



UC Berkeley
Teaching Professor
Dan Garcia

BJC: YOU'LL LOVE IT!

**Watch the student
testimonials about the
course, what it means to
them, and how it has
changed their lives.
Inspiring!**

The Beauty and Joy of Computing

Lecture #1 Welcome Abstraction





BJC in one slide

▪ Big Ideas of Programming

- Abstraction
- Algorithms
- Recursion
- Functions-as-data
- *Programming Paradigms*
- *Concurrency*
- *Distributed Computing*

▪ Beauty and Joy

- “CS Unplugged” activities
- All lab work in pairs
- Two 3-week projects in pairs
 - Of your own choice!!
- One “paper”
 - Of your' own choice!!

▪ Big Ideas of Computing

- HowStuffWorks
 - Computers (binary numbers)
 - Internet
- Research Summaries
 - AI
 - HCI
- Social Implications of Computing
- Saving the World with Computing
- Power of Big Data
- Limits of Computing
- Future of Computing
- Robots



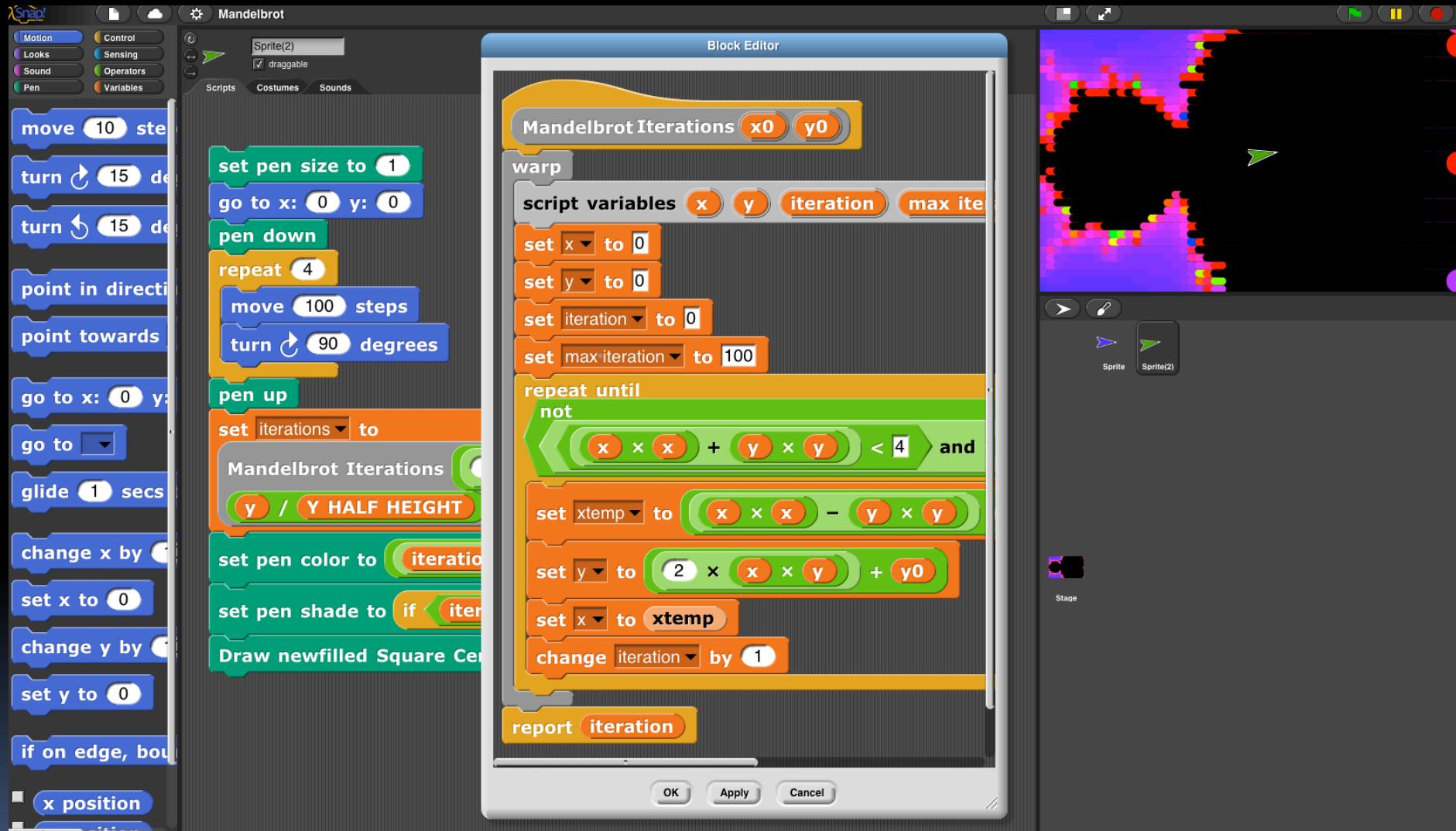
▪ Set you up for follow-up 61A

- We also teach Python!



bjc

Incredibly easy-to-learn coding in Snap!



The image shows a screenshot of the 'Snap!' programming environment. On the left, the script editor displays a script for a sprite named 'Mandelbrot'. The script starts with a 'set pen size to 1' block, followed by a 'go to x: 0 y: 0' block, a 'pen down' block, and a 'repeat (4)' loop. Inside the loop are 'move (100) steps' and 'turn (90) degrees' blocks. After the repeat loop, there's a 'pen up' block, followed by a 'set [iterations] to [Mandelbrot Iterations v1]' block. This is followed by several 'set pen color to [iteration]' blocks, 'set pen shade to [if <iteration> then <#>]' blocks, and a 'Draw newfilled Square Center' block. On the right, the stage shows a colorful fractal pattern resembling the Mandelbrot set. The bottom right corner of the stage has two sprite icons: 'Sprite' and 'Sprite(2)'. The bottom left corner features the 'Stage' button.

Mandelbrot

Scripts Costumes Sounds

Block Editor

Mandelbrot Iterations x0 y0

warp

script variables x y iteration max iterations

set x to 0
set y to 0
set iteration to 0
set max iteration to 100

repeat until not $x \times x + y \times y < 4$ and

set xtemp to $x \times x - y \times y$
set y to $2 \times x \times y + y_0$
set x to xtemp
change iteration by 1

report iteration

OK Apply Cancel





Week at a glance (on cs10.org)

	Mon 8/29	Tue 8/30	Wed 8/31	Thu 9/1	Fri 9/2
9am		Lab 13 200 SD - Will	Lab 19 200 SD - Lara + Steven	Lab 13 200 SD - Will	Lab 19 200 SD - Lara + Steven
10am				CS 10 William's OH Soda-Alcove-611	
11am	Carlos' OH Soda-Alcove-611 Cap:15	Lab 14 200 SD - Arany	Lara's OH Soda Alcove 341A (Cap:15)	Lab 20 200 SD - Lizzy	Lab 20 200 SD - Lizzy
12pm				Lab 14 200 SD - Arany	Disc. 16 229 Dwinelle - Janna
1pm		Lab 15 200 SD - Yifat		Lab 15 200 SD - Yifat	Disc. 12 B56 Hildebrand - Lara + Steven
2pm			Steven's OH Soda-Alcove-651 Cap:10	Erik's OH Soda-Alcove-611 Cap:15	Disc. 17 3 Evans - Will
3pm	Lecture	Lab 16 200 SD - Janna	Lecture	Lab 16 200 SD - Janna	Disc. 19 3119 Etcheverry - Yifat
4pm	Lab 11 200 SD - Jobel		Lab 11 200 SD - Jobel	Yifat's OH Soda-Alcove-611 Cap:15	Disc. 20 105 Dwinelle -
5pm		Lab 17 200 SD - Carlos + Christian		Lab 17 200 SD - Carlos + Christian	Disc. 13 310 Soda - Carlos +
6pm	Lab 12 200 SD - Erik		Lab 12 200 SD - Erik		Disc. 14 320 Soda - Erik
7pm					Disc. 15 320 Soda - Jobel





Let's check enrollments...

- We have NEVER turned anyone away, and we don't intend to turn anyone away this semester!

Class Availability			
Class Capacity	270	Wait List Capacity	150
Enrollment Total	268	Wait List Total	41
Available Seats	2		



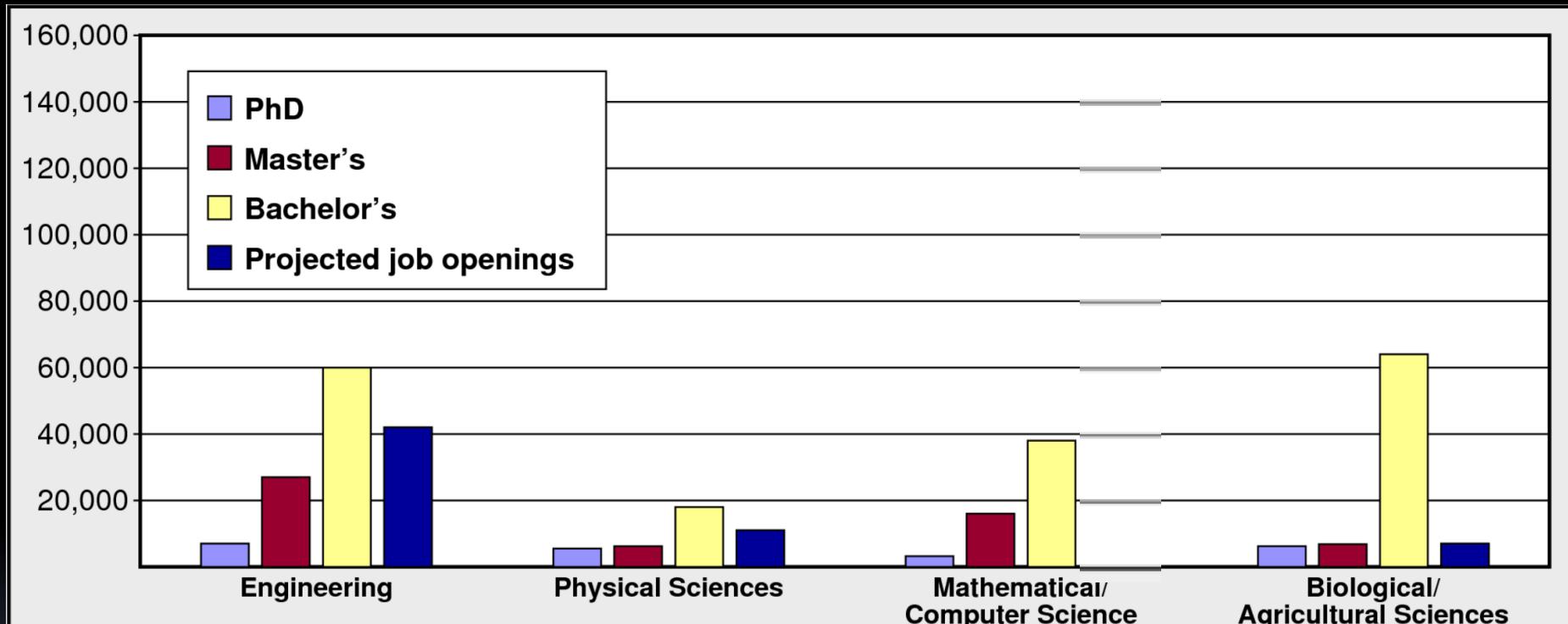
Other Introductory Courses

- **Foundations of Data Science, Data Science 8 (CS C8 in the catalog)**
 - Foundations of data science from three perspectives: inferential thinking, computational thinking, and real-world relevance. Given data arising from some real-world phenomenon, how does one analyze that data so as to understand that phenomenon? It teaches critical concepts and skills in computer programming and statistical inference, in conjunction with hands-on analysis of real-world datasets, including economic data, document collections, geographical data and social networks. It delves into social and legal issues surrounding data analysis, including issues of privacy and data ownership. (You learn how to use Python as a tool, not how to program)
- **Structure and Interpretation of Computer Programs, CS 61A**
 - Introduction to programming and computer science. This course exposes students to techniques of abstraction at several levels: (a) within a programming language, using higher-order functions, manifest types, data-directed programming, and message-passing; (b) between programming languages, using functional and rule-based languages as examples. It also relates these techniques to the practical problems of implementation of languages and algorithms on a von Neumann machine. There are several significant programming projects. (You learn how to program Python well!!)



How does a 6-figure/year job sound?

Annual degrees and jobs in broad engineering fields



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 Systems Completion 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.



Peer Instruction

- Increase real-time learning in lecture, test understanding of concepts vs. details
- After a few slides pass, ask multiple choice question
 - 1-2 minutes to decide yourself
 - 2 minutes in pairs/triples to reach consensus. Teach others!
 - 2 minute discussion of answers, questions, clarifications



Garcia



bj

Piazza for {ask,answer}ing questions

The screenshot shows the Piazza interface. At the top, there's a search bar and a button to "Add Question/Note". On the right, a user profile for "Dan Garcia" is shown. The left sidebar has sections for "QUESTION FEED" and "FILTERS", and categories for "This week" and "Last week". A question titled "When are TA / professor office hours?" is displayed, asking for help with course material. It has 3 views and 1 follow. The response from "Instructors' response" says: "We haven't established our office hours yet, but we'll make that information available as soon as possible. Check back here for an update by the second week of classes." This was last updated by Luke Segars 2 days ago. Below the response, there are buttons for "Good Answer!", "Ask a Followup >", and "Start off a Students' Response". A "followup discussions" section is also present. At the bottom, it shows the average response time as "N/A" and mentions that Luke Segars answered the question 2 days ago. It also indicates that 3 users were online this week, with 1 online now. The footer includes links to About Piazza, Privacy Policy, Copyright Policy, Terms of Use, Report a Bug!, and a copyright notice for 2013.

PIAZZA CS 10 Questions Statistics 35

Search or ask a question... Add Question/Note

Dan Garcia Piazza Help

Popular tags: #instructor-question #admin #logistics #welcome

QUESTION FEED FILTERS

▼ This week

When are TA / professor office hours?
When can I meet up with a GSI or professor to get help with the course material? #admin
#instructor-question #admin

When are TA / professor office hours?
When can I meet up with a GSI or professor to get help with the course material? #admin

Last updated by Luke Segars 2 days ago

Actions ▾ Good Question!

Instructors' response.

We haven't established our office hours yet, but we'll make that information available as soon as possible. Check back here for an update by the second week of classes.

Last updated by Luke Segars 2 days ago

Actions ▾ Good Answer! Ask a Followup >

Start off a Students' Response

followup discussions.

Still Confused? Ask New Followup

AVERAGE RESPONSE TIME SPECIAL MENTIONS

N/A

Luke Segars answered When are TA / ... in 1.1 hr. 2 days ago

USERS ONLINE THIS WEEK

3 Online Now: 1

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Pro-student Grading Policies

- **EPA**
 - Rewards good behavior
 - Effort
 - E.g., Office hours, doing every single lab, hw, reading Piazza pages
 - Participation
 - E.g., Raising hand in lec or discussion, asking questions on Piazza
 - Altruism
 - E.g., helping other students in lab, answering questions on Piazza
- **You have 3 "Slip Days"**
 - You use them to extend due date, 1 slip day for 1 day extension
 - You can use them one at a time or all at once or in any combination
 - They follow you around when you pair up (you are counted individually)
 - E.g., A has 2, B has 0. Project is late by 1 day. A uses 1, B is 1 day late
 - Late is 1/3 off/day





What you will be able to do!

- **Battleship game**
 - <https://www.youtube.com/watch?v=L8QbIaWD6o8>
- **Sudoku**
 - https://www.youtube.com/watch?v=_yAzgt4AGbY
- **WatercolorBot**
 - <https://www.youtube.com/watch?v=-CNTN92ptlo>
- **IMMBY**
 - <https://www.youtube.com/watch?v=tzf2Eey57Pw>
- **Kinect**
 - <http://www.youtube.com/watch?v=hF5DsX1XGBE>



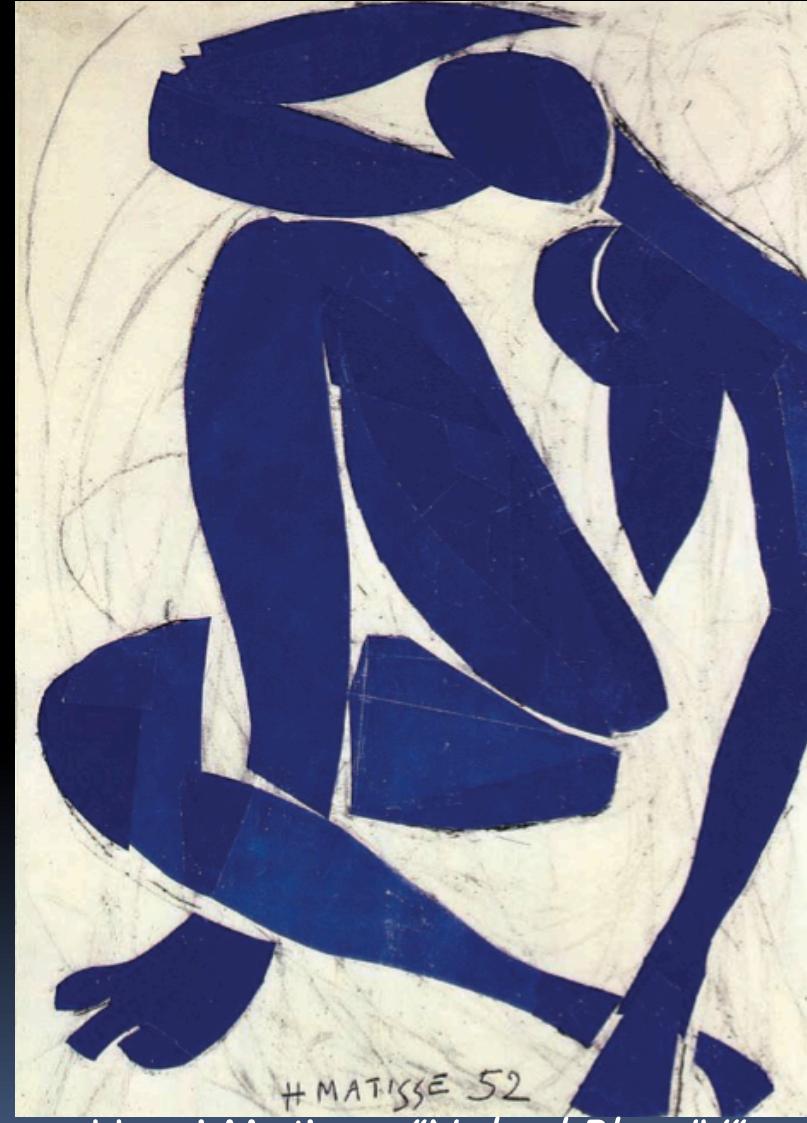
Abstraction

- **Detail removal**

- “The act or process of leaving out of consideration one or more properties of a complex object so as to attend to others.”

- **Generalization**

- “The process of formulating general concepts by abstracting common properties of instances”

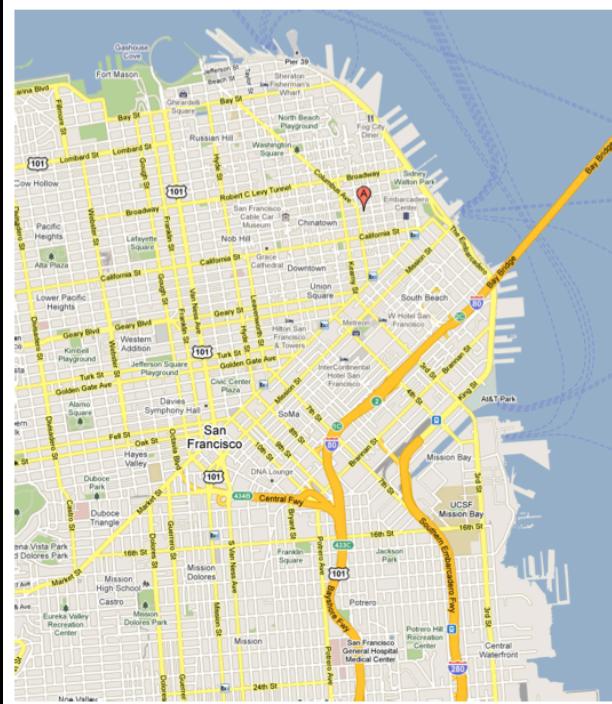


Henri Matisse "Naked Blue IV"

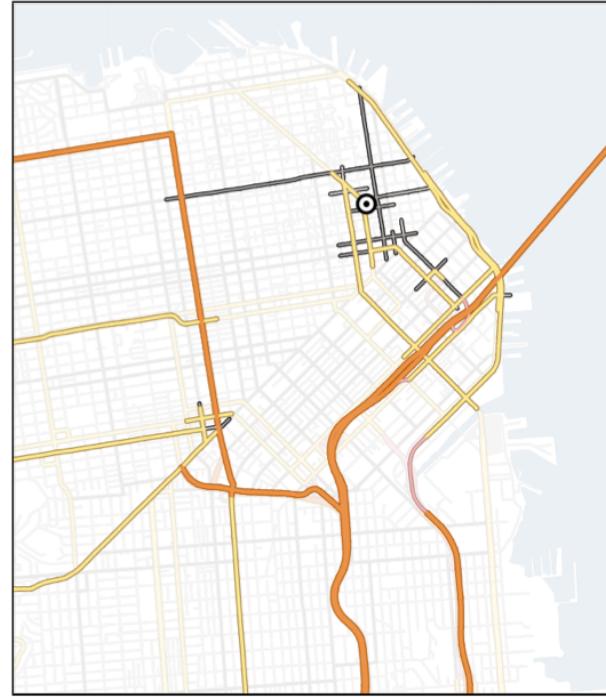


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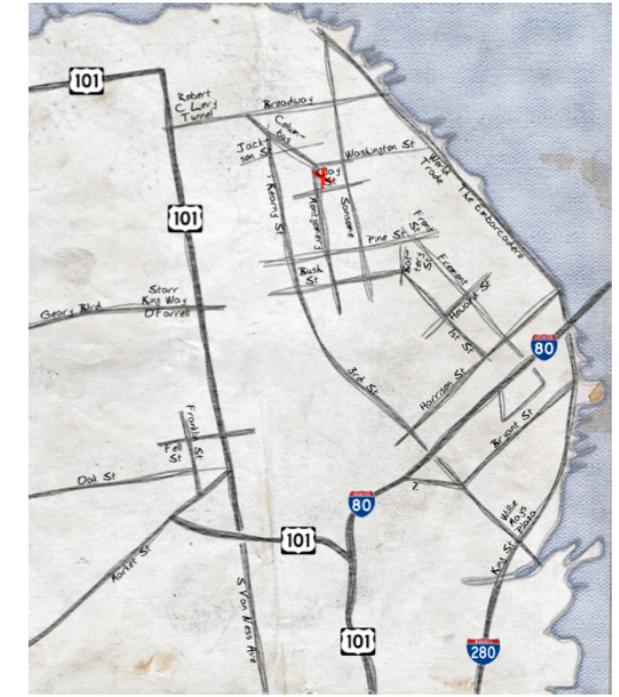
Detail Removal



General Purpose Online Map



Selected Roads



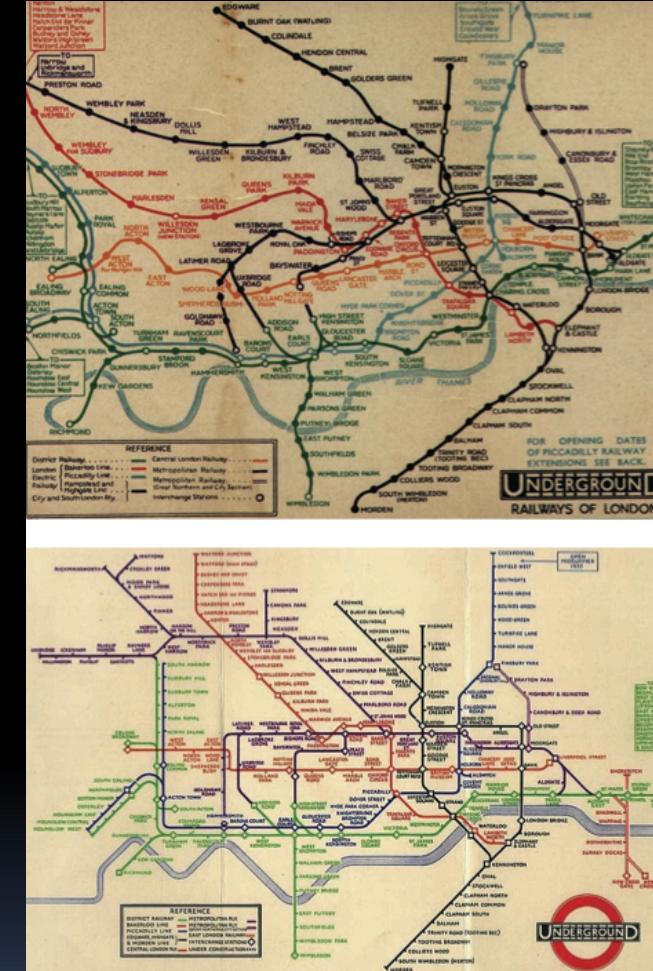
Our Result

Automatic Generation of Detail Maps
Prof. Maneesh Agrawala, among others



Detail Removal (in BJC)

- You'll want to write a project to **simulate a real-world situation**, or play a game, or ...
- Abstraction is the idea that you **focus on the essence**, the cleanest way to map the messy real world to one you can build
- Experts are often brought in to know what to remove and what to keep!



The London Underground 1928 Map & the 1933 map by Harry Beck.



Generalization Example

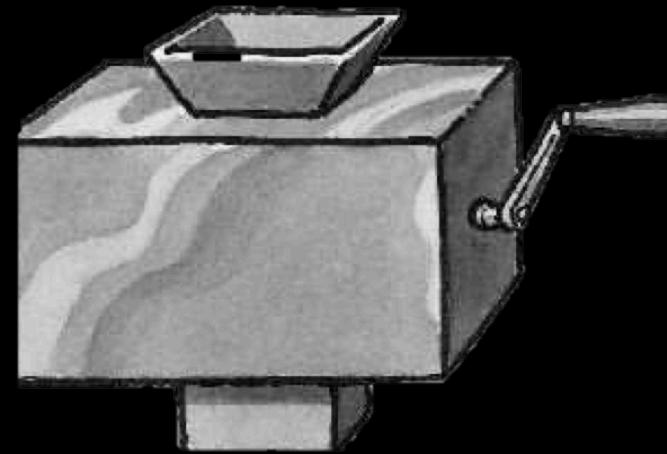
- You have a farm with many animal kinds.
- Different food for each
- You have directions that say
 - To feed dog, put dog food in dog dish
 - To feed chicken, put chicken food in chicken dish
 - To feed rabbit, put rabbit food in rabbit dish
 - Etc...
- How could you do better?
 - To feed <animal>, put <animal> food in <animal> dish



Generalization (in BJC)

- You are going to learn to write functions, like in math class:

$$y = \sin(x)$$



- You should think about what inputs make sense to use so you don't have to duplicate code

"Function machine" from *Simply Scheme* (Harvey)



The Power of Abstraction, everywhere!

- **Examples:**

- Functions (e.g., $\sin x$)
- Hiring contractors
- Application Programming Interfaces (APIs)
- Technology (e.g., cars)

- **Amazing things are built when these layers**

- And the abstraction layers are getting deeper by the day!

*We only need to worry about the interface, or specification, or contract
NOT how (or by whom) it's built*

Above the abstraction line

Abstraction Barrier (Interface)

(the interface, or specification, or contract)

Below the abstraction line

This is where / how / when / by whom it is actually built, which is done according to the interface, specification, or contract.



Summary

- Abstraction is one of the big ideas of computing and computational thinking
- Think about driving. How many of you know how a car works? How many can drive a car? Abstraction!



Someone who drove in 1930 could still drive a car today because they've kept the same Abstraction!

(right pedal faster, left pedal slow)

...they probably would have trouble starting a new one though, or shifting an electric car from "park" into "drive"

