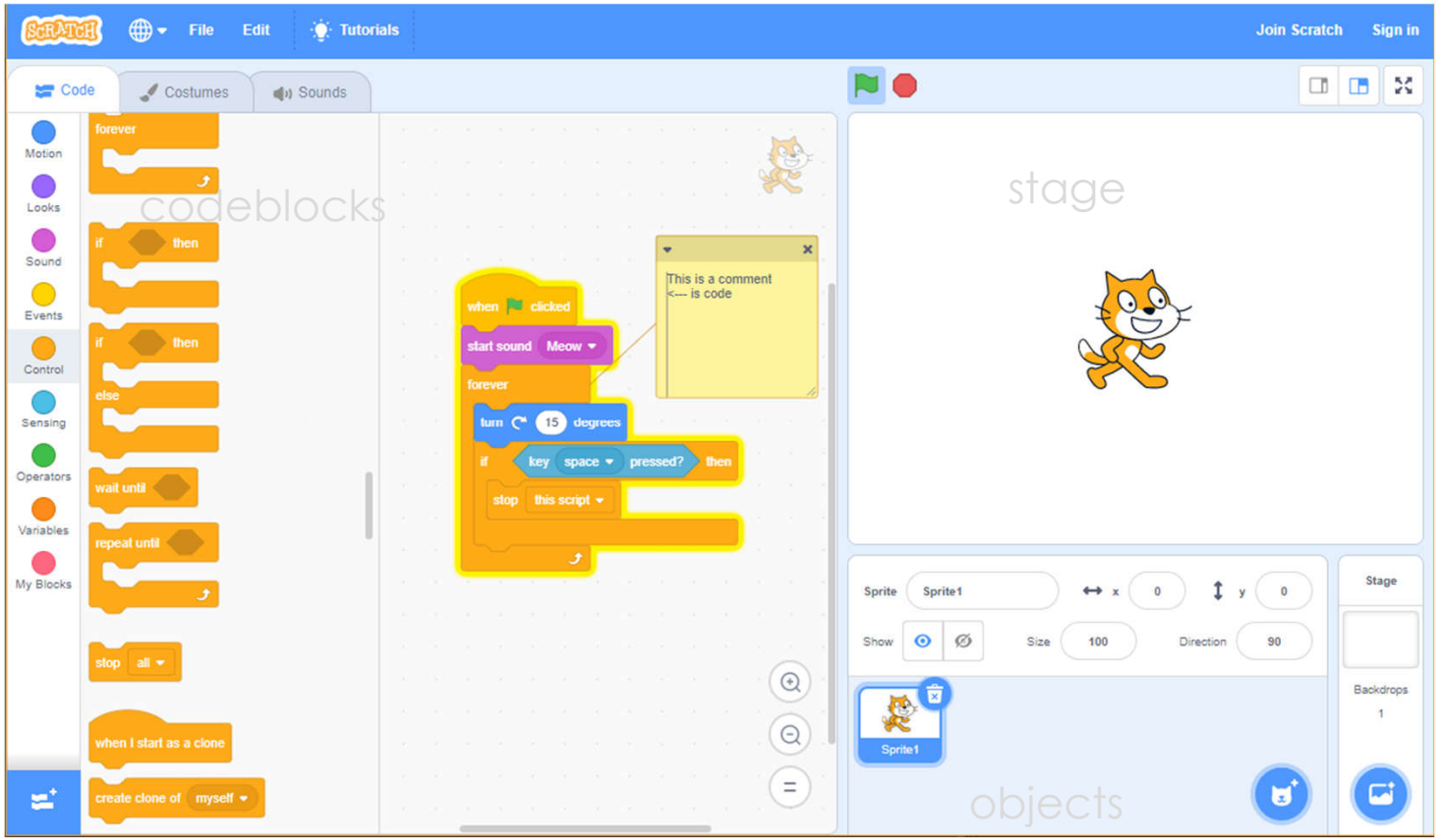
- Command
- Function
- For/While
- Condition

HOW TO START

Blocked-based programming

- Scratch
- Turbowarp (Scratch)
- MachineLearningForKids.co.uk/scratch3
- Code.org (both block and text)
- Codelabs (blocklycodelabs.dev)
- Microsoft MakeCode (include Minecraft coding)

HOW TO START


File
Edit
Tutorials
Join Scratch
Sign in
Code
Costumes
Sounds
Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
forever
codeblocks
if then
if then
else
wait until
repeat until
stop all
when I start as a clone
create clone of myself
when clicked
start sound Meow
forever
This is a comment
<--- is code
turn 15 degrees
if key space pressed? then
stop this script
stage
Sprite
Sprite1
x
0
y
0
Show
Size
100
Direction
90
Stage
Backdrops
1
Sprite1
objects

Grades K-5

Learn to make your own game, app, or computer drawing.

Learn more

Grades 6-12

Build real working apps, games and websites using blocks, JavaScript, CSS, HTML and more.

Learn more

Beyond K-12

Take the next step on your CS Journey. Explore career paths, extended learning, scholarships, internships, and more.

Learn more

Hour of Code

View more Hour of Code tutorials

If you don't have time for a full length course, try a one-hour tutorial designed for all ages. Join millions of students and teachers in over 180 countries by starting with an Hour of Code.

Dance Party

Featuring Katy Perry, Shawn Mendes, Panic! At The Disco, Lil Nas X, Jonas Brothers, Nicki Minaj, and 34 more!

Minecraft

Use your creativity and problem solving skills to explore and build underwater worlds with code!

AI for Oceans

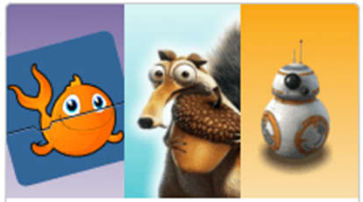
Learn how AI and machine learning can be used to address world problems.

View more

View more Hour of Code tutorials

Computer Science Fundamentals for Elementary Schools

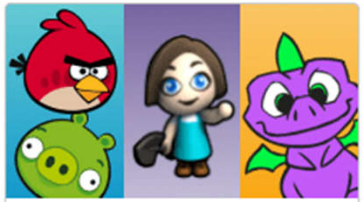
For pre-readers in elementary school classrooms



Course A

Ages 4-7

An introduction to computer science for pre -readers.

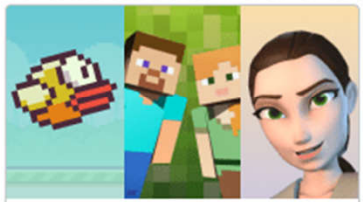


Course B

Ages 5-8

An introduction to computer science for pre-readers. (Similar to Course A but with more variety for older students.)

For older students in elementary school classrooms



Course C

Ages 6-10

Learn the basics of computer science and create your own art, stories, and games.

Course D

Ages 7-11

Quickly cover concepts in Course C, then go further with algorithms, nested loops, conditionals and more.

Course E

Ages 8-12

Quickly cover concepts in Course C & D and then go further with functions.

Course F

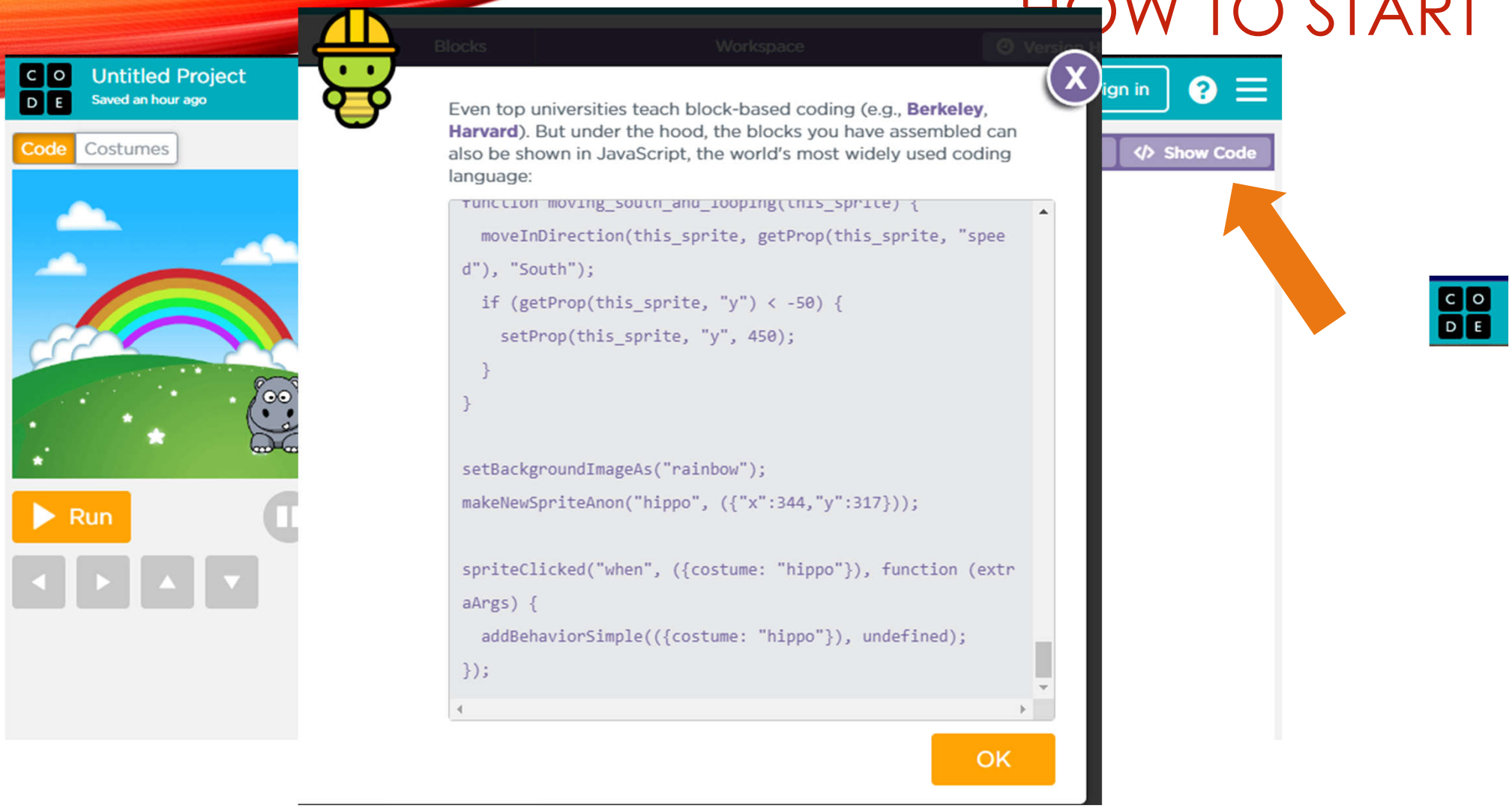
Ages 9-13

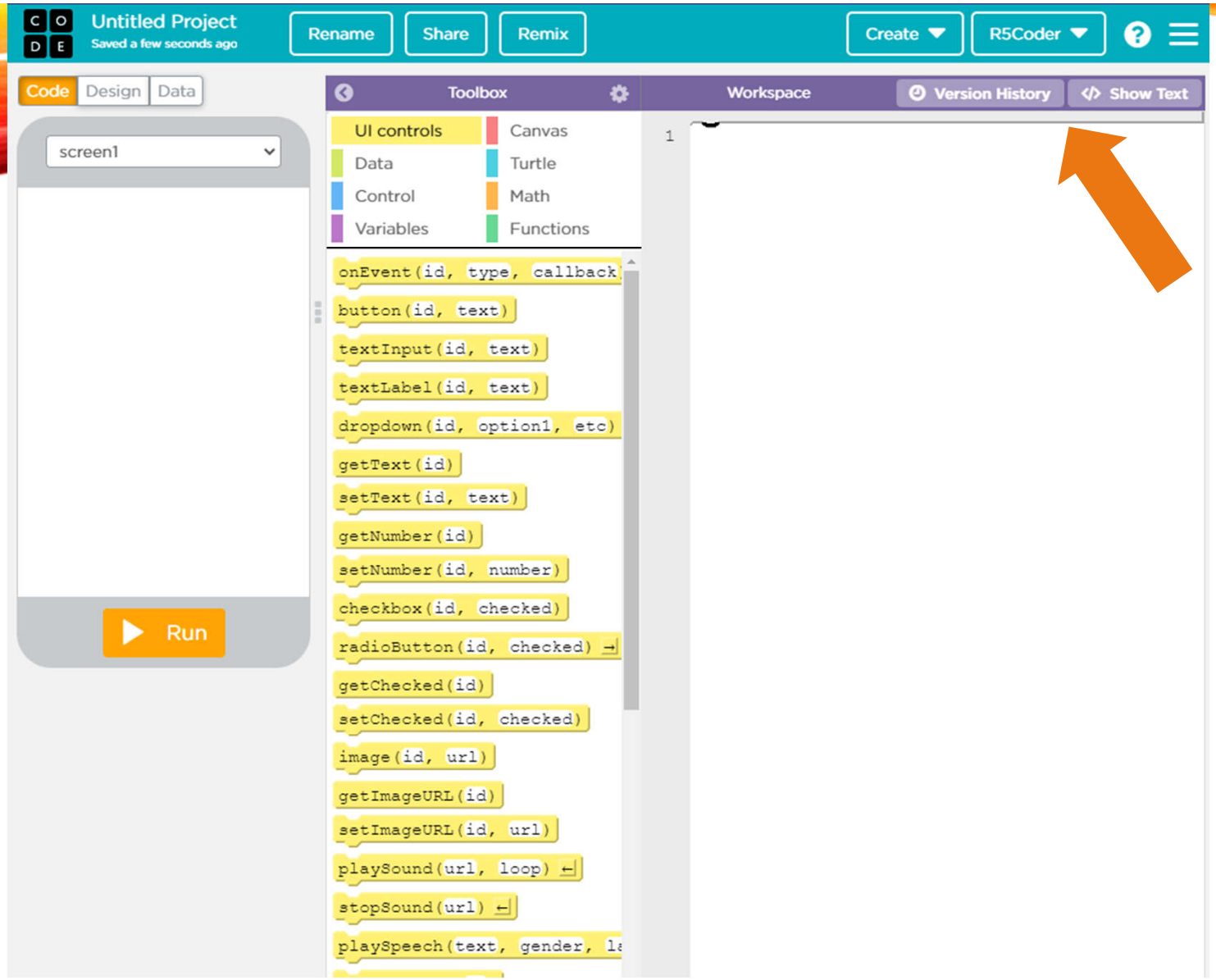
Learn all the concepts in Computer Science Fundamentals and create your own art, story or game.

HOW TO START

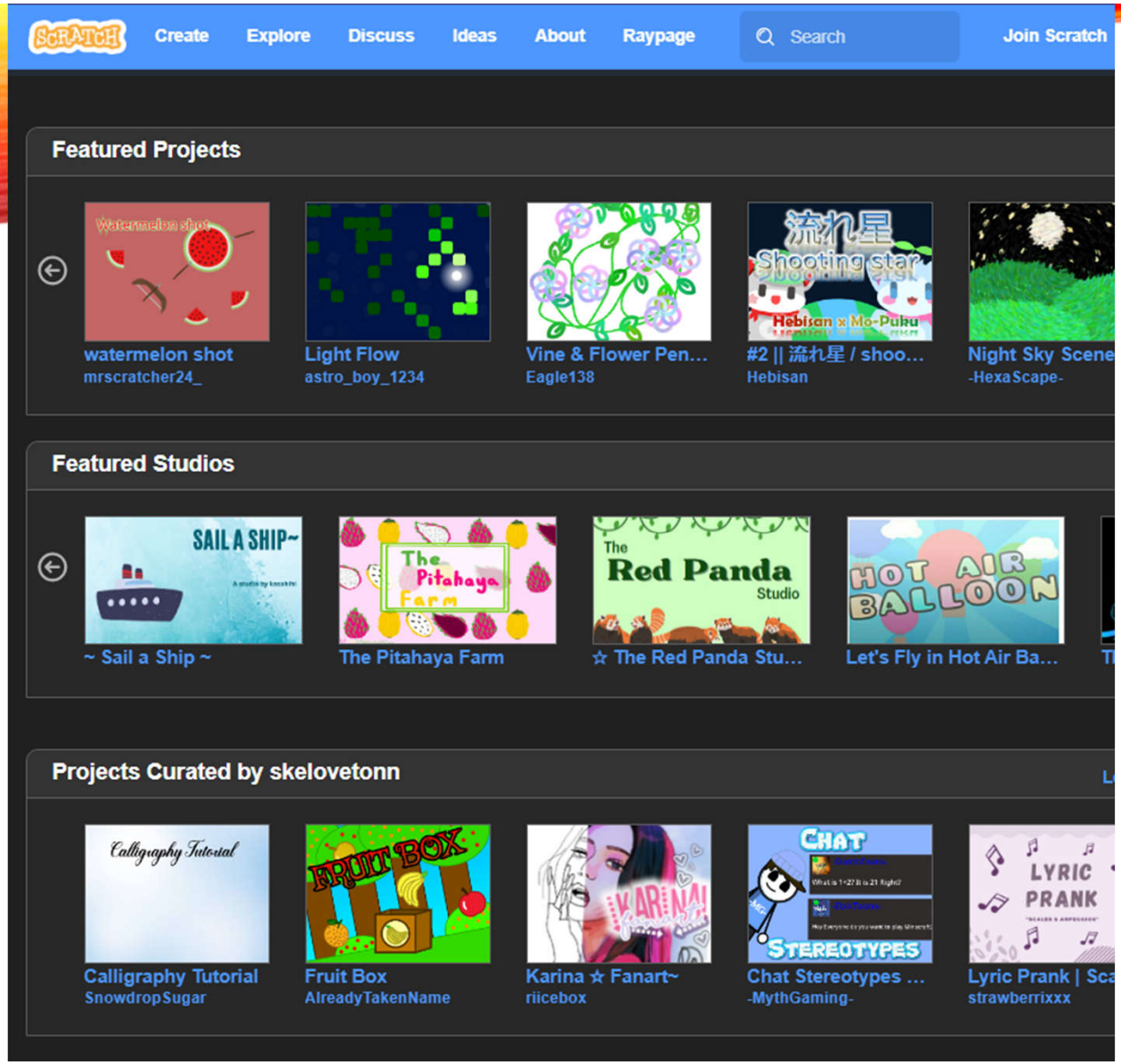
Untitled Project
Saved an hour ago
Rename
Share
Remix
Create
Sign in
Code
Costumes
Blocks
Workspace
Version History
Show Code
World
Sprites
Locations
Events
Behaviors
Loops
Variables
Math
Logic
Functions
Text
Comments
when run
set background to
make new
sprite at
(344, 83)
when
clicked
sprite
begins
Run

HOW TO START

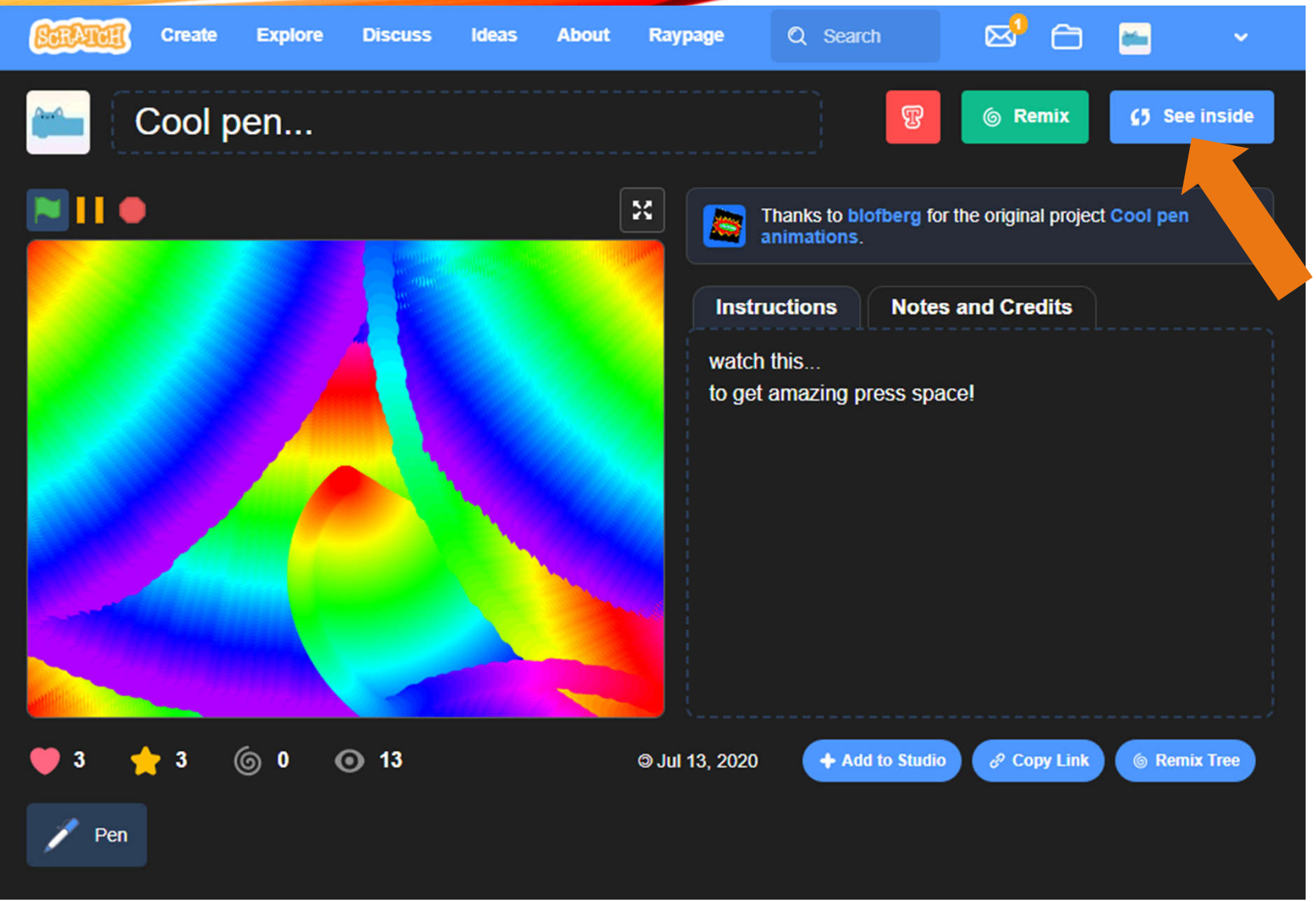

Untitled Project
Saved an hour ago
Code
Costumes
Run
Blocks
Workspace
Even top universities teach block-based coding (e.g., Berkeley, Harvard). But under the hood, the blocks you have assembled can also be shown in JavaScript, the world's most widely used coding language:
function moving_south_and_looping(this_sprite) {
moveInDirection(this_sprite, getProp(this_sprite, "speed"), "South");
if (getProp(this_sprite, "y") < -50) {
setProp(this_sprite, "y", 450);
}
}
setBackgroundImageAs("rainbow");
makeNewSpriteAnon("hippo", ({"x":344,"y":317}));
spriteClicked("when", ({costume: "hippo"}), function (extraArgs) {
addBehaviorSimple(({costume: "hippo"}), undefined);
});
OK
ign in
Show Code

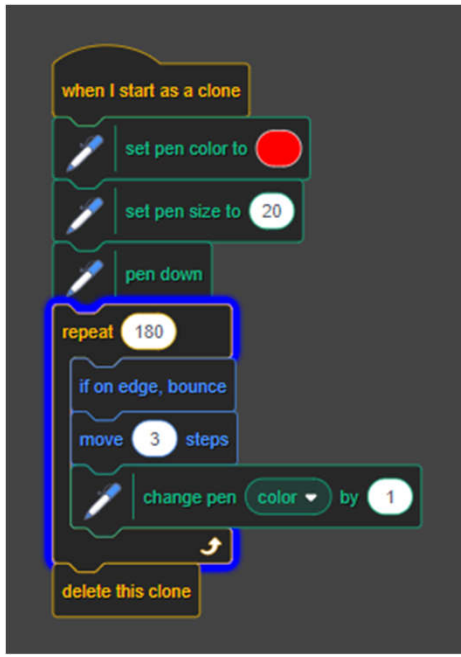

Untitled Project
Saved a few seconds ago
Rename
Share
Remix
Create
R5Coder
Code
Design
Data
screen1
Run
Toolbox
Workspace
Version History
Show Text
UI controls
Canvas
Data
Turtle
Control
Math
Variables
Functions
onEvent(id, type, callback
button(id, text)
textInput(id, text)
textLabel(id, text)
dropdown(id, option1, etc)
getText(id)
setText(id, text)
getNumber(id)
setNumber(id, number)
checkbox(id, checked)
radioButton(id, checked)
getChecked(id)
setChecked(id, checked)
image(id, url)
getImageURL(id)
setImageURL(id, url)
playSound(url, loop)
stopSound(url)
playSpeech(text, gender, la
1

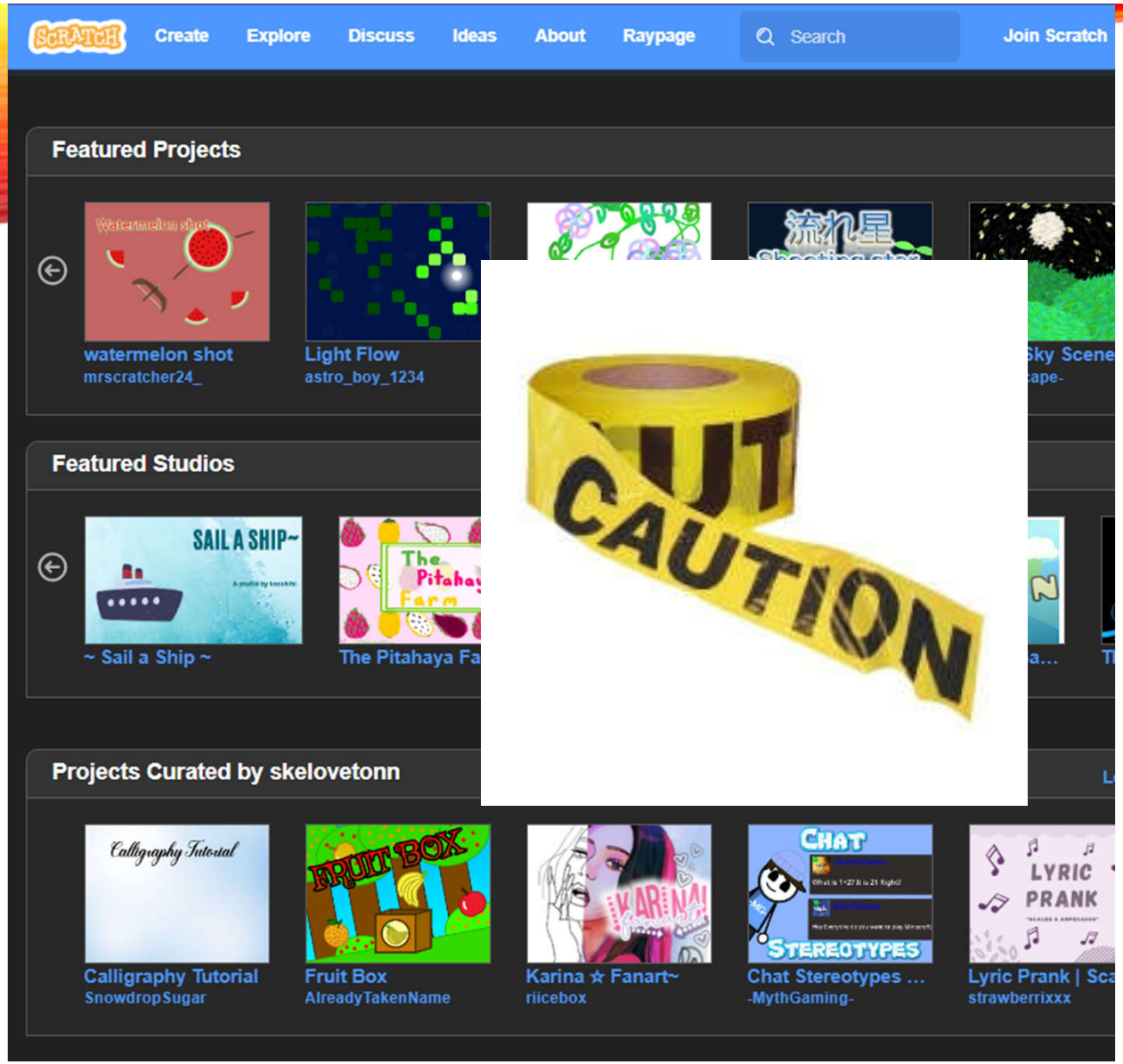
HOW TO START



Modify and enhance others' projects.

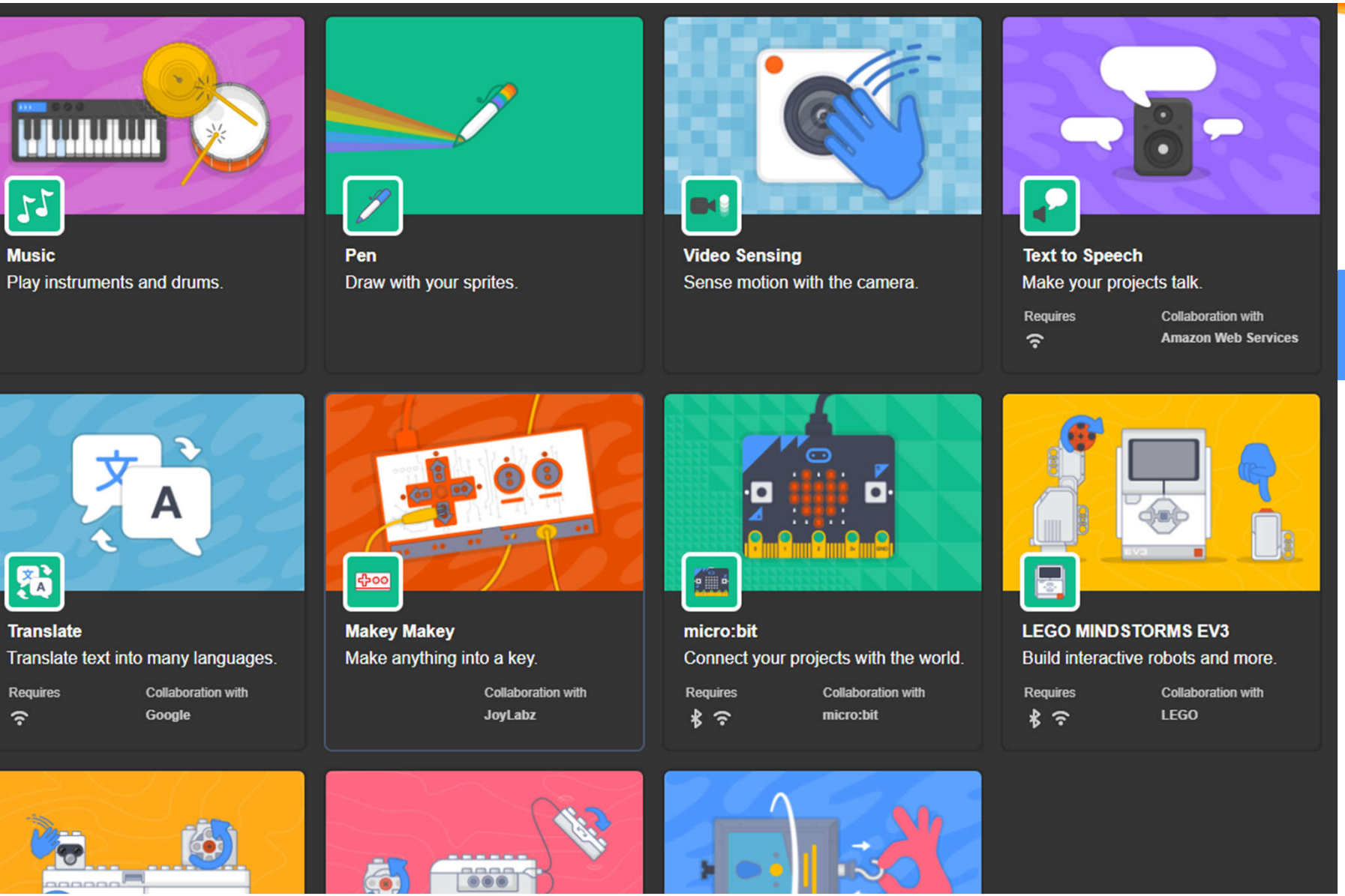

Create
Explore
Discuss
Ideas
About
Raypage
Search
Cool pen...
Remix
See inside
Thanks to blofberg for the original project Cool pen animations.
Instructions
Notes and Credits
watch this...
to get amazing press space!
3
3
0
13
Jul 13, 2020
Add to Studio
Copy Link
Remix Tree
Pen


when I start as a clone
set pen color to
set pen size to 20
pen down
repeat 180
if on edge, bounce
move 3 steps
change pen color by 1
delete this clone



HOW TO START

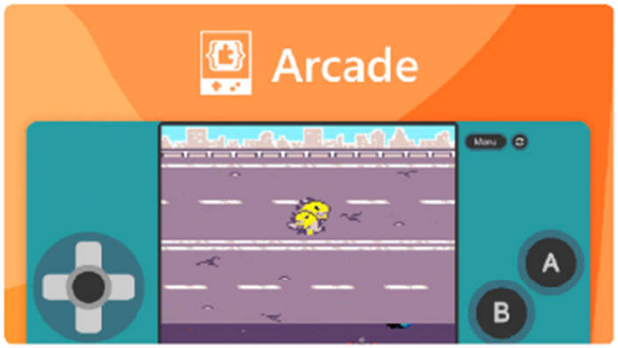
Are they programming/learning? Or are they watching sloppy videos and games on scratch?


Music
Play instruments and drums.
Pen
Draw with your sprites.
Video Sensing
Sense motion with the camera.
Text to Speech
Make your projects talk.
Requires
Collaboration with
Amazon Web Services
Translate
Translate text into many languages.
Requires
Collaboration with
Google
Makey Makey
Make anything into a key.
Collaboration with
JoyLabz
micro:bit
Connect your projects with the world.
Requires
Collaboration with
micro:bit
LEGO MINDSTORMS EV3
Build interactive robots and more.
Requires
Collaboration with
LEGO

Addons

HOW TO START

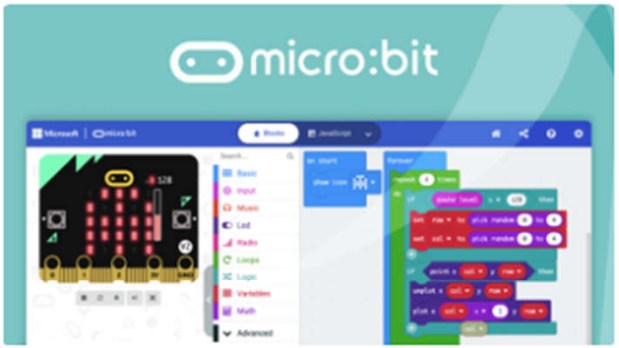
Microsoft | MakeCode



Make retro style Arcade games

100+ game mechanics ready to add to your game

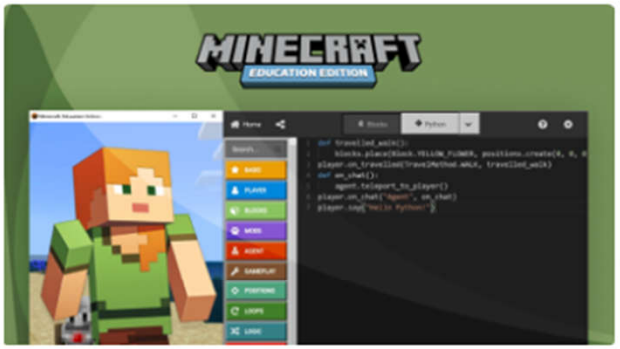
Start coding > Learn more >



Write programs for the micro:bit

The pocket-sized computer that you could embed into any project - no hardware necessary

Start coding > Learn more >

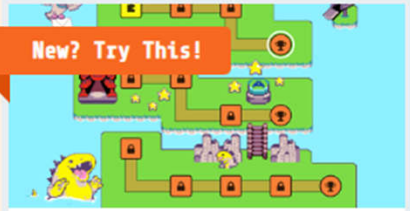


Code mods for Minecraft

*Requires Minecraft: Education Edition

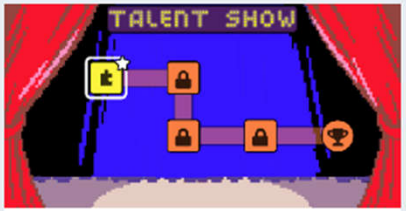
Get access > Learn more >

Skillmaps



Beginner Skillmap

Monster Truck Racer

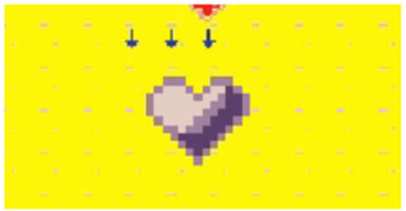


Talent Show

Shark Attack

Tutorials

Chase the Pizza

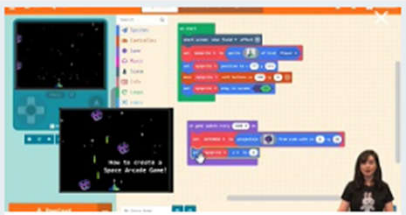


Flee My Valentine

Time Flies

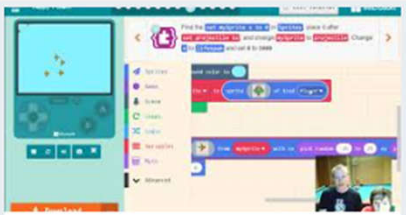
Happy Flower

Live Coding

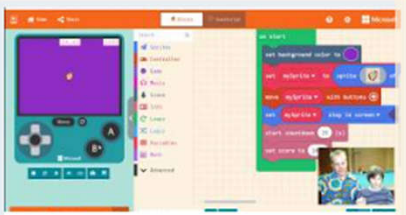


Space Arcade Game

Chase the Pizza



Happy Flower



Lemon Leak

START

oft | MakeCode

machinelearningforkids.co.uk

HOW TO START

About Worksheets Pretrained Book News Help Log In Language

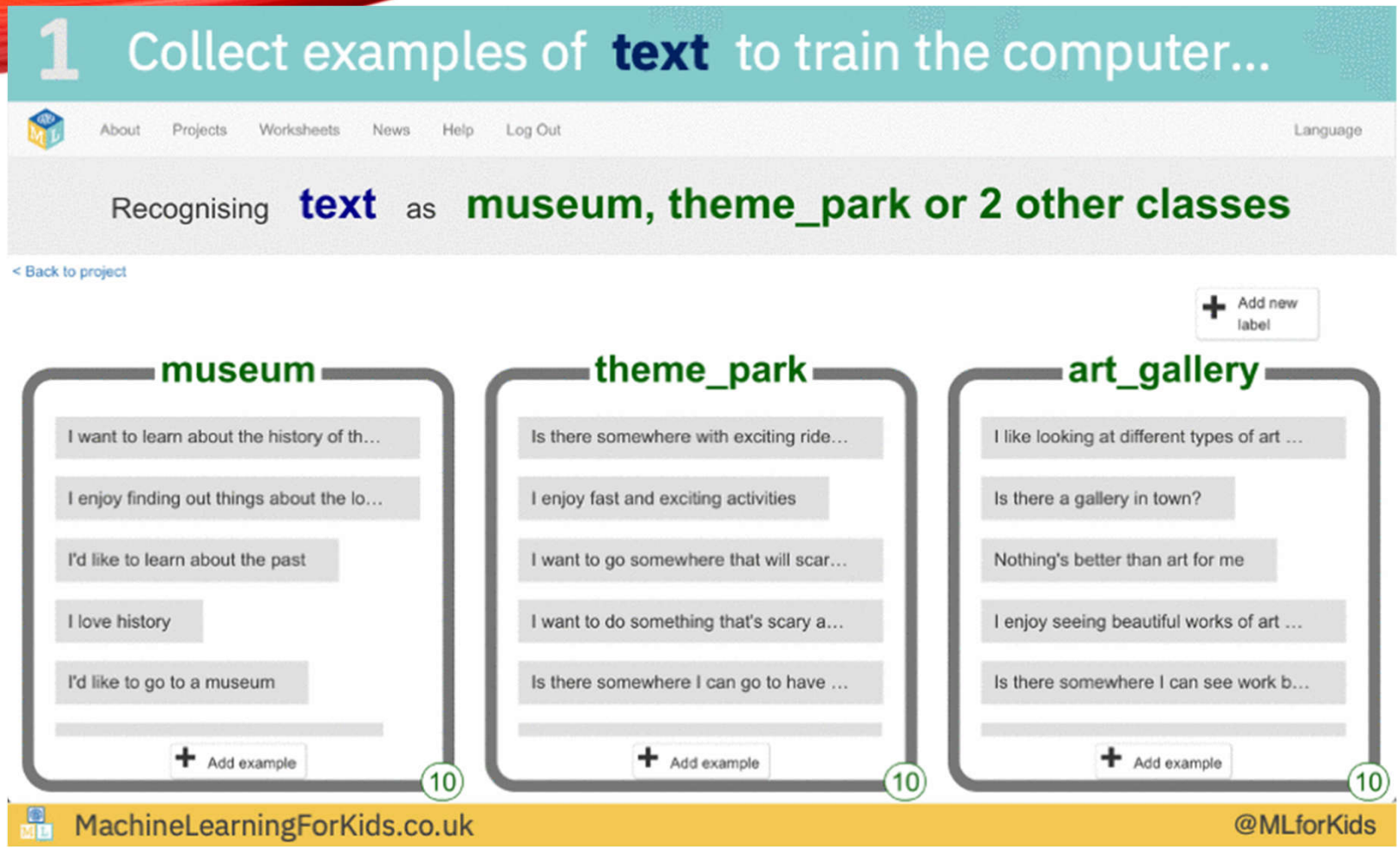
Teach a computer to play a game

Get started Learn more

1. Collect examples of things you want to be able to recognise
2. Use the examples to train a computer to be able to recognise them
3. Make a game in Scratch that uses the computer's ability to recognise them

machinelearningforkids.co.uk

HOW TO START



HOW TO START

Pre-trained models

machinelearningforkids.co.uk

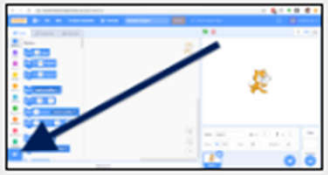
How to use

Get started

Click on the button to go to Scratch.

Go to the version of Scratch 3 available from Machine Learning for Kids.

Pre-trained models are available from the Extensions panel. Click on the blue extensions button in the bottom-left of the Scratch window to find them, then click on the one you want to add to your project.



The blocks for the pre-trained model will be added to the Scratch toolbox.

Are there other machine learning models you would like to be able to use in your Scratch projects?

Let me know by asking in the ML for Kids forum.

Speech to text

This model can be used to recognize speech recorded through your microphone.

It gives you a block you can use to record some audio and then give you the text that it recognized, and a block that you can tell it to listen out for a particular word or phrase.

It uses the speech recognition capability that comes with Google Chrome, so the ML model that you'll be using comes from Google. (It also means that you can only use this model if you're using the Google Chrome web browser, sorry!)

Face detection

This model can be used to recognize your face in the video feed from your webcam.

It gives you blocks that will find the x,y coordinates of your eyes, nose and mouth.

This uses a top-down technique - it starts by looking for something that looks like a face in the picture. Once it has found that, it tries to identify facial features in that area. The machine learning model is based on MobileNet (a ML model designed for mobile devices, so it doesn't need much computing power).

The training data used for this model came from a set known as WIDER FACE.

Pose detection

This model can be used to recognize your pose in the video feed from your webcam.

It gives you blocks that will find the x,y coordinates of different parts of your body, like shoulders, elbows, wrists, knees, and ankles.

This uses a bottom-up technique - looking for human body key points (like shoulders, elbows, knees, etc.) and then grouping them to identify a person and the pose that they're in.

The training data used for this model came from a set known as Common Objects in Context (COCO).

For more information, including a description of some of the challenges and potential issues with the model, see the model card.

Hand detection

This model can be used to recognize your hand in the video feed from your webcam.

It gives you blocks that will find the x,y coordinates of different parts of your hand: the tips of each of your fingers, and your wrist.

It can only return information about one hand in the view.

For more information, including a description of some of the challenges and potential issues with the model, see the model card.

Toxicity

This model can be used to recognize whether text contains toxic content.

It gives you blocks that will predict the percentage probability that some provided text contains toxic content such as threatening language, insults, obscenities, or identity-based hate.

The training data used for this model came from two million user-generated comments posted on news articles.

Imagenet

This model can be used to recognize objects in a costume.

It gives you blocks that will predict the main object shown in a sprite.

It has been trained to recognize photos of one-thousand common objects. The machine learning model is based on MobileNet (a ML model designed for mobile devices, so it doesn't need much computing power).

It has been trained to recognize photos, and won't recognize cartoons or drawings very well.

Question Answering

This model can be used to find answers to questions.

It gives you a block that will look for the answer to a question in some text that you give it.

It is a type of machine learning model called BERT which is useful for projects with text.

It has been trained using a set of questions and answers from Wikipedia articles collected by Stanford University called SQuAD.

This is a complex model, so you might find that it is slow and needs a lot of memory on your computer.

Pitch estimation

This model can be used to recognize a note being sung from your computer's microphone.

It gives you blocks that will return the frequency of a note it recognized, and to convert that into the name or MIDI note.

The model, called SPICE, has been trained to identify the dominant pitch in sung audio, including being able to recognize a sung note even if there is background music and noise.

The training data used for this model came from MIR-1K, which is a set of 1000 short sound recordings of amateur singers singing along to karaoke.

You will need to let Scratch use your microphone to use this model.

TensorFlow

Open a TensorFlow model

TensorFlow is a toolkit for training and running machine learning models.

If you know how to create your own machine learning model with TensorFlow, click the button above to use it in Scratch.

You can build your own model, using programming languages like Python.

Or you can use tools like Teachable Machine to easily train a TensorFlow model, and then make something with it in Scratch here.

More...

(Only image classifiers are supported today, but support for more types of machine learning models is coming soon!)

HOW TO START?

6 and above

bitsbox

- No debugging
- Easily to share
- Easy to get started on

& Toilet

```
1  fill('flush')
2  time = 3500
3  poo = stamp('poop',500)
4  poo.rotate (1080, time)
5  poo.size(0,time)
6  sound('flush')
7
8
9
```

HOW TO START?

bitsbox

HOW TO START?

6 and above

- BitsBox
- CodeMonkey
- CodeCombat
- Crunchzilla
- Code Monsters

HOW TO START?

9 and above

- Python
- Web development
- ….

- Easy interface
- Set aside a regular time

WHAT TO CODE?

9 and above

- **Say hello to the world!**

» From reddit: Posted by u/SuchShopping3828

WHAT TO CODE?

- 100s of books
- Simple games
  - Upload uncle's face; touch uncle's face to fart!
  - Make fireworks (have a 6 yr to code, and a 1.5 yr old one to test!)
  - Freeze dance
  - Simple puzzle (6 pieces in the correct location)
  - Shoot flying aliens
- Greeting cards (personalized messages/music/design)
- Simple day to day tools
  - (up or down) Counter
  - To-do list

Kids are full of IDEAS

NOT INTERESTED?

It's ok!

- It's supposed to be fun!
  - If not fun, try again later!
- Make Art
  - Videos/Jokes
  - Greeting cards
  - Abstract art
- Try games
  - Robots
  - Snap circuits with Arduino

CAUTION

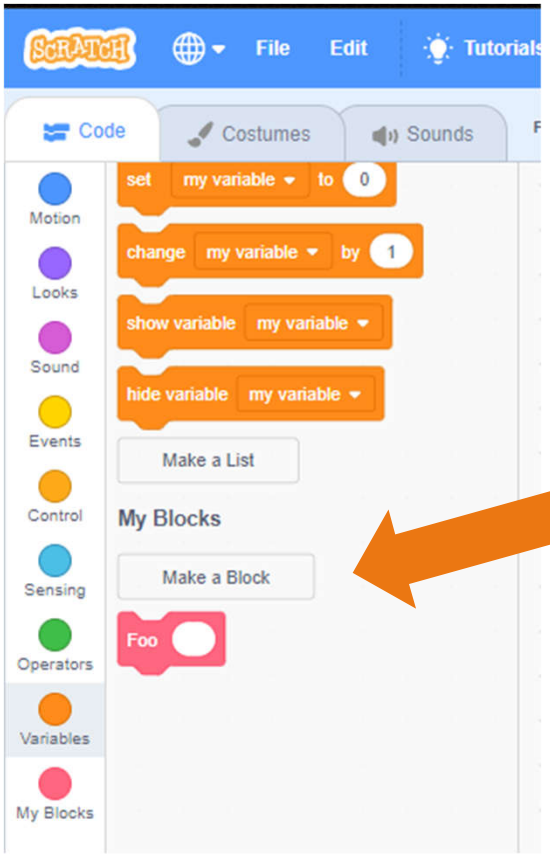
FYI …

- Slooooowwww type
- Ok to quit!
- Who's programming here?
- Silly/unrealistic/useless ideas
- Coordinates

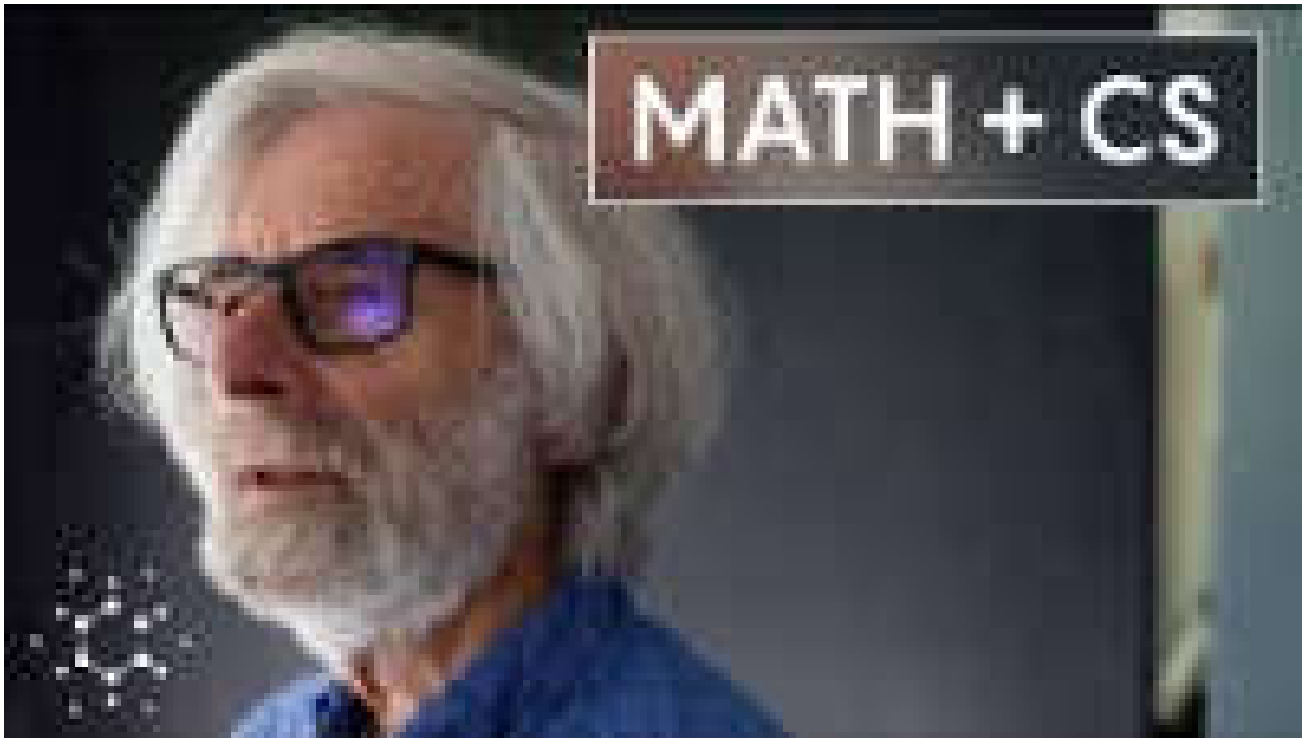
CAUTION

Imprint good coding practices

- Bad names
- Duplicated code
- Organized code
- Const variables vs. Hardcoded numbers
- Comments



CAUTION



Coding vs. programming (by Leslie Lamport)

Programming vs. Software development (by Titus Winter)

https://youtu.be/rkZzg7Vowao?t=77

CAUTION

You have no idea!

- Things you don't know
- Things you don't want them to know
- Things that are incorrect
- Bad language/mean comments
- Wrongdoing!

stackoverflow

YouTube CA

reddit

Show them **reliable** resources.

CAUTION

What if…..