

Squeak- a Free Computer Application to Enhance Math and Science Learning

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AT INDIANA UNIVERSITY

Outline

(distrib copy of Squeak?)

- ◆ Collective “thank you”
- ◆ My/Lab’s background and interests
- ◆ Intro to Squeak – with demos
- ◆ Interactive – with you
- ◆ Your thoughts and ideas



Speaker's background

- ◆ **B.S. Comp Math, Eastern Illinois U.**
- ◆ **M.S. Comp Science, U. of Utah**
- ◆ **M.A. Mathematics, Arizona State U.**
- ◆ **25 yrs scientific programming**
- ◆ **Scientific data visualization/analysis**
- ◆ **2 children (ages 9 and 5)**
- ◆ **SDA Lab: improve science understanding**



If you need to leave early

- ◆ <http://squeakland.org>
- ◆ <http://sda.iu.edu/K-12>
- ◆ heiland@iu.edu



Squeak

- ◆ What is it?
- ◆ How can you get it?
- ◆ What can it do?
- ◆ What can't it do (easily)?



Squeak – what is it?

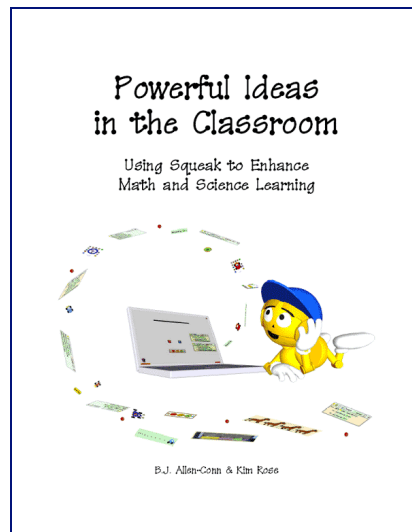
- ◆ 2-D graphics application
- ◆ Open source (=free) (for Windows, Mac, Linux)
- ◆ Multimedia authoring environment
- ◆ Drag & drop programming environment
- ◆ Constructivist learning environment



Squeak – how can you get it?

- ◆ Download from squeakland.org
(installer ~6M ; virus-free)
- ◆ a.k.a. Etoys=Educational toys

Optional
media (\$)
Book, DVD



Squeak – what can it do?

- ◆ Let children be artistically creative
- ◆ Let children create dynamic “stories”
- ◆ Let children create [mathematical] games and artwork
- ◆ Teach (object-oriented) programming
- ◆ Let children create math & science simulations



Squeak – what can't it do (easily)?

- ◆ 3-D graphics
- ◆ Automatic graphing of data (it's not a spreadsheet application)
- ◆ Image editing (it's not Photoshop)
- ◆ Sharing over the Internet
- ◆ Custom sounds/music

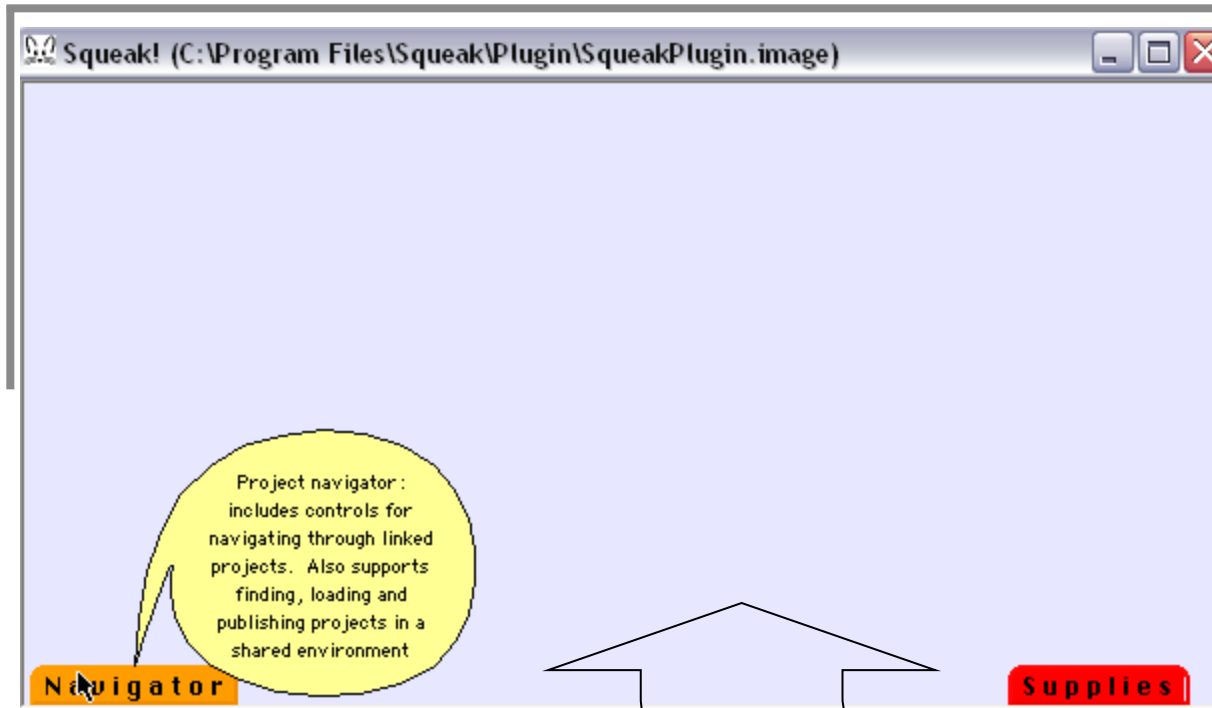


Demos...

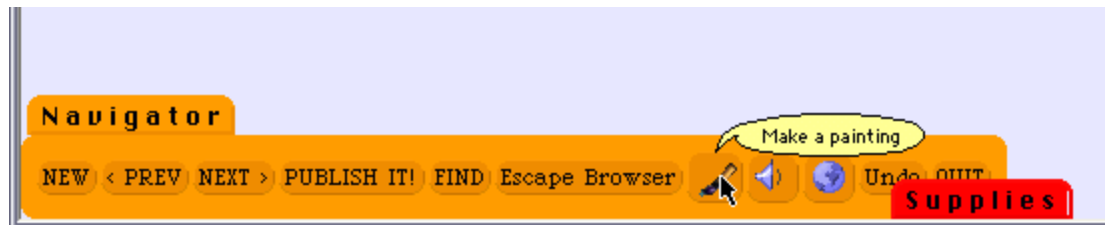
- ◆ Getting started
- ◆ Paint a sketch
- ◆ Program (script) a sketch
- ◆ Math/Science simulations



Getting started



“Mousing over” something often produces balloon help.

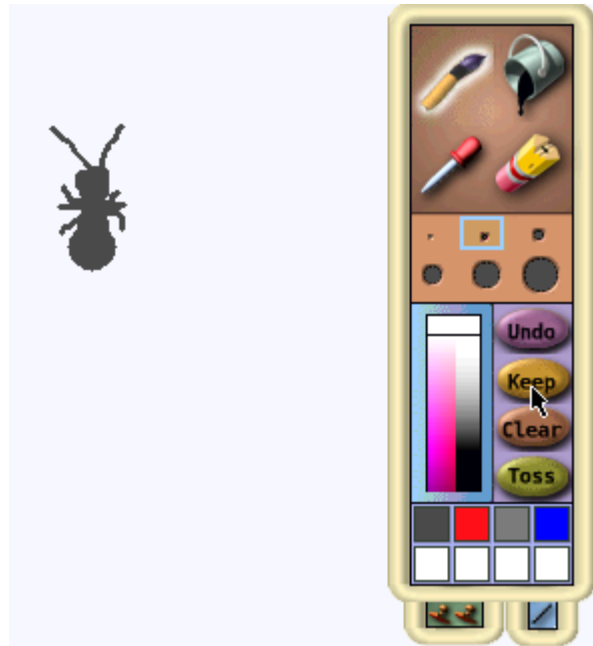


Open region = “World”

Click on the paintbrush



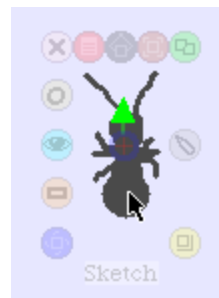
Paint a sketch



Experiment with the paint tools to create a sketch. When you're done, 'Keep' it.

→ Observe your world.

“Mousing over” your sketch will show its halos.



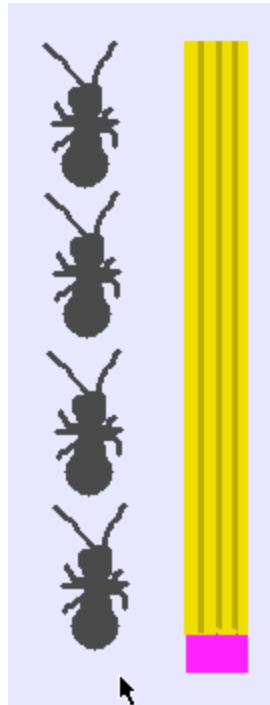
A sketch's default orientation is 'up' (green arrow).

You'll directly edit your sketch via the halos.

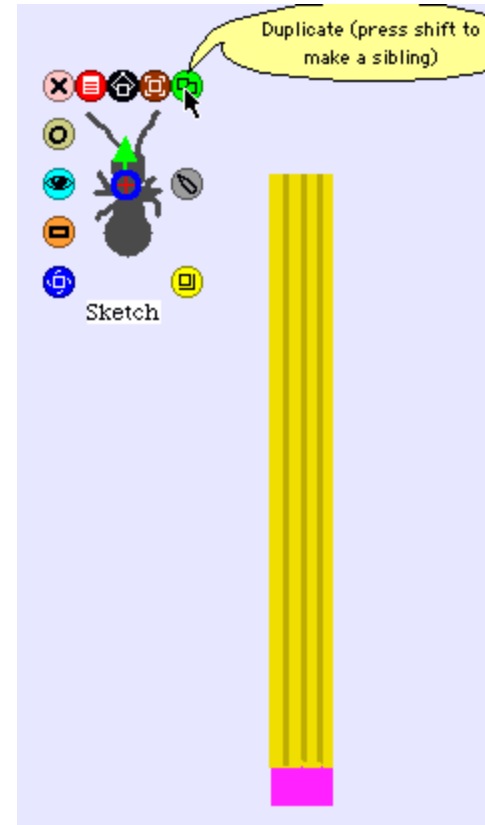


Paint another sketch: pencil

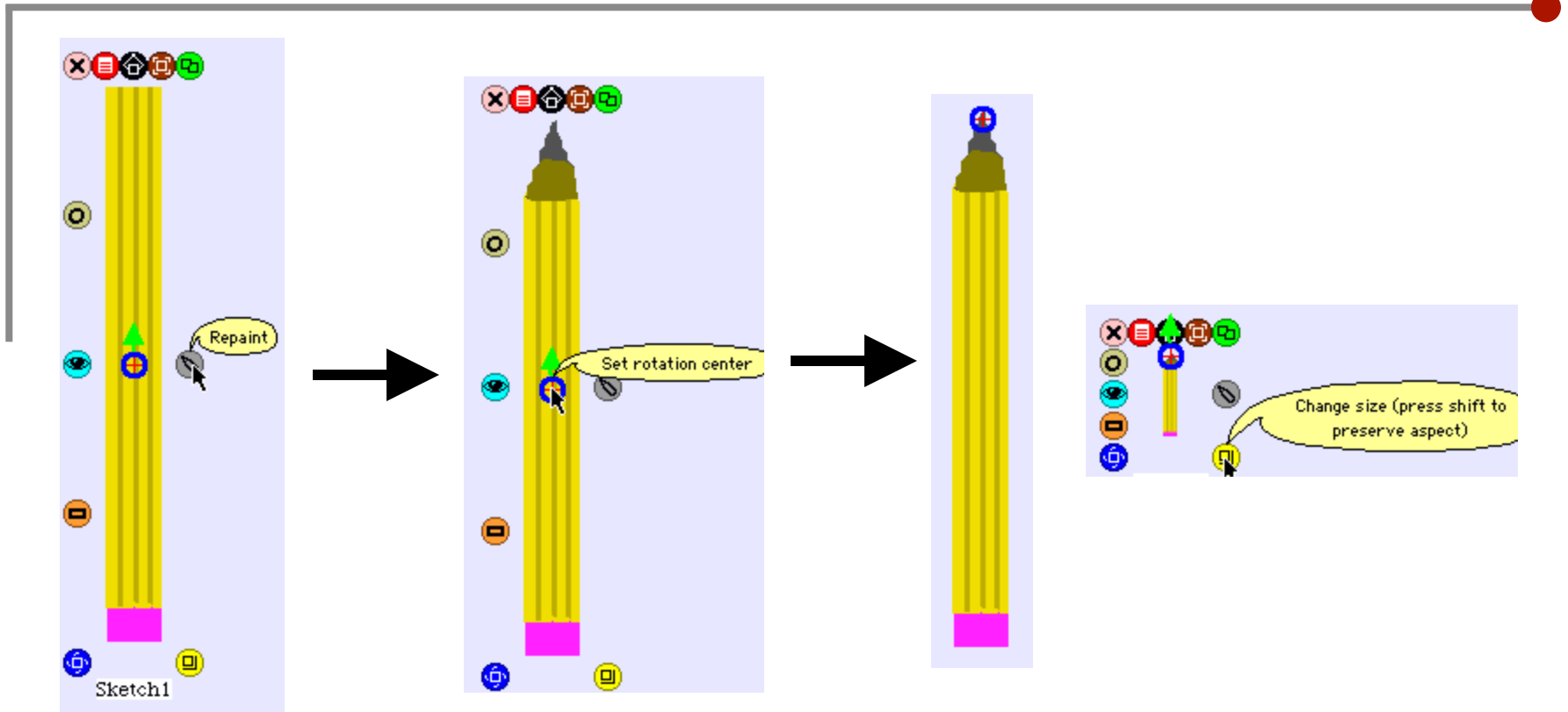
- ◆ Q: how many ants is the same length as a pencil?



Counting, estimation



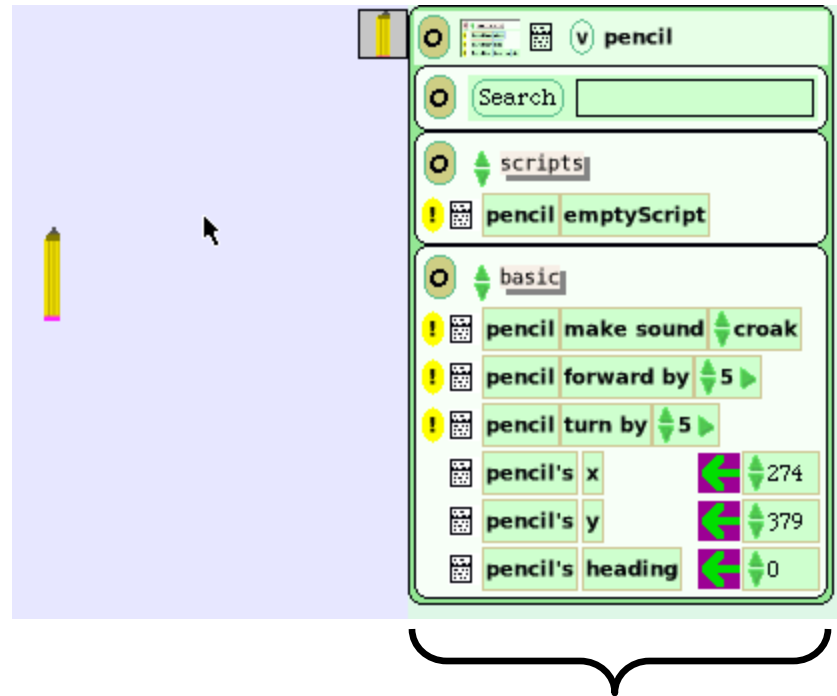
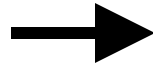
Repaint: “sharpen” the pencil



After repainting/Keep, move its rotation center to the tip (hold **Shift** key to move it) then shrink the pencil.



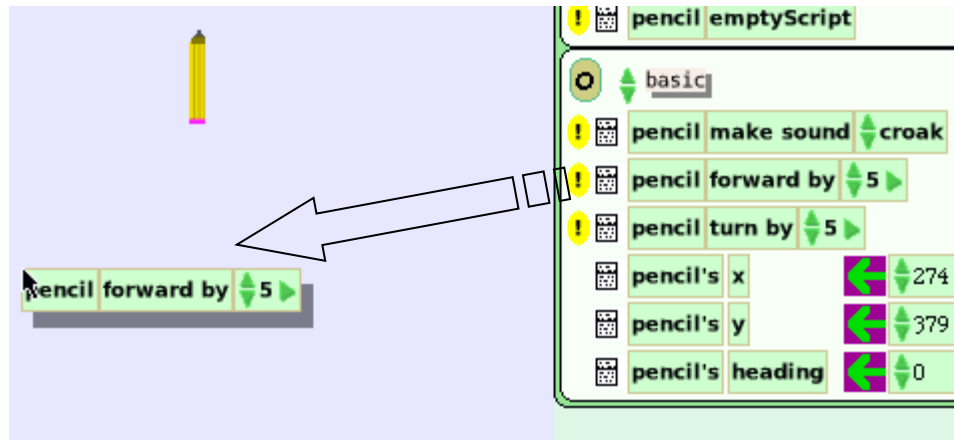
Program (script) a sketch



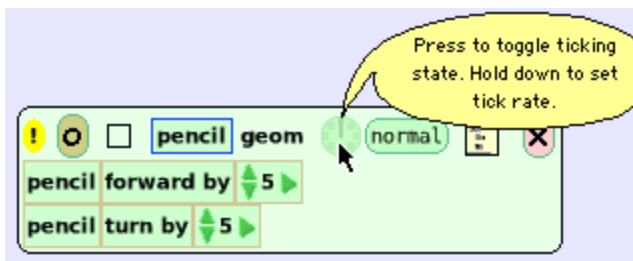
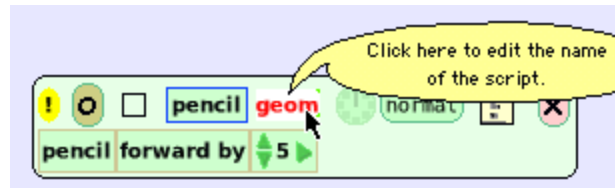
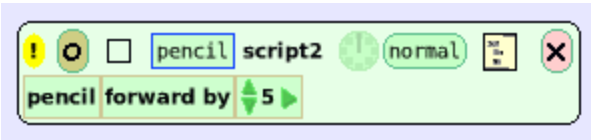
A viewer contains tiles
(in categories/blocks)



Program a sketch (2)



Drag/drop a tile into the World to create a script.



Click on the timer clock to run the script (toggle on/off)



Simple geometry

pen use

- ! pencil clear all pen trails
- pencil's dotSize ← 6
- pencil's penDown ← false
- pencil's penSize ← 1
- pencil's trailStyle ← lines

drag from here to obtain an assignment phrase.

pencil geom

- ! pencil forward by 5
- pencil turn by 5
- pencil's penDown ← true

pencil orient

- ! pencil orient normal
- pencil's heading ← 90

Click here to run this script once; hold button down to run repeatedly

pencil hex

- ! pencil hex normal
- pencil forward by 50
- pencil's heading increase by 60

pencil orient

- ! pencil orient normal
- pencil's heading ← 90

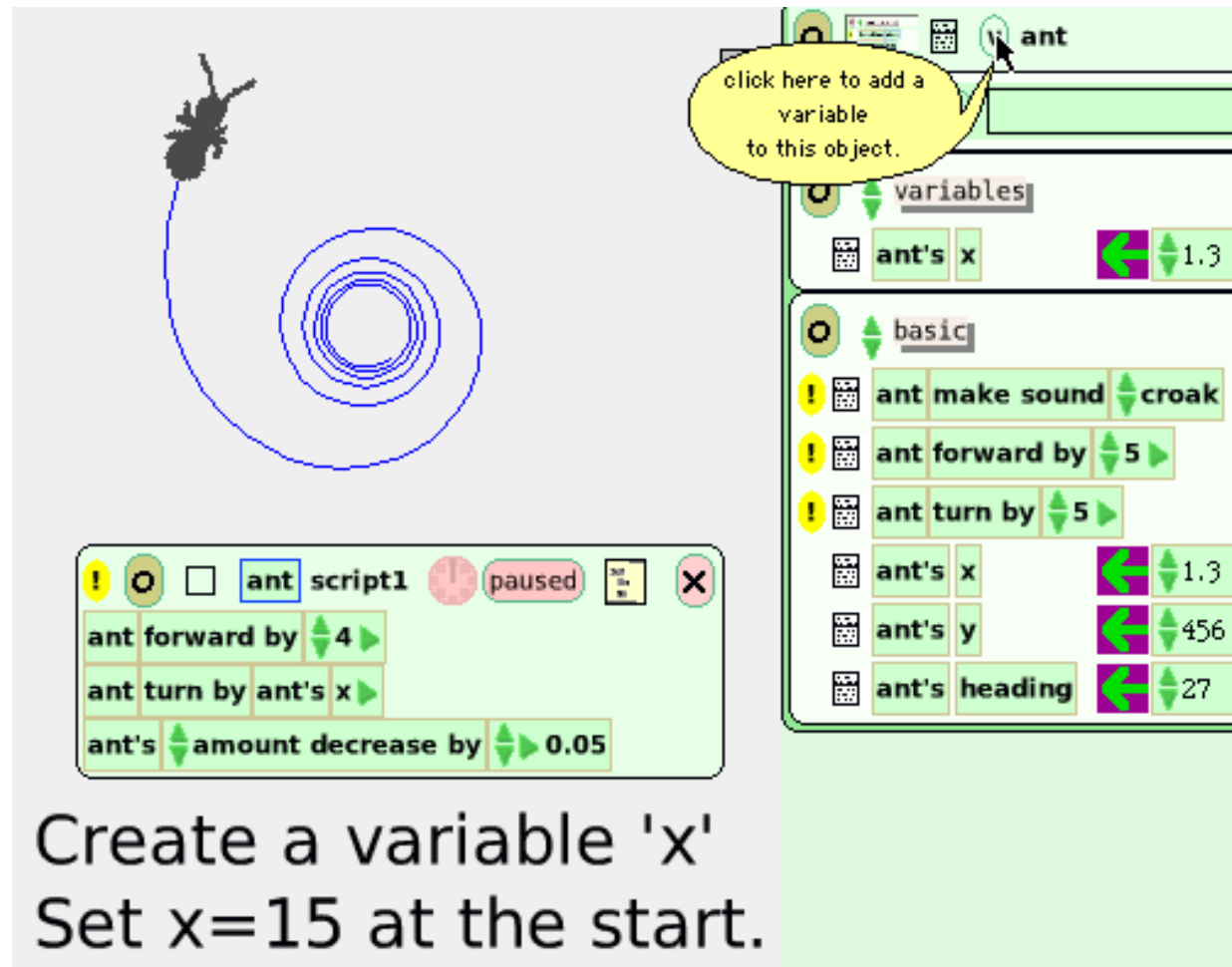
pencil polygon

- ! pencil polygon normal
- pencil forward by 50
- pencil's heading increase by 90

Visually seeing effect of direct manipulation of numbers (+/-)



More geometry + algebra



The image shows a Scratch workspace with an ant object and a script editor. The ant is moving in a spiral pattern. The script editor contains the following code:

```
ant forward by 4  
ant turn by ant's x  
ant's amount decrease by 0.05
```

The variables panel shows the following variables:

- ant's x: 1.3
- ant's y: 456
- ant's heading: 27

A yellow callout bubble points to the 'ant' object with the text: "click here to add a variable to this object."


Create a variable 'x'
Set x=15 at the start.

What happens if you keep 'turn by' fixed but change the 'forward by' (speed) ?

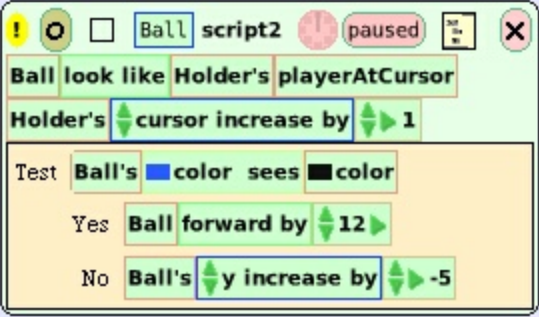


Animations: logic and programming

The Rolling Ball Challenge




Can you make the ball fall/roll down the steps?



Ball script2 (paused)

- Ball look like Holder's playerAtCursor
- Holder's cursor increase by 1
- Test: Ball's color sees color
 - Yes: Ball forward by 12
 - No: Ball's y increase by -5



(5 separate sketches)



Physics

Reset

Test **Box's y > 220**

- Box clock
- Box accelG
- Box friction
- Yes: Box acceleration
- Box velocity
- No: Box forward by Box's velocity

Box's acceleration = 0.0 Box's time = 0.0 Box's accelG = 19.4

Box's friction = 7.0 Box's velocity = 0.0

Incline's inclination = 19 Box's coeffric = 0.36 Box's mass = 9

0 90 0 1 0 100

Overview

This simulation emulates a box of given mass sliding down an inclined plane. There are three variables which can be controlled by the user; the boxes mass, the coefficient of friction between the box and the incline, and the angle of inclination. The box's mass is in kg, the higher the mass, the greater the acceleration of the box. The coefficient of friction determines how much friction will result of the physical action. This number should be between 0 (no friction) and 1 (complete friction). The final variable is the angle of inclination, which represents the angle, in degrees, that the incline forms with the surface, and should be between 0 and 90, but preferably somewhere inbetween 30 and 60.

Instructions

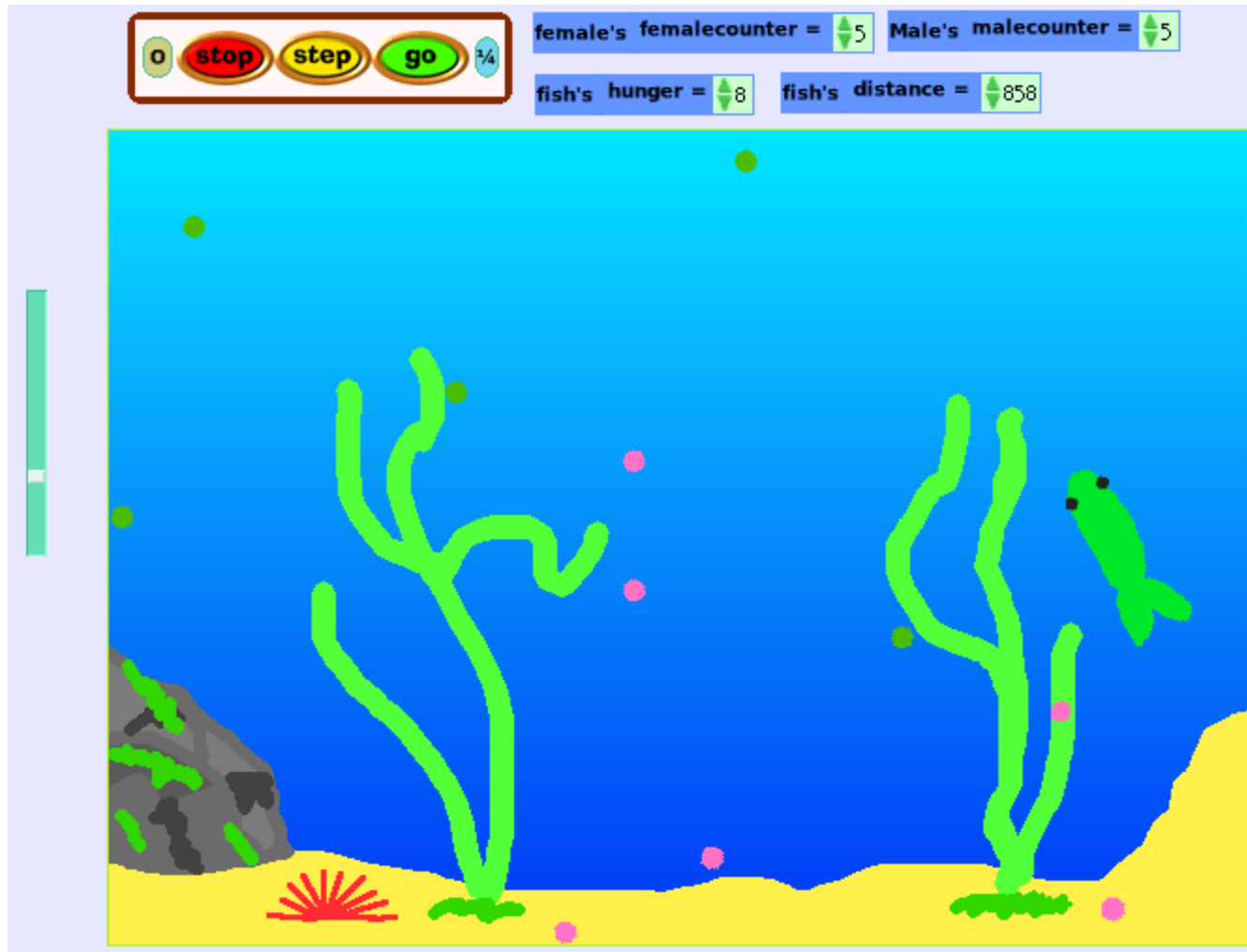
Before you begin, set the three variables on the bottom row variables on the top of the screen, which are mass, coeffric, and inclination. Next, press the reset button, and then place the box on the surface. Then run the 'run' script'. At the top of the screen, you can see the various qualities of the box. Refer to the table to determine the coefficient of friction for a specific surface.

Coefficients of Friction	
Surface	Coefficient
Ruber	0.84
Glass	0.31
Wood	0.59
Aluminum	0.19
Ice	0.48

From squeakland.org → kids play → Etoys



Ecology



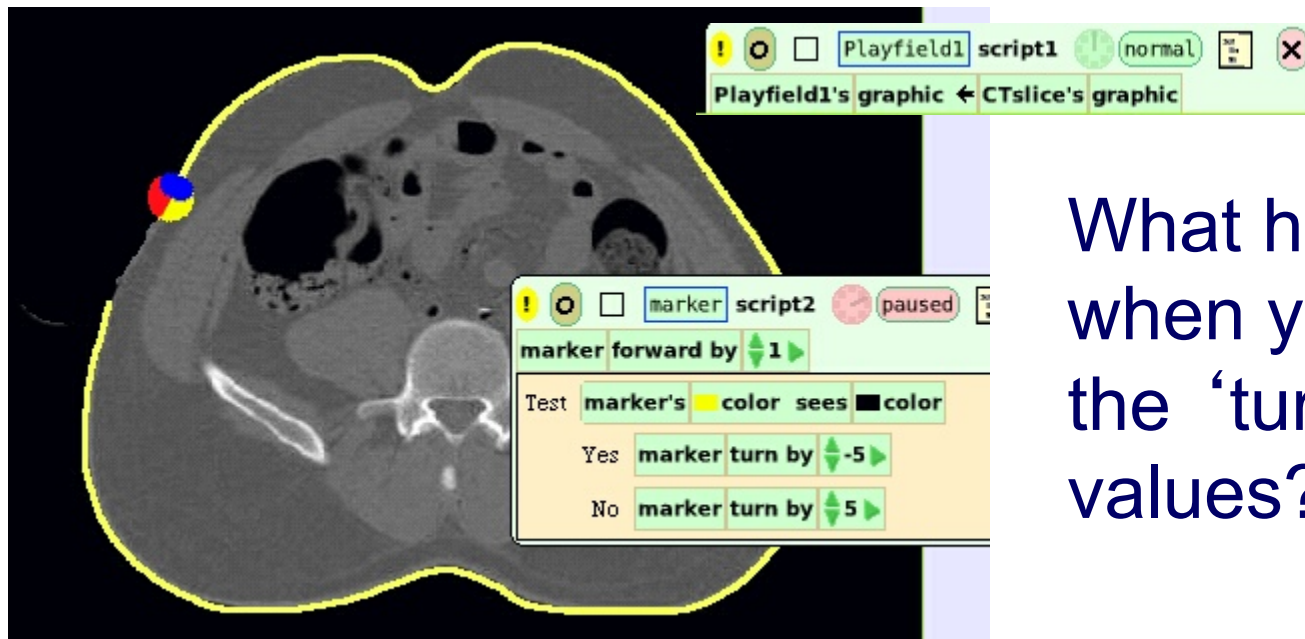
From squeakland.org → kids play → Etoys



Medical image analysis

Simply drag/drop images from your computer into Squeak's World

Image segmentation:



What happens when you change the 'turn by' values?



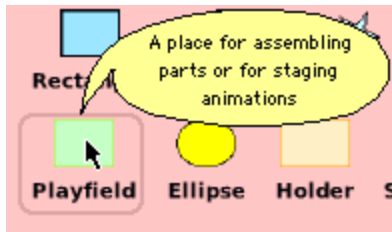
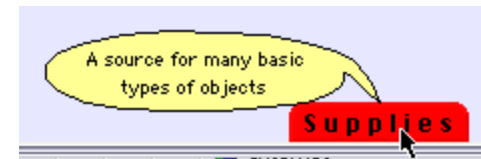
Health education



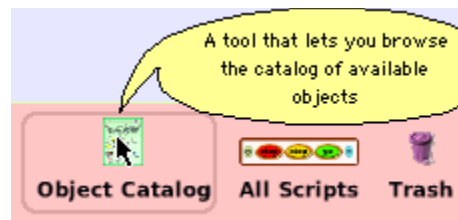
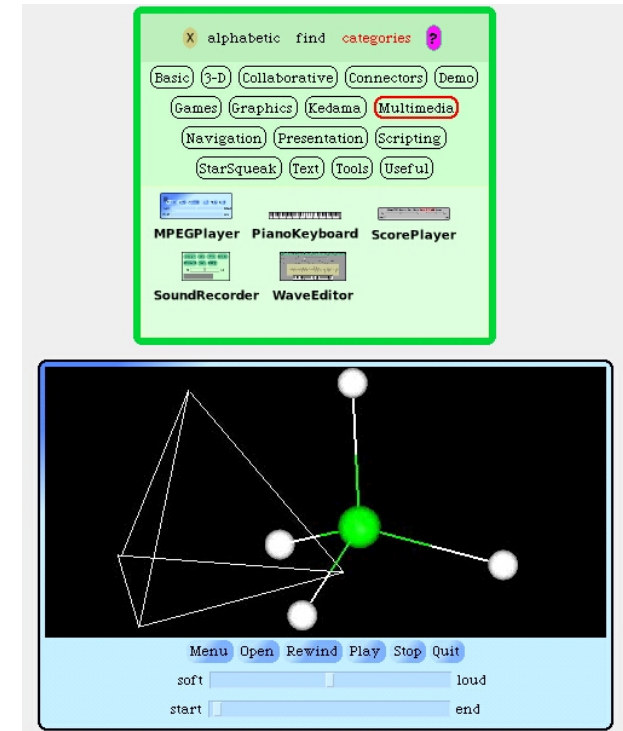
A simulation that shows blood cells flowing through a vein but getting clogged by plaque (in white). The plaque decreases as more fruits and vegetables are consumed.



Misc: 'Supplies' tab



Drag a 'playfield' into the World to provide a fenced in region for sketches.



Mpeg player

A white arrow pointing upwards and to the left, indicating the location of the Mpeg player interface in the previous image.



Help at squeakland.org

Painting Supplies

Tools

- Paintbrush
- Eraser
- Color Picker
- Paint Bucket

Brush Size

Color

Color Picker

Previous Colors

Stamps

Shapes

Toss - Remove painting supplies

Clear - Erase contents of painting window

Keep - Finish and keep painting object

Undo - Undo the last action

Object Handles

- Copy** - Makes a copy of your object.
- Debug** - Advanced tools for programmers.
- Color Picker** - Pick a color for the object.
- Menu** - Contains many useful tools for objects.
- Move** - Moves your object inside the container.
- Pick Up** - Lifts the object out of the container.
- Repaint** - Lets you repaint your object.
- Rotate** - Rotates the object.
- Resize** - Changes the size of your object.
- Tile** - Brings up a tile with the object's name.
- Trash** - Moves the object to the trash.
- Viewer** - Opens a viewer for the object.

Squeak Scripting

Viewer

- Edit name
- Options Menu
- Add category pane
- Remove viewer from screen
- Remove pane
- Search for methods
- Previous/Next category
- Run command once
- New Menu
- Drag from here to obtain an assignment phrase

Script

- Ticking dock state
- Script name
- The Scriptee
- Tiles to code
- When the script runs
- Test for yes or no
- Destroy script

Control Buttons

- Pause ticking scripts
- Run paused scripts once
- Run all scripts

