

UNIVERSITY of WISCONSIN-MADISON
Computer Sciences Department

CS 202
Introduction to Computation

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How can computation... help visualize data?

For data to solve problems, what do we need to do?

Capture

- Collect or obtain

Store

- Where? what if it gets lost?

Share

- Who should have access? Anonymize for privacy

Organize

- Sort it? put in categories?

Process it

- Search through it, analyze it, mine it for correlations

Visualize it

- What is useful for humans to look at?

Use results to inform our decision

Data Visualization

TED talk (Technology, Entertainment, Design)

"Demo: Stunning data visualization in the AlloSphere"

- See, hear and interpret scientific data
- Dive into the brain, feel electron spin, hear the music of the elements
- 6 minutes

http://www.ted.com/talks/joann_kuchera_morin_tours_the_allosphere.html

Data Visualization

TED talk

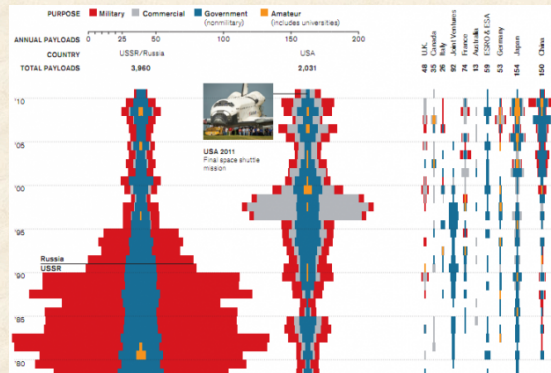
Hans Rosling: "Let my dataset change your mindset"

- Visualizing time-series data sets can give new insights
- Data-bubble software bursts myths about the developing world (health, wealth)
- 20 minutes

http://www.ted.com/talks/hans_rosling_at_state.html#

Similar goal to Homework 5 data visualization

Data Visualization



<http://flowingdata.com/>

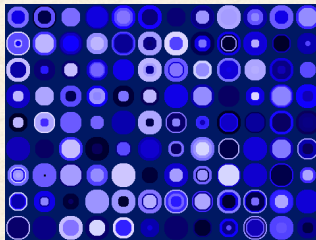
Steps towards Visualization in Scratch



Forever

- Goto random location on grid
- Random size within space
- Stamp random shade of blue

What is result of running Scripts?



Forever

- Goto random location on grid
- Stamp random shade of blue
- Random size within space

How to draw a function?

How to use Scratch to draw: Use pen and go to all (X,Y) coordinates such that $Y = \text{absolute}(X)$

$Y = \text{absolute}(X)$

Initialize X, Y (-240, 240)

Put pen down

Repeat until X = 240

- Set Y to abs(X)
- Goto X,Y
- Change X by 1

How to draw a function?



What if don't set Y in repeat loop?

How to make function draw faster?

What if change from abs to mod?

set Y to X mod 20

What if want to plot non-mathematical data set?

Have data set you care about

- Example: population in some small village over time
- Data for every year for 100 years
- One value for each year (100 data points)

How can we store this in Scratch?

Lists

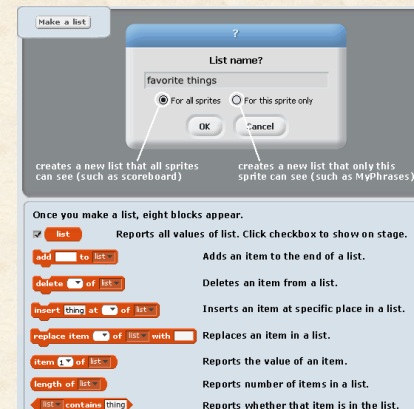
Lists are common data structure

- List of items to buy at grocery store
- List of high scores for game
- List of student names in class
- List of account balances at bank
- List of cities in Wisconsin

Name the List as a whole

- Index into List to access individual items, elements

Lists in Scratch: How to Create?



Example List in Scratch

- Name: Valuable Numbers
- List of N elements:
Element1, Element2, ..., ElementN
- N=100 for Valuable Numbers
 - What value is at element 1? element 10?
 - At what location (or element or index) is value 73?



Lists: How to Look at Contents?

list

say Here is what you have! for 2 secs
say your list for 5 secs

say "Here's what you have:" for 2 seconds
say all the items in the list for 5 seconds

map keys lamp

Click the checkbox (next to the block) to show the monitor on the stage:

☒ your list

your list

1	map
2	keys
3	lamp

length: 3

The **list** block reports all the items in a list.
For individual items, use this block: **item** of **list**

Lists: How to Change the Contents?

add to list name

add rock to my list
add paper to my list
add scissors to my list

add "rock" to the list
add "paper" to the list
add "scissors" to the list

my list

1	rock
2	paper
3	scissors

length: 3

say item any of my list for 2 secs
say one of the items in the list

Use this block if you want to add an item to the end of a list.

add your words or number here to your list

Can't find the list blocks? You need to first to make a list: [Make a list](#)

Lists: How to Change the Contents?

insert thing at of list

when lamp clicked
insert lamp at 1 of my list

when the lamp sprite is clicked
insert the item "lamp" at the first place in the list

Before:

1	compass
---	---------

length: 1

After:

1	lamp
2	compass

length: 2

You can indicate where in the list you want to add an item.

insert score at 2 of scoreboard inserts item at the specified place in the list

insert Hello, world! at any of greetings inserts item at a random place in the list

Lists: How to Change the Contents?

replace item **1** of **list** with

replace item **1** of **scoreboard** with **score** replaces item 1 in the list with the current score

Before:

scoreboard	
1	3
2	8

length: 2

After:

scoreboard	
1	10
2	8

length: 2

You can choose where in a list to put an item. For example:

replace item **2** of **race times** with **timer** replaces item 2 in the list

replace item **last** of **questions** with **How are you?** replaces last item in the list

Lists: How to Remove Items?

delete **1** of **list**

say item **1** of **supplies** for **2** secs says the first item from the list

delete **1** of **supplies** deletes the first item in the list

Before:

supplies	
1	water
2	piece of fruit
3	biscuits

length: 3

After:

supplies	
1	piece of fruit
2	biscuits

length: 2

Lists: How to Remove Items?

You can specify the number of the item you want to delete. For example:

delete **2** of **my list** deletes item 2 from the list

To delete the last item in the list, choose "last" from the pull-down menu:

delete **last** of **my list**

You can also choose to delete everything in the list:

delete **all** of **my list**

Lists: How to Look at the Contents?

item **1** of **list**

say item **any** of **phrases** for **2** secs say one of the items from a list of phrases

if **score > item 1 of top scores** if the current score is greater than item 1 on a top score list

play sound **clap** play a clapping sound

The item block reports the value of the item at the specified place on a list.

item **1** of **my list**

select from the menu or insert a number to indicate which item you want

You can fit an item block into other blocks, for example: say, switch to costume, play sound, or broadcast.

Check-Up

How many items can you put in a list?

How do you find the number of items in a list?

length of Random Numbers

What is the difference:

add thing to Random Numbers
insert thing at 1 of Random Numbers

What is the difference:

delete all of Random Numbers

Delete a list

For the given list, what would this code do?

```
if Random Numbers contains 149
  play sound Bird until done
else
  play sound Cricket until done
```

Valuable Numbers	
1	689
2	42
3	575
4	823
5	33
6	563
7	320
8	591
9	93
10	639
11	132
12	73
13	859
14	149
15	197
+ length: 100	

Today's Summary

Today's topic

- Visualizing data can help everyone better understand the world we live in

"Reading"

- TED talks linked on Course Schedule page

Announcements

- Exam 1 graded, returned
- Homework 5 available - compose music w/ lists, visualization