UNIVERSITY of WISCONSIN-MADISON
Computer Sciences Department

CS 202
Introduction to Computation

Professor Andrea Arpaci-Dusseau
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Lecture 9: Computation helps... remember information?

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"Rather than learning how to solve that, shouldn't I be learning how to operate software that can solve that?"

A.BACALL

Fish Eaten   10

Click the green flag.
Move the mouse to eat
the small fish

How to Track Information?

What is your name?

Every person has a Name

- "Name" is label or placeholder
- Name is a **variable (different than variable in math)**

People have different

values for Name

- Any value can be placed there
- Value varies across individuals

HELLO
my name is

Inigo Montoya

What if Information Change?

How old are you?

Every person has an Age

- "Age" is a variable
- People have different values for age

Value of age varies over time!

- Increases by one each year

What are Interesting Variables?

Examples?

- Money in your bank account
- Your GPA
- Number of facebook friends
- Top grossing film of all time
- Current President of United States
- Winner of World Cup
- Number of current points in basketball game

Can be referred to without knowing current value

What type of values do variables hold?

- Often strings (words) or numbers (integers and floating point)

Why the Interest in Variables?

Sometimes just want to know value

Sometimes value of variable changes our behavior
• Current value of variable determines what we do

Variables in Scratch

Scratch contains some variables by default...

Examples?   "answer" can hold a string

Value of Variables Changes Program Behavior

"answer" can hold a number

What is output if user enters:
• 95?
  – Excellent
• 100?
  – Perfect
• 105?
  – How did you do that?
• 63?
  – Better luck next time?

How to see output "Great"?
• 81, 82, ... 89, 90

Variables in Scratch

Scratch contains some variables by default...
• Every Sprite has some associated variables

Examples?

Variables in Scratch

Scratch allows user to allocate/declare new variables

- Give variable any name you'd like
- Very important to give descriptive names
  - Helps other people understand your code
  - Helps YOU understand your code later
  - Can be displayed to user as well

Variables in Scratch

Once you create a variable, five blocks appear.

score	Reports the value
set score to 0	Stores a value
change score by 1	Changes the value
show variable score	Shows the variable monitor on the stage
hide variable score	Hides the variable monitor on the stage

Using Variables

Variables can hold numbers or strings

Can be used any place a number of string is used

Setting and Changing Variables

when the green flag button is clicked
set score to 0 (reset the score)
keep doing this:
  point towards the mouse-pointer
  move
  if you catch Sprite2
  increase your score

Example

Want to be in Guinness Book of World Records
- Talent for standing on one foot

What variable are you interested in?
- "Longest Duration Balancing on One Foot"

Current Value?
- 76 hours 40 minutes = 4600 minutes

What is algorithm to check if we are record holder?
- If we balance longer, we are new record holder!

World Record in Scratch

How to Track Points?

Can you change Fish Chomp game so it tracks the number of fish eaten?

Old Code: No Points

Little Fish Scripts

Big Fish Scripts

Add Variable: Fish Eaten

New Big Fish Scripts

```
when [flag] clicked
set Fish Eaten to 0
switch to costume open-mouth
forever if < distance to mouse-pointer > 10 >
    point towards mouse-pointer
    move 3 steps
```

```
when I receive got-me
change Fish Eaten by 1
play sound chomp
repeat 2
    switch to costume closed-mouth
    wait 0.3 secs
    switch to costume open-mouth
```

Is this code same?

```
when [flag] clicked
set Fish Eaten to 0
switch to costume open-mouth
forever if < distance to mouse-pointer > 10 >
    point towards mouse-pointer
    move 3 steps
```

```
when I receive got-me
set Fish Eaten to Fish Eaten + 1
play sound chomp
repeat 2
    switch to costume closed-mouth
    wait 0.3 secs
    switch to costume open-mouth
```

Yes! Scratch variables are not mathematical equations.
Same variable can appear on both sides of "set" block

How to Remember if Something Happened?

Basic format of adventure game

Character can enter portal and advance to next level only after gets certain object

How to know if cat picked up bananas yet or not?

Variables Can Track Whether Something Happened

```
when [flag] clicked
hide
```

```
when I receive level1
show
wait until < touching Sprite1? and has banana? = 1 >
broadcast level2
```

```
when I receive level2
show
wait until < touching Sprite1? and has ball? = 1 >
broadcast level3
```

```
when I receive level3
show
wait until < touching Sprite1? and has hat? = 1 >
say All done! for 2 secs
```

How to control moving to next level?

Stage

```
when [flag] clicked
switch to background background1
wait until < key space pressed? >
broadcast level1
```

Variables Can Track Whether Something Happened

Banana Sprite Scripts

```
when [flag] clicked
hide
set has banana? to 0
```

```
when I receive level1
show
wait until < touching Sprite1? and key space pressed? >
change has banana? by 1
hide
```
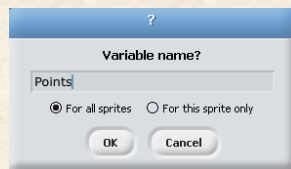
How to record that bananas have been picked up?

How to Have Different Variables for Different Sprites?
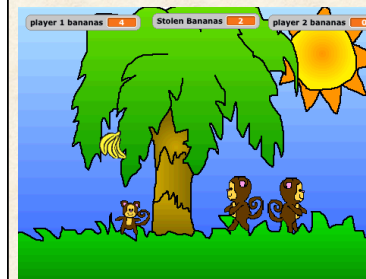
Variables can be either:
- Visible to all Sprites (global, public)
  - Any Sprite can set
- Visible to only one Sprite (private)
  - Only one Sprite can set

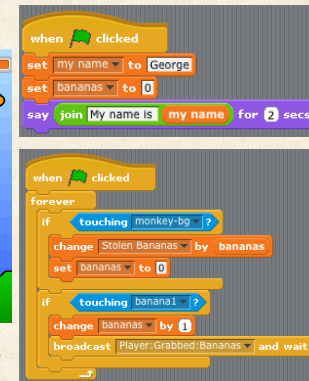**Why use private variables?**
- Similar Sprites can share same instructions, but act slightly differently
- Simplifies code
- Example: Two-person game

```
?
Variable name?
Points
● For all sprites    ○ For this sprite only
    OK        Cancel
```

Two-Player Monkey Game

Just duplicate Sprite with private variables and change controlling keys

Today's Summary

Today's Topics
- Variables: hold different values over time, may be different for different Sprites
- Variables can hold numbers or strings
- Extremely useful!

Reading:
- "If you liked this, sure to love that" – recommendation systems
  - Posted on course web page

Announcements
- Assignment 3 due today
- Assignment 4 available: Pencil and paper (no programming)
  - Binary numbers and understanding existing code