



Creative Programming in Scratch

NCCE 2011

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<http://garfieldcs.com/ncceScratch>





You might be wondering...

- Why is programming worth teaching?
- What kind of learning can Scratch support?
- What kinds of projects help students develop critical thinking skills?
- How can Scratch projects be assessed?
- How can Scratch support your course goals?





Who is in the room?

- Name
- School, role(s)
- What comes to mind when you hear ‘programming’
- What do you know about Scratch?
- Your goals for tonight





Hélène Martin

- Computer science teacher at Garfield HS
 - Exploring CS
 - Creative Computing
 - AP CS
- Computer Science degree from UW
- Desire to increase participation in CS
- Find me at <http://helenemartin.com>,
[@purplespatula](#)





Programming?

- “Telling the computer what to do”
- Writing, testing and maintaining source code
- Creating original digital artifacts

- Rule-based, detail-oriented
- Empowering!





Why teach programming?

- Increase problem-solving abilities
 - Algorithmic thinking
 - What computers can/can't do
- Reinforce learning from core subjects
 - Algebra
 - Geometry
 - Scientific method
- Increase interest in computing fields



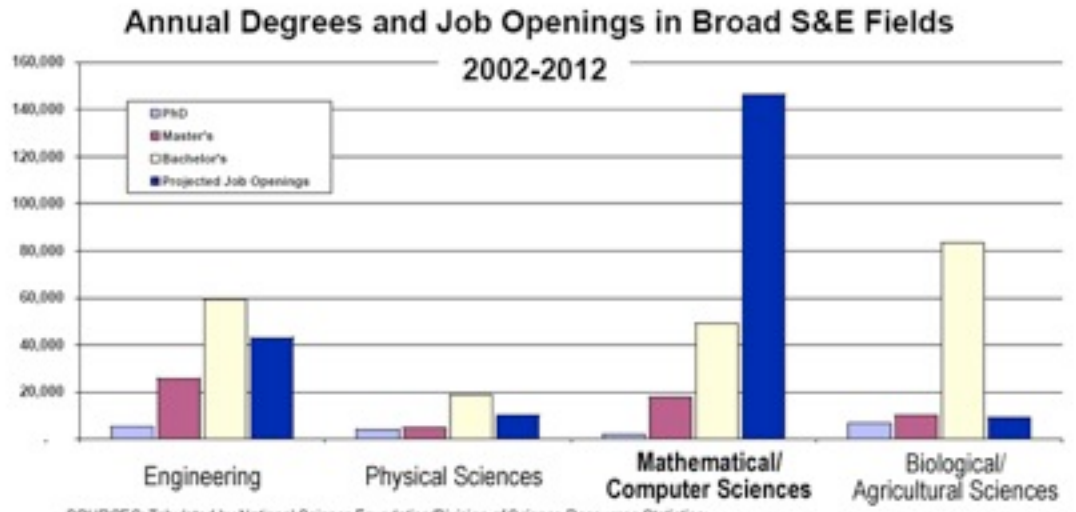


The stereotypes





The reality



SOURCES: Tabulated by National Science Foundation/Division of Science Resources Statistics; Degree data from Department of Education/National Center for Education Statistics: Integrated Postsecondary Education Data System Completions Survey; and NSF/SRS: Survey of Earned Doctorates; Projected Annual Average Job Openings derived from Department of Commerce (Office of Technology Policy) analysis of Bureau of Labor Statistics 2002-2012 projections





The reality





Scratch: visual programming

- <http://scratch.mit.edu>

ROTATION STYLE
Control whether costumes rotate with the sprite.

CURRENT SPRITE INFO

TABS
Click tabs to edit scripts, costumes, or sounds.

TOOLBAR

GREEN FLAG
A way to start scripts.

PROJECT NOTES

BLOCKS PALETTE
Blocks for programming your sprites.

SCRIPTS AREA
Drag blocks in, snap them together into scripts.

PRESENTATION MODE

STAGE
Where your scratch creations come to life.

NEW SPRITE BUTTONS
Create a new character or object for your project.

SPRITE LIST
Thumbnails of all your sprites. Click to select and edit a sprite.





Why Scratch?

- No syntax learning-curve
- Build intuitions about computing concepts relevant to all languages
- Immediate feedback
- Great social networking component





Check it out

- Try out different projects on <http://scratch.mit.edu/channel/featured> (second link from workshop website)
- Look for projects relevant to your subject area





Scripts

- Formalized algorithms
- Combination of blocks
- Attached to sprites or the stage
- Blocks only fit where syntactically correct





Statements

- Commands or instructions
- Simple statements are verbs

move 10 steps

say Hello!

add apple to my list

change pen size by 1

set instrument to 1

play sound pop

set size to 100 %

set feeling to happy

point towards





Repetition

- Loops are used to repeat a piece of code
 - Iteration is critical in CS but also math, science





Your turn: bouncing cat

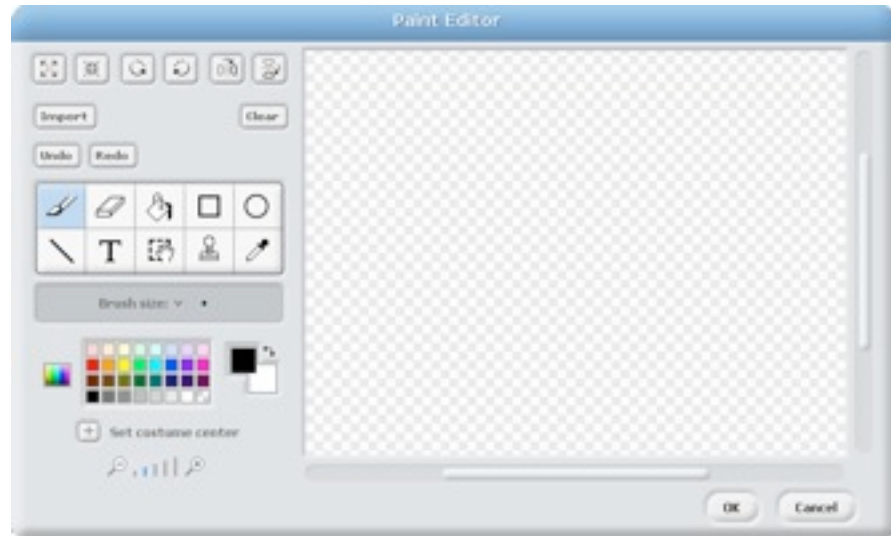
- Make your cat sprite go back and forth across the screen until the user clicks the mouse
- Explore!





Visuals

- Sprites have costumes
- The stage has backgrounds



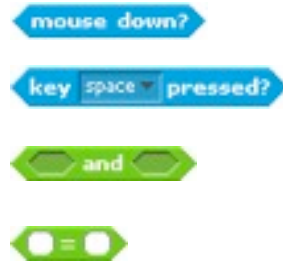


Conditionals

- Not all statements should be run all the time



- Boolean expressions define conditions
 - Evaluate to true or false





Your turn: bouncing ball on beach





Variables

- Placeholders for values
- Named by the user
- Your turn: resizable polygon





Rubric: Resizable polygon

- __/2 - has a size variable
- __/2 - has a sides variable
- __/2 - changing variables has desired effect
- __/1 - has a creative background
- __/2 - variable sliders on stage for user to set
- __/1 - clicking on green flag starts program





Threads

- ADVANCED programming topic
- Coordination of multiple things going on at once
- Any block beginning with 'When' starts a thread





Events

- Signal from one thread to another
- Broadcast blocks send events
- Your turn: LeBron James buttons project





Lists

- A type of variable that contains multiple related values
- See writeup for graphing assignment

Scripts Costumes Sounds

when clicked

This short script should let you set the list's values based on a function.

This script is going to be a little LONG but not HARD. It should give you practice with reasoning in the plane.

40px margin

Create a 10 element list. Here I've run the short script to populate the list with points for $y = .33 * x$

10 evenly-spaced tick marks

points are size 10

Cat ends in the corner

Points
1 0.33
2 0.66
3 0.99
4 1.32
5 1.65
6 1.98
7 2.31
8 2.64
9 2.97
10 3.3

+ length: 10





Practicing problem solving

- Understanding problem statements
- Decomposing problems into solvable pieces
- Incremental design
- **Sample problem:** The user can set `gridHeight`, `gridWidth` and `gridMargin` with sliders. The cat should draw a grid of size `gridHeight` by `gridWidth`, `gridMargin` away from the edge of the screen.





Breaking down the grid problem

- **(Syntax)** How can we get Cat to draw a horizontal line 30 from the top of the screen?
- **(Geometry)** How can we get Cat to draw 5 evenly spaced horizontal lines?
- **(Syntax)** What kind of loop should we use?
- **(Algorithm)** How many times will it repeat?
- **(Algebra)** What if we want a margin of 30 on top and bottom?





Writing: proposal

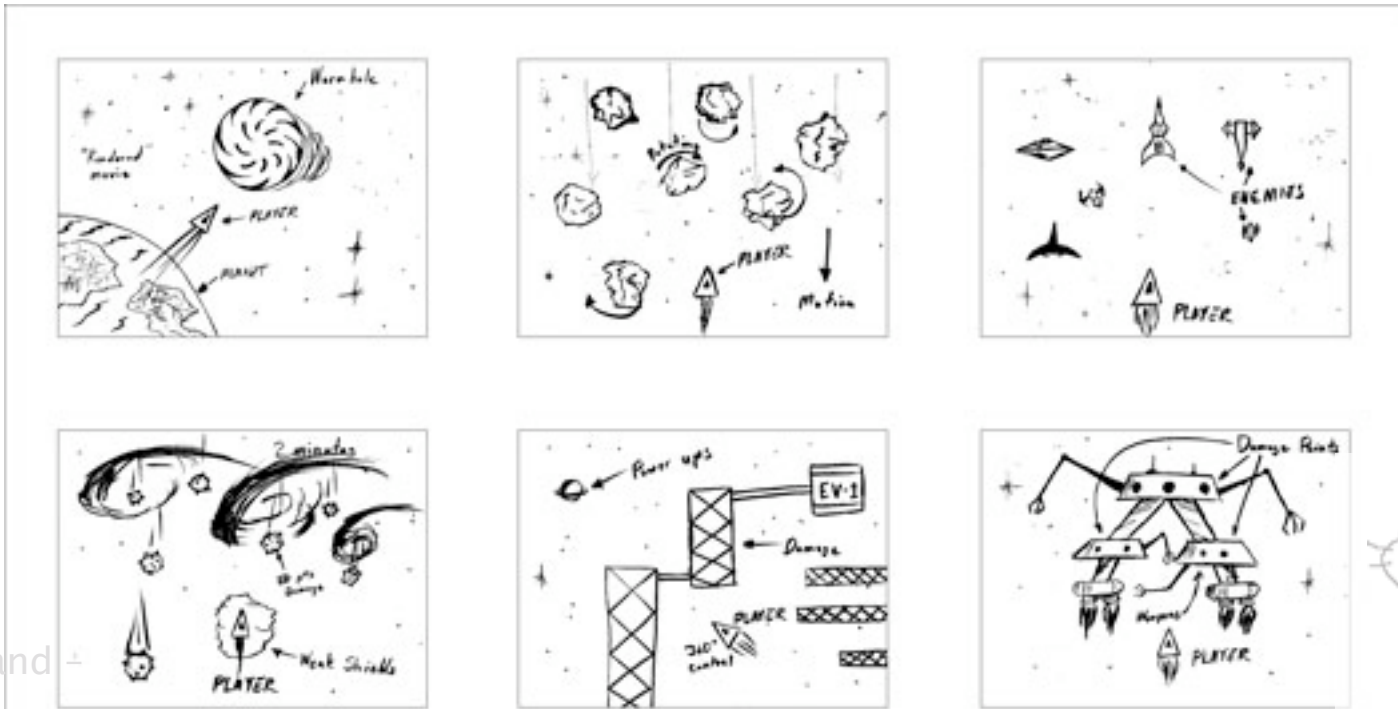
- Students write formal project proposals
- Teach technical writing
- Bring in industry guest to hear elevator pitches





Design: storyboarding

- Encourage students to plan before acting
- Help students develop storytelling abilities
- Introduce a real-world technique





Parting words

- Encourage students to be tech producers
- Allow “guided play”
- Teach meaningful critical thinking skills
- “Hide” important lessons in a playful environment
- Leverage existing materials





Want more?

- Summer CS4HS workshop
 - UW: <http://cs4hs.cs.washington.edu/>
 - Oregon:

- Scratch@MIT conference

