



Unit 1: SOLAR ENERGY

Fall 2013

Introductory Material

- An Introduction to Solar Energy/Occupations
- More about Solar Energy
- A Sun Story: Coyote and Eagle Steal the Sun and Moon
- What's Your Story? Interactive & Writing Activities
- Explore More! Web-based Resources on Energy and Solar Energy

Activity 1: Predicting Temperature

- Activity 1: Directions
- Take It Home! Take your thermometer home and explore the temperature inside and around your house.

Activity 2: Build a Pizza Box Solar Oven

- Overview: Solar Energy for Heat
- Activity 2: Directions
- Take it Home! Take home your Solar Oven and make S'mores.

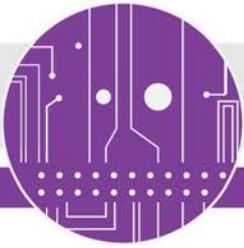
Activity 3: Experimenting with UV Beads: Solar Energy & Chemical Reactions

- Overview of UV Rays (Ultra Violet) and their effect on people.
- Activity 3: Directions (UV Beads)

*Activity 4 Computer Programming (Preparation for Solar Robot Field Trip)

- Introduction to Scratch (a computer program for kids)
- Activity 4: Directions (for using Scratch)

*This is an optional activity. The Scratch program should be loaded on computers.



Introduction to Solar Energy

The sun is an endless source of energy. Solar energy (energy from the sun) is called radiant energy. The sun's radiant energy reaches the earth in rays of sunlight. We can use solar energy/power in two different ways—as a heat source, and as an energy source. Solar energy in the form of heat and light sustains life on earth. Solar energy can also be collected, stored and put to work by converting it to pollution-free thermal (heat) energy and electricity.

Tucson is a sunny city! We have sunshine an average of 350 days per year—that's almost every day of the year!

In your **Science Journal**, list some ways that we can use the sun's energy in our daily lives.



Tucson is a **Science City**! Tucson is a world leader in science exploration and research. Tucson is home to

aerospace companies and the University of Arizona.

Tucson is a growing city!

There are endless opportunities for **solar related jobs** and **careers** in **Tucson**!

Here are a few:

Scientific Occupations

- Physicists
- Materials scientists
- Mechanical Engineers
- Computer software developers

Manufacturing Occupations

- Coating and painting machine setters, operators, and tenders
- Computer-controlled machine tool operators
- Electrical and electronics installers and repairers
- Industrial production managers
- Welding, soldering, and brazing workers
- Glaziers



*****See the Careers in Solar Power link on your Explore More! page for details!**

Solar Energy

The sun is a giant ball of gas. Our earth gets most of its energy from the sun. We call this energy **solar energy**.

Sol means sun.

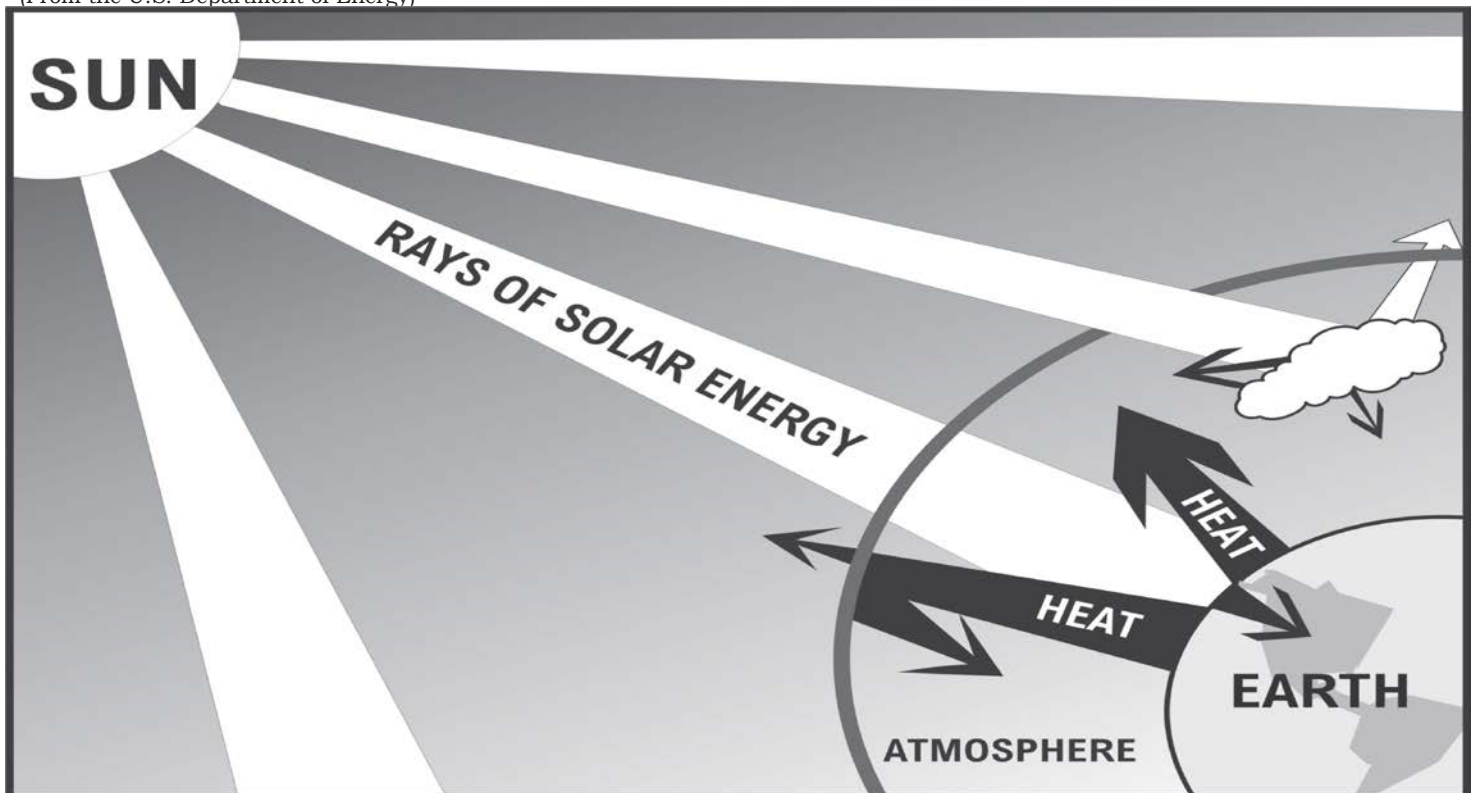


Solar energy travels from the sun to the earth in **rays**. Some are light rays that we can see, and some are rays we can't see, like x-rays. Energy in rays is called **radiant energy**.

The sun sends out huge **rays of solar energy** every day. Most of these **rays** go off into space. Only a small percentage of the rays actually reach the earth.

When the rays of solar energy reach the earth, some bounce off clouds back into space, the rest is **absorbed and** the solar energy is turned into **heat**. This heat warms the earth and the air around it--the **atmosphere**. Without the sun, we couldn't live on the earth—it would be too cold.

(From the U.S. Department of Energy)



Coyote and Eagle Steal the Sun and the Moon

Tribe: Zuni

Region: New México, Arizona



Back when it was always dark, it was also always summer. Coyote and Eagle went hunting. Coyote was a poor hunter because of the dark. They came to the Kachinas, a powerful people. The Kachinas had the Sun and the Moon in a box. After the people had gone to sleep, the two animals stole the box. At first, Eagle carried the box, but then, Coyote convinced his friend, Eagle, to let him carry the box. The curious Coyote opened the box and the Sun and Moon escaped and flew up to the sky. This gave light to the land, but, it also took away much of the heat, thus, we now have winter.



- ❖ In what ways does the sun affect you in your everyday life?
- ❖ Make up a story about the sun or the energy from the sun. Write it in your journal or tell it to your mentor or to a friend or family member.
- ❖ List some ways you and your family use the sun or the energy from the sun in your everyday life.
- ❖ Share stories you have heard about the sun or the energy/heat from the sun with your mentor.
- ❖ Draw some symbols that relate to the sun that you see in your community.
- ❖ Ask an Elder or a family member to tell you a story about the sun or a story related to the sun. Write it in your journal or share it with your mentor.





Activity 1

The Sun's Rays at Work: Predicting Temperature

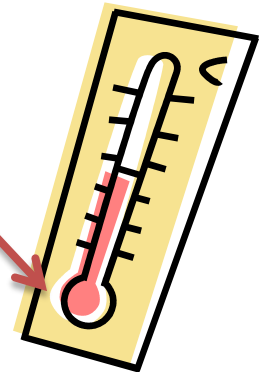


When radiant energy hits objects, some of the energy is reflected and some is absorbed and changed into heat. Some colors absorb more radiant energy than others. Let's predict which colors absorb more radiant energy.

Supplies Needed:

- Three thermometers
- One piece of black paper
- One piece of white paper
- A pencil to record your predictions

Bulb



Procedure:

Step 1: Place the three thermometers in a **sunny spot**. Place them at least 2-3 feet away from one another.

Step 2: Cover the **bulb** of the middle thermometer with black paper. Cover the **bulb** of the thermometer on your right with white paper; leave the remaining thermometer uncovered (*your thermometers have already been covered for you*).

Step 3: Predict which thermometer will get the hottest. Number them 1-3, with 1 as the hottest.

Step 4: Observe the thermometers for three minutes.



Step 5: Record your results by shading in the tubes of the thermometers.



Step 6: Look at the results. Number the thermometers 1-3 with 1 as the hottest.

Step 7: Explain your results in your **Science Journal**.

- a) Which thermometer was the hottest?
- b) Did you predict that result?
- c) Why do think that one was the hottest?

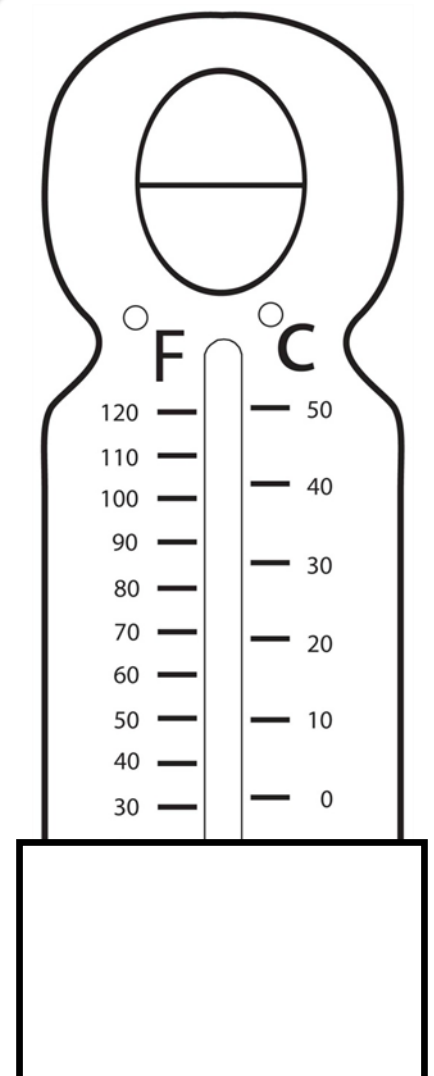
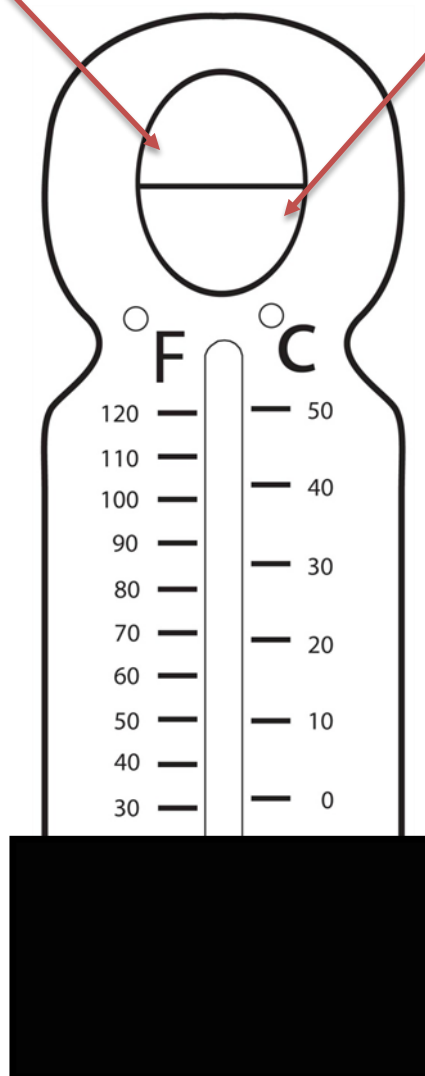
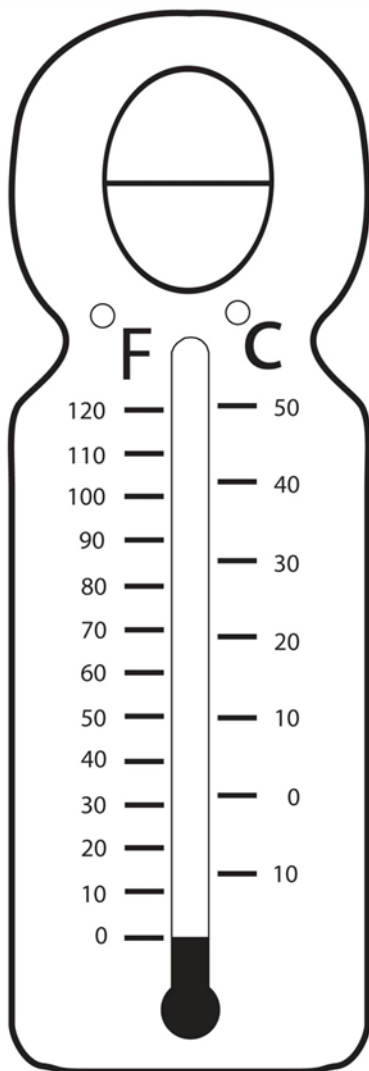
When you are planning to be outside on a very hot day, do think about the color of the shirt you will wear? Should you?



PREDICTION



RESULT





iSTEM ■ Take it Home!

Information • Science • Technology • Engineering • Mathematics



TAKE IT HOME!



Take your thermometer home and test it out! Fill in the chart and share your findings with a family member!

Where is the coolest place in your home?
Where is the hottest? What about outside or in the shade?



Location	Temperature	Notes
(Example) My room	80° F	9:00pm 10/8/12



Build a Pizza Box Solar Oven!

The sun is hot enough to bake food. Here's how to make a simple solar oven that gets hot enough to heat food. It won't get really hot, though, so you can't bake things in it and you won't burn yourself when playing with it. **Today, you will make solar nachos!**

Your Solar Oven has already been built for you!

LET'S GIVE IT A TRY!

On a sunny day, carry your oven outside to a sunny spot. Open the box and put the tortilla chips in the center with the cheese on top. Close the lid of the box. Now, open the flap and turn the box so the foil is facing the sun. The shadow of the flap should go straight back from the back of the box. Move the flap up and down and note how it reflects the sunlight. Use the ruler to prop up the flap so that it bounces the sunlight into the box. Wait about 10 minutes for the box to warm up in the sun. Then, enjoy your solar nachos!

WHAT'S HAPPENING?

The tin foil on your solar oven reflects sunlight and the sun's heat into the box. The cling film seal creates a seal so that air can't escape. The sun's energy heats up the air inside the box and cooks the food. The black paper absorbs heat to make sure that as little as possible escapes.

If you would like to build a solar oven at home, this is what you will need:

SUPPLIES AND TOOLS

- 1 pizza box
- scissors
- tape
- black construction paper
- clear plastic wrap
- aluminum foil
- ruler



How do you think your great-great-grandparents cooked their food? Ask an elder in your family!

DIRECTIONS for building a solar oven

1. Draw an 8 1/2 inch x 11 inch square in the lid of the assembled box.
2. Cut out three sides of the square, and fold the flap back along the uncut edge.
3. Cover the inside of this flap with aluminum foil, using tape to hold the edges securely.
4. Line the inside bottom of the box with black construction paper. Use tape to hold the edges down.
5. Tape one piece of plastic wrap (stretched tightly) to the underside of the lid opening, to cover. Tape another piece on the top of the lid opening to create a layer of insulation to help hold the heat in the box.
6. Prop the box at an angle facing the sun. Use a ruler to prop the flap open.



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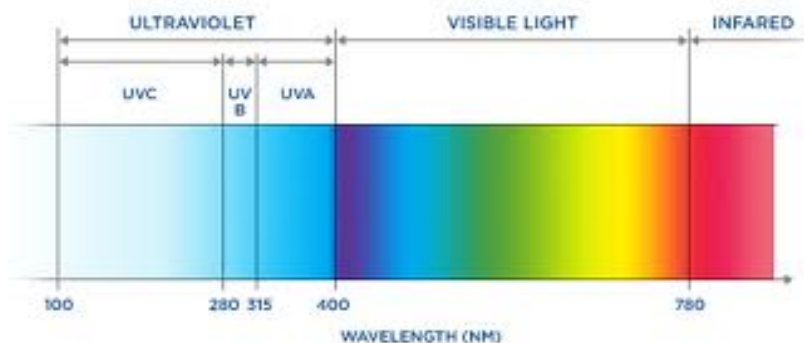
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Activity 3 Experiment with UV Beads Solar Energy & Chemical Reactions



The UV Beads contain different pigments that change color when exposed to ultraviolet light from any source, including the sun. The beads are all white in visible light. In UV light, depending on the pigment added to each bead, you will see different colors.



The term "light" is often used as a generic word to describe many different forms of light such as incandescent light, fluorescent light, or sunlight, for instance. However, not all light is made up of the same energy. Using Energy Beads, you will be able to uncover an invisible form of light energy called ultraviolet light. None of the energy in the ultraviolet region of the light spectrum is visible to the naked eye. Just as there are many different colors of wavelengths in the visible spectrum (red, yellow, green, blue...), so are there many wavelengths of ultraviolet light.

UV Beads are the perfect tool for understanding how solar radiation can be harmful and to recognize preventative measures that can be taken to reduce the risks associated with exposure to sunlight. When you expose bare skin to sunlight, your skin will either burn or tan (which doctors warn is still not healthy for your body). UV radiation wavelengths are short enough to break chemical bonds in your skin tissue and, with prolonged exposure, your skin may wrinkle or skin cancer may appear. These responses by your skin are a signal that the cells under your skin are being assaulted by UV radiation.



Activity 3: Solar Energy

Experiment with UV Beads Solar Energy & Chemical Reactions—

Supplies Needed

- UV Beads
- Pipe cleaners
- Zip lock plastic bags (sandwich sized)
- Sun Screen SPF 4, 15, 30
- Sharpie Markers

Note: It is important that the UV beads be kept from exposure to UV light. Students should see that they are white before going outside, and change color when they are exposed to sunlight. Putting the beads in individual small snack-size plastic bags before starting the activity can help minimize exposure if your classroom has large windows.

Choose One or More of these Experiments

A. Sunscreen Test

- 1) Place 10-20 beads in a zip-lock bag and apply a layer of sunscreen to the outside of the bag.
- 2) Use a permanent marker to write the SPF number of the sunscreen you're testing on the outside of the bag.
- 3) Be sure to set up one bag without any sunscreen coating for comparison purposes. The bag with no sunscreen coating will serve as the control in your experiment.
- 4) Expose the beads to direct sunlight for 5 minutes and look for any changes in color.
- 5) Place a handful of UV beads near a fluorescent light. Do any of the beads change color? Can you get a sunburn or a tan by sitting next to a fluorescent light?



The beads will always change color, regardless of how well the sunscreen blocks UV - the beads are very sensitive! The key is to rate the color of the beads on a scale of 1-5, with 5 showing the most color or "burning" and 1 showing the least color. The bag without any sunscreen is an automatic "5." What did you notice?





Activity 4

Scratch Programming: Introducing Scratch

Have you heard of **Scratch**? If you have not heard, seen, or played with **Scratch**, then you've been missing out, because it is a lot of FUN!!!

What can you do with **Scratch**?


Scratch is a programming language for all, even for kids. In fact, **Scratch**, unlike all other programming languages, is designed first and foremost for kids. Because it's designed for kids, it's very easy to learn and to use. You can create animations like never before. For you older kids, you can create single-level or multi-level **Scratch games** too!

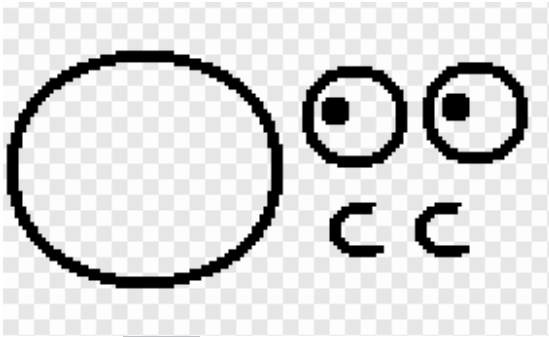
About **Scratch**:


- It's an object oriented program
- **"SPRITES"**—are the object
- You program the **SPRITES** to make them move, talk, dance, etc., by sliding blocks to the middle part of the screen, and "snapping" them together! Then, just click on the green flag and watch your **SPRITE** go!

Check out this video on Scratch and creating **SPRITES**!


<http://www.youtube.com/watch?v=jxDw-t3XWd0>

Next, click **Stamp Tool** () button and select the eyeball to copy by dragging your pointer over it. **Drag** the eyeball copy to where you want the new eyeball to be. Do the same for the ear to make two ears.




Use Fill Tool () to fill the face and the eye ball.

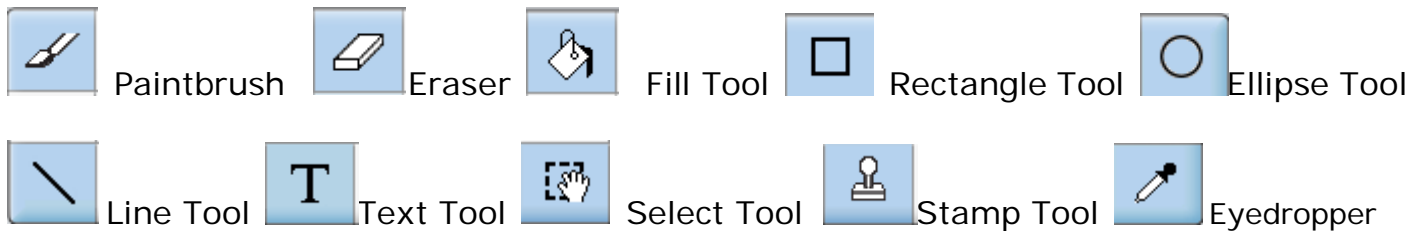


Click Select Tool () button and select both eyes; move them to the face.

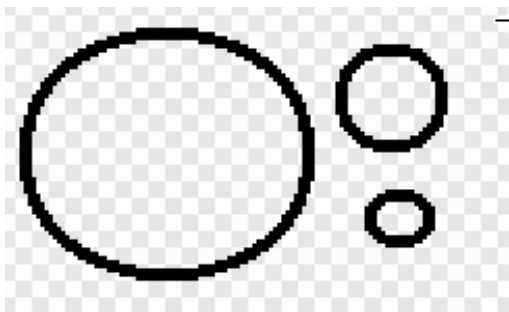





If you would like to create your own sprite, follow these instructions!

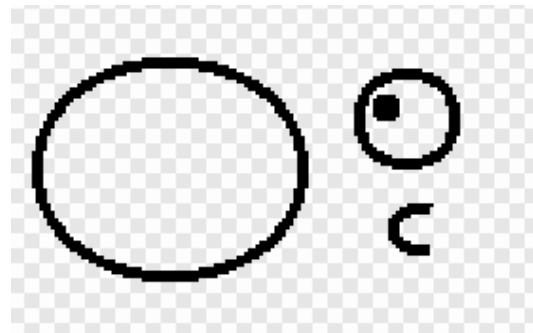
Click the  ("Paint new sprite" button) to open the Paint Editor. I created the following sprite using mostly the following:



Click **Ellipse Tool** () and click **hollow mode** (). Draw three circles.



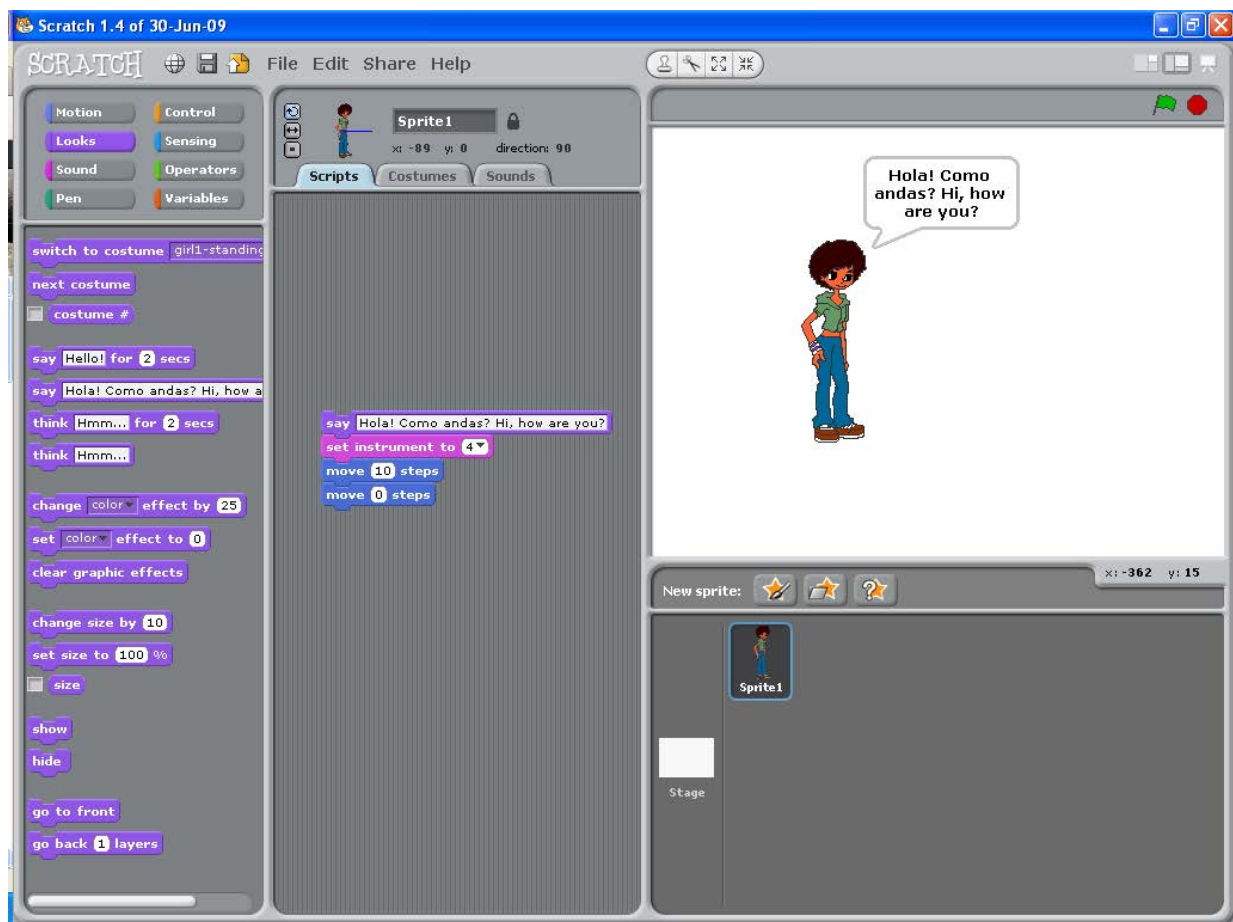
Click **Ellipse Tool** () and click **solid mode** (); draw a little dark solid circle inside the medium circle, which will be the eye. Use **Eraser** tool () to trim the smallest circle; this will be the ear.





When you click on the **start icon**, the sequence of instructions in the **sprite editor** section, in the middle, will take effect. This will make the sequence of instructions or **scripts** repeat until you press the 'stop' icon.


Practice dragging the colored blocks to the middle to see how you can program your sprite to do and say what you want! Don't forget to add music from the **sound** section!



Step 2: Choose Your Sprite

You should now be on the home page.

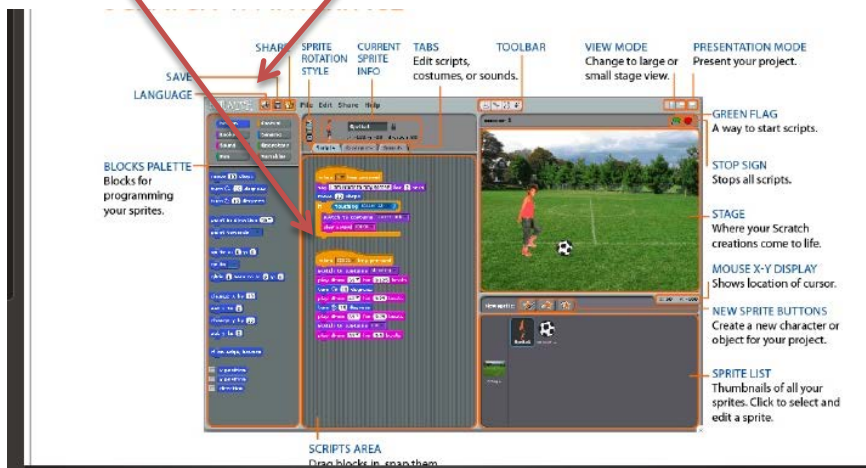
Delete the kitten sprite by right clicking on "sprite1" in the **SPRITE SELECTION AND CREATION** section and select "delete".

All the sprites in the program are shown in the bottom right-hand side. You can create new sprites using the  icons. The first will allow you to paint your own sprite. The second allows you to open a save sprite from your computer, and the last one will pick a random sprite from the library and put it in your program.

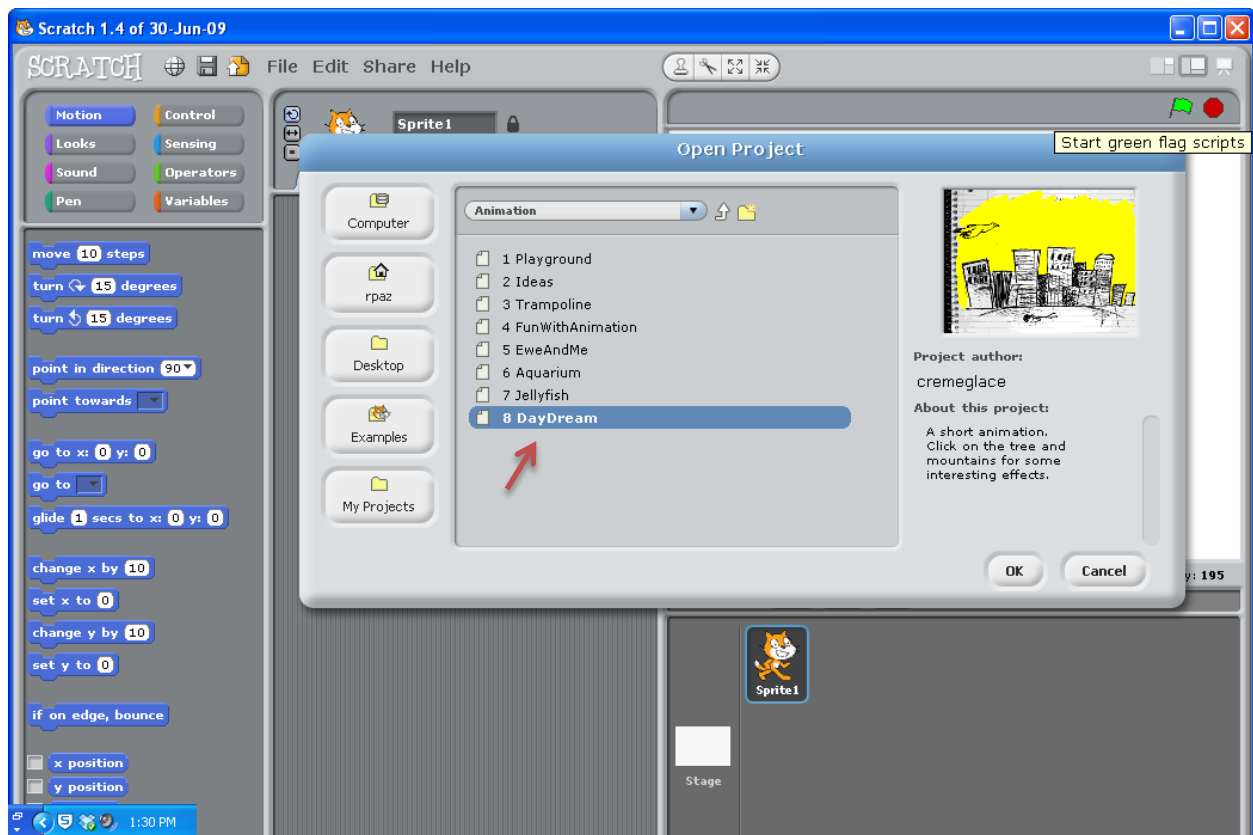
Choose your new sprite from the middle icon .

Create the following **script** for the sprite that you have just created. Scripts are colored blocks that you drag together to program or command your sprite.

These can be found in the **motion**, **looks**, **sound** and **control** tabs on the section on the left, and should be dragged onto the **script** **sprite editor** section in the middle part. This is where you tell your sprite what to do!

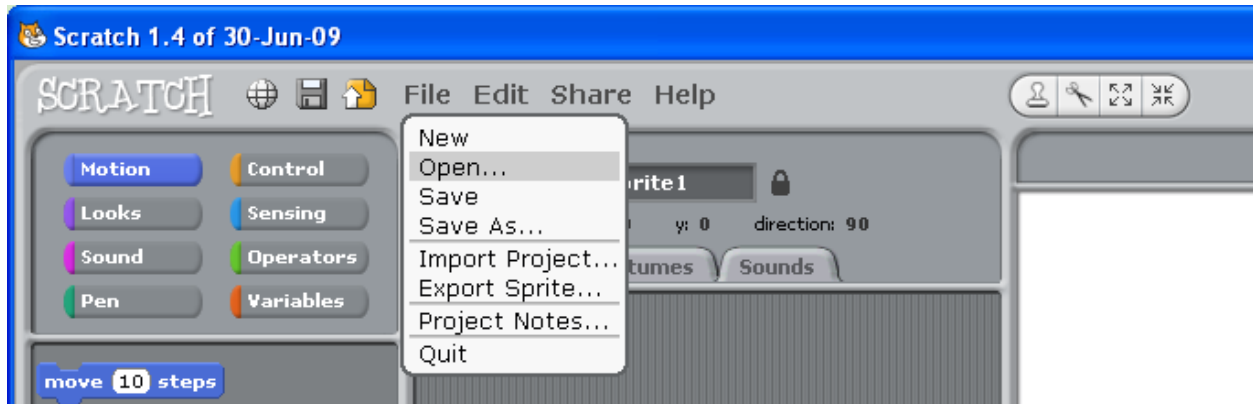


Click on the sample project “Daydream” from Animation folder. Click “ok”. Then, click the green flag for the demo to start! Check out the other folders too by double-clicking them and then the green flag to start! Make sure your volume is turned on!

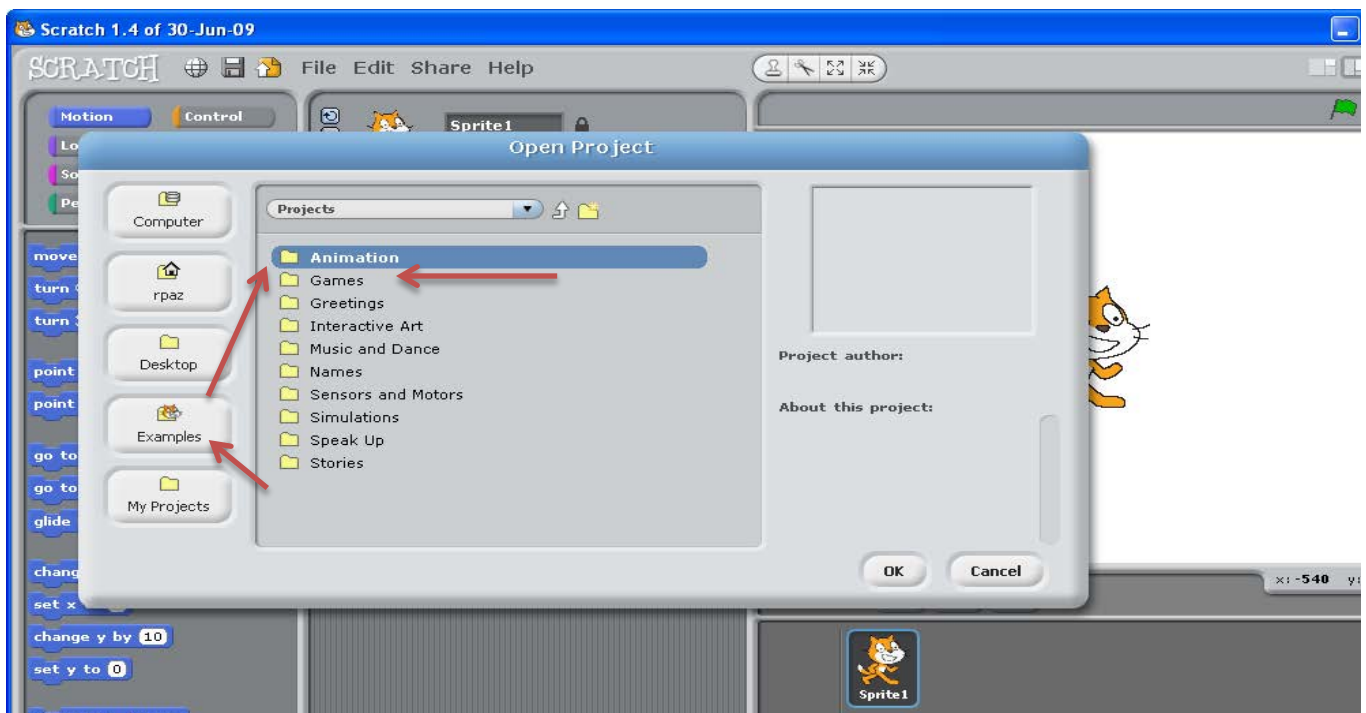


Now that you have explored the **Animations** and **Games** folders, hopefully you have some new ideas about what type of program you would like to create! Let's get started by creating your very own “**Sprite**”! Now, go to **File** and click **New!** This will bring you back to the page with the kitten sprite. Let's begin!


Let's take a look at available sample projects. Click "File", then "Open" on the top of the Scratch window.

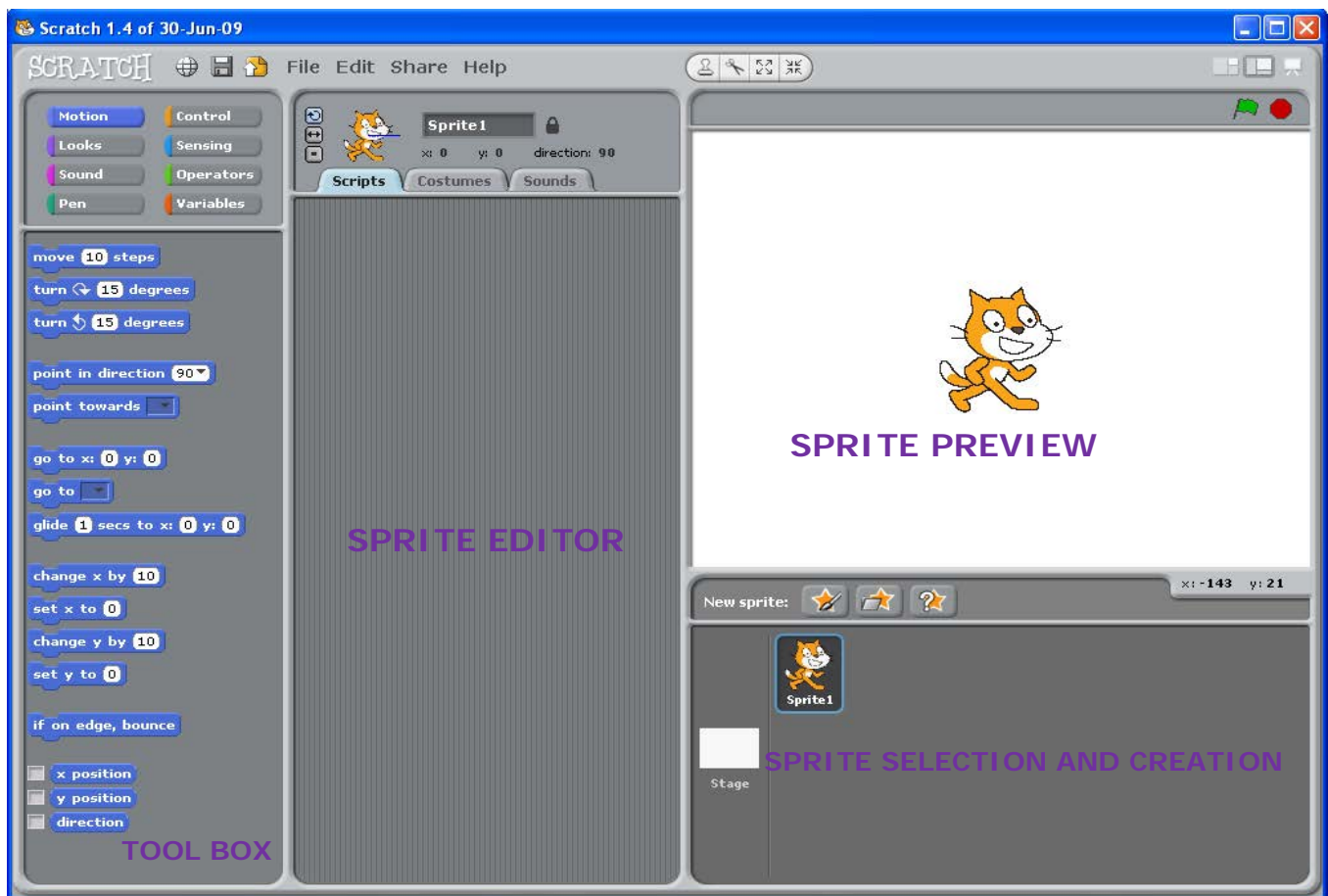



"Scratch Projects" will open. Click the "Examples" folder on the left. You'll want to try out "Animation" and "Games"! Preview the animation and games folders to check out sample Scratch projects!





Step 1: First Look at Scratch

Start the Scratch Program. Scratch can be started by double-clicking  on your Desktop. Sprite **Preview** lets you preview a project. Sprite **Selection** and **Creation** lets you select an existing Sprite or create a new Sprite. Sprite **Editor** lets you edit a Sprite's Scripts, Costumes, and Sounds. **Tool Box** is like a bucket of Legos; it provides single script blocks for building combo script blocks.





Click Select Tool () button and select left ear; drag it to its place.





Click Select Tool () button and select the right ear; click  to flip it. Then drag the right ear to its place.

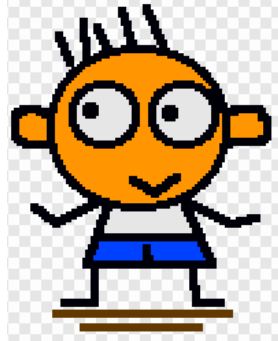
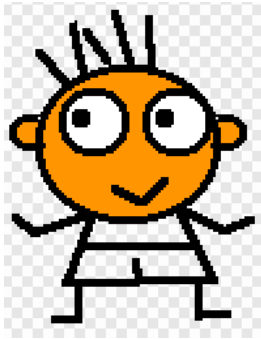


Click Eyedropper Tool () and click the face to copy the face color. Click

Fill Tool () and fill both ears with the face color.



Use Line Tool () to add hair, body, arms, legs, and clothes. Fill in color with Fill Tool ().

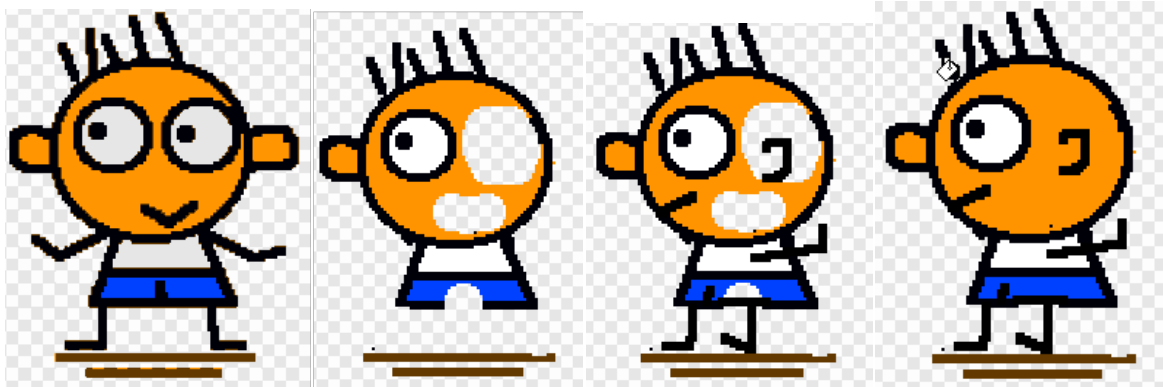



Once you are happy with your own **Virtual Me** sprite, **click OK to save**. Rename the costume to "front". This is the front view.

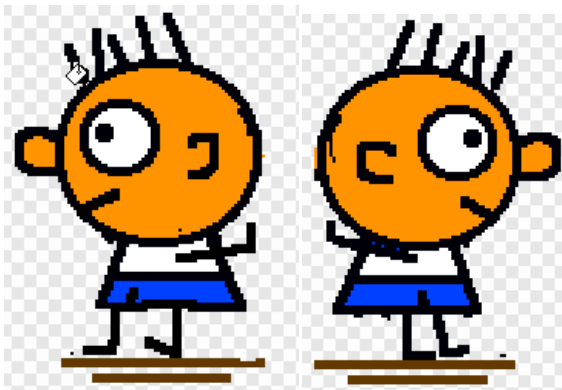
STEP 3: CREATE BACK, LEFT SIDE, and RIGHT SIDE VIEWS

To create back view, make a copy of costume "front" (click "Copy" button next to costume "front"). Use Erase tool to erase eyes and mouth. Use Eyedropper tool to copy the face color. Then use Fill Tool to paste the color in the empty area. Click OK to save. Rename this costume as "back".

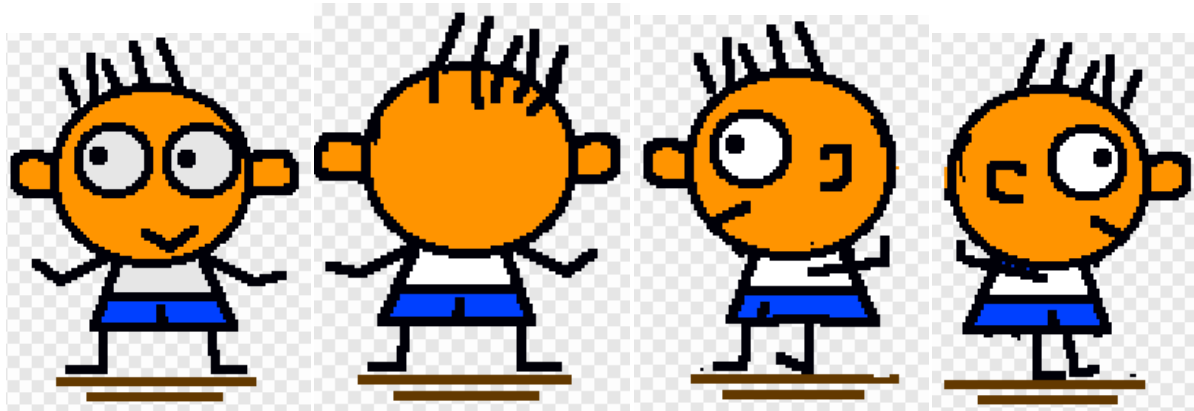
Then, copy the costume “back”. Erase extra body parts. Redraw body parts. Refill color of the face and the pants using Eyedropper Tool and Fill Tool. Click OK to save and rename this costume as “facing left”



Copy the costume “facing left” and click  to flip the figure horizontally. Click OK to save and rename the costume as “facing right”.



We've just created four costumes for the same sprite: “**front**”, “**back**”, “**facing right**” and “**facing left**”.



Your **Sprite Editor** should look something like this:



Click the **ok** button to save and, at the bottom of the “Save Project” window, enter “dance” as file name. Then click OK.



New Filename:

Now you are ready to create your own **scripts** program using your very own, unique sprite!