

# UC Berkeley's CS 10

## The Beauty and Joy of Computing

LOCKHEED MARTIN



### UC Online Pilot

UC Berkeley presents  
Bears Breaking Boundaries Contest

Grant  
Winner

Grant  
Winner

Award  
Winner

## STATUS...

- 2009Fa : 16 students (half course)
- 2010Fa : 90 students (full course)
- 2011Sp : 90 students (full course)
- 2011Su : 29 high school teachers
- 2011Fa : 240 students (full course)
- 2012Sp : Confirmed ... **online too!**



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# The “Passion, Beauty, Joy, Awe”

## movement



Grady Booch @ SIGCSE 2007

- Need to articulate, emphasize the “wonder and awe” of computing



PBJA<sub>1</sub> session @ SIGCSE 2008

- Crisis in computing, what can help in K-12, working w/student groups



Rebooting Computing Summit

- Subtitle: “Magic & Beauty of CS”
- Working group: K-8 FUNdamentals



PBJA<sub>2</sub> session @ SIGCSE 2009

- Crisis update, Listening to our students, Relevant projects to them



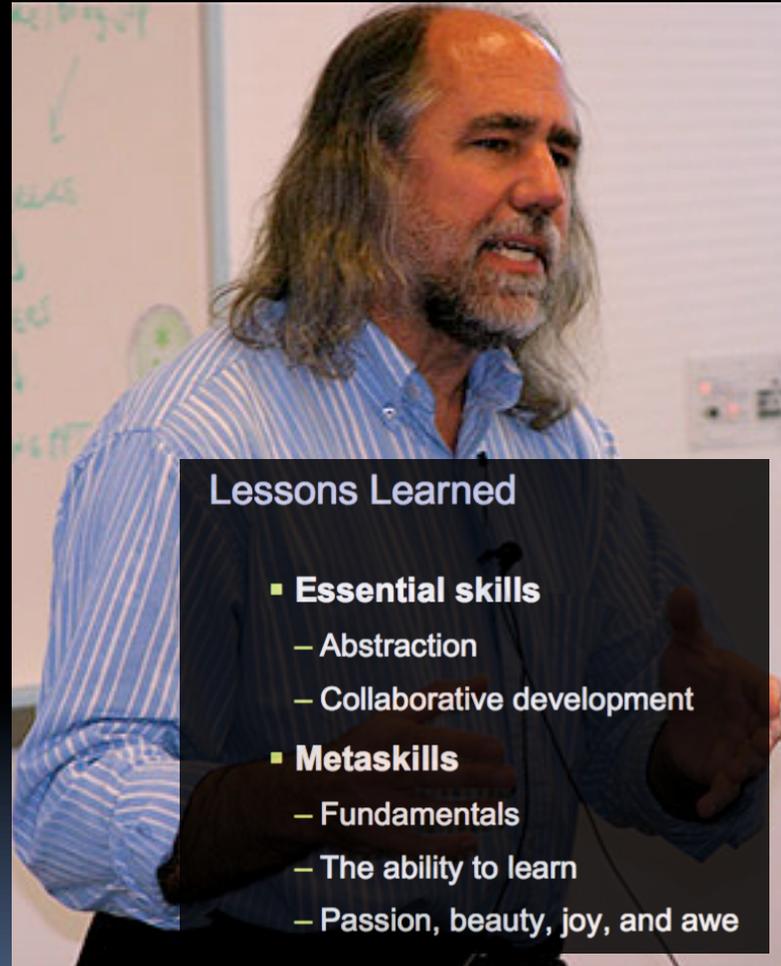
PBJA<sub>3</sub> session @ SIGCSE 2010

- Curriculum, PD, community, industry fighting “there’s an app for that”



PBJA<sub>4</sub> session @ SIGCSE 2011

- 3 others in K-12 share vision



### Lessons Learned

- **Essential skills**
  - Abstraction
  - Collaborative development
- **Metaskills**
  - Fundamentals
  - The ability to learn
  - Passion, beauty, joy, and awe

Grady Booch @ SIGCSE 2007

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# comes around the corner

Create and share your own interactive stories, games, music, and art

[Check out](#) the 2,128,597 projects from around the world!



To create your own projects:



Download Scratch

# BYOB adds functions, generic lists, $\lambda$

- BYOB (Build Your Own Blocks)
  - developed by Jens Mönig w/design input and documentation from Brian Harvey & others @ Cal
  - Leverages awesomeness of Scratch (design, simplicity, multi-media, community of users)
  - Adds enough so Scratch can be used in CS0 and CS1



Building a For Loop and calling it. Can you do this in your language?

# CS10 in one slide

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- Big Ideas of Programming
  - Abstraction
  - Algorithms (2)
  - Recursion (2)
  - Functions-as-data,  $\lambda$  (2)
  - *Programming Paradigms*
  - *Concurrency*
  - *Distributed Computing*
- Beauty and Joy
  - “CS Unplugged” activities
  - All lab work in pairs
  - Two 3-week projects in pairs
    - Of their own choice!!
  - One 3-page paper
    - Of their own choice!!
- Big Ideas of Computing
  - HowStuffWorks
    - 3D Graphics
    - Video Games
    - Computational Game Theory
  - Research Summaries
    - AI
    - HCI
  - Apps that Changed the World
  - Social Implications of Computing
  - Saving the World with Computing
  - How Twitter Works (guest lecture)
  - Cloud Computing
  - Limits of Computing
  - Future of Computing



# Format & Textbooks

- Format (7 hrs/wk \* 14 wks)

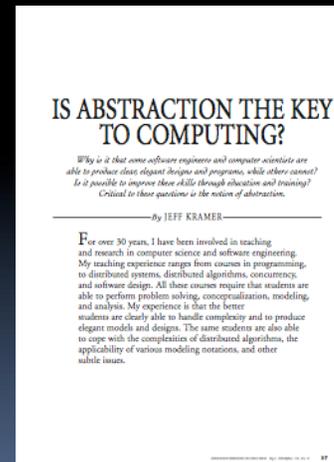
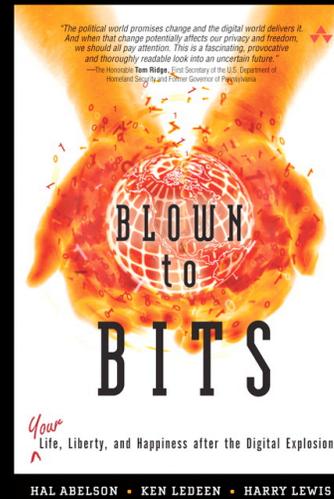
Mon	Wed	Fri
Lecture	Lecture	Discussion
Lab	Lab	
Lab	Lab	

- Selected Reading

- Taken from great book (“Blown to Bits” by Abelson, Ledeen & Lewis) + articles + videos
- Current events EVERY DAY (e.g., IBM’s Watson vs Jeopardy)

- All resources FREE

- Even clickers!



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# Peer Instruction in Lecture

- Increase real-time learning in lecture, test understanding of concepts vs. details
  - Improves interactivity greatly!
- Ask multiple choice question
  - 1-2 minutes to decide
  - 2 minutes in pairs/triples to reach consensus. Teach others!
  - 2 minute discussion of answers, questions, clarifications



# CS10 curriculum leads

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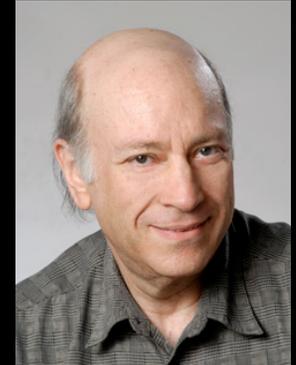
- Dan Garcia

- Lecturer SOE



- Brian Harvey

- Lecturer SOE



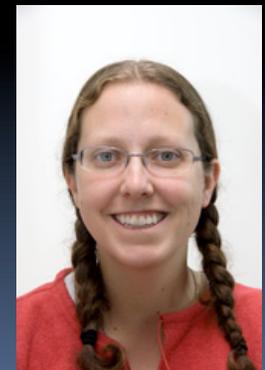
- Luke Segars

- TA, Grad Student



- Colleen Lewis

- TA, Grad Student



...many others @ Cal!

# CS 10 YouTube Testimonial

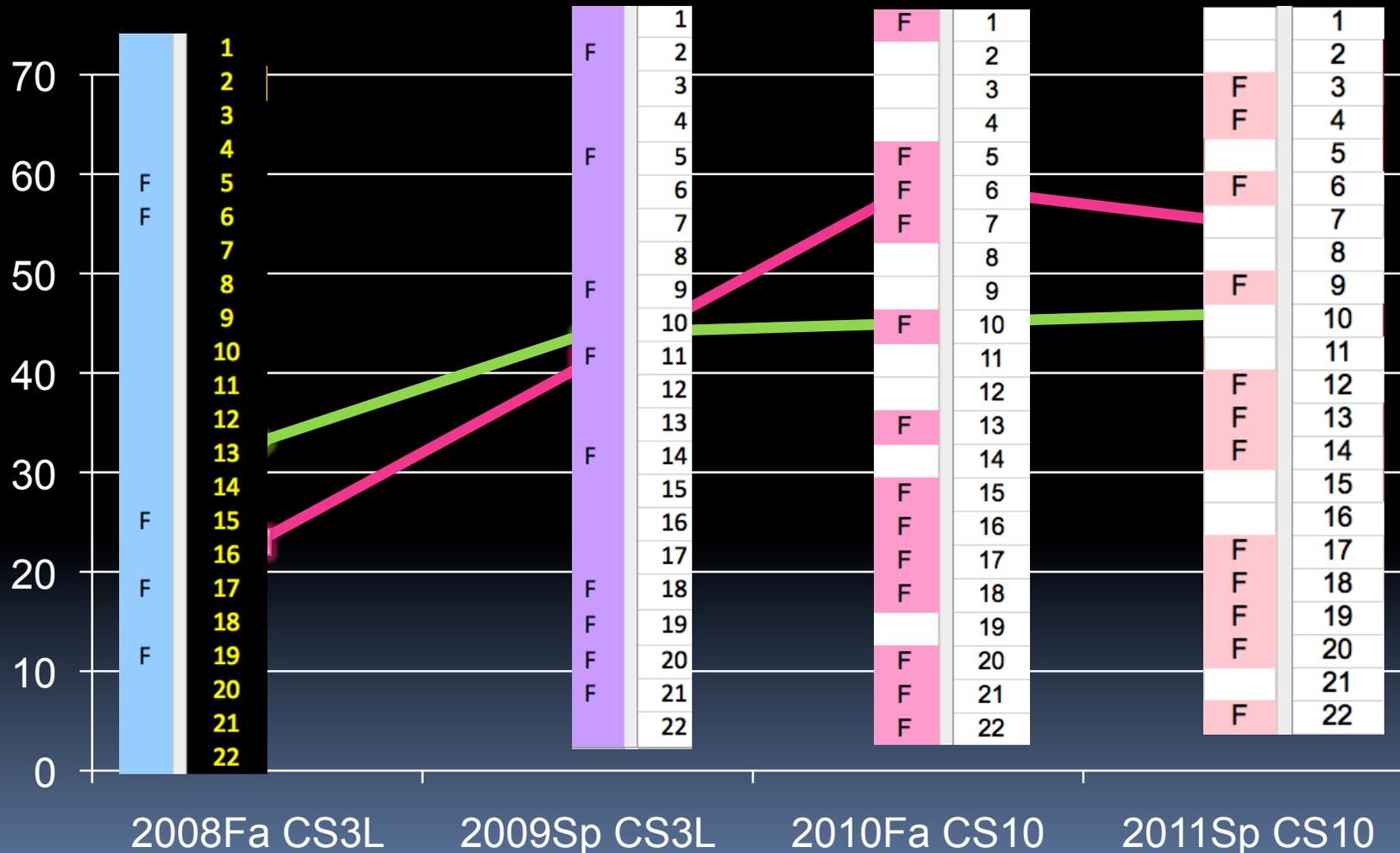


- Justin Barnes (L) & Ian Birnam (R)
  - Ian: “The class itself was amazing ... I had a really fun time ... Building our own projects was great ... The lectures were really interesting ... I never really got into computing but because of this class now I’m really interested in computing and being a possible CS major. ... **Anyone even remotely interested in computers should take it!**”
  - Justin: “The class is incredibly engaging. The atmosphere is unlike anything I’ve ever taken here. I would recommend it to any friend. I’m a senior, but **honestly, if I had taken this class earlier, I would have considered CS as a major.**”



# 45% Women, ~57% of top 22 students!

◆ % Women    ■ % Women in Top 22    
 Women GPA: 3.06    3.14  
Men GPA: 2.87    3.09



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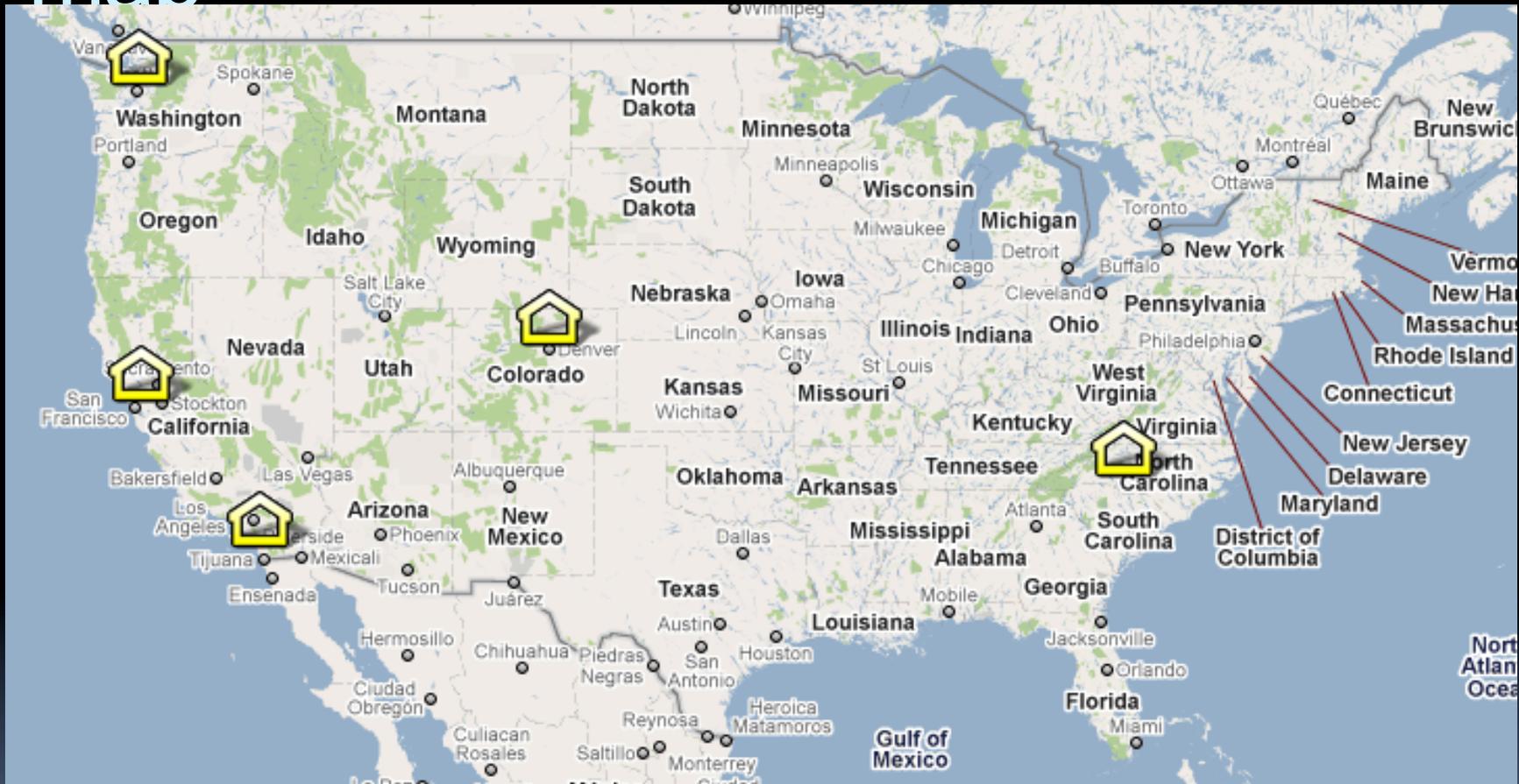
# Summary, Reflection

- CS10 is complete, available. Reviews ↑
  - UC Online pilot!
    - “Does it scale?” ... yes!
    - 6-week summer course
    - “1-6-1” professional dev
      - 29 high school teachers took our summer 2011 PD
  - NSF CE21 to train 100+ teachers!
- The Beauty and Joy of Computing  
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▫ If interested, contact

# 5 Pilots chosen by CollegeBoard, map



# 5 Pilots : Comparison

School	Name	Language	Size	Contact Hrs
MSCD	Living in a Computing World	Lightbot + Scratch	20	60
UCSD	Fluency w/ Information Technology	Alice + Excel	900	50
UW	CS Principles	Processing	40	50
UNCC	The Beauty and Joy of Computing	BYOB based on Scratch	30	45
UCB	The Beauty and Joy of Computing	BYOB based on Scratch	90	98



# Summary: design constraints of CS10

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- UC Berkeley's first course for majors (CS61A) expects programming experience & recursion
  - CS10 hits that in week 5, the same time as the old course
- What should undergrads know about computing?
  - History, CS+X, apps that changed the world, hot research
  - Computing is really fun, de-mystification
- Passion, Beauty, Joy & Awe
  - Take every step to make attractive to women, URM
  - Let them choose projects and paper relevant to them!
- Make all resources free, available (Berkeley way)
  - Videos, notes, exercises, clickers, book!



# High School Collaborators



Ray Pedersen

- Albany HS



Eugene Lemon

- Ralph Bunche HS



Josh Paley

- Gunn HS

