The Beauty and Joy of Computing

Lecture #1
Welcome Abstraction

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!

cs10.org

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!

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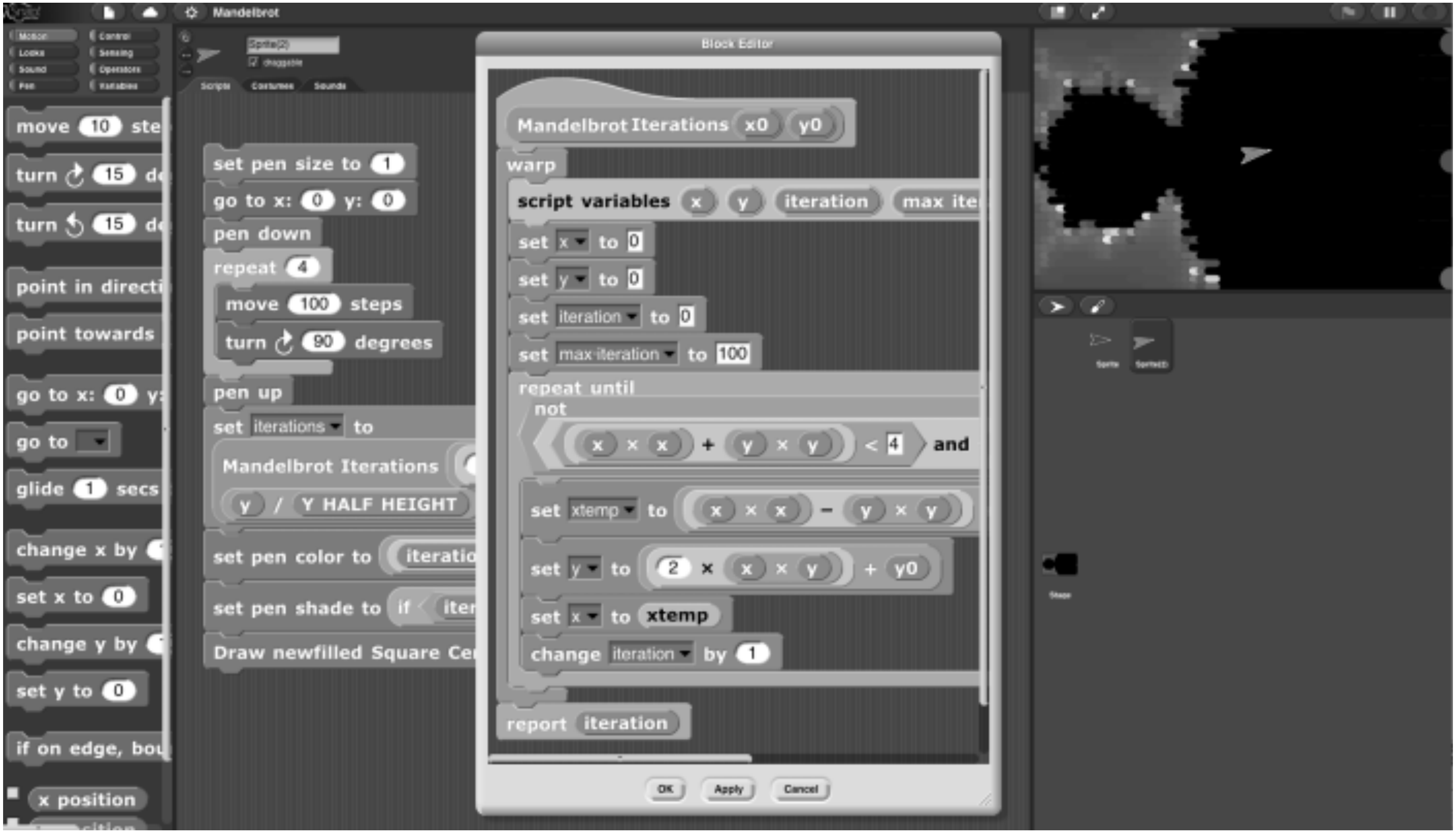
Incredibly easy-to-learn coding in Snap!



```
set pen size to 1
go to x: 0 y: 0
pen down
repeat 4
    move 100 steps
    turn ↻ 90 degrees
pen up
set iterations to
    Mandelbrot Iterations (
    (y) / (Y HALF HEIGHT)
set pen color to (iteratio
set pen shade to if < iter
Draw newfilled Square Ce
```

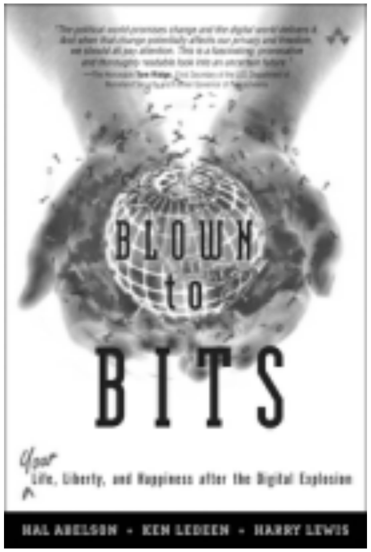
```
Mandelbrot Iterations x0 y0
warp
    script variables x y iteration max ite
    set x to 0
    set y to 0
    set iteration to 0
    set max iteration to 100
    repeat until
      not < ((x × x) + (y × y)) < 4 and
        set xtemp to ((x × x) − (y × y))
        set y to ((2 × (x × y)) + y0)
        set x to xtemp
        change iteration by 1
report iteration
```

Format & Textbooks

- **Format (7 hrs/wk * 14 wks) + ~5 hrs of proj/hw/reading**

Mon	Tue	Wed	Thu	Fri
Lecture	Lab	Lecture	Lab	Discussion
	Lab		Lab	

  - Taken from great book ("Blown to Bits" by Abelson, Ledeen & Lewis) + articles + videos
  - Current events EVERY LECTURE (e.g., IBM's Watson vs Jeopardy)
- **All resources FREE**
  - Even clickers!
- **Pair Programming!**



BLOWN to BITS

Your Life, Liberty, and Happiness after the Digital Explosion

HAL ABELSON • KEN LEDEEN • HARRY LEWIS

contributed articles

Designing Games With A Purpose

IS ABSTRACTION THE KEY TO COMPUTING?

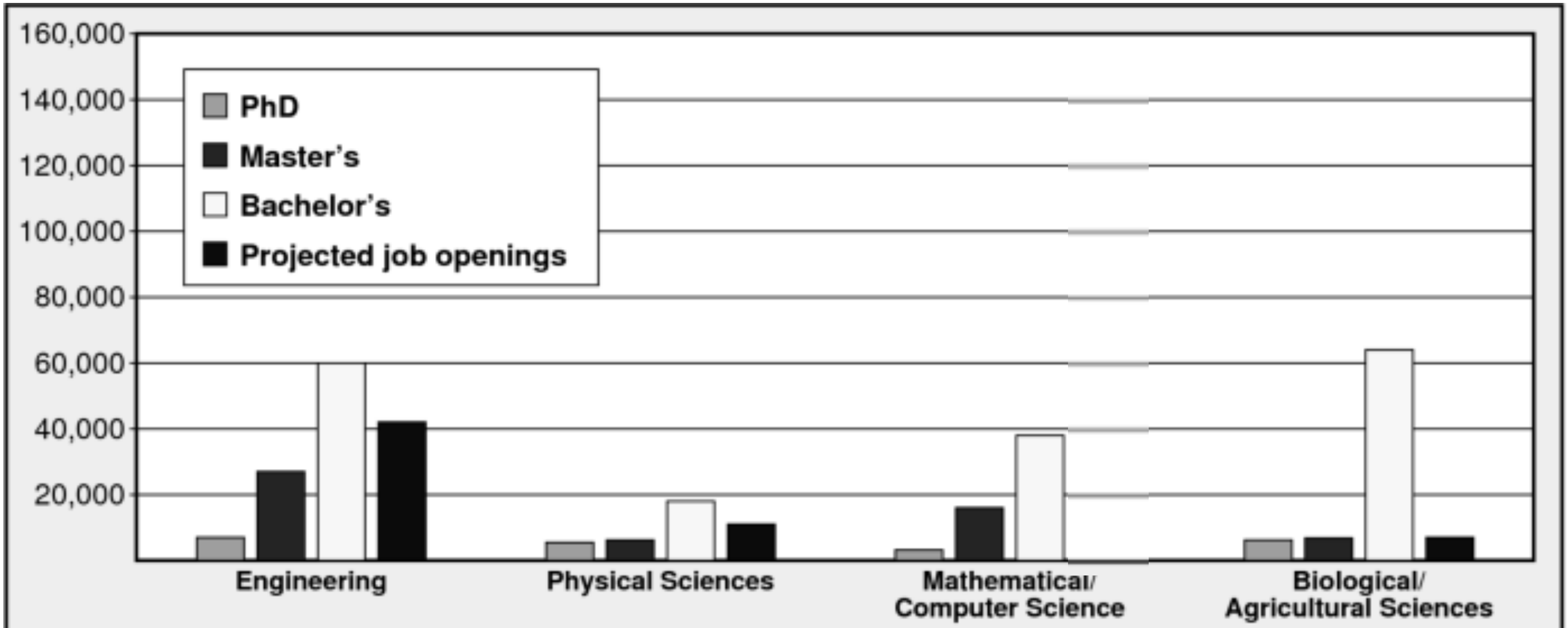
contributed articles

Scratch: Programming for All

. . .

How does a 6-figure/year job sound?

Annual degrees and jobs in broad engineering fields

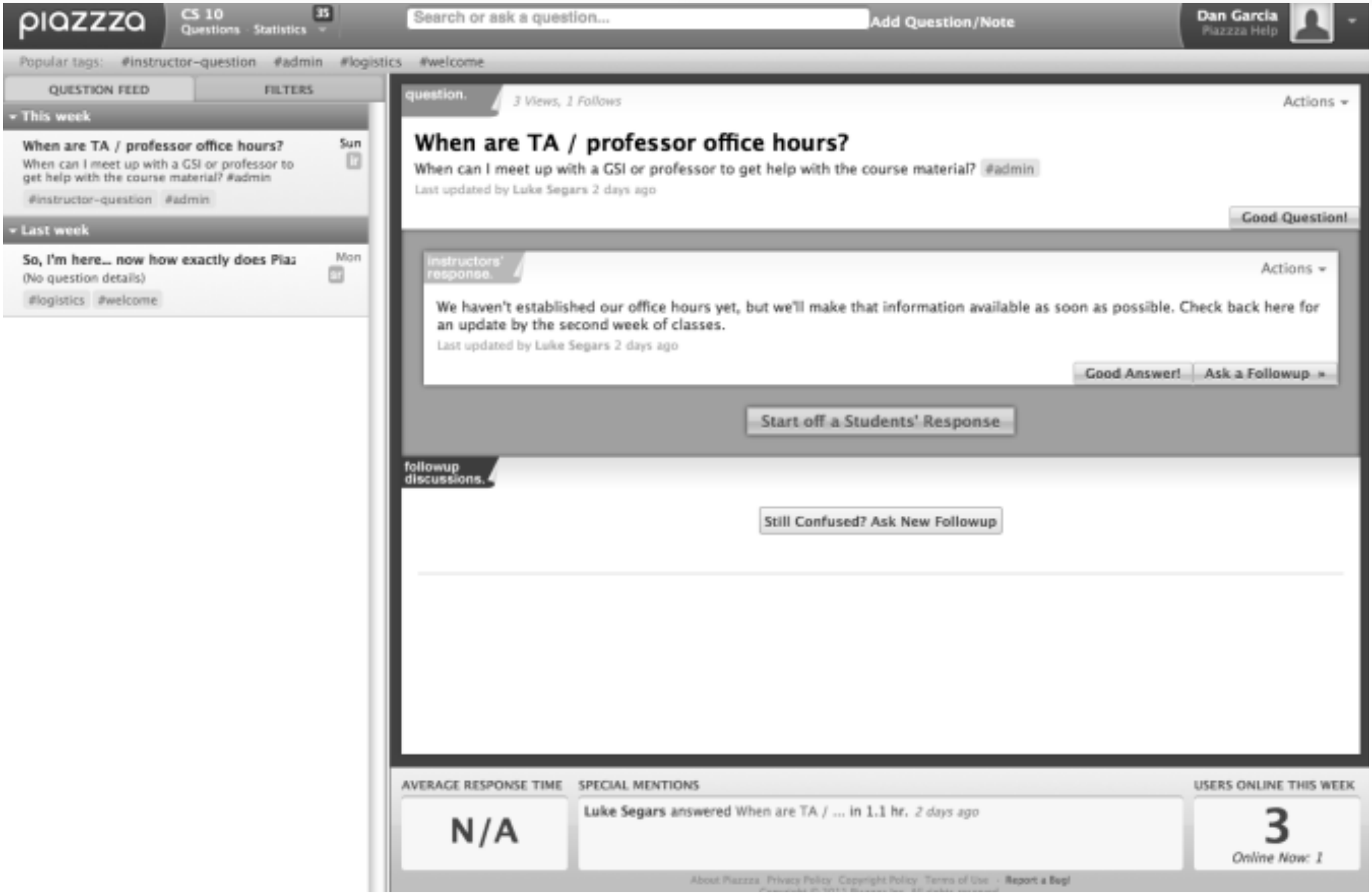


SOURCES: Tabulated by National Science Foundation/Division of Science Resources Statistics; degree data from Department of Education/National Center for Education Statistics, Integrated Postsecondary Education Data Systems Completion Survey, and NSF/SRS Survey of Earned Doctorates; Projected Annual Average 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

Piazza for {ask,answer}ing questions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35
Questions · Statistics
Search or ask a question...
Add Question/Note
Dan Garcia
Piazzza Help
Popular tags: #instructor-question #admin #logistics #welcome
QUESTION FEED
FILTERS
This week
Last week
question.
Actions
Good Question!
instructors' response.
Actions
Good Answer!
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When are TA / professor office hours? Sun
When can I meet up with a GSI or professor to get help with the course material? #admin
#instructor-question #admin

So, I'm here... now how exactly does Piaz Mon
(No question details)
#logistics #welcome

3 Views, 1 Follows

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

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

AVERAGE RESPONSE TIME	SPECIAL MENTIONS	USERS ONLINE THIS WEEK
N/A	Luke Segars answered When are TA / ... in 1.1 hr. 2 days ago	3 Online Now: 1

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=-CNTN92pt1o
- **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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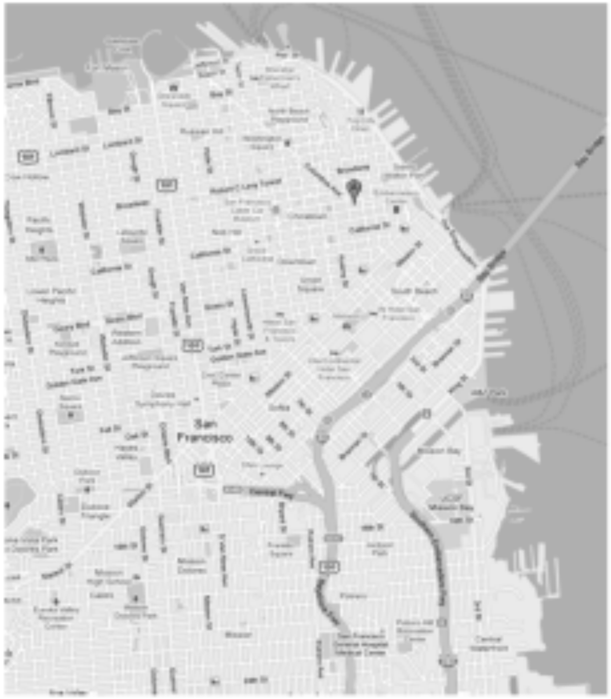
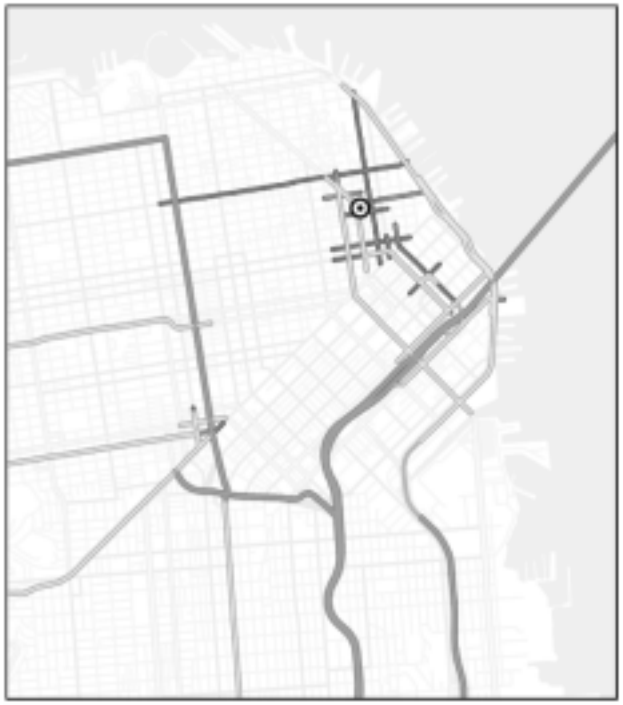
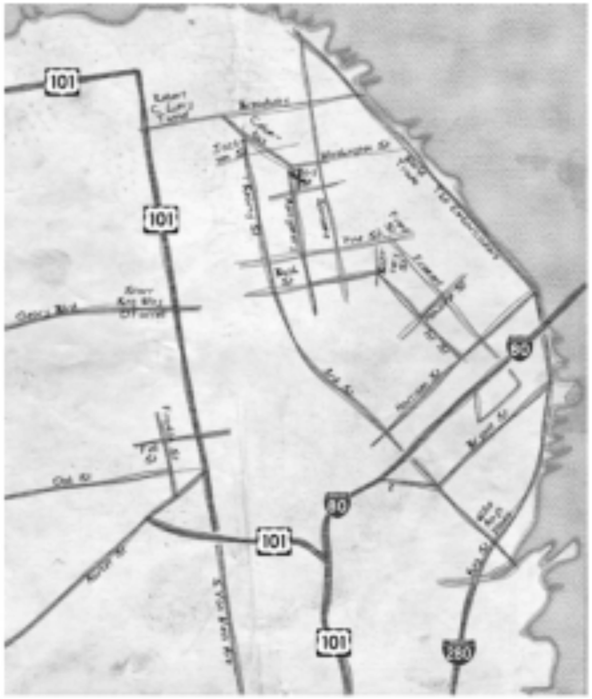
Detail Removal



General Purpose Online Map



Selected Roads



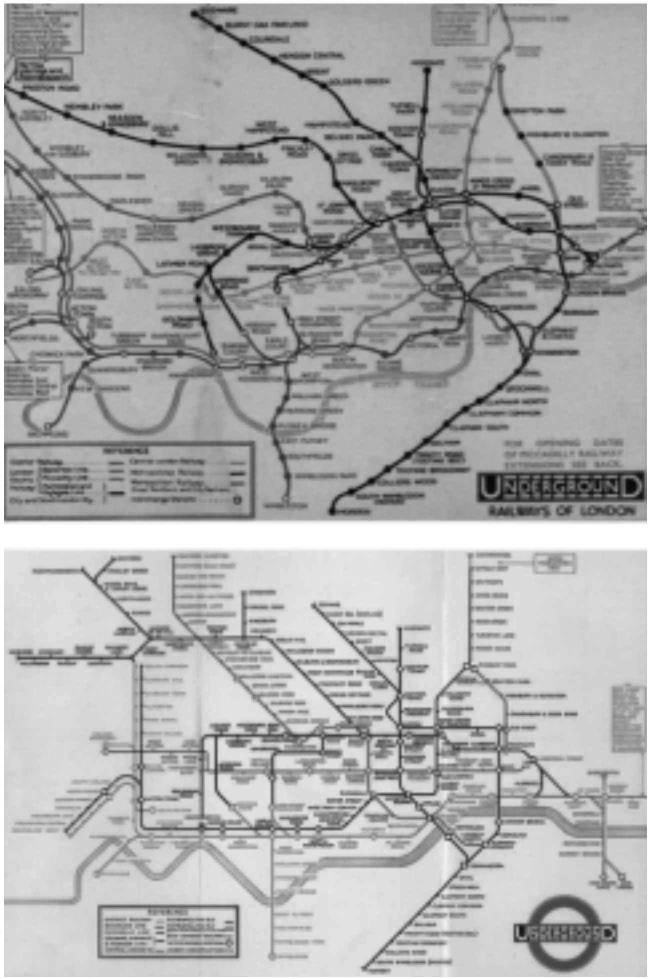
Our Result

Automatic Generation of Detail Maps

Prof. Maneesh Agrawala, among others

Detail Removal (in BJC)

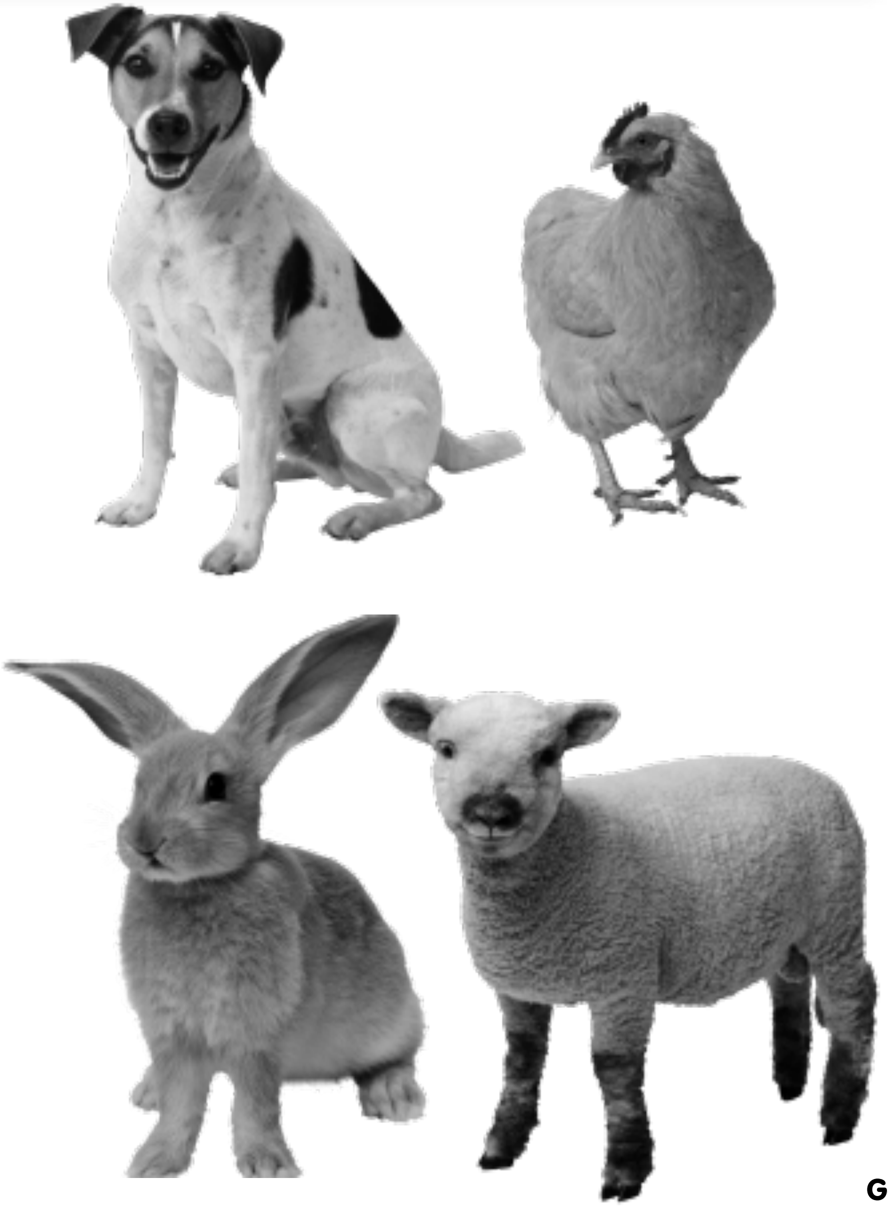
- You'll want to write a project to simulate a real-world situation, or play a game, or …
- Abstraction is the idea that you focus on the essence, the cleanest way to map the messy real world to one you can build
- Experts are often brought in to know what to remove and what to keep!



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

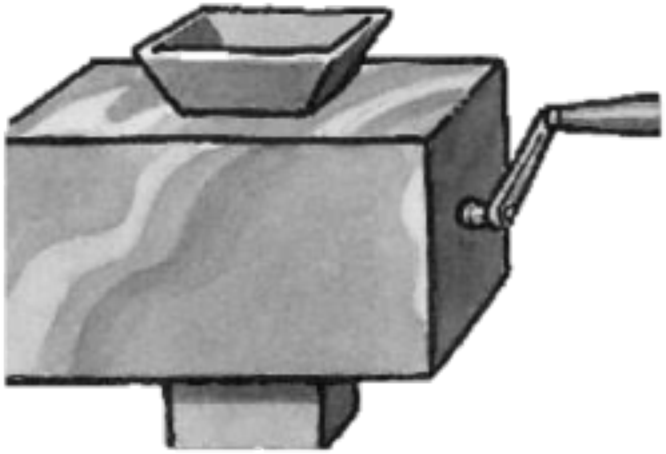


Generalization (in BJC)

- 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)

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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 layer**
  - 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

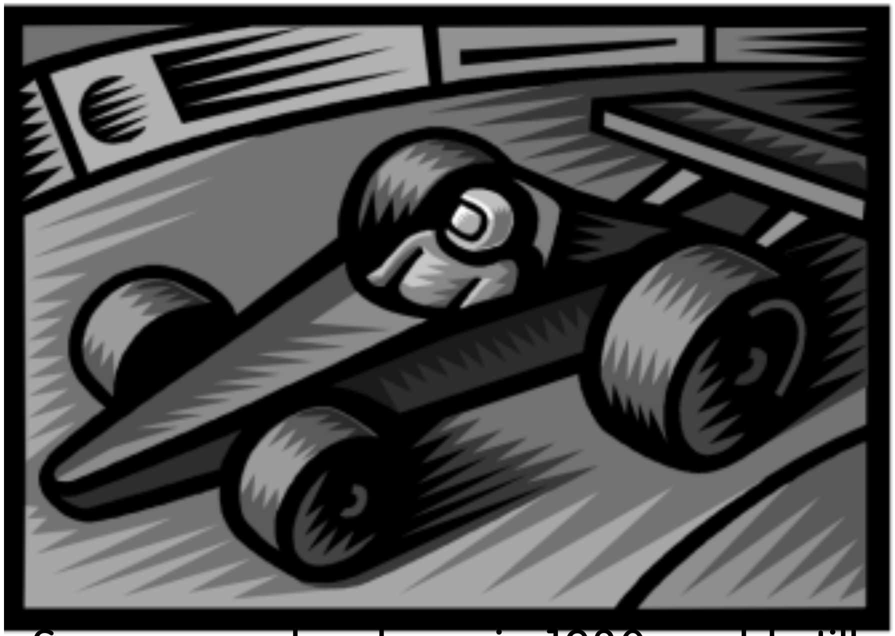
Abstraction Barrier (Interface)
(the interface, or specification, or contract)

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"

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