

FINCH ROBOT: SCRATCH

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THE FINCH IS A GREAT WAY TO GET STARTED WITH PROGRAMMING. WE'LL USE **SCRATCH**, A VISUAL PROGRAMMING LANGUAGE, TO CONTROL OUR FINCH.

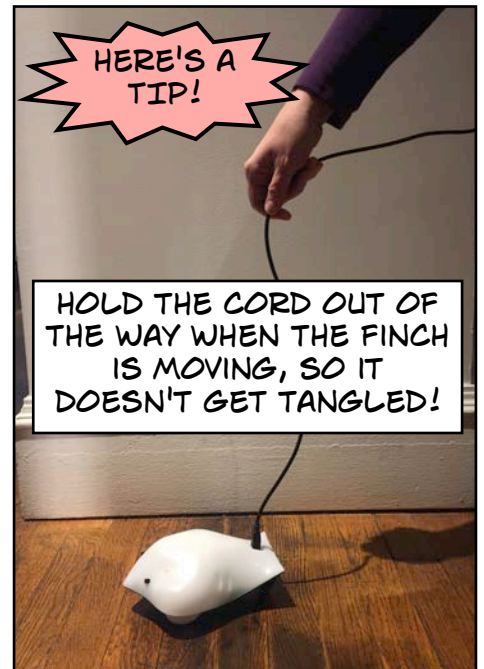


FIRST, PLUG THE FINCH INTO YOUR COMPUTER. USE THE PORT ABOVE THE TAIL.



HERE'S A TIP!

HOLD THE CORD OUT OF THE WAY WHEN THE FINCH IS MOVING, SO IT DOESN'T GET TANGLED!



ON A MAC OR PC, OPEN "BIRDBRAIN ROBOT SERVER."



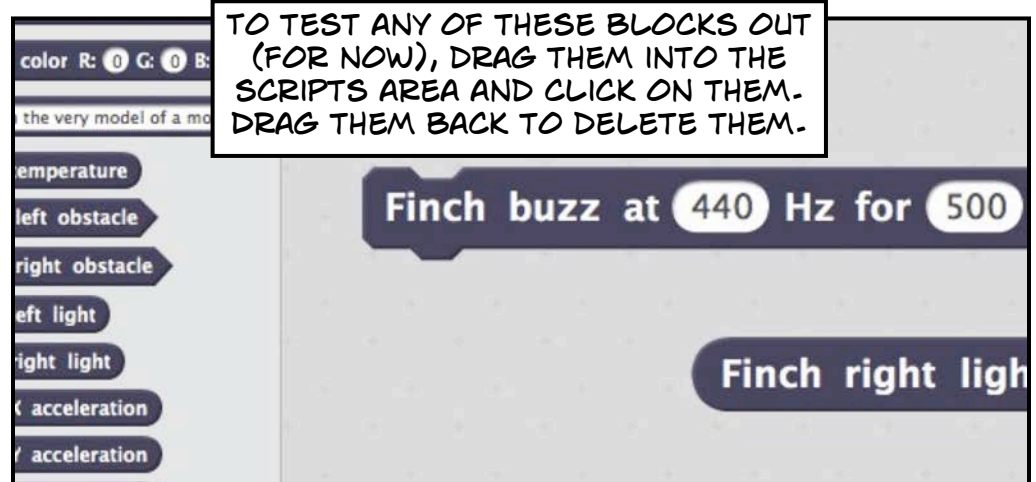
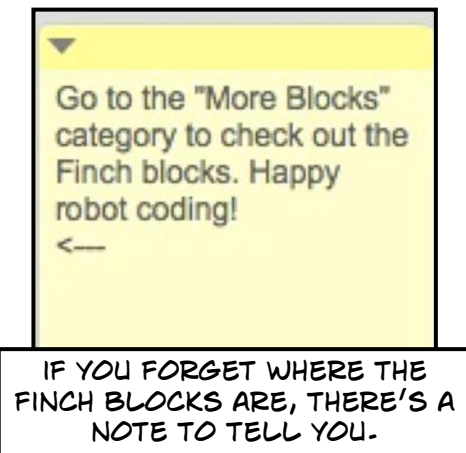
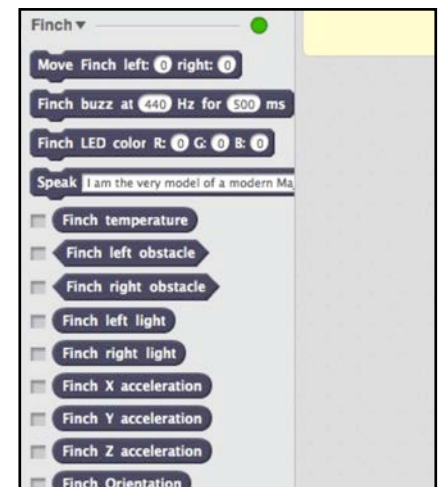
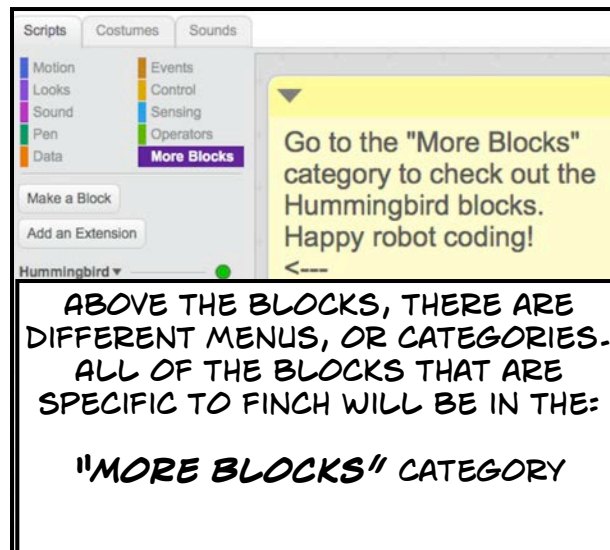
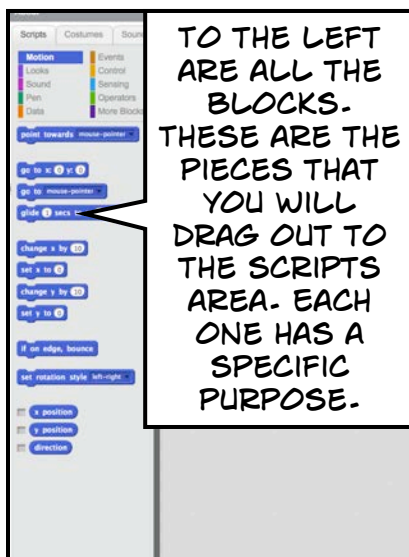
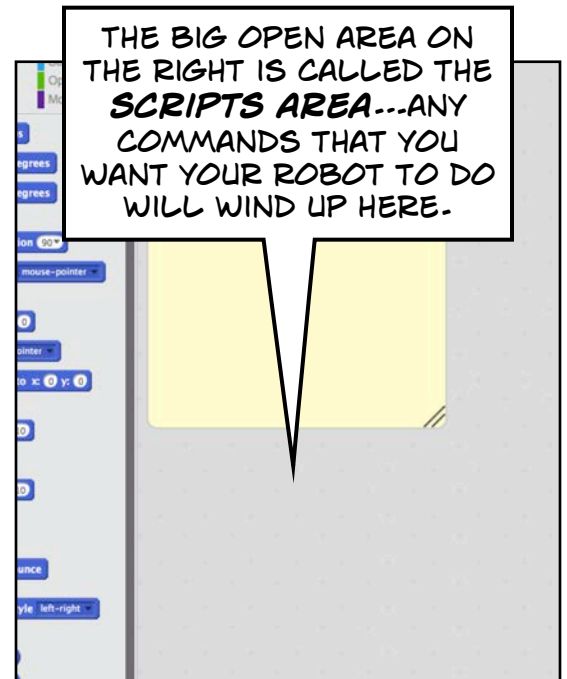
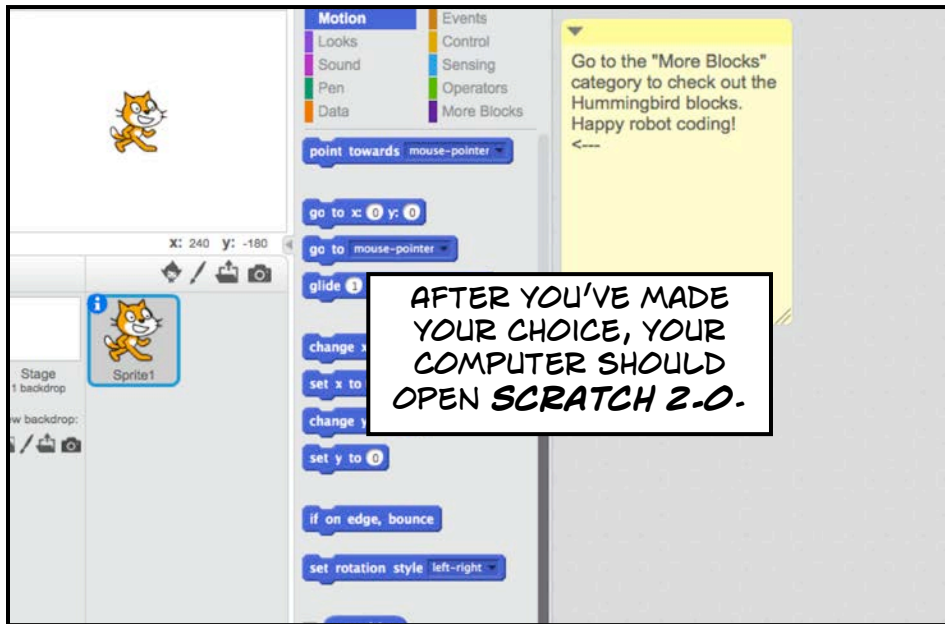
BirdBrainRobotServer

ON A CHROMEBOOK, OPEN "FINCH CONNECTION APP."



Finch Connection App





THERE ARE FOUR MAIN TYPES OF FINCH-SPECIFIC BLOCKS IN SCRATCH. THEY ARE ALL IN THE **MORE BLOCKS** MENU.

MOTION BLOCK

Move Finch left: 0 right: 0

LOOKS BLOCK

Finch LED color R: 0 G: 0 B: 0

SOUND BLOCK

Finch buzz at 440 Hz for 500 ms

FIRST, WE'LL TRY
OUT THE MOTION
BLOCKS AND GET
THE FINCH'S WHEELS
ROLLING!

SENSOR BLOCKS

Finch temperature

Finch left obstacle

Finch right obstacle

Finch left light

Finch right light

Finch X acceleration

Finch Y acceleration

Finch Z acceleration

Finch Orientation

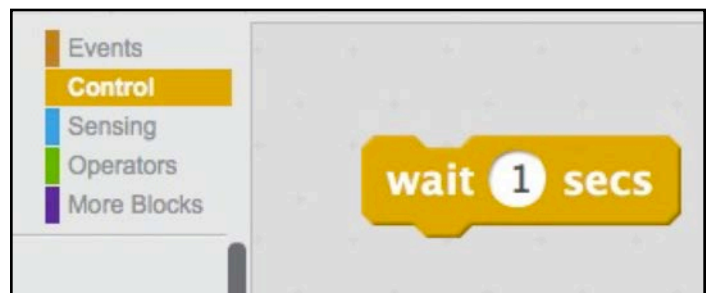
TO USE THE MOTION BLOCKS, WE
WANT TO WRITE **PROGRAMS** THAT
SCRATCH WILL UNDERSTAND. FOR
EXAMPLE, LET'S TELL IT:

"MOVE FORWARD AT MEDIUM SPEED
FOR ONE SECOND, THEN STOP."

BUT IN ORDER TO DO THAT, WE NEED
MORE THAN JUST THE MOTION BLOCKS.
WE'LL ALSO NEED THE DARK YELLOW
EVENT BLOCKS AND THE LIGHT YELLOW
CONTROL BLOCKS.



IN THE **EVENTS** MENU, YOU'LL FIND THE
"WHEN SPACE KEY PRESSED" BLOCK. CLICK
ON THE BLACK TRIANGLE IN THE BLOCK TO
CHOOSE A DIFFERENT KEY.



IN THE **CONTROL** MENU, YOU'LL FIND THE
"WAIT 1 SECOND" BLOCK. YOU CAN TYPE
ANY NUMBER INTO THE WHITE CIRCLE.

WE'LL USE BOTH OF THESE BLOCKS TO GET THE FINCH MOVING. DRAG THEM BOTH INTO THE **SCRIPTS** AREA. THEN, HEAD BACK TO THE **MORE BLOCKS** MENU.

START OUT BY DRAGGING OUT THE "MOVE FINCH" BLOCK. SNAP IT TO THE "WHEN SPACE KEY PRESSED" - YOU'LL SEE WHITE LINES THAT MEAN THE BLOCKS WILL SNAP TOGETHER.



NEXT, WE NEED TO SET THE LEFT AND RIGHT WHEEL SPEEDS. THEY RANGE FROM 0 TO 100. WE'LL GO WITH 50.



NEXT, WE NEED TO TELL THE FINCH HOW LONG IT SHOULD GO.



WE CAN DO THIS BY USING THE "WAIT" BLOCK. YOU CAN MAKE THE FINCH MOVE AS LONG AS YOU'D LIKE.

HOWEVER, WE NEED TO ADD ANOTHER "MOVE FINCH" BLOCK TO REALLY END THE PROGRAM. BY SETTING THE MOTORS TO ZERO, WE TELL THE FINCH TO STOP MOVING AFTER THE "WAIT" TIME HAS PASSED.



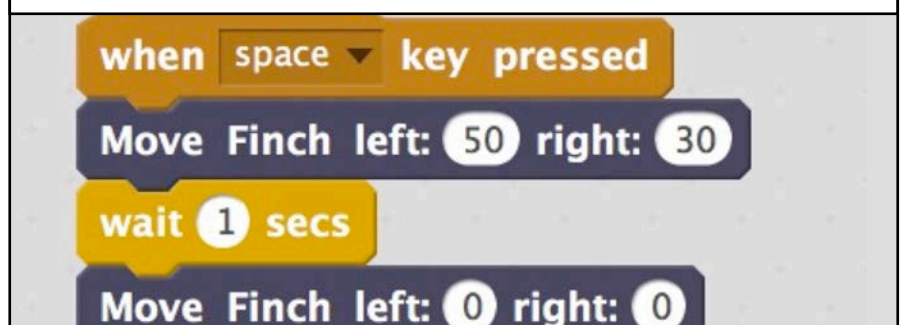
WHAT HAPPENS IF YOU INSERT NEGATIVE VALUES INTO THE "MOVE" BLOCK?

TO HAVE THE FINCH SPIN IN PLACE, ONE WHEEL NEEDS TO MOVE BACKWARDS (HAVE A NEGATIVE VALUE).

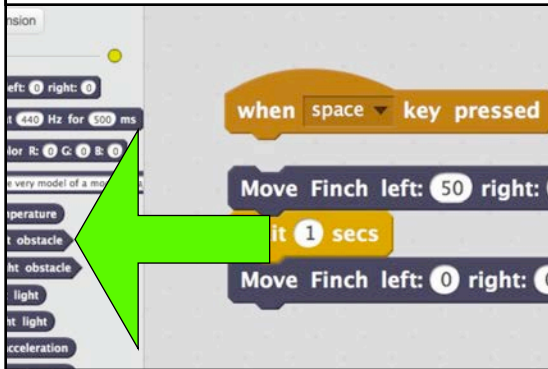


MOVING FORWARD (OR BACKWARD) IS HELPFUL, BUT YOU MAY NEED TO TURN THE FINCH. TO DO THIS, THE WHEELS NEED TO MOVE AT DIFFERENT SPEEDS.

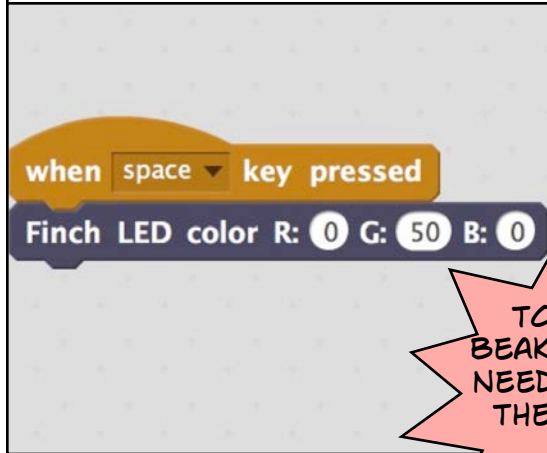
TO HAVE THE FINCH MOVE IN A CURVED LINE, ONE WHEEL NEEDS TO MOVE SLOWER THAN THE OTHER.



NOW WE CAN USE OTHER FEATURES OF THE FINCH, SUCH AS BEAK COLOR AND THE BUZZER. REMOVE THE PREVIOUS PROGRAM BY DRAGGING THE MOTION BLOCKS BACK OVER TO THE MENU.



THE BLOCK THAT CONTROLS BEAK COLOR IS THE "FINCH LED" BLOCK. PULL IT OUT AND SNAP IT TO THE CONTROL BLOCK.



TRY ENTERING DIFFERENT VALUES (0-100) IN THE RED, GREEN, AND BLUE SLOTS. WHAT HAPPENS WHEN YOU MIX COLORS?

TO TURN THE BEAK OFF, YOU'LL NEED TO SET ALL THE VALUES TO ZERO.

TO MAKE THE FINCH BUZZ, HEAD TO THE SOUND MENU AND PULL OUT THE "BUZZER" BLOCK.



TRY MESSING AROUND WITH THE VALUES. THE FIRST CONTROLS PITCH, WHICH CAN BE SET FROM 50-20,000HZ. THE SECOND IS THE LENGTH OF THE SOUND IN MILLISECONDS.



TRY MAKING A PROGRAM WITH "BUZZER" BLOCKS SEPARATED BY "WAIT" BLOCKS. CAN YOU MAKE THE FINCH SING?

NOW YOU CAN MAKE YOUR FINCH MOVE, ALTER ITS APPEARANCE, AND EVEN SING A SONG! BUT WHAT IF YOU WANT THE FINCH TO REACT TO ITS ENVIRONMENT? THE FINCH IS EQUIPPED WITH SENSORS THAT ALLOW YOU TO DO JUST THAT.

THE ACCELERATION SENSOR REPORTS ON THE FINCH'S ORIENTATION-- WHERE IT IS IN SPACE.

THE TEMPERATURE SENSOR DETECTS THE TEMPERATURE AROUND THE FINCH.

THE LIGHT SENSORS DETECT LIGHT, ALLOWING THE FINCH TO DETERMINE WHETHER IT IS DARK OR BRIGHT.

Finch X acceleration

Finch Y acceleration

Finch Z acceleration

Finch temperature

Finch left light

Finch right light

THE OBSTACLE SENSORS DETECT WHETHER THERE ARE OBJECTS IN FRONT OF THE FINCH.

Finch left obstacle

Finch right obstacle

THE ORIENTATION SENSOR DETECTS THE POSITION OF THE FINCH - BEAK UP, UPSIDE DOWN, ETC.

Finch Orientation

THE OBSTACLE BLOCKS AND THE ORIENTATION BLOCKS ARE BOTH A LITTLE DIFFERENT! OBSTACLE BLOCKS GIVE RESULTS IN **BOOLEAN** (TRUE OR FALSE), AND THE ORIENTATION BLOCK DELIVERS A **STRING** (WORDS). ALL OTHER SENSORS GIVE **NUMBERS**.

LET'S BUILD A **PROGRAM** USING THE SENSORS.

IF THE ROOM IS DARK, TURN THE FINCH'S BEAK ON. IF NOT, KEEP THE BEAK OFF.

THIS PROGRAM IS A LITTLE MORE COMPLEX THAN THE LAST ONE. WE WILL NEED TO USE A FEW MORE OF THE CONTROL BLOCKS, SPECIFICALLY THE "IF, ELSE" BLOCK AND THE "FOREVER LOOP" BLOCK.



THE "IF, ELSE" BLOCK IS LIKE A LITTLE SENTENCE:

IF (SOME CONDITION IS MET), THEN DO THIS **ACTION**, OR **ELSE** DO THIS OTHER **ACTION**.

BUT WHAT GOES IN THE **FIRST** PART OF THE "IF, ELSE" BLOCK?

Finch left light



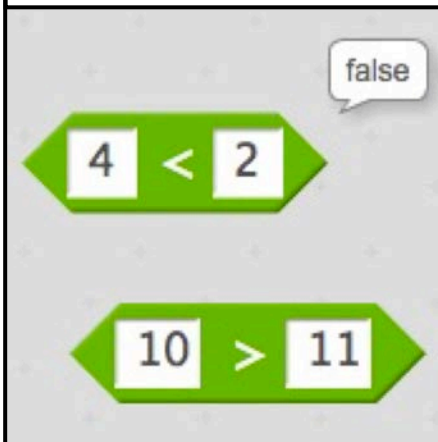
THAT'S WHERE WE'LL PUT THE SENSING BLOCKS AS WELL AS SOME GREEN BLOCKS CALLED **OPERATORS**. THEY CAN BE FOUND IN THE OPERATORS MENU.

WITH THE GREEN **OPERATOR** BLOCKS, WE'RE GOING TO LOOK AT TWO SYMBOLS YOU MIGHT REMEMBER FROM MATH CLASS:

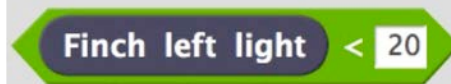
< (LESS THAN)
> (GREATER THAN)



IF YOU PUT IN SOMETHING **FALSE**...LIKE THAT 9 IS MORE THAN 10, IT WILL TELL YOU WHEN YOU CLICK ON IT!



WE CAN PUT OUR **SENSORS** IN THESE BLANKS! FOR EXAMPLE, THIS IS SAYING "THE LIGHT HITTING OUR SENSOR IS LESS THAN 20"!

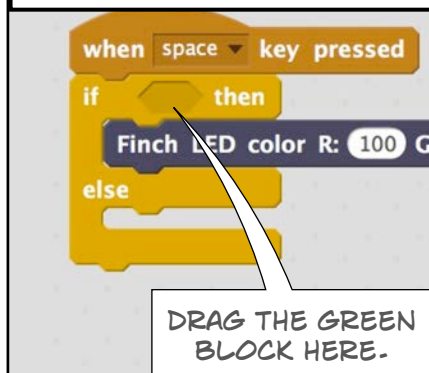


IS THAT TRUE OR FALSE? DEPENDS ON HOW BRIGHT THE ROOM IS!

NOW, WE NEED TO SET THE FIRST ACTION FOR THE "IF, ELSE" BLOCK. DRAG THE BEAK LED BLOCK INTO THE FIRST SECTION OF THE "IF, ELSE" BLOCK.



WE CAN HAVE THE SENSOR CHECK THE LIGHT IN THE ROOM -TO DO THAT, WE'LL PUT OUR OPERATOR INSIDE THE "IF, ELSE" BLOCK DIAMOND.



TIP: SNAP ON A "WHEN SPACE KEY PRESSED" AT THE TOP TO BE AN ON SWITCH!

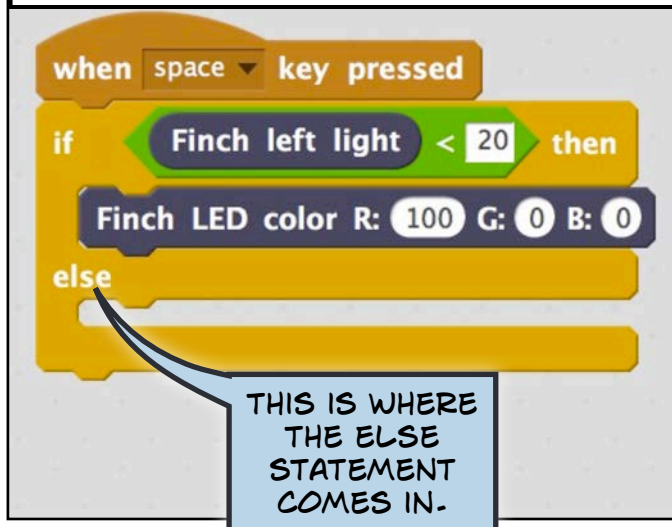
NOW YOU HAVE THIS PROGRAM:

IF THE LIGHT HITTING OUR SENSOR IS LESS THAN **20**, TURN THE BEAK RED!



DOES IT WORK? IF NOTHING CHANGES, TRY TURNING OFF THE LIGHTS IN THE ROOM AND TRYING AGAIN!

BUT, WHAT IF YOU TURN THE LIGHTS BACK ON? HOW DO YOU GET THE LED TO TURN **OFF** WHEN IT'S NOT NEEDED?



WE WANT TO CREATE A PROGRAM THAT SAYS: **IF** THE LIGHT HITTING OUR SENSOR IS **LESS** THAN **20**, TURN THE LED TO 100.

OTHERWISE, TURN THE LED TO ZERO.

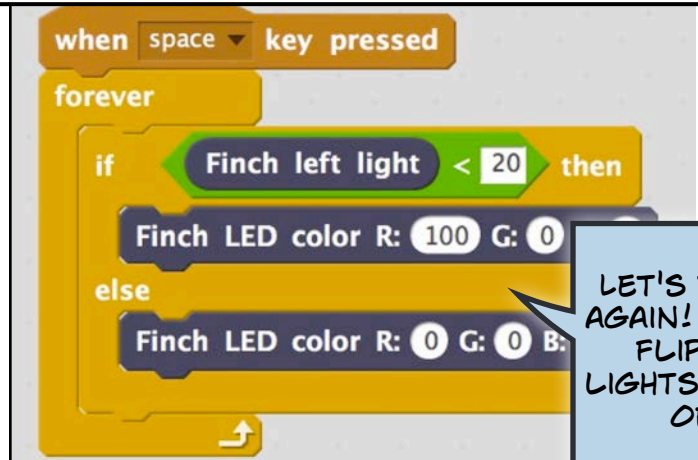
THE **ELSE** IS THE SECOND PART OF THIS STATEMENT. **ELSE** APPLIES WHEN THE FIRST **IF** CONDITION IS NOT MET.

ADDING THE **ELSE** ACTION IS EASY - IT'S JUST LIKE ADDING THE FIRST **IF** ACTION.



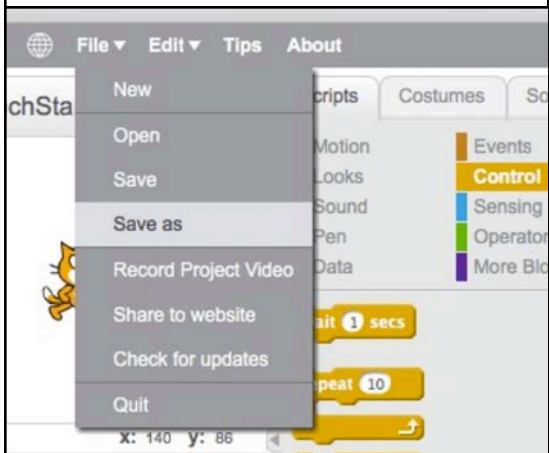
THIS TIME, WE'LL SET THE LED INTENSITY TO ZERO - COMPLETELY OFF.

AS IT STANDS, THAT STATEMENT WILL ONLY CHECK THE ROOM **ONCE**. TO HAVE IT CONSTANTLY CHECK, PUT EVERYTHING INSIDE A "FOREVER" BLOCK. THE "FOREVER" BLOCK CAN BE FOUND IN THE CONTROL MENU.



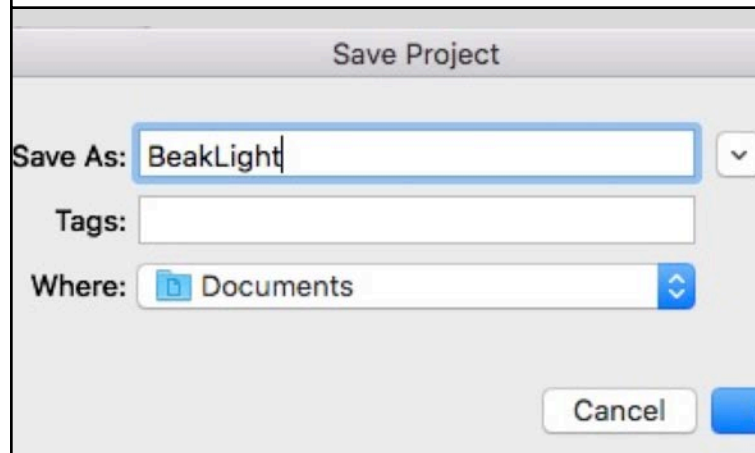
LET'S TEST IT AGAIN! TRY THE FLIPPING LIGHTS ON AND OFF.

BE SURE TO SAVE YOUR WORK!



GO TO THE **FILE** MENU AND CHOOSE "SAVE AS".

REMEMBER TO MAKE A NOTE OF THE LOCATION WHERE YOU ARE SAVING THE FILE. TRY TO NAME IT SOMETHING RELATED TO THE PROJECT AT HAND.



THESE ARE JUST A FEW OF THE THINGS YOU CAN DO WITH THE FINCH ROBOT! CHECK WWW.BIRDBRAINTechnologies.com FOR MORE IDEAS, LESSONS, AND ACTIVITIES.

