2013

Explorations in Computer Science for High School Educators

Changing the Perception of Computer Science

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School of Computer Science
Carnegie Mellon University

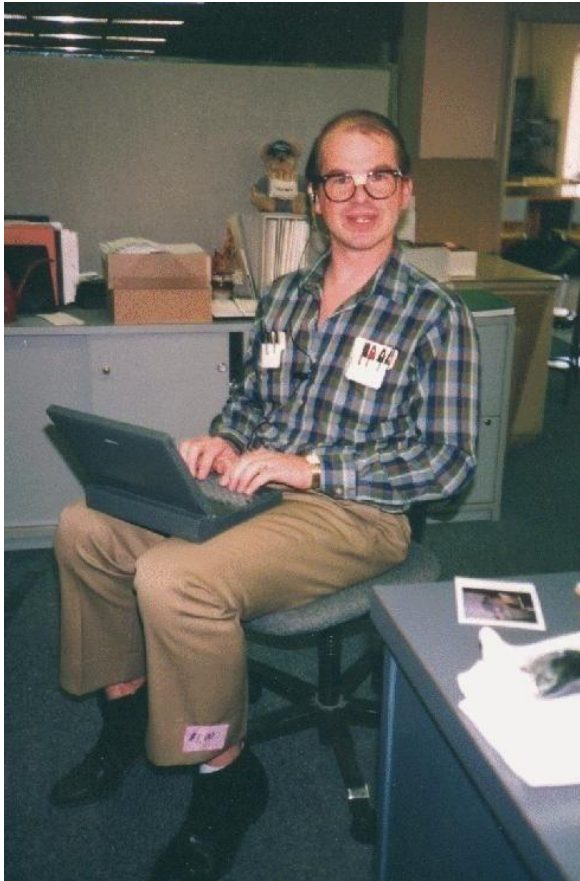# How is Computer Science Perceived in the USA?

By:

- General Public?
- Your students?
- Parents?
- School Councilors?

Familiar Images: Stereotypes

Familiar Images: Stereotypes

Familiar Images:
CS as "provider of services"

Familiar Images: Gamers

Mostly Negative

SOMETHING, SOMEWHERE WENT TERRIBLY WRONG.

Stereotypes and Research at University of Washington

"More women pick computer science if media nix outdated 'nerd' stereotype"

http://www.washington.edu/news/2013/06/25/more-women-pick-computer-science-if-media-nix-outdated-nerd-stereotype/

Why Are Images Important in Our Culture?

Images are a primary source of mass communication in *our* culture:

e.g. TV, movies, magazines, internet, YouTube, etc…

Why Are Images Important in Our Culture?

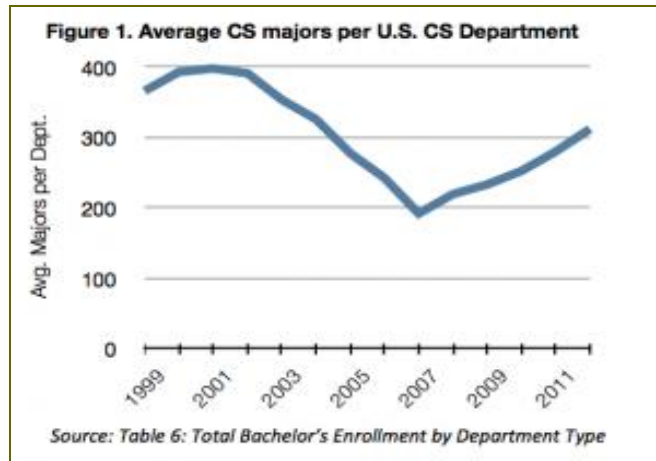• Many people get their "**information/knowledge**" from the images that surround them.

• We are surrounded by images and constantly "reading" images and creating stories (consciously and unconsciously) to make sense of the world in which we live.
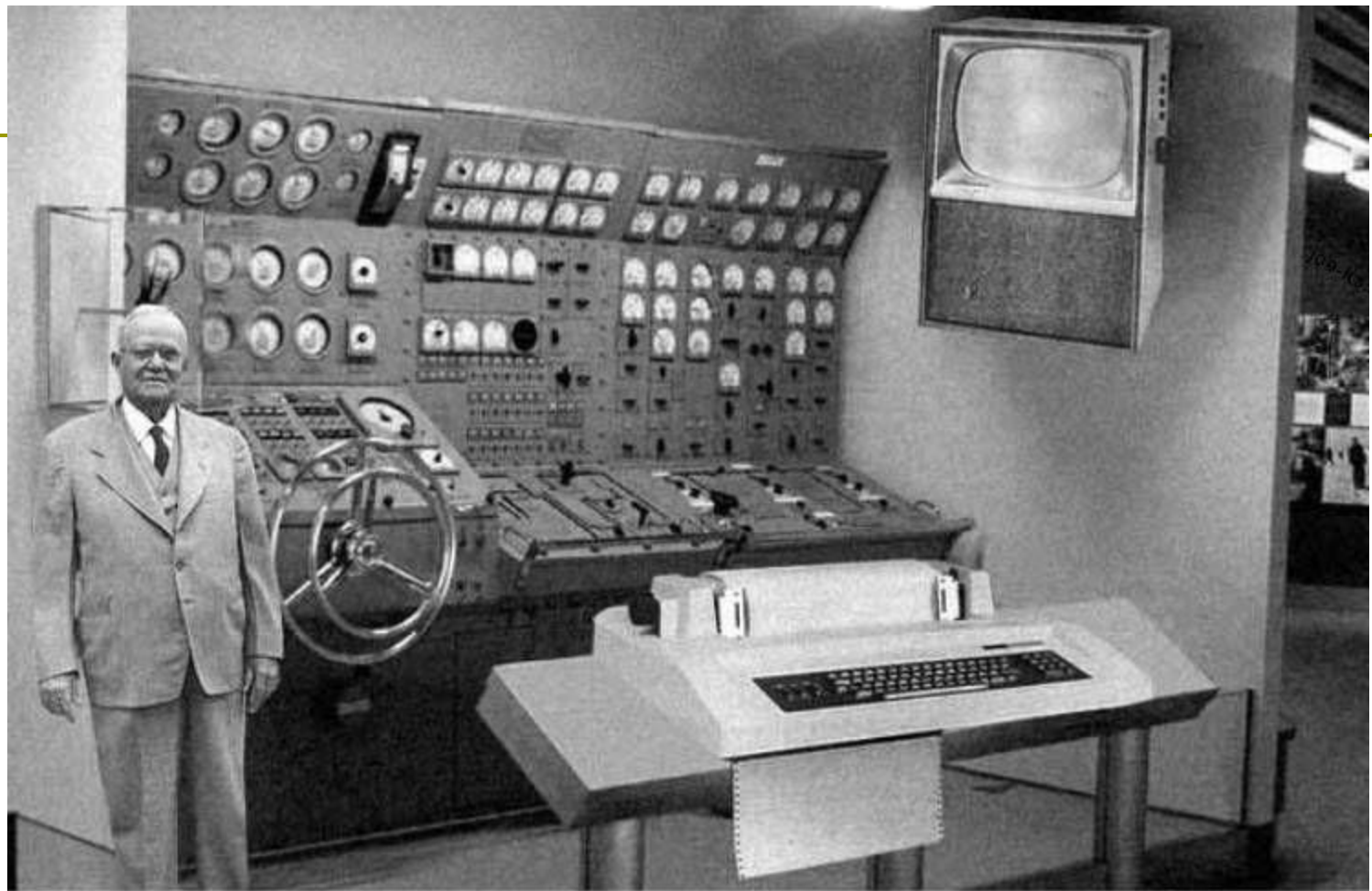
Scientists from the RAND Corporation have created this model to illustrate how a "home computer" could look like in the year 2004. However the needed technology will not be economically feasible for the average home. Also the scientists readily admit that the computer will require not yet invented technology to actually work, but 50 years from now scientific progress is expected to solve these problems. With teletype interface and the Fortran language, the computer will be easy to use.

CS Education: Participation at the Undergraduate Level

CS Bachelor's Average Enrollment (Figure 1.) and Production (Figure 2.) (2013 CRA Taulbee Report)

Figure 1. Average CS majors per U.S. CS Department

Source: Table 6: Total Bachelor's Enrollment by Department Type

Figure 2. BS Production (All Departments)

Source: Table 3: Bachelor's Degrees Awarded by Department Type

Good News!

But not the whole story...

CRA Taulbee Report: http://cra.org/govaffairs/blog/2013/03/taulbeereport/
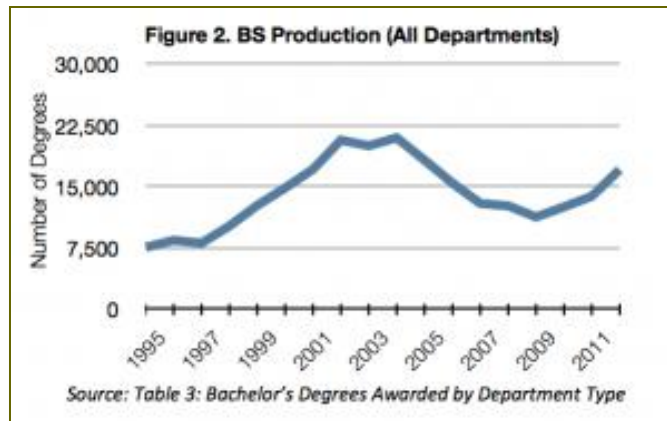
CS Bachelor's Degrees Awarded by Gender
(2013 CRA Taulbee Report: 2011-2012 activity)

Table 4. Bachelor's Degrees Awarded by Gender	CS		CE		I		Total	
Male	9,349	87.1%	2,106	89.4%	2,129	82.8%	13,584	86.7%
Female	1,387	12.9%	250	10.6%	441	17.2%	2,078	13.3%
Total Known Gender	10,736		2,356		2,570		15,662	
Gender Unknown	313		0		0		313	
Grand Total	11,049		2,356		2,570		15,975	

- The 2013 Taulbee survey shows the national graduation rates for women in CS stand at **12.9%.** This represents a small increase (up from 11.7% to 12.9%) for the first time *since 1984.*

- **2013 CMU Enrolled CS Female Freshmen: 35%**

CS Bachelor's Recipients by Ethnicity

(2013 CRA Taulbee Report: 2011-2012 activity)

Table 5. Bachelor's Degrees Awarded by Ethnicity	CS		CE		I		Total	
Nonresident Alien	619	6.8%	216	10.5%	98	4.1%	933	6.9%
Amer Indian or Alaska Native	39	0.4%	6	0.3%	12	0.5%	57	0.4%
Asian	1,477	16.3%	447	21.7%	341	14.2%	2,265	16.7%
Black or African-American	407	4.5%	107	5.2%	203	8.4%	717	5.3%
Native Hawaiian/Pac Islander	18	0.2%	4	0.2%	3	0.1%	25	0.2%
White	5,793	64.0%	1,154	55.9%	1,522	63.2%	8,469	62.6%
Multiracial, not Hispanic	130	1.4%	27	1.3%	26	1.1%	183	1.4%
Hispanic, any race	575	6.3%	102	4.9%	203	8.4%	880	6.5%
Total Residency & Ethnicity Known	9,058		2,063		2,408		13,529	
Resident, ethnicity unknown	732		117		89		938	
Residency unknown	1259		176		73		1,508	
Grand Total	11,049		2,356		2,570		15,975	

US Population: Hispanic 15.4%, African Americans 12.8%

2010 Quick Facts http://quickfacts.census.gov/qfd/states/00000.html

Why Does This Matter?

Key Facts About Computer Science

The Good News 🙂

• **By 2018, current government projections show that more than 800,000 high-end computing jobs will be created in the economy**, making it one of the fastest growing occupational fields. The U.S. Bureau of Labor Statistics projects that by 2020, there will be nearly 1.4 million computing-related jobs added to the U.S. workforce.

• **Five of the top ten fastest growing jobs will be in computing-related fields** (i.e., computer software engineer jobs expected to grow 45% over the next five to seven years).

• **Top Salaries!** Computer science and computer engineering bachelor degrees are in high demand and command two of the top three average salary offers from employers among all majors **(60K-70K starting salaries, CMU even higher!)**
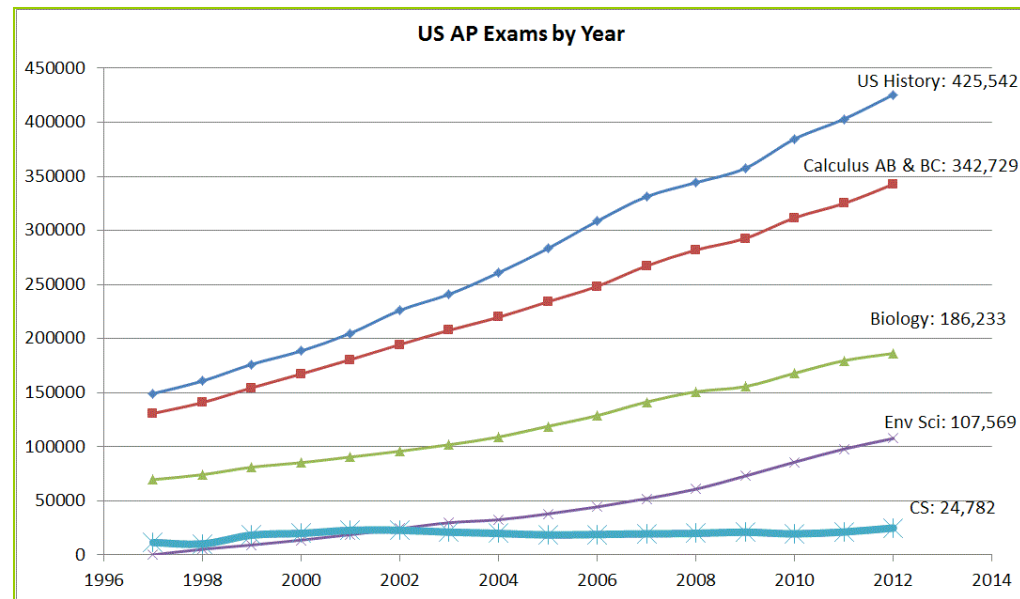
Thanks to ACM, U.S. Bureau of Labor, NCWIT, TEALS, and CSED Week for Data

Key Facts About Computer Science Education

The Bad News

• **The percent of high schools with rigorous computer science courses** fell from 40% to 27% from 2005-2009, and continues to decline.

• **The majority of states have no certification for computer science teachers**; in states where certification or endorsement exists, the requirements may have little, if any, computer science content.

• **Many people are missing out on creative and lucrative job opportunities** in what is probably the fastest growing field in the nation.

• **USA is falling behind.** Given the existing pipeline of students we'll be able to fill only <u>30%</u> of projected jobs with computing graduates. Tech industry is now a global market! USA needs talent and more workers in the field to stay competitive.

• **CS may suffer from a waste of potential talent.** The field is missing out on diversity of people and ideas. Education, research and innovation enriched by multiple viewpoints, life experiences, etc.

Thanks to ACM, U.S. Bureau of Labor, NCWIT, TEALS, and CSED Week for Data

Number of US schools offering AP courses, 1997-2012

US AP Exams by Year

US History: 425,542
Calculus AB & BC: 342,729
Biology: 186,233
Env Sci: 107,569
CS: 24,782

"In 2010 only 19,390 students in the United States out of some 14 million took the Computer Science Advanced Placement test. This number represents only 0.6% of all AP tests taken that year."

See the TEALS program (Technology Education And Literacy in Schools) http://tealsk12.org/

Low Access to CS AP Continues…

"The real problem is that, when it comes to high school CS, *we're just not there*. If you choose a high school at random, you are ten times more likely to find one that offers *no CS* than to find one offering AP CS. …. **Most kids just don't have access**."
(Computing Education Blog, April 21st, 2011)

http://computinged.wordpress.com/tag/apcs/

What History Tells Us

What History Tells Us

Rear Admiral Grace Hopper's Team: "First" Computer Bug, 1947
http://www.history.navy.mil/photos/pers-us/uspers-h/g-hoppr.htm

What History Tells Us

• **ENIAC**
Women pioneers were involved in building the Electronic Numerical Integrator and Computer, ENIAC, the first general-purpose electronic digital computer (used for the Manhattan project).

• In 1940s WW2 women and men, who became known as "computers", worked on calculating weapons trajectories. **In 1943 almost all "computers" were women,** and women were perceived as best for the job:"Programming requires lots of patience, persistence and a capacity for detail and those are traits that many girls have".

Quoted in Denise Gurer, "Pioneering women in computer science", ACM SIGCSE Bulletin, Volume 34 , Issue 2, ACM Press, 2002 p. 176.

Since 2002 CMU Studies Have Found a Spectrum of Attitudes Towards CS: *No Strong Gender Divide!*
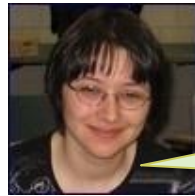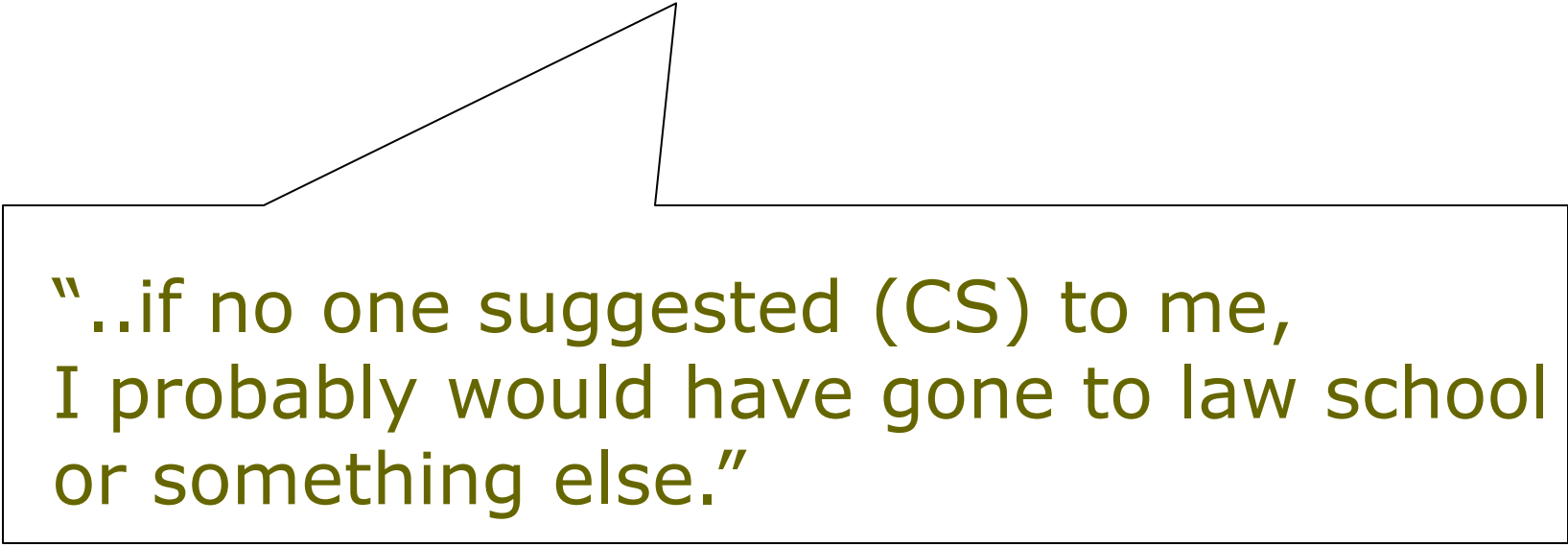
Choice or Opportunity?
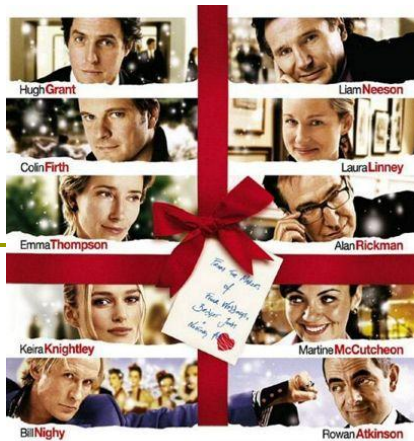
CS Senior Female at Carnegie Mellon

"..if no one suggested (CS) to me,
I probably would have gone to law school
or something else."

From **CSTA** and **ACM**: Running on Empty

State-by-State Results

http://csta.acm.org/runningonempty/roemap.html
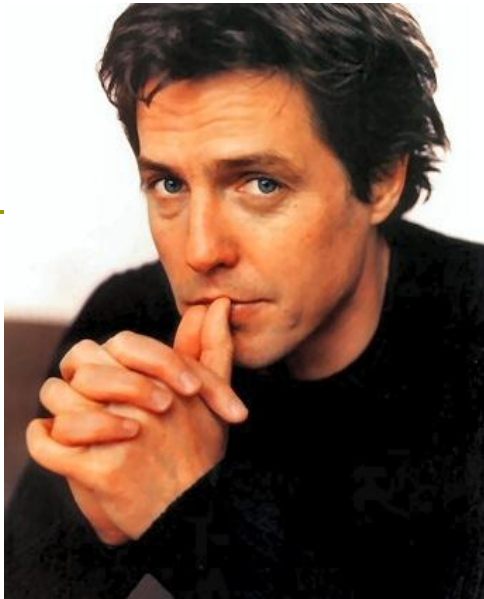
Hugh Grant ….

"…film acting is incredibly tedious, just by its nature. It's incredibly, mind numbingly slow."

"Yet, few people think film acting is boring. Not because it isn't, but because it's never portrayed that way. Computer Science has the opposite problem." **Jill Ross**

Slide from Jill Ross, Director, Image of Computing Taskforce

Are Perceptions Changing?

NYT Article: "Computer Studies Made Cool, on Film and Now on Campus"

Time Magazine "Person the Year 2010"

The Girl with the Dragon Tattoo: Book and Movie

http://jabcatmovies.com/2010/05/the-girl-with-the-dragon-tattoo-jabcat-twitter-review/

What We Can Do to Change the Perceptions of Computer Science?

Broaden understanding of what CS is all about

• HS Teachers: CMU offers CS4HS workshops
• Bring the breadth of computing concepts into your classroom
• Showcase CS during Computer Science Education Week
• Talk to administrators/educators about the importance of computing
• Develop and present your own student Roadshow

Broaden understanding of Careers and Where the Jobs Are

• Discuss career opportunities and salaries
• Check out data on CSTA and NCWIT

Broaden understanding of WHO can do CS

• Mentor/Target/Encourage Girls and Minorities and Boys who may be missing out especially those on a Math/Science Track
• Challenge the Stereotypes
• Show Roles Models
• Encourage Problem Solving e.g. Chess Playing
• Encourage Spatial Skills Activities e.g. Building, 3D Puzzles

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What **LOCAL** Area **HS** Teachers Can **Do**

- Spread the Word about CS4HS

- If you like the Roadshow invite us to present at your school!
http://women.cs.cmu.edu/

- Middle School Girls can attend our FREE weekly TechNights Program:
http://women.cs.cmu.edu/technights/

Thank You!!