

UNIVERSITY of WISCONSIN-MADISON
Computer Sciences Department

CS 202: Introduction to Computation Professor Andrea Arpaci-Dusseau

Computation helps... remember information

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

What if Information Change?

How old are you?
Every person has an **Age**

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

How is "age" different than "name"?

- 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

Often value of variable changes behavior

- Current value of variable determines what we do

```

if bank account < 0
  say Your bank account is overdrawn. for 2 secs

if GPA < 2.0
  say You are on academic probation. for 2 secs

if GPA > 3.75
  say You are on the honors list. for 2 secs
  
```

Variables in Scratch

Scratch contains some variables by default...

- Example: answer

```

answer
ask: Do you want an apple or orange? and wait
if answer = apple
  switch to costume holding an apple
if answer = orange
  switch to costume holding an orange
  
```

asks question and waits for person to type in an answer
if the answer is 'apple' do this
if the answer is 'orange' do this

ask and wait asks a question and stores the keyboard input in answer .

Variables Change Program Behavior

```

when clicked
ask: Enter the numeric grade you received... and wait
if answer < 100
if answer > 90
  say Excellent! for 2 secs
else
if answer > 80
  say Great! for 2 secs
else
if answer > 70
  say Good! for 2 secs
else
  say Better luck next time! for 2 secs
else
if answer = 100
  say Perfect! for 2 secs
else
  say How did you do that? for 2 secs
  
```

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?

x position
 y position
 direction

Sprite1 x position -142
 Sprite1 y position -43
 Sprite1 direction 90.0
 Sprite1 costume # 1
 Sprite1 size 100

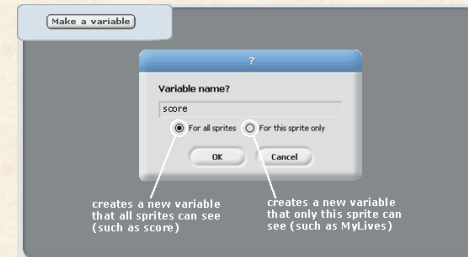


Variables in Scratch

You can 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

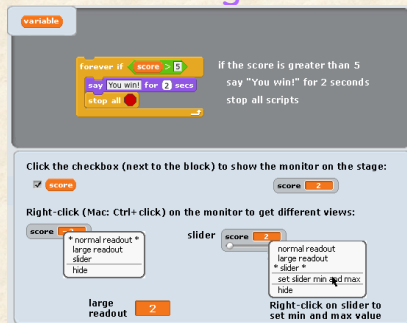
Variables in Scratch



Once you create a variable, five blocks appear.

- | | |
|--|---|
| | Reports the value |
| | Stores a value |
| | Changes the value |
| | Shows the variable monitor on the stage |
| | Hides the variable monitor on the stage |

Using Variables

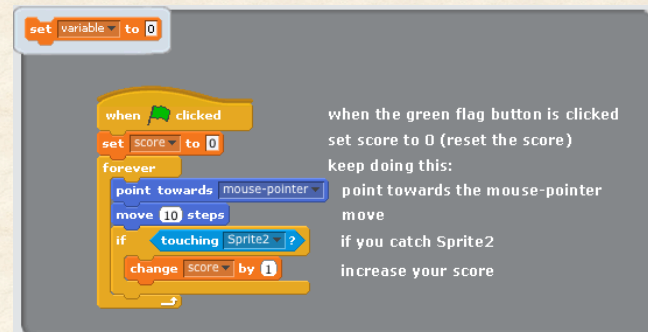


Variables can hold numbers or strings

Can be used any place a number or string is used

- At some point, you'll be surprised by this...

Setting and Changing Variables



Exercise: Moving Around Stage

Version 1:

- Create a variable **Time**
- Ask user for value of **Time**
- Forever: **Glide** to a **random** (x, y) position in that time

Version 2:

- Before gliding, **say** the (x, y) position you are going to (Hint: Use "join" block under Operators category)

Version 3

- Take one second longer each time you glide!

Answer: Moving Around Stage

```

when clicked
ask How many seconds should I take to glide? and wait
set Time to answer
forever
set new x to pick random -240 to 240
set new y to pick random -180 to 180
say join I'm going to x: join new x join y: new y for 2 secs
glide Time secs to x: new x y: new y
change Time by 1
    
```

Exercise: How to Track Points?



Change Fish Chomp game to track number of fish eaten? (Open Examples/Games/3 Fish Chomp)

Old Code: No Points

Little Fish Scripts

```

when clicked
show
point in direction 90
forever
move 2 steps
turn pick random 20 to 20 degrees
if on edge, bounce
if color is touching ?
broadcast got-me
hide
wait 3 secs
go to x: -200 y: pick random -200 to 200
show
    
```

Big Fish Scripts

```

when clicked
switch to costume open-mouth
forever if distance to mouse-pointer > 10
point towards mouse-pointer
move 3 steps

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

Hint: Make as few changes as possible. Where to initialize Fish Eaten? Where to increment Fish Eaten?

Add Variable: Fish Eaten

New Big Fish Scripts

```

when clicked
  set Fish Eaten to 0
  switch to costume open-mouth
  forever if distance to mouse-pointer > 10
    point towards mouse-pointer
    move 5 steps
  
```

```

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

Is this code same?

```

when clicked
  set Fish Eaten to 0
  switch to costume open-mouth
  forever if distance to mouse-pointer > 10
    point towards mouse-pointer
    move 5 steps
  
```

```

when I receive got-me
  set Fish Eaten to Fish Eaten + 1
  play sound thump
  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

Exercise: 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?

Exercise : Problem Statement

Initial State:

- Level 1 background
- Banana showing (it is not picked up)

When banana is picked up (touching cat)

- It should hide (and remember it has been picked up)
- Hint: Use a variable to remember this!

When touch portal (after picking up banana)

- Advance to level 2 (Switch to level 2 background)

Announcements

Feel free to work in 1370 at any time

Day	Time	Instructor or TA	Room
Mon	11:00 - 12:00	Prof. A Arpaci-Dusseau	CS 7375 (office)
Tue	12:30 - 2:25	Thea Hinkle	CS 1370 (lab)
Wed	11:00 - 12:00	Prof. A Arpaci-Dusseau	CS 7375 (office)
Wed	12:00 - 2:00	Victor Bittorf	CS 1370 (lab)
Thurs	4:15 - 6:15	Thea Hinkle	CS 1370 (lab)
Friday	11:00 - 1:00	Victor Bittorf	CS 1370 (lab)

Homework 3 due Monday

- Should be able to do all 3 parts now
- Ideas for sharing Interactive Stories???