

# Introduction to Face Sensing AI using Scratch

Lesson plan for grades 6-10

NGSS standards aligned along with DoD Critical Technologies

# Table of contents

| Title                                                        | Page Number |
|--------------------------------------------------------------|-------------|
| Standards and connections .....                              | 3           |
| Materials, learning targets and lesson objectives .....      | 4           |
| Student Introduction .....                                   | 5           |
| Instructor Demonstration.....                                | 6           |
| Guided Lesson, Student activities and lesson conclusion..... | 7           |
| Extension Questions and Activity.....                        | 8           |
| Fool the AI: An Extension Activity .....                     | 9-11        |

**Activities included in this lesson plan:**

Introduction to Face Sensing AI

Extension activity: Fool the AI

**NGSS Learning Standards: Middle School**

- **MS-ETS1-1:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.
- **MS-ETS1-2:** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-LS1-8:** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

**NGSS Learning Standards: High School**

- **HS-ETS1-4:** Use a computer simulation to model the impact of a proposed solution on people, society, and the natural world.
- **HS-ETS1-3:** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics.
- **HS-LS1-3 (Optional Extension):** Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

*This can be applied when comparing the human nervous system's feedback loops to AI systems processing facial inputs in real time.*

**DoD Critical Technologies Connections:**

- **Artificial Intelligence (AI)**

Students will be introduced to the fundamentals of **machine learning** and **facial recognition**, which are core aspects of AI. They will learn how algorithms are used to recognize patterns in images, such as identifying faces, laying the groundwork for more complex AI applications in real-world systems like security or autonomous vehicles.

- **Semiconductors and Microelectronics**

In real-world applications, face sensing AI systems rely on microchips to process large volumes of data and perform tasks like face detection in real-time. These chips are crucial for powering devices that enable face recognition in smartphones, security cameras, and other smart devices.

- **Future Computing Technologies**

As students explore machine learning for face recognition, they will understand how future computing innovations, like cloud computing and edge devices, will accelerate AI performance. These technologies enable faster, more efficient data processing, which is critical for real-time applications like face detection and recognition.

## **Materials:**

- Computers:
  - Each computer needs to have a camera and internet access
  - Instructor computer with connection to a projector
  - One per student pair
  - You may need the Scratch Webcam Extension. It will typically ask for permission when starting the program. (Also available on the website under the extensions section)
- Scratch Lab packets (one per student pair)
- Fool the AI extension activity (at teacher discretion)

## **Learning Targets: Middle school**

- I can code by dragging and dropping blocks to use algorithms, variables, and control structures to solve problems and create unique projects.
- I can test and debug my code to improve its performance and fix errors.
- I will contrast human learning with machine learning to understand the strengths and weaknesses of both.

## **Learning Targets: High school**

- I can design and implement programs using visual block-based coding that include algorithms, control structures, and variables to solve real-world problems.
- I can test, debug, and refine my code to ensure reliability, efficiency, and intended functionality.
- I can analyze and compare human learning with machine learning to evaluate their respective strengths, limitations, and applications in AI systems.

## **Lesson Objective:**

In this lesson, students will explore how to use Scratch to create an interactive project that responds to facial movements. They will gain an understanding of how input, such as facial gestures, can influence a game or project, making interactions more dynamic. Through hands-on practice, they will design a simple interactive game or animation where the sprite reacts to user input based on face movement captured by the webcam. This activity encourages creativity while reinforcing the connection between physical actions and digital responses.

**Ask students:**

"Who has heard of the website Scratch?" *(Allow students time to respond.)*

**Explain what Scratch is:**

"Scratch is a website where you can create your own games, stories, and animations by putting together blocks of code. You drag and drop different blocks to make your characters do things."

**Introduce the Scratch Lab:**

"Today, we're going to be using a part of Scratch called the **Scratch Lab**. You don't need an account to use it. In the Scratch Lab, we're going to be experimenting with Face Sensing AI!"

**Ask students:**

- "Who knows what AI stands for?" *(Allow students time to respond.)*
- "Can anyone think of something that uses AI, or where you've seen AI in action?" *(Allow students time to respond. **Possible answers might include Smartphones, Chatbots, Smart devices, AI in video games, etc.**)*

**Say to students:**

- "AI helps computers and software think, learn, and make decisions like humans. It's already part of daily life, from apps that recognize faces to video games that adjust to how players move. AI is also used in industries like healthcare to find patterns in data and improve decision-making. As AI becomes more advanced, it's important that it works safely and reliably, especially in self-driving cars and security systems. Making sure AI can be trusted is a big challenge, but it will play a major role in solving global problems and driving innovation in the future."

**Introduce the activity:**

"Today, we'll be using the Scratch Lab to create a project where a character (called a **sprite**) will react to your facial or body movements. Your movements will control how the sprite behaves!"

**The set up:**

- On a computer with internet access, a projector, and a camera, open [lab.scratch.mit.edu/face](https://lab.scratch.mit.edu/face)

**Student Reminders:**

- They do not need an account to use Scratch.
- For the demonstration, they should focus on watching and taking notes, not working along on their computers. Hands-on practice will come later.

**Introducing Key Sections:**

- **Things to Try:** Scroll down the page and point out the "Things to Try" section. This section contains helpful activities and examples for students to explore.
- **FAQ:** Scroll down to show students the "FAQ" section. Let them know they can refer to this area if they have questions before asking for instructor help.
- **Try it out:** Scroll back to the top and click on the "Try it out" button to begin the activity.
- **Code Blocks:** There are categories of drag and drop code blocks on the top left side of the workspace.
  - **Tabs: Code, Costumes, Sounds**
  - Under the **Code** tab, the following categories are available:
    - **Motion, Looks, Sound, Events, Control, Sensing, Operators, Variables, and My Blocks**
    - **Note:** If students add extensions (located at the bottom-left), these will appear in the code area as well.
- **Sprites:** The Sprites are located on the right side of the workspace. This is the character they will code.
  - Hover over the animal icon at the bottom-right of the screen to reveal options for choosing a sprite.
  - When coding, ensure that students have selected the sprite they want to use. The code will be attached to that sprite.
- **Start and Stop the Program:** There are two buttons at the top right of the workspace.
  - **Green Flag:** Click to start the program.
  - **Red Stop Sign:** Click to stop the program.
- **Deleting Code Blocks:** To delete a block:
  - Right-click on the block you want to remove then select **Delete** from the dropdown menu.

**Reminder on Coding**

*Emphasize the importance of selecting the correct sprite before starting to code, as the script will only apply to the chosen sprite. Let students know that backgrounds will be covered in a future lesson, so they can focus on the sprites for now.*

Distribute **one** Scratch packet to each pair of students

Write the link on the board for students or share it with them online. ([lab.scratch.mit.edu/face](https://lab.scratch.mit.edu/face))

**Say to students:**

- "Follow along with what I'm doing, and do not work ahead."
- "There are multiple projects in your packet that you'll be working on with your partner, but do not start them now."

**Starting the Program:**

- Walk the students through how to start the program. They will go to the link they are given and click "Try it Out" like the instructor did during the demo.

**Demonstrating the Scratch Interface**

- **Say to students:** "Alright, now you should see the Scratch interface. Follow along as I demonstrate, and make sure you're on the same screen as me."
- **Guide students through the Try Out Face Sensing lesson in their Scratch packet.**

You may need to pause periodically to make sure students are following along.

**Student Activity(s):** 20-30 minutes

1. Quick Overview Before Starting
  - Before releasing students to work independently (in their pairs), briefly review the packet with them.
  - Highlight important instructions and expectations.
2. Continue with packet activities:
  - Once done with the guided activity students are free to work through the remaining activities in the packet in any order.

Offer support and guidance as needed.

**Conclusion:** 5-10 minutes

**Say to students:** "To wrap up today's lesson, we've explored how AI can make games and projects respond to your movements. This is just a small part of how AI works in the world. In the military, AI is being used to help make decisions faster and keep people safe. But just like we saw today with Scratch, for AI to be useful and safe, it must be trusted. As you continue learning about AI, think about how it might be used in the future to solve big problems and keep us safe."

### Extension Questions /Activity:

*\*\*All extension questions are open-ended. They can be explored through whole-group discussions or assigned as individual extension tasks.*

Extension questions:

- How do you think AI could help make military operations safer and more effective?
- What are some potential risks of using AI in the military, and how could we make sure it's used safely?
- How can the knowledge we learned about AI in Scratch help us understand more complex AI systems in the real world?
- What are some ways that AI could help people in fields like healthcare or education?
- If you could use AI to solve one problem in the world, what problem would you choose, and how would AI help?

Extension Activity:

- Fool the AI extension activity (work sheet assignment)

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Fool The AI: An Extension Activity

This activity is an extension of the “Fool the AI” activity from the Scratch packet. You will build on what you have learned by analyzing how AI detects faces and movements. Be sure to read all the directions carefully and answer in complete sentences. Support your answers with data from your observations whenever possible.

---

### Observations:

1. Test the AI: When does the AI detect or fail to detect a face? Find out! Try different strategies such as changing lighting, wearing masks or glasses, moving quickly or slowly, or covering parts of your face. Using the space below, take notes on when the AI accurately detects movements and when it does not.

### Analysis Questions:

2. What patterns did you notice in how the AI detects movements?
3. What factors seem to affect whether the AI recognizes a face or not?
4. What strategies did you use to fool the AI, and why do you think they worked?

5. How do you think technology decides how to respond to a face?
6. How could this technology be improved for better accuracy?
7. What real world applications might use this type of AI?
8. How might AI powered facial recognition be useful in daily life?
9. What are the benefits of AI powered facial recognition?
10. What are the risks or privacy concerns associated with AI facial recognition?

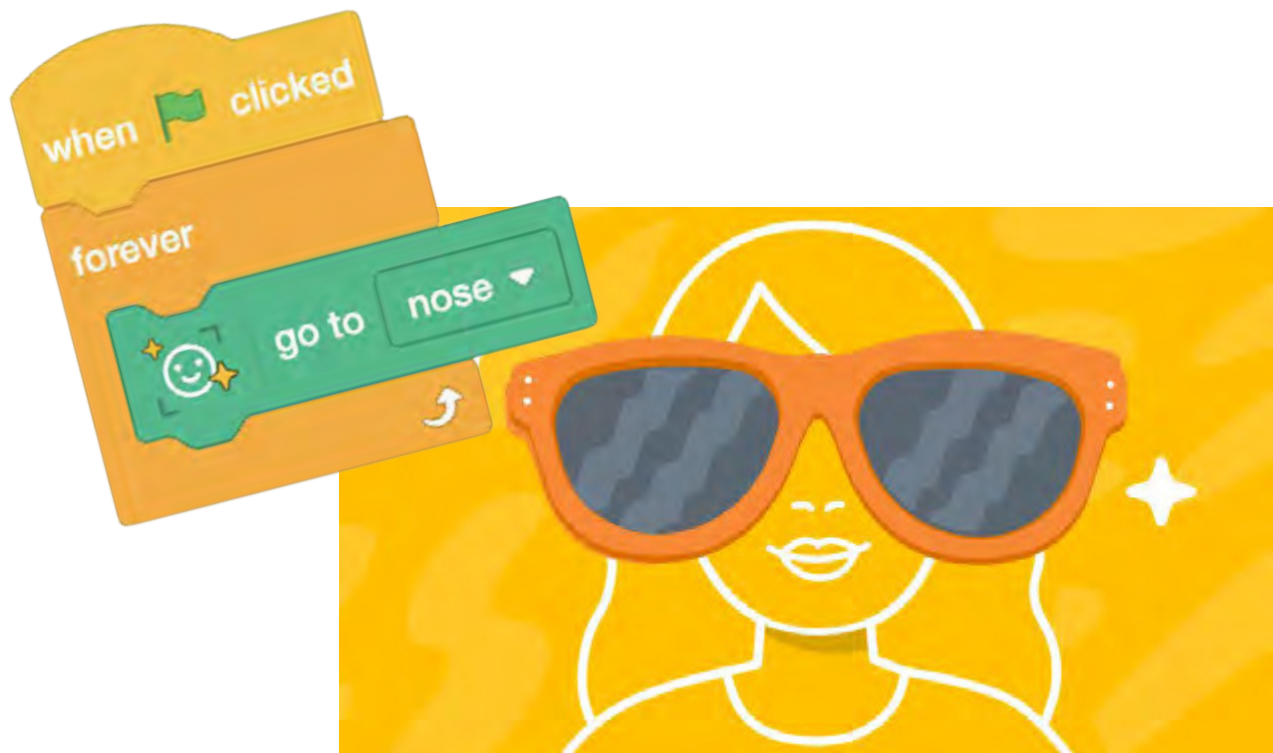
### Conclusion:

11. Summarize your findings from this activity and share your thoughts on AI powered facial recognition. Back up your answers with data from your observation where possible. Write your response below, be sure to use complete sentences.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no text or other markings on the paper.



# Scratch and AI: Face Sensing



**Explore ways AI can be integrated into  
Scratch projects on Scratch Lab**

Edited for this lesson. Not the same as the original from the scratch website.

[lab.scratch.mit.edu/face](https://lab.scratch.mit.edu/face)



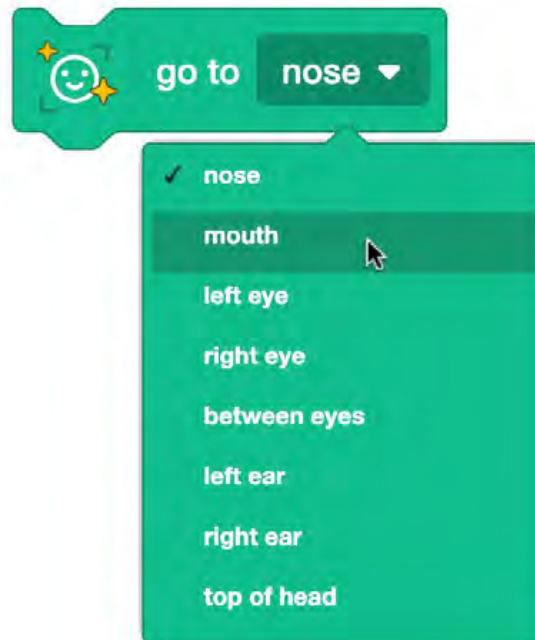


# What's in this packet

- Try Out Face Sensing
- Create a Face Filter
- Create a Face Sensing Game
- Use Your Nose As a Pen
- Fool the AI / Save Your Project

*Or combine with other cards like “Pong Game” or “Catch Game” but alter the code to make your face control the player!*

# Try Out Face Sensing



- Go to **lab.scratch.mit.edu/face** and click the “Try it out” button.
- Select the “go to nose” block.
- Click the block while your face is **visible on the stage**. Did the sprite go to your nose? Move and click again.
- What happens if you click on the dropdown list and choose another feature for the sprite to go to?

# Try Out Face Sensing

lab.scratch.mit.edu/face

## GET READY

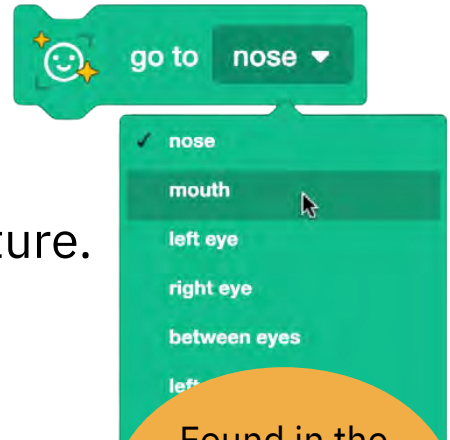


Choose any  
sprite.



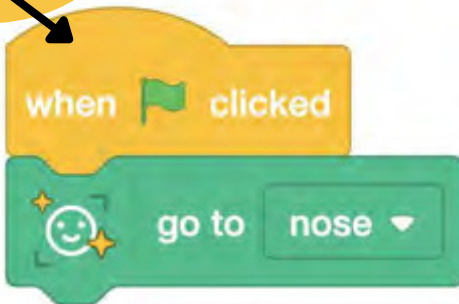
Pico Walking

Choose a  
facial feature.



## ADD CODE

Found in the  
**Code** tab  
under **Events**



Found in the  
**Code** tab  
under **Control**

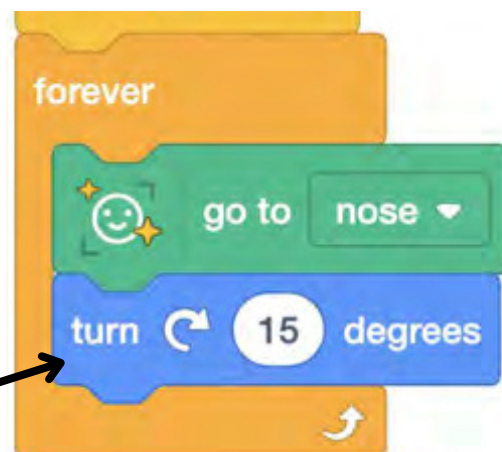


1. Add a “when green flag clicked” block to the “go to nose” block. Click the green flag.

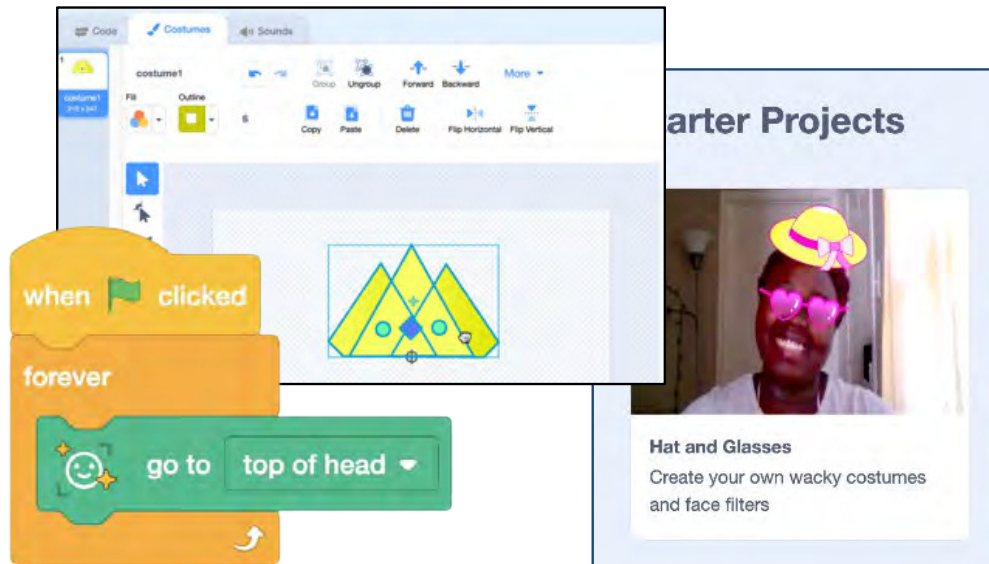
2. Add a “forever” loop to have the sprite stick to your chosen feature.

3. Try adding additional blocks from the Motion or Looks category to animate the sprite.

Found in the  
**Code** tab  
under  
**Motion**



# Create a Face Filter



1. Go to **lab.scratch.mit.edu/face**.
2. On the Face Sensing homepage, click on the **“Hat and Glasses” starter project** to experiment with the sprites and sample code.
3. Draw your own hat, glasses, or other accessory with the **Scratch paint editor** tools and **code a face filter**.

Edited for this lesson. Not the same as the original from the scratch website.

# Create a Face Filter

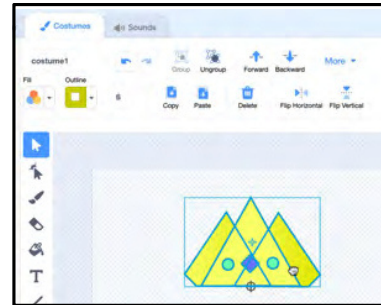
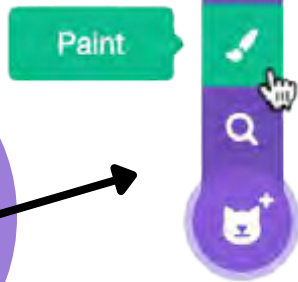
lab.scratch.mit.edu/face

Directions to  
create your  
own using the  
**paint** feature

## GET READY

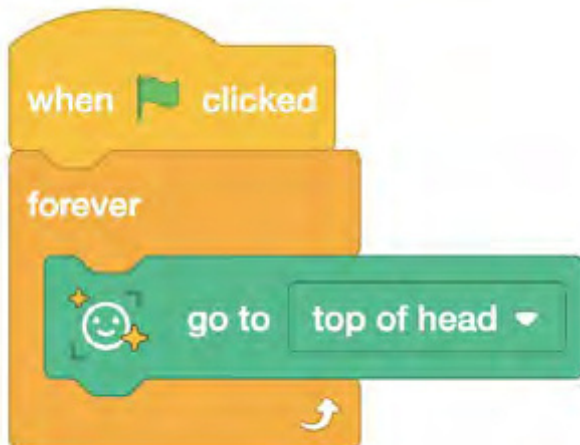
Choose “Paint”  
from the sprite  
menu.

Hover over  
the purple  
sprite logo  
for this  
menu



Use the tools to draw a  
hat costume or two.

## ADD CODE



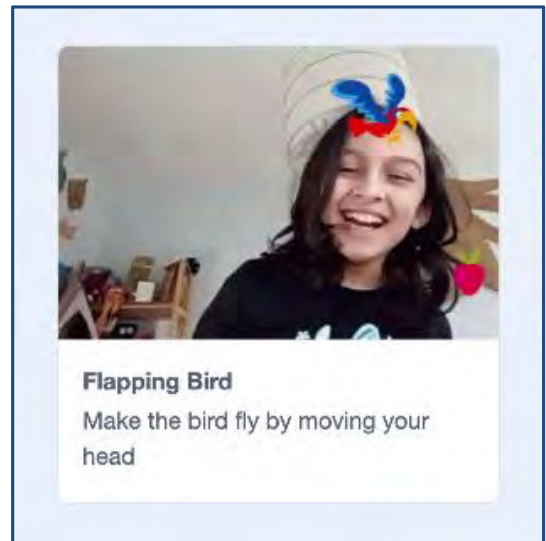
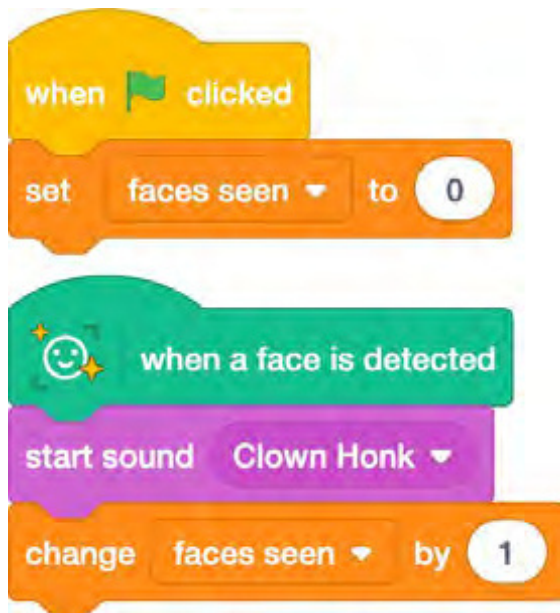
1. Add code so it sticks  
to the top of your  
head.



2. Add blocks so the sprite  
scales to match the size  
and points in the direction  
of your face.

Have multiple costumes? Add code to switch costumes.

# Create a Face Sensing Game



1. Go to **lab.scratch.mit.edu/face**.
2. On the Face Sensing homepage, click on the **“Flapping Bird” starter project** to experiment with the sprites and sample code.
3. Code a game that uses your face to score points or control a player sprite.

# Face Sensing Game

lab.scratch.mit.edu/face

## GET READY



Choose a first  
sprite



Parrot



Choose a  
second sprite



Strawberry

## ADD CODE

1. Add code to the first sprite so you can control it with your face. This will be the player.



2. Add code to the second sprite so it moves to a random position on the stage and gives the player a point when they touch.

3. Create a score variable to track points. Don't forget to reset it each time a new game is started. Make customizations!

Found in the  
**Code** tab under  
**Variables**

Click the drop down  
menu. You will need to  
rename the variable.

Found in the  
**Code** tab under  
**Sound**

Found in the  
**Code** tab under  
**Sensing**



# Use Your Nose As a Pen



- Go to **lab.scratch.mit.edu/face** and click the “Try it out” button.
- Add the Pen Extension.
- Select the “go to nose” block.
- Put the pen down and use your nose to draw.

*Optional:* Use your head tilt to put the pen up and down. Or try adjusting the pen size based on your face size.

---

Edited for this lesson. Not the same as the original from the scratch website.

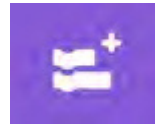
# Use Your Nose As a Pen

lab.scratch.mit.edu/face

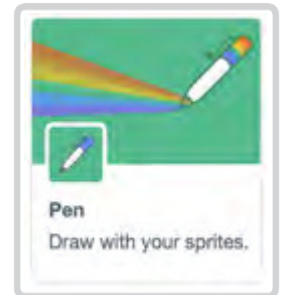
## GET READY



Choose any  
sprite to act as  
the Pen.



Add Pen  
Extension.



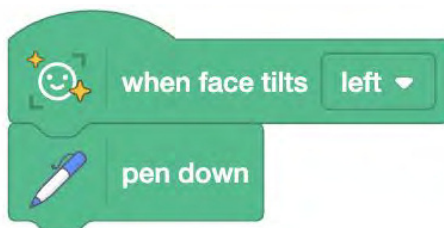
## ADD CODE

1. Add a Pen block to put the pen down. Then have the pen follow your nose.
2. Try variations like changing the pen color or setting the pen size based on your face size.



Found in the  
**Code** tab  
under **Pen**

3. Want more control? Use “when face tilts” to control when the pen is up and when it is down.



# Fool the AI

*Face Sensing blocks try to detect if a face exists, but they are not able to identify who the face is, or even if it is a human face!*

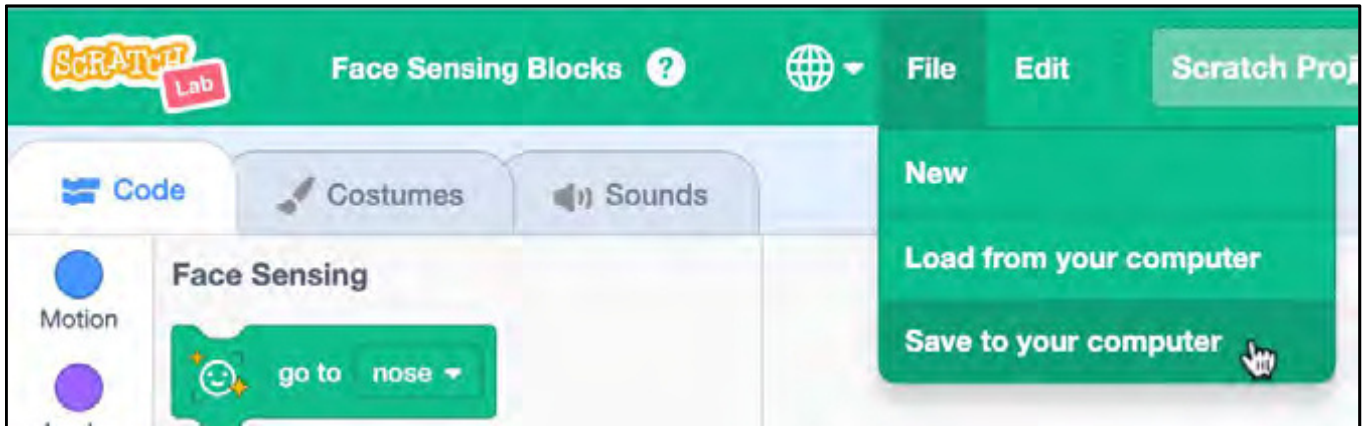
*That means sometimes the AI makes interesting mistakes. Identifying these mistakes can help us see the difference between our own human intelligence and AI.*

Can the AI find the parts of a face if:

- You are in disguise, your face is covered, or your face is tilted or upside down?
- What if the lighting in the room is very bright or very dark?
- You step out of frame and hold up a drawing of a smiley face?
- What about two googly eyes attached to fingertips?

What variables can you change to try to fool it into thinking it sees a face? What limitations can you find?

# Save Your Project



Projects created on Scratch Lab cannot be saved to an account on [scratch.mit.edu](https://scratch.mit.edu). But the file can be saved to your computer and uploaded to the Scratch Lab project page if you want to continue working on your project.

- Click “File,” then choose “Save to your computer.”
- Next time you want to work on your project, go to [lab.scratch.mit.edu/face](https://lab.scratch.mit.edu/face) and click “File,” choose “Load from your computer,” and upload your project.