Carnegie Mellon
School of Computer Science

Transforming the Culture of Computing @ Carnegie Mellon

Similarity is the Difference

Lenore Blum
Distinguished Career Professor of Computer Science

http://www.aladdin.cs.cmu.edu

The ALADDIN Center

ALgorithm ADaptation, Dissemination and INtegration

Technology Transfer

Theory → Practice

09/06/2001

ALADDIN

NSF-0122581

Guy Blelloch, Lenore Blum • Carnegie Mellon University
In collaboration with Princeton University

ALgorithmic ADaptation, Dissemination and INtegration

Research Objectives

Improve the Process of Applying Algorithms to Real-World Problems

Approach

Organized Around **PROBEs**

- **PROB**lem-Oriented **E**xplorations

Each Starts with a **Workshop**

- Leads to ongoing research relationships and results

Broader Impact

Research / Industry Synergies

- Better theory
- Better applied technology

Combined with Outreach

- Better algorithms education

College Workshop – Carnegie Mellon, June 26-28, 2003

Women@SCS Outreach Roadshow

REUs – 22 students over three summers

Significant Results: A Sampling

The CAPTCHA project

Computer Human Authentication

- CAPTCHA used by Yahoo! et al
- ESP Game labels web images

Workshop on Human Interactive Proofs – Palo Alto, January 9-11, 2002

Privacy in DATA

- Theory of **k-Anonymity**

Privacy in DATA Workshop – Carnegie Mellon, March 27-28, 2003

SNP and Haplotype Analysis

- New methods for characterizing and applying haplotype structure

2nd RECOMB Satellite Workshop on Computational Methods for SNPs and Haplotypes – Carnegie Mellon, February 20-21, 2004

Meshing for Blood Flow

- Meshing with dynamically moving interfaces

Meshing Interface Workshop – Ithaca, September 2, 2

Graph Cuts for Vision and Data Analysis

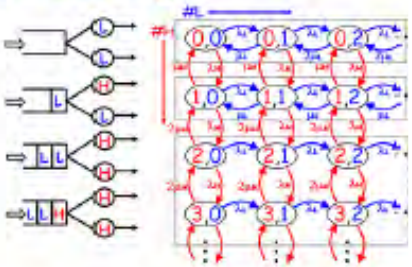
- Graph partitioning for combining labeled and unlabeled data

Graph Partitioning in Vision and Machine Learning – Carnegie Mellon, January 9-11, 2003

SYNC and Multiserver Scheduling

- Dramatically improved mean response time

Workshop on Multiserver Scheduling – Carnegie Mellon, April 18-19, 2004



Dynamic Algorithms

- Self-adjusting computation

Workshop on Dynamic Algorithms & Applications – New Orleans, January 14, 2004

Integrated Logistics

Integrated Logistics Workshop – Princeton, Oct. 31 – Nov. 1, 2002

Integrated Logistics Workshop II – Carnegie Mellon, March 27-29, 2003

Algorithms in Economics

- Extended Meyerson mechanism

Workshop on Auction Theory and Practice – Carnegie Mellon, November 7-8, 2004

Web Structure and Algorithms

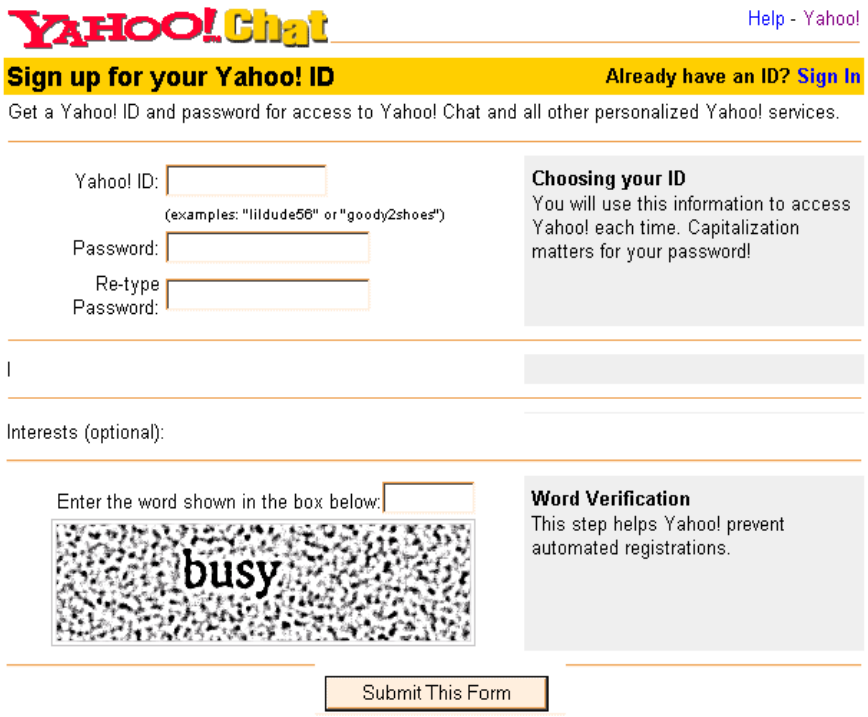
- Analysis of "geometric" model having a power law and small separators

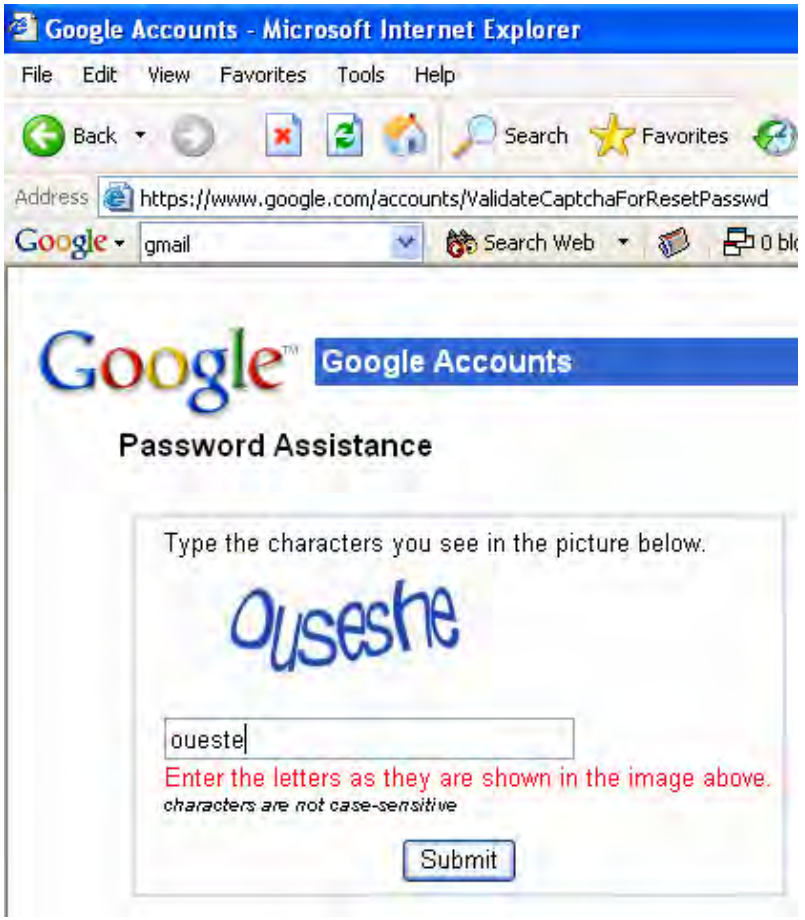
Workshop on Web Structure and Algorithms – Carnegie Mellon, April 9-10, 2004

ALGORITHMIC CORE

CAPTCHA

Completely Automatic Public Turing Test to Tell Computers and Human Apart





Word verification technology developed in collaboration with the **CAPTCHA Project at Carnegie Mellon University.**

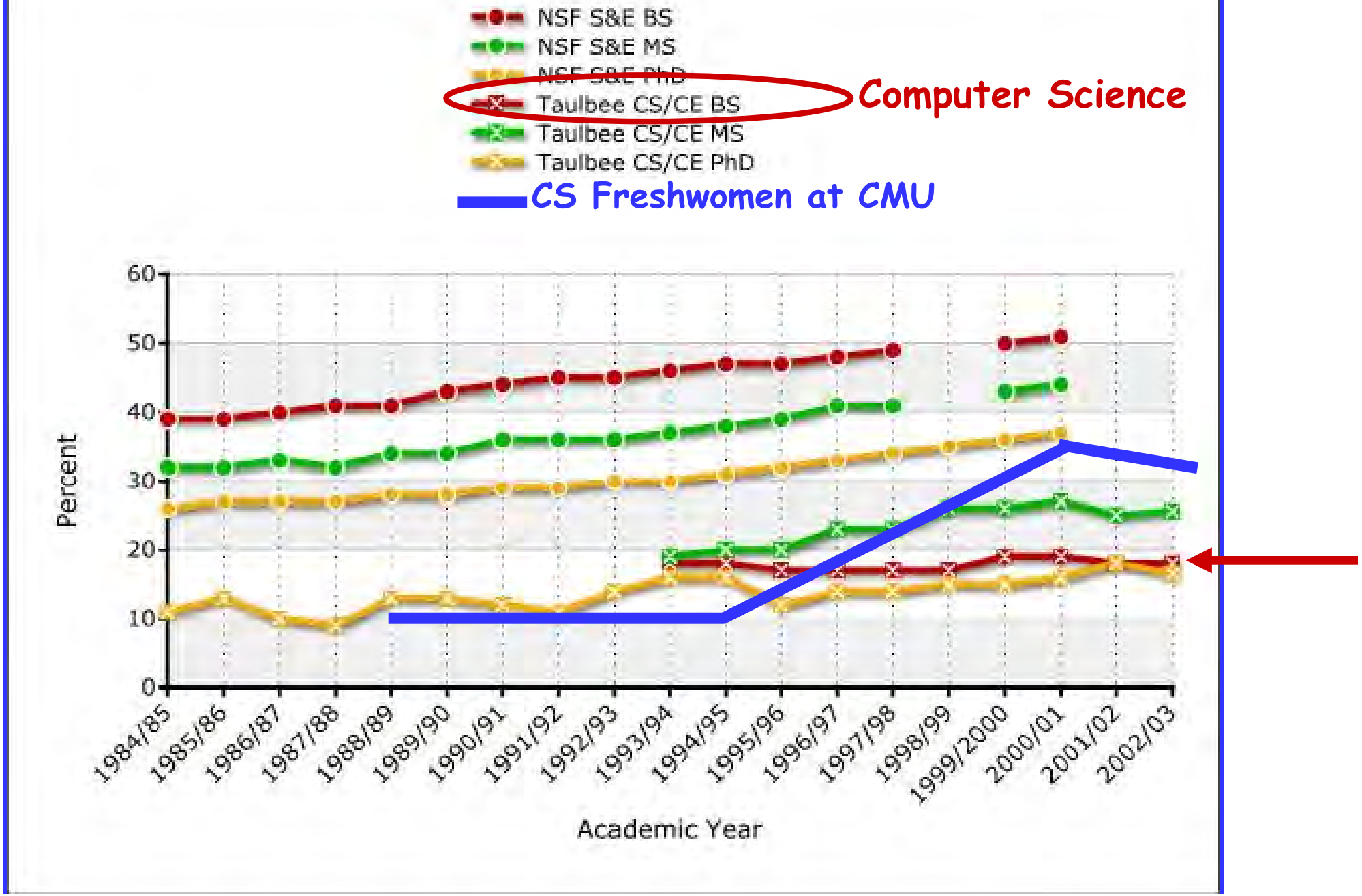
Talk Outline

1. **ACTION:** Transforming the Culture of Computing

2. **FINDINGS:** In a More Balanced Computer Science Environment, **Similarity is the Difference.**

3. **CONCLUSION:** **Correcting the Image** of Computer Science (the field and its participants) **and Introducing exciting CS** into the k-12 curriculum **is Critical** for Full Participation and for the Health and Future of the Enterprise and the Nation.

Figure 1. Percentage of S&E and CS/CE Degrees Granted to Women



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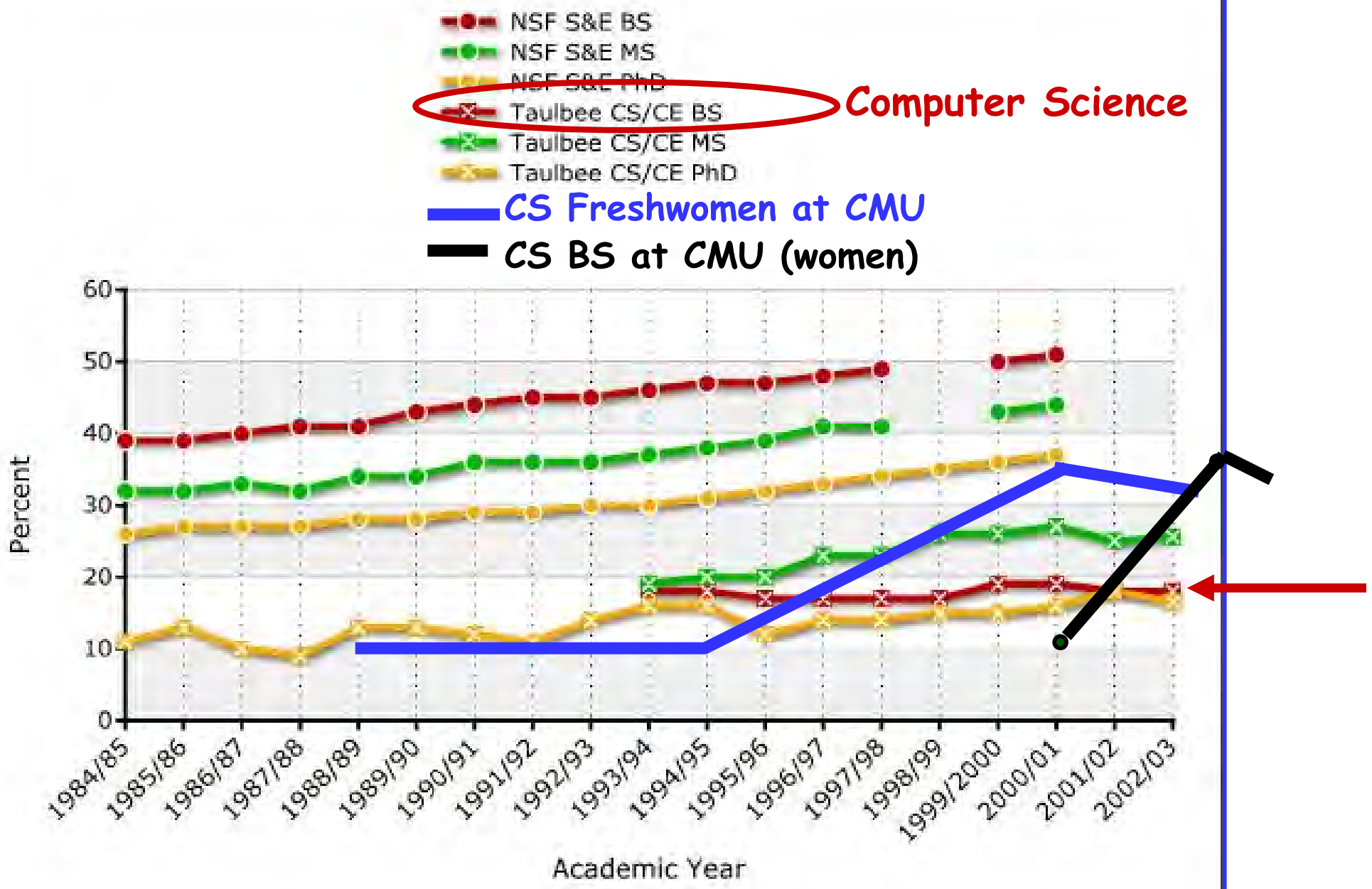


Carnegie Mellon Bachelor's degrees in CS (2001-2005)

Grad year	Women	Total	% Female CMU	% Female National *
Spring 01	14	116	12%	20%
Spring 02	23	125	18%	18.8%
Spring 03	36	105	34%	19.4%
Spring 04	44	115	38%	17.7%
Spring 05	37	112	33%	

*Taulbee Surveys of PhD granting departments

Meeting with some

First Year CS Students at Carnegie Mellon, Sept 2001


Meeting with some
First Year CS Students
at Carnegie Mellon, Sept 2002

Meeting with some

First Year CS Students at Carnegie Mellon, Sept 2003


Meetng with some
First Year CS Students
at Carnegie Mellon, Sept 2004

Meeting with some

First Year CS Students at Carnegie Mellon, Sept 2005

Carnegie
Mellon

How did this change Come to Be?

Action, Action, Action

and more Action

Carnegie Mellon

Undergraduate Level

How did this change Come to Be?

Prior to 1999:

1. **Outreach:** to High School (AP CS) Teachers
2. **Rational Admissions Criteria:** De-emphasizing Prior-Programming and emphasizing broad interests (while maintaining high academic achievement)
3. **Access: Multiple Entry Routes** into the CS curriculum

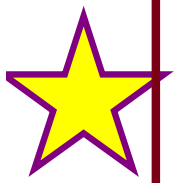
Starting in 1999:

4. **Professional Community**/ Support Infrastructure

All Adaptable to Other Venues

Carnegie Mellon

1. Outreach
(Fisher/Stehlik/Margolis/Sanders)



NSF Summer Institute at Carnegie Mellon for High School Teachers of *Advanced Placement* Computer Science (3 summers, 1996-1998)

Provided gender equity discussions along with CS technical training

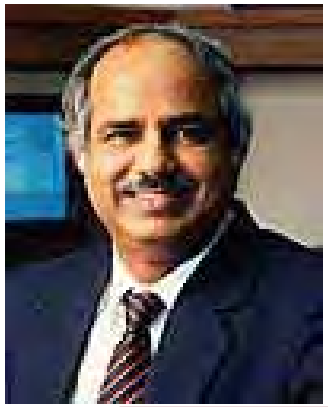
240* teachers came to the CMU campus

*15-20% of active AP CS teachers in the US.

Carnegie Mellon

2.Changes in Admissions Criteria

- **Allan Fisher**, (then) **Associate Dean for Undergraduate Computer Science Education**, advised the Carnegie Mellon Admissions Office that **prior programming experience was not a pre-requisite for success in the CS major**.



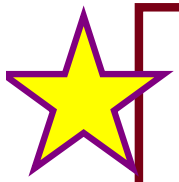
- **Raj Reddy**, (then) **Dean of Computer Science**, requested that the Admissions Office develop criteria that could help **select future visionaries and leaders in CS.**

The **Admissions Office** started placing high value on activities that demonstrated commitment to **"giving back to the community."**

Carnegie Mellon

2.Changes in Admissions Criteria

Old: High Achievement + prior programming experience

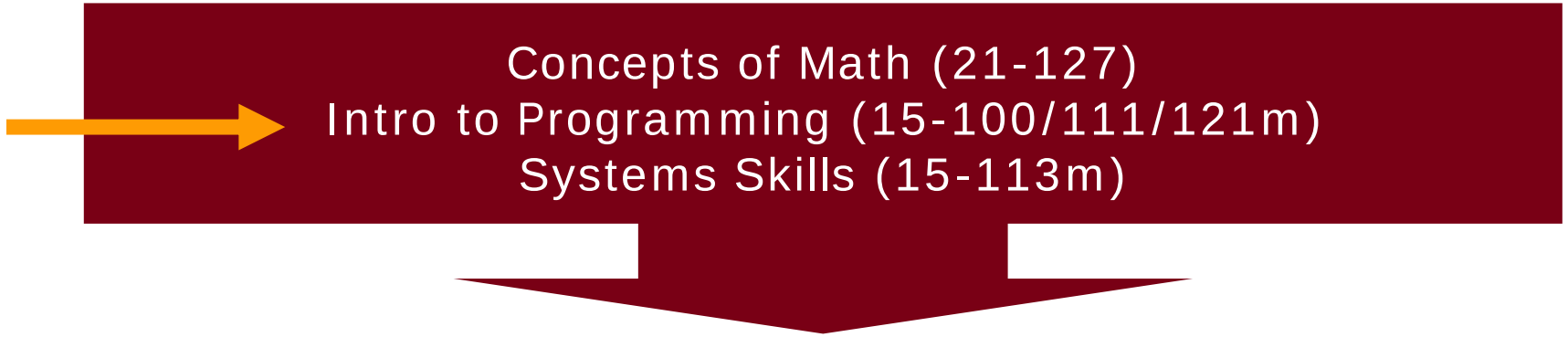


New: High Achievement + broad interests + diverse perspectives

Carnegie Mellon

3.Changes in Entry Level Curriculum

Multiple Entry Points



- Freshmen Immigration Course

Carnegie Mellon

Undergraduate CS Curriculum (Still Boot Camp for CS)

Concepts of Math (21-127)
Intro to Programming (15-100/111/121m)
Systems Skills (15-113m)

Data Structures and Algorithms (15-211)
Principles of Programming (15-212)
Introduction to Computer Systems (15-213)
Great Ideas in Computer Science (15-251)

"Deep Thinking"/Algebra (15-351/355,21-xxx...)

Algorithms (15-451)

Foundations Menu

Systems Menu

Applications Menu

Electives, Research, and Teaching

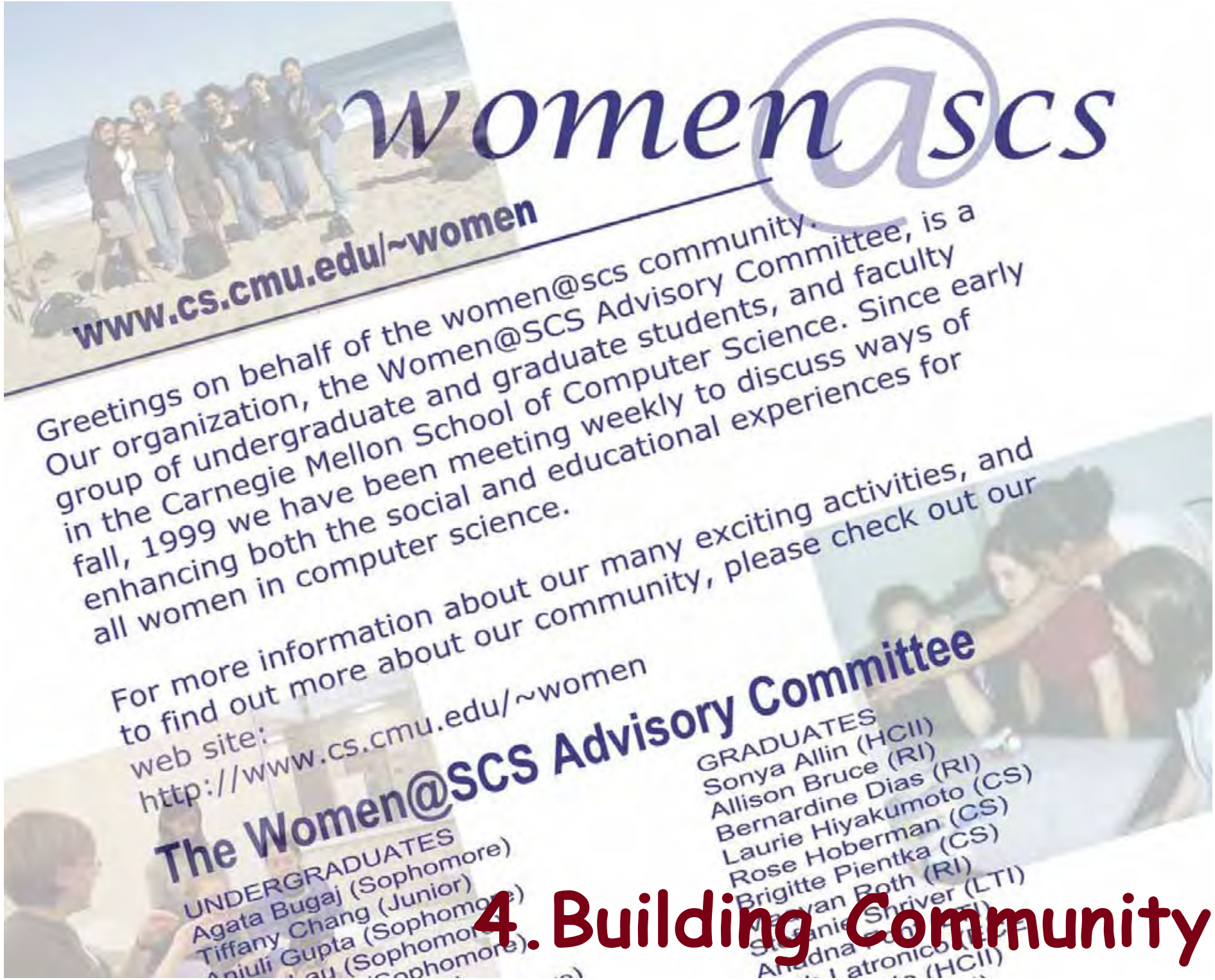
Math / Statistics

Engineering / Science

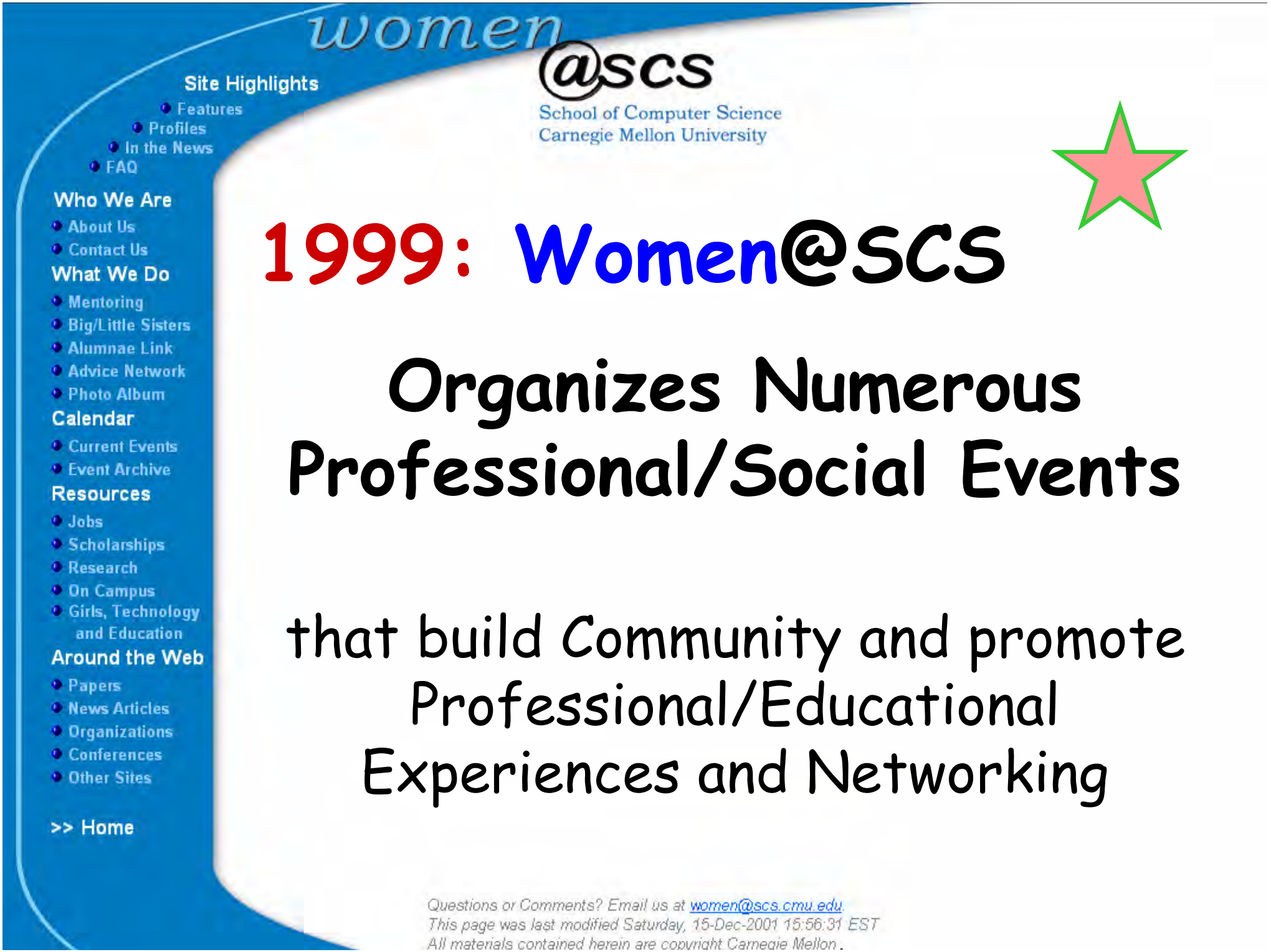
Humanities / Writing

Minor Degree

"Upper-



4. Building Community


women
@scs
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1999: Women@SCS
Organizes Numerous Professional/Social Events
that build Community and promote Professional/Educational Experiences and Networking
Questions or Comments? Email us at women@scs.cmu.edu
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- Women@SCS explicitly provides crucial educational and professional experiences generally taken for granted by the majority in the community, but typically not available for the minority participants.

- Many of these experiences are casual and often happen in social settings. For example, in an undergraduate CS program, male students often have the opportunity to discuss homework with roommates and friends late at night or over meals. Course and job information and recommendations are passed down from upperclassmen, from fraternity files and from friends.

- Women students being in the minority, do not have access to, in fact are often excluded from, these implicit and important advantages. As one proceeds into the professional world, similar phenomena occur.

_Some Current Members of the

Women@SCS Advisory Council (10/11/05)

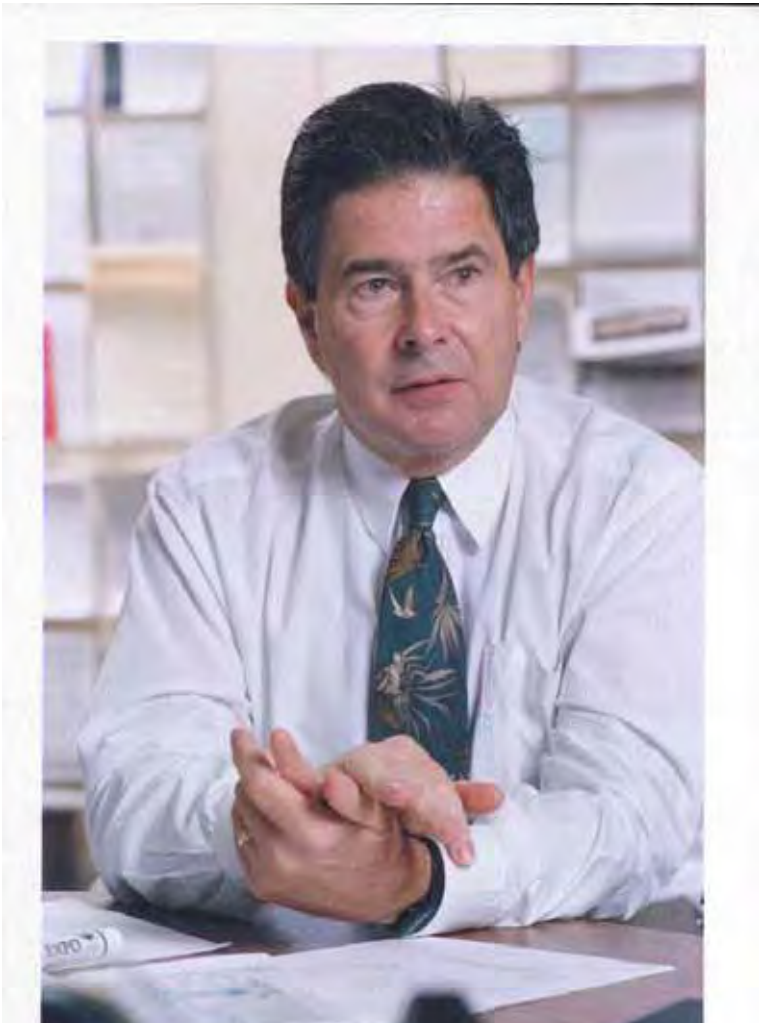
Carnegie Mellon

CMU President Jared Cohon

Major Supporter of Women@SCS

Carnegie Mellon

Former SCS Dean Jim Morris



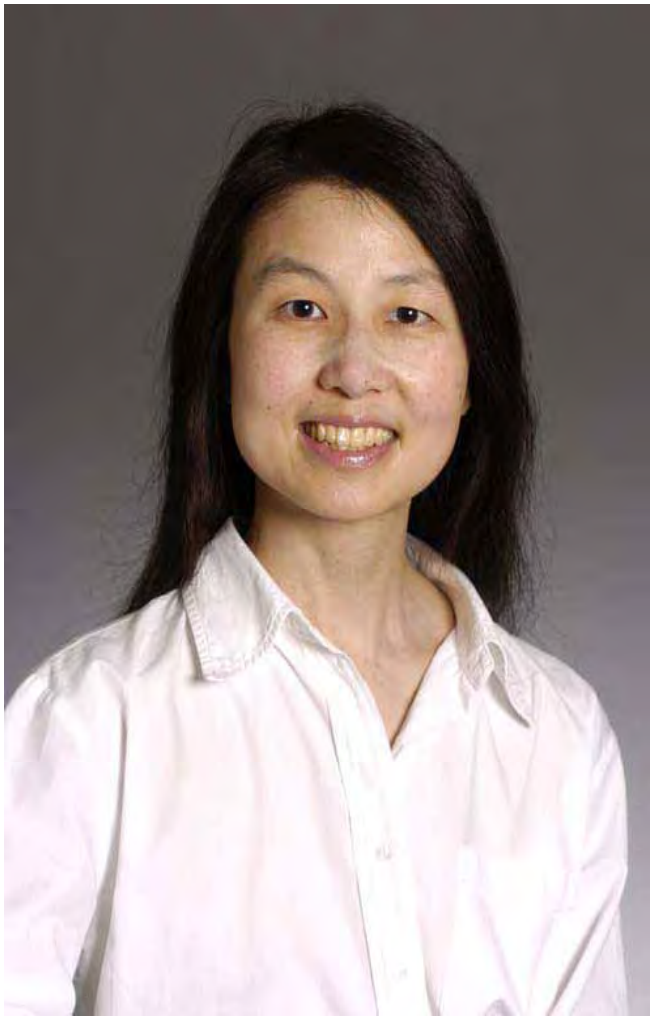
Major Supporter of Women@SCS

Carnegie Mellon Current SCS Dean Randy Bryant

Major Supporter of Women@SCS

Carnegie Mellon

CS Dept Head Jeannette Wing



Major Supporter of Women@SCS

The Women@SCS Web Team

women@SCS

School of Computer Science, Carnegie Mellon University

"As a woman in CS, I know that thinking differently can be nerve-wracking. Keep in mind that seeing things from different perspectives is a valuable asset."
- Leah Miller, Class of 2002

Women@SCS presents

Undergraduate Research: SURG An Information Dinner/Social Sponsored by IBM

When: Thursday, Sept. 13th, 7.00-8.30pm
Where: Wean Hall 4623

ALCOA AFRICAN AMERICAN SPEAKER SERIES

Professor

Valerie Taylor

Northwestern University

Prophesy: An Infrastructure for Analyzing and Modeling the Performance of Parallel and Distributed Applications

ABSTRACT

Efficient execution of applications requires insights into how system features impact the performance of the application. The availability of national, high-speed networks has made available distributed systems for execution of large-scale applications. Distributed systems, however, consists of heterogeneous components, such as networks, processors, run-time systems, operating systems, etc. This heterogeneity complicates the task of gaining insights into the performance of the application.

This talk presents the Prophesy Project, an infrastructure that aids in gaining this needed insight based upon one's experience and that of others. Prophesy consists of three major components: a relational database that allows for the recording of performance data, system features and application details; an application management component that automatically instruments applications and manages the application runs; and a data analysis component that facilitates the development of performance models, predictions and trends. As a result, the Prophesy system can be used to develop models based upon significant data, identify the most efficient implementation of a given function based upon the given system configuration, explore the various trends implicated by the significant data, and predict the performance on a different system.

BIOGRAPHY

Valerie E. Taylor received her B.S. in Computer and Electrical Engineering and M.S. in Electrical Engineering from Purdue University in 1985 and 1986, respectively. She received her PhD in Electrical Engineering from University of California at Berkeley in 1991.

Site Highlights
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Who We Are
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The Big Sister/Little Sister Program

About the program:

The Big Sister/Little Sister program in SCS was started in the fall of 1999 with 34 participants. It was formed to strengthen the bonds of women in SCS and encourage a forum for discussion and support. It works in pairs so that each upperclassman or graduate Big Sister has a Little Sister who is an underclassman. This helps women in computer science suceed by giving them a mentor to turn to who has been through it before.

women@SCS

School of Computer Science, Carnegie Mellon University

"What made being a female in computer science even harder in 1997 was that I had to deal with comments like 'you got in just because you were a girl.' I felt like I always had to prove myself to my male peers in order for my ideas to be heard."

- Ting-Chih Shih, Class of 2001

Advice Network

You've got questions.

We've got answers.

Click on the icon on the left to send email.

B-board

Subscribe to: graffiti.wscsac
To post: send mail to bb+graffiti.wscsac@andrew.cmu.edu

Undergraduate Academic Advice

Faculty members who will answer academic questions such as schedule planning, the current or changing curriculum, course concerns, finding tutors,etc.:

- Mark Stehlik (Mark.Stehlik@cs.cmu.edu), Assistant Dean of Undergraduate Computer Science
- Jim Roberts (jar@cs.cmu.edu), Freshmen Advisor

Career Counseling

For help finding and applying for jobs, writing resumes, internships, interview tips, and other career planning questions:

- Kevin Collins (kevinc@andrew.cmu.edu), Computer Science Career Consultant

Peer Advice

Women in Computer Science: Carnegie Mellon's Women@SCS - What We Do - Alumnae - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://women.cs.cmu.edu/What/Alumnae/

women SCS

School of Computer Science, Carnegie Mellon University

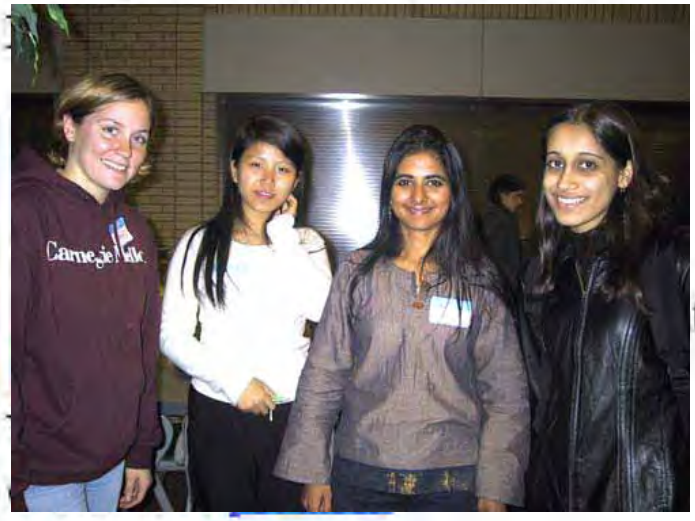
"A ship in port is safe, but that is not what ships are for.
Sail out to sea and do new things"
- Grace Hopper

Alumnae Link

Contact Us
womalum@cs.cmu.edu

Welcome

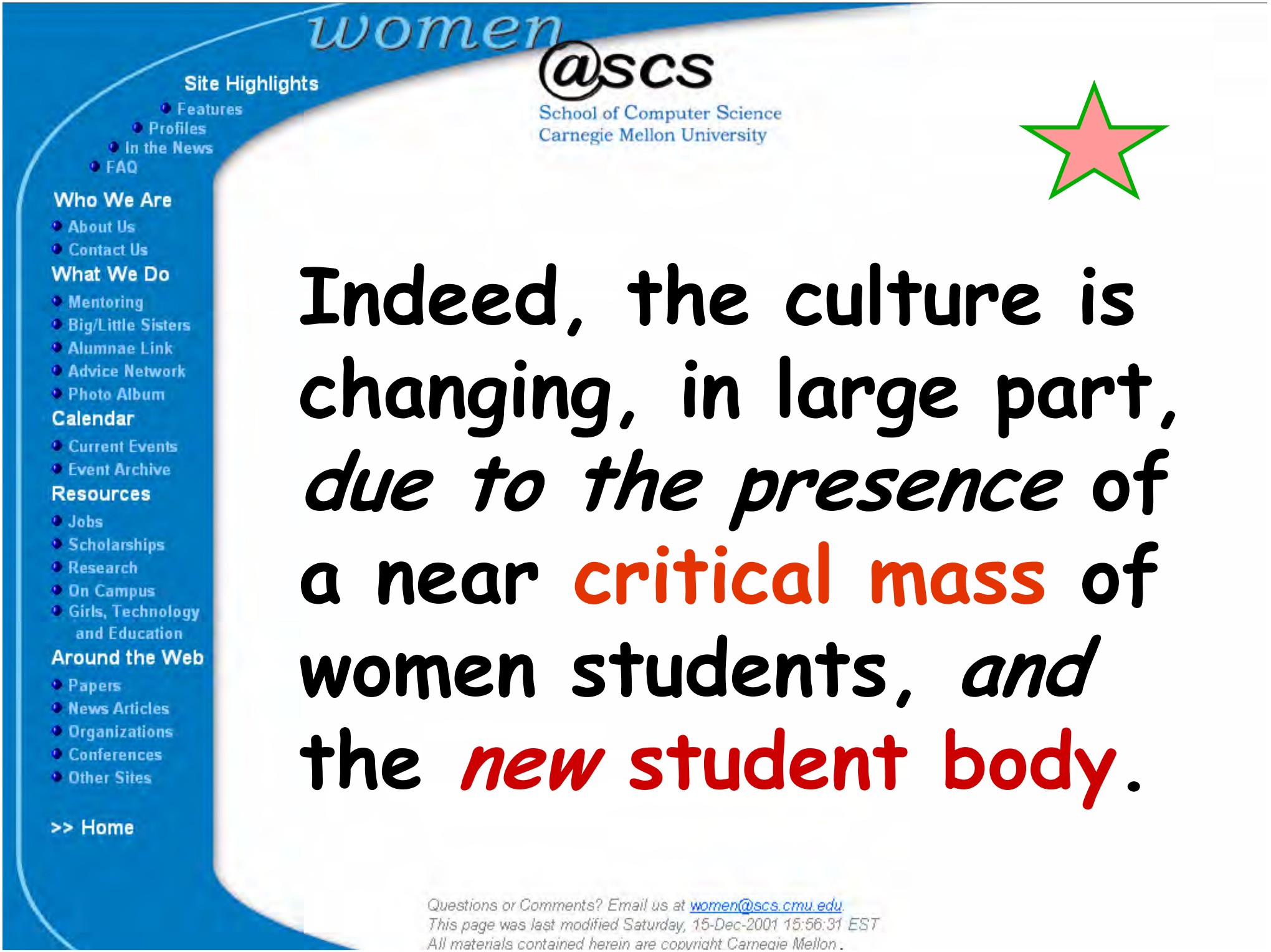
We would very much like our SCS Alumnae to be a special part of our community. On those occasions when Alumnae have joined us as invited speakers or made themselves available for advice, or simply kept in touch,



Annual Women@SCS Faculty/Student Dinner

Over 90 women gathered in NSH Atrium for the annual faculty/graduate and undergraduate student dinner. Prof. Lenore Blum and Prof. Manuela Veloso gave words of wisdom and inspiration, and in spite of long lines good food was eventually enjoyed by all! See pictures.


ESPANOL
First 1024 Digits of Pi
SCS Day 2003 Celebrating Incredible Diversity
Photos by Ralf Brown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Indeed, the culture is changing, in large part, due to the presence of a near critical mass of women students, and the new student body.
Questions or Comments? Email us at women@scs.cmu.edu
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Talk Outline

1. ACTION: Transforming the Culture of Computing

2. FINDINGS: In a More Balanced Computer Science Environment, Similarity is the Difference.

3. CONCLUSION: Correcting the Image of Computer Science (the field and its participants) and Introducing exciting CS into the k-12 curriculum is Critical for Full Participation and for the Health and Future of the Enterprise and the Nation.

GenderGap Studies

Earlier studies (eg Margolis-Fisher at Carnegie Mellon in the late 1990's) point to strong gender differences.

- Differences in motivation/interest:
- Men tended to view the computer as an object of study in itself.
- Women tended to view the computer as a tool.

Our Interpretation of M-F Findings:

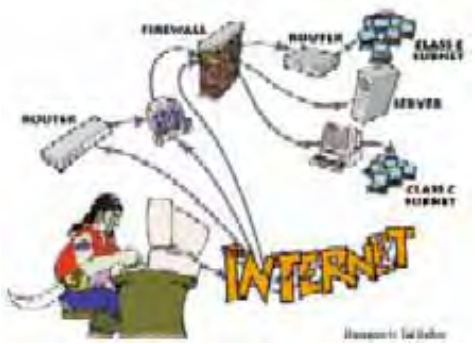
Old study tells us more about

the (old) **Culture of Computing**, *the kind of student we were looking for*, and resulting ***biases*** in our **admissions criteria**,

- ***rather*** **than** **essential differences** between men and women *who like, and are good at*, Computer Science.

- **Old culture: CS = Programming**

So value students with "hacker personality."



- **New vision: CS = Ubiquitous, Interdisciplinary**

So value students with broad interests and diverse perspectives.

New Sloan Study (Blum-Frieze 2002,2004)

Indeed, new studies at Carnegie Mellon show that, in a *more balanced** computer science environment, men and women are *more alike* than different.

**More balanced* in 3 critical domains:

Gender,

Mix of students and breadth of their interests, and

Professional experiences afforded all students.

New Sloan Study (Blum-Frieze 2002,2004)

Indeed, new studies at Carnegie Mellon show that, in a *more balanced** computer science environment, men and women are *more alike* than different.

We are now finding *similar spectra* of interest & motivation amongst women and amongst men:

Some women are hackers, some men are hackers.

Some women like applications, so do some men.

Mostly, everyone has some of each quality.

New Sloan Study (Blum-Frieze 2002,2004)

Indeed, new studies at Carnegie Mellon show that, in a *more balanced** computer science environment, men and women are *more alike* than different.

*** Beware, danger of Marginalization.

Modify curriculum with caution!

The image of "dreaming in code" as the dominant characteristic of male computer science students was clearly being challenged.

(2004, F) "It's always fun to sit down in front of a computer and kind of producing code until something is done and it's such a good feeling. A lot of time once I sit down and do programming I find myself living in the cluster for a day without eating or sleeping."

(2002, M) "I still find computers to be very interesting. But because the field of computer science has grown as I've learned more about it, it's *no longer the computer itself and the programming that is interesting.* It's what can be done with the programs that is now interesting. …The computer I see more as a tool now, as opposed to this neat toy."

Definition of computer science crosses gender lines:

The *most common theme* to emerge was that computer science meant "problem solving" & "a way of thinking."

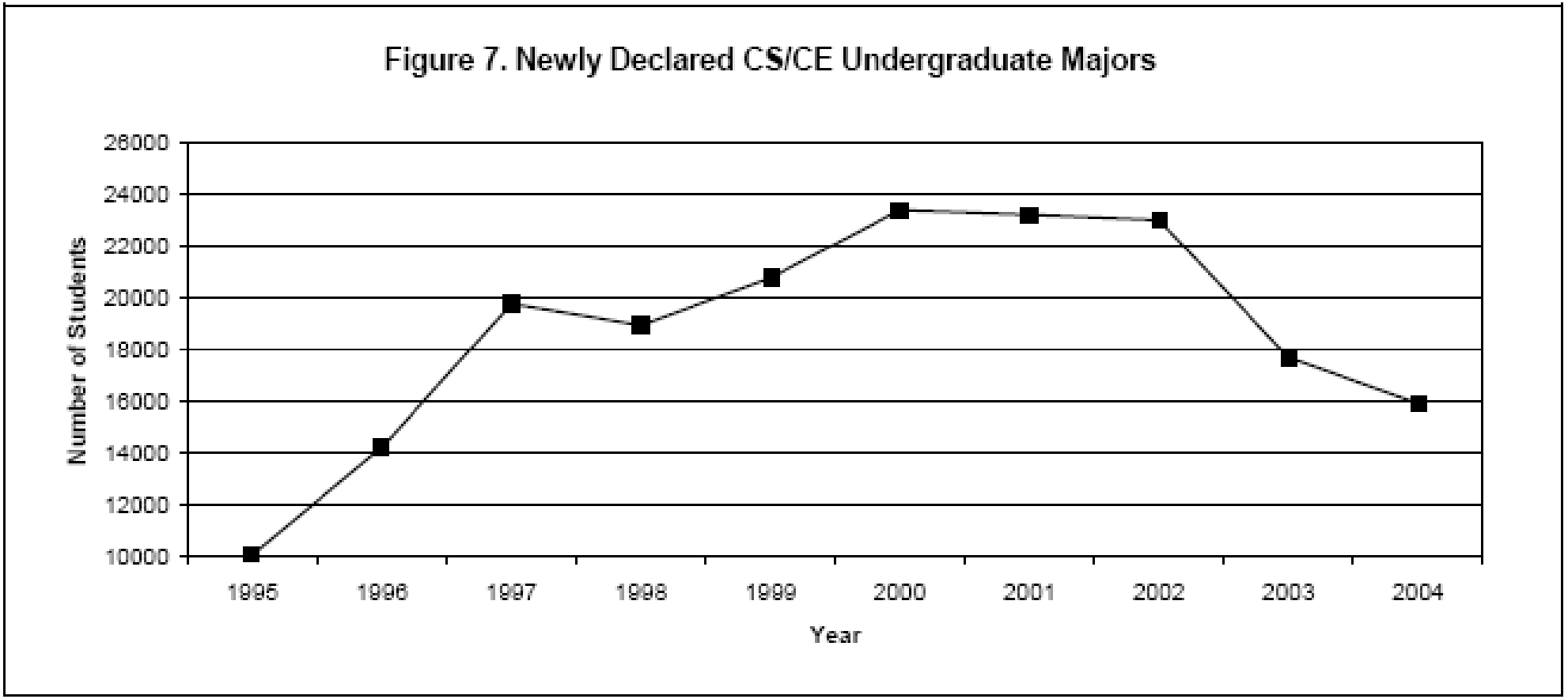
(2004, F) "I look at computer science as a sort of logic based way to solve problems."

Contrary to earlier findings, the confidence of most women in our cohort *had increased* by their senior year and had not been "extinguished".

(2002, F) "I see myself as one of the best of the best now".

(2004, F) "Once you start working on different projects or having more projects under your belt you just feel a little better. ... Public speaking and having a more professional front is all part of it. And joining a group like Women@SCS really helps because there are plenty of chances to speak, talk and I think just growing more as an individual."

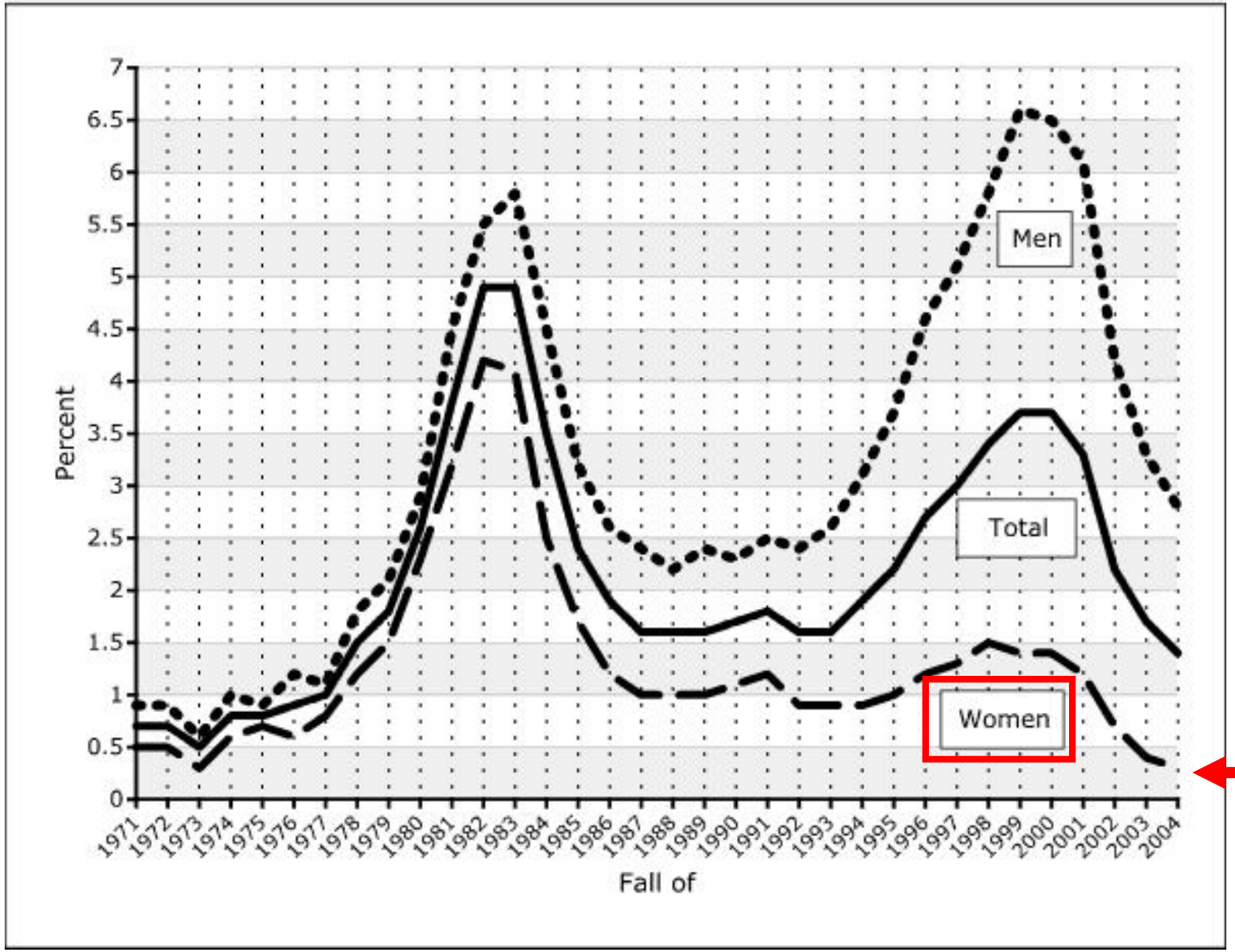
BUT..There is a Crisis in Computer Science !



From Taulbee Survey 2004

Implications for our Nation's future is alarming!

Figure 1. Computer Science Listed as Probable Major Among Incoming Freshmen
Source: HERI at UCLA



Fundamental misconceptions

about computer science

--rather than gender differences-

are a root cause of gender under-representation as well as the current crisis in the field.

The fundamental misconception, of course, is that CS = Programming.


CS = Programming

Very few of the pioneers and current professors of computer science were "hackers." Many were motivated by their interest in **logic** and in **understanding intelligence** and **problem solving.**

Today, in the twenty first century, with the increasing ubiquity of computing, women and men with a broader and diverse vision and deeper perspective are critical for the field and will drive its future.

Let's make sure our educational programs reflect that!

What to DO?

- Long Term
- Short Term....
- Workshops for High School Math and Computer Science Teachers
- Provide supplementary curricular materials for hs math and CS courses
- Programs for HS students
- Outreach Activities

Revamp entry level CS at colleges and universities

CS4HS SUMMER WORKSHOP

Explorations in Computer Science for AP CS Teachers 2006

Friday, July 21 – Monday, July 24

Do you need resources to show your high school students the exciting world of computer science? Join us for a 3-day summer workshop at Carnegie Mellon University where you can learn how to use lots of exciting examples in your classes to open the world of computer science to your students!

- Explore real-world examples of computation in action with the help of Google.
- Learn how to get the interest of your students with food and teach them something about computer science while you're at it.
- See how ideas from computer science have helped to revolutionize the biological sciences.
- Bring a robot to class.
- See new tools for teaching students the principles of program development and computational thinking.
- Hear from experts in the field about how you can help broaden participation in computer science at your high school.

Click on the links above and find out more about this summer workshop and how you can join us for this exciting event at Carnegie Mellon University. Registration is $25. On-campus housing and the Friday night dinner will be provided for admitted applicants. Participants will be responsible for their own travel and meals.

The CS4HS workshop is funded in part by generous gifts from:

Google CWIT women@SCS Carnegie Mellon School of Computer Science

CS4HS SUMMER WORKSHOP

Explorations in Computer Science for AP CS Teachers 2006

Carnegie Mellon University School of Computer Science

Overview

One important issue our nation must confront is the declining interest in computer science among high school students. Interest in majoring in computer science among incoming college freshmen dropped approximately 60 percent between 2000 and 2004, according to a Computing Research Association study published in May 2005. Additionally, according to the National Center for Women and Information Technology (NCWIT), the existing educational policy of election rarely requires computing in secondary school, resulting in students that have a narrow and inaccurate view of what computer science and information technology study involves, what careers are possible, or how students can make an impact on society by becoming a computer scientist. With some experts projecting the addition of 1.5 million computer and information technology jobs to the U.S. workforce by 2012, the results of this trend could prove catastrophic to our nation's technological leadership and economic infrastructure.

Carnegie Mellon University is addressing this critical decline in interest in computer science at the high school level by working on classroom solutions that will result in a reversal of this trend. The new Computer Science for High Schools (CS4HS) program at Carnegie Mellon is running a summer workshop to disseminate curriculum modules that high school AP computer science instructors can implement in the classroom that provide students with an exposure to the versatility and applicability of the programming skills they have learned throughout the school year. Educators can use the modules from the workshop to show students that computer science is much more than computer programming.

CS4HS

SATURDAY, JULY 22 2006

9:15-10:00 KEYNOTE: Computational Thinking (Jeannette Wing, CMU)

10:15-12:30 FEATURE TOPIC I: CS Unplugged (Craig Nevill-Manning, Google)

2:00-3:00 Careers and Social Responsibility in CS (Mark Stehlik, CMU)

3:15-5:30 FEATURE TOPIC II: Great Ideas in CS (Food for Thought: Cutting Cakes and Flipping Pancakes (Manuel Blum & Steven Rudich, CMU)

SUNDAY, JULY 23 2006

9:00-10:00 PANEL Broadening Participation in CS (Lenore Blum & Carol Frieze, CMU; Orit Hazzan, Technion; Claudia Morrell, CWIT))

10:15-12:30 FEATURE TOPIC III: Robotics (Tom Lauwers,Dave Touretzky,CMU)

2:00-3:00 MINI-SESSION: Teaching Computational Thinking; Visualizing Computation using RAPTOR (Tom Cortina, CMU)

3:15-5:30 FOCUS TOPIC IV: Computational Biology (Guy Blelloch, CMU)

MONDAY, JULY 24 2006

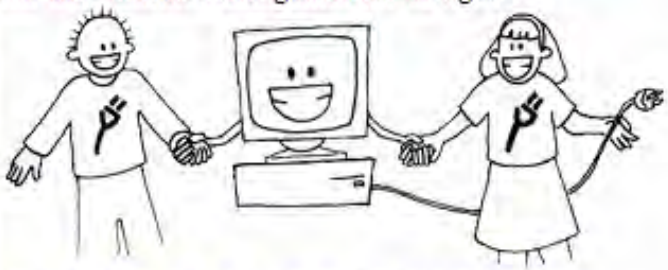
9:00-10:00 MINI-SESSION : Cognitive Tutors (Ken Koedinger, CMU)

10:15-11:45 Group Presentations

11:45-12:00 WRAP-UP & evaluations

COMPUTER SCIENCE Unplugged

Off-line activities and games for all ages



By Tim Bell, Ian H. Witten and Mike Fellows
With assistance from Robin Adams, Jane McKenzie and Matt Powell

Now teachers can teach children many important topics in computer science… without using computers at all!

The *Unplugged* project provides teachers with a series of *off-line* activities designed to let people of all ages have fun exploring some of the interesting ideas i computer science, *without having to use a computer at all!* The book is also an interesting introduction to the field of computer science for the lay-person.

NEW! We've made some short videos about three Unplugged activities.

Unplugged for Teachers

The original *Unplugged* book has been adapted for classroom use by Robyn Adams and Jane McKenzie. Many of the activities have been revised and extended to better suit primary-aged children, and there is advice for using *Unplugged* activites as part of the primary school curriculum. Additionally, the book has been re-typeset, and many new illustrations have been added.

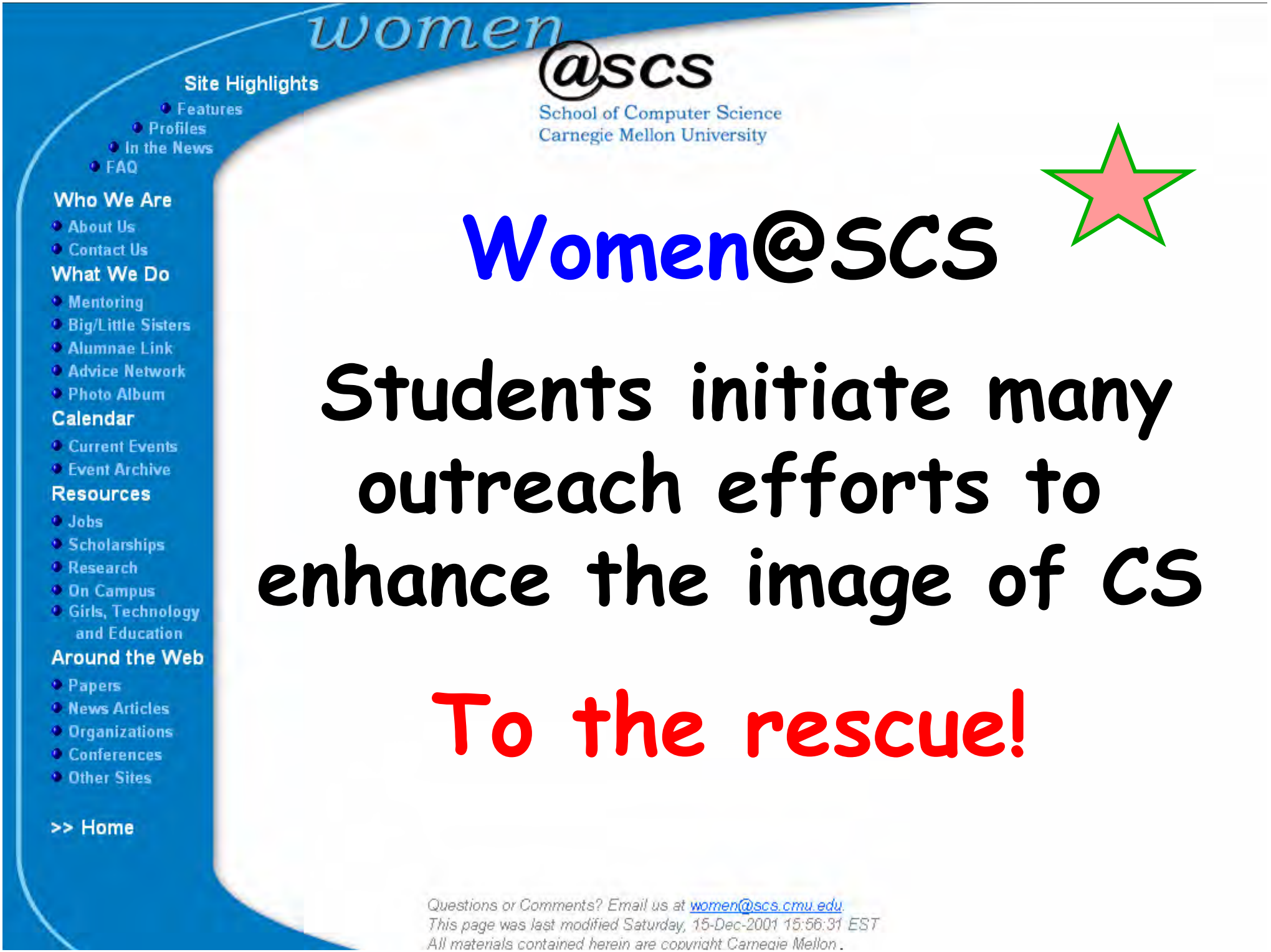
- Try some sample activities.
- View the table of contents.
- Buy *Computer Science Unplugged* as either a printed book, or as a PDF. (Translations to Ελληνικά, 國語 and 한국어 are coming soon!)

Talk Outline

1. ACTION: Transforming the Culture of Computing

2. FINDINGS: In a More Balanced Computer Science Environment, Similarity is the Difference.

3. CONCLUSION: Correcting the Image of Computer Science (the field and its participants) and Introducing exciting CS into the k-12 curriculum is Critical for Full Participation and for the Health and Future of the Enterprise and the Nation.


women
@scs
School of Computer Science
Carnegie Mellon University
Site Highlights
Features
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Girls, Technology and Education
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Papers
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Organizations
Conferences
Other Sites
>> Home
Women@SCS
Students initiate many outreach efforts to enhance the image of CS
To the rescue!
Questions or Comments? Email us at women@scs.cmu.edu
This page was last modified Saturday, 15-Dec-2001 15:56:31 EST
All materials contained herein are copyright Carnegie Mellon .

Site Highlights
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- Big/Little Sisters
- Alumnae Link
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- Photo Album

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- Event Archive

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- Girls, Technology and Education

Around the Web
- Papers
- News Articles
- Organizations
- Conferences
- Other Sites

>> Home

Expanding Your Horizons

"Is There a Robot in Your Future?"

The group of enthusiastic middle schoolers

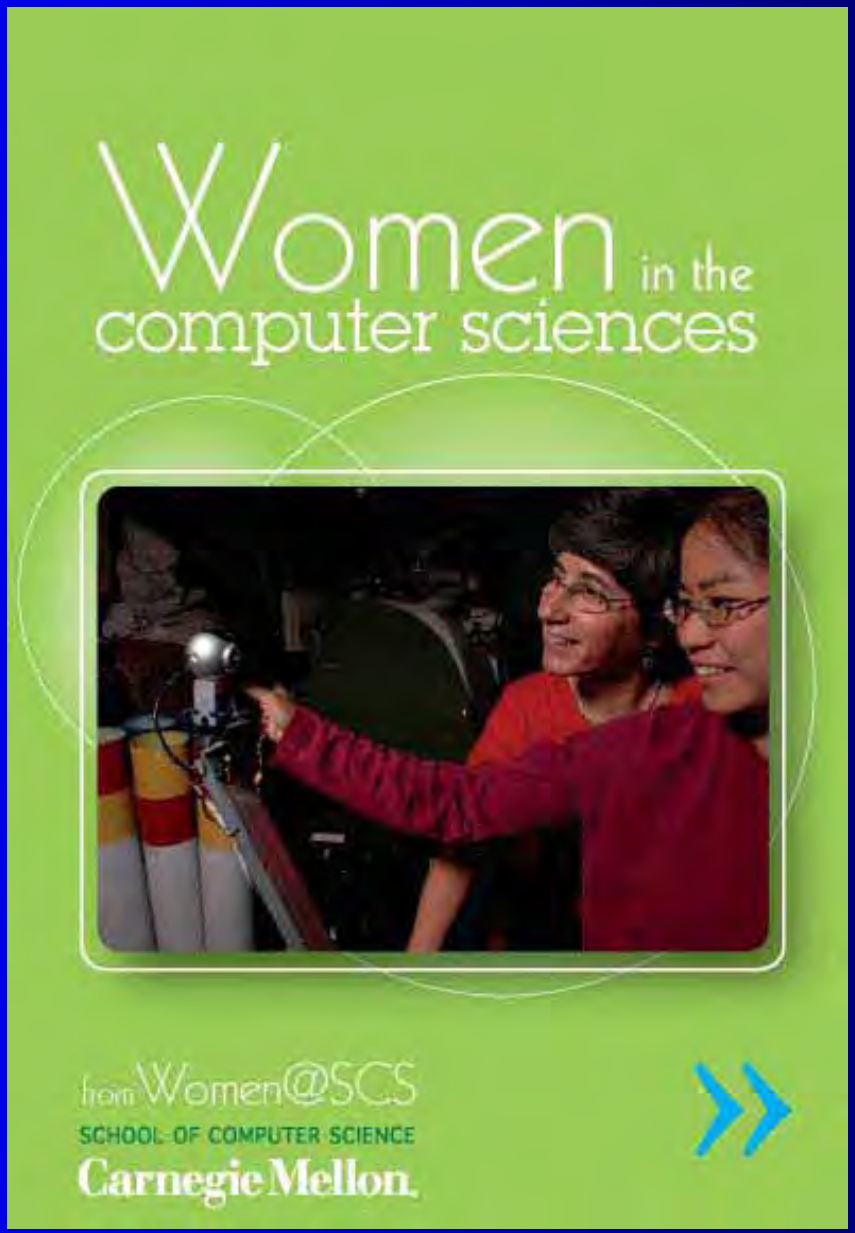
Allison Explains

Discussing designs

Beginning the task

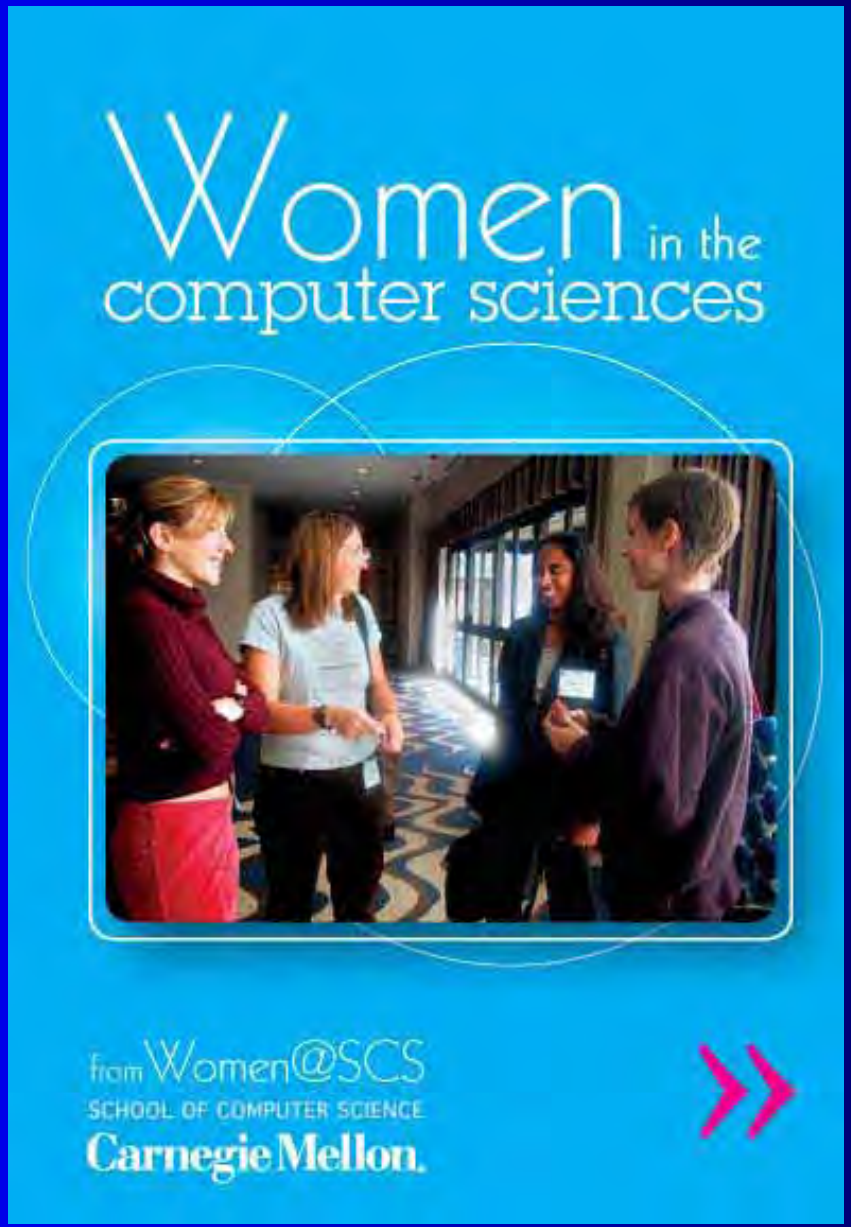

Women@SCS
Students
Middle School
Girls
EYH Workshop "Is there a Robot in Your Future?"
Saturday, March 16, 2002

Outreach Brochures



For Middle and High School Students

Outreach Brochures



For Undergraduate Students

Computer Science

Human Computer Interaction

Robotics, Vision & Graphics

Language Technologies

Software Engineering

Algorithms, Complexity, Systems, Programming Languages, Networking, Architecture, AI & Machine Learning, Databases, Privacy & Security, NanoComputing...

Computational-Biology & Medicine

Brain & Cognitive Sciences

Entertainment Technology

Business & Public Policy

Computer Science is Everywhere!

Women@SCS Roadshow

http://women.cs.cmu.edu/

The exciting world of computer science!

School of Computer Science, Carnegie Mellon University

The Women@SCS Outreach Roadshow

Different Versions/Different Audiences:

- Middle/high school boys and girls
- Teachers, parents
- Undergraduate men and women

Student Teams:

- Undergraduates (seniors, juniors, sophomores, freshmen)
- Graduates representing: *Computer Science, Robotics, Language Technologies, Human Computer Interaction Software Engineering, Entertainment technology and more……..*

Conference Presentations

The Women@SCS Outreach Roadshow

Goals:

- To challenge stereotypes
- To show breadth and diversity of the field
- To get students (and parents and teachers) excited about the science and the possibilities
- To increase the visibility of young women in the field
- To leave our audiences wanting to find out more hopefully through further studies …….

- To have fun!

Who We Are

Liz Crawford
PhD, CSD

Stefanie Tomko
PhD, LTI

Renée Rivas
Junior, CSD

Amani Ahmed
Senior, CSD

Gwendolyn Stockman
Senior, CSD

Who can do Computer Science

?

Guess who are the Computer Scientists in the following pictures:


b
d
e
a
c
h
i
k
l
j


BUCA PER DUE 22.95
CHOCOLATE CANNOLI
BUCA™ BREAD PUDDING
TIRAMISU
TORTA FORMAGGIO CON RASPBERRY
TORTONI
CHICKEN WITH LEMON
EGGPLANT PARMIGIANA
VEAL PARMIGIANA
CHICKEN PARMIGIANA


GRACE HOPPER


© Ralf Brown


Concertmate


Society for Advancement of Chicanos and Native Americans in Science
SACNAS NEWS
A QUARTERLY JOURNAL
HITTING THE HIGHWAY
with Mathematics
By Richard Tapia
Mathematics Designs a Super Cow
Telemedicine's Promise for Native Communities
Science Literacy for All Children


© Ralf Brown

What is Computer Science and what can you do with it

Problem Solving

Learn how to build *Algorithms* ...

a sequence of steps/instructions to solve a problem

Algorithm type Puzzle 1.

- you have a pair of scales
- you have 12 coins
- 11 weigh the same
- the other is heavier

- How do you find the heavy coin if you are allowed 3 weighings? ..

Programming

- a computer can only do what it is told to do
- a program is a set of instructions telling a machine what to do.
- you can write a program that runs the functions in your cell phone …or a program that lets you view your digital pictures
- Programming is at the heart of computer science ……
-
- BUT COMPUTER SCIENCE IS SO MUCH MORE!

Internet and Instant Messenger

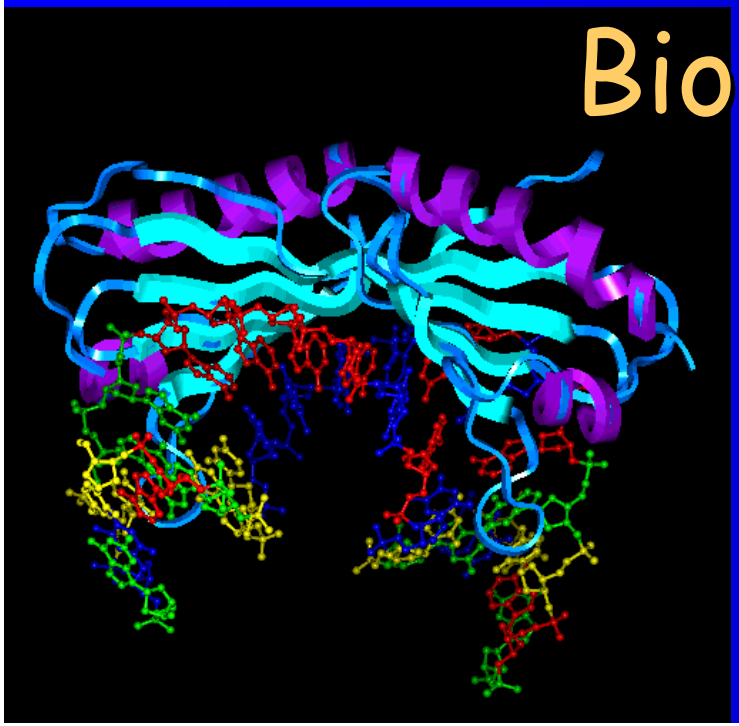
Do you use email?
Have you ever wondered how your message goes from your computer to your friend's computer?

Do you use IM?
Have you ever wondered how it works?

The science of computer science is behind it all!

Neuroscience + Computer Science

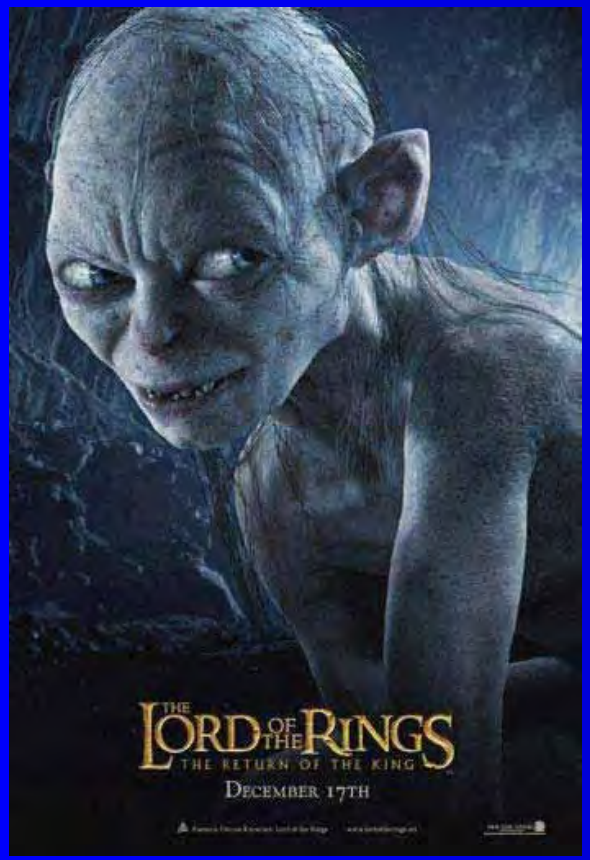
We can use computers to see what happens in a person's brain when they think, and to model how the brain solves problems



Biology + Computer Science

We can use computer science to find patterns in DNA, model biological systems, determine the structure of molecules, and much much more…

Graphics: Art, Animation + Computer Science



Web Site Building

Talking heads

Developed by OHSU Center for Spoken Language Understanding, CU Center for Spoken Language Research, UoE Centre for Speech Technology Research, and UC Santa Cruz Perceptual Science Laboratory

Talking Heads

Developed by OHSU Center for Spoken Language Understanding, CU Center for Spoken Language Research, UoE Centre for Speech Technology Research, and UC Santa Cruz Perceptual Science Laboratory

Human Computer Interaction and Language Technologies

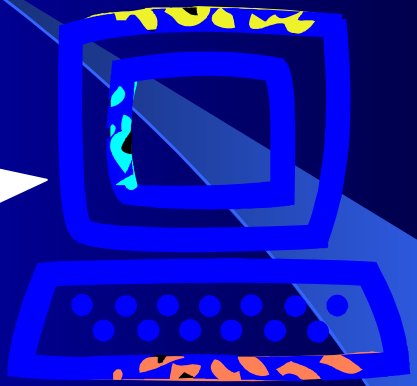
Automatic Sign Translation

Learning Technologies

User interfaces for speech recognition

When's the next plane to Boston?

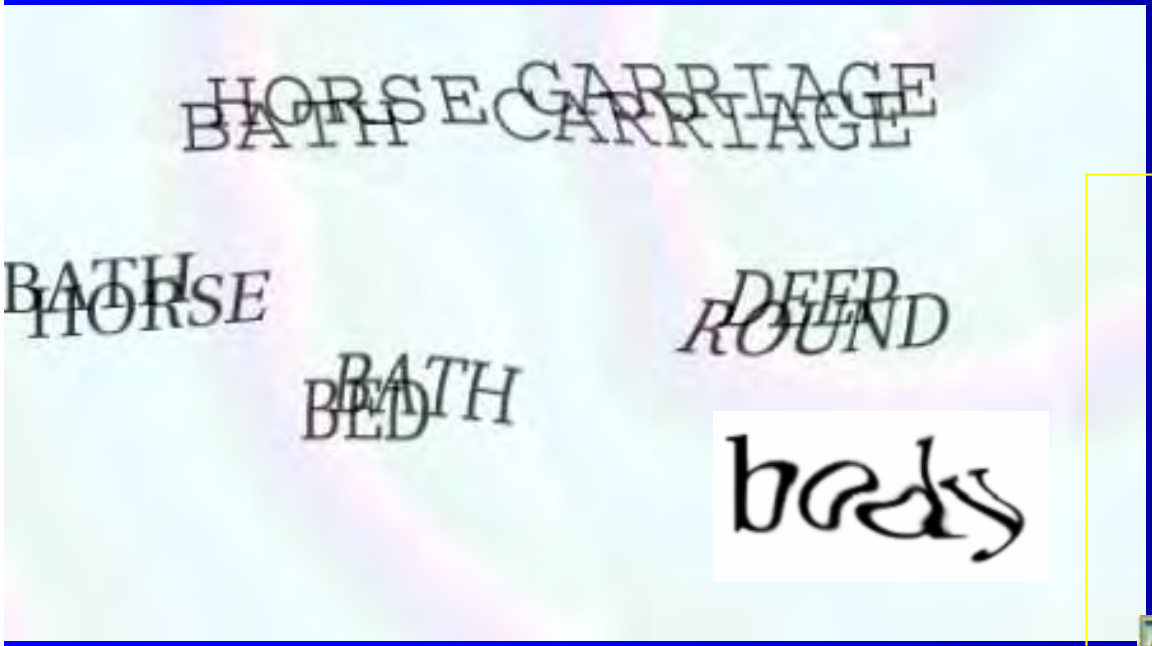
The next train to Austin leaves at 4:45pm.



How do we keep users happy

when a system is likely to make errors?

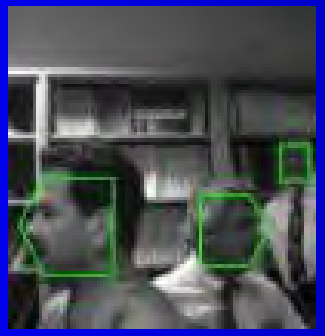
Artificial Intelligence + Computer Science



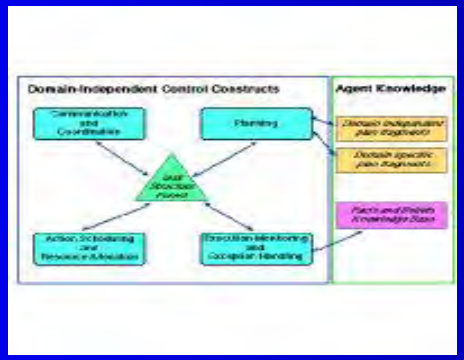
The Captcha Project was developed by computer scientists from the Aladdin Center at Carnegie Mellon http://www.captcha.net

Robotics

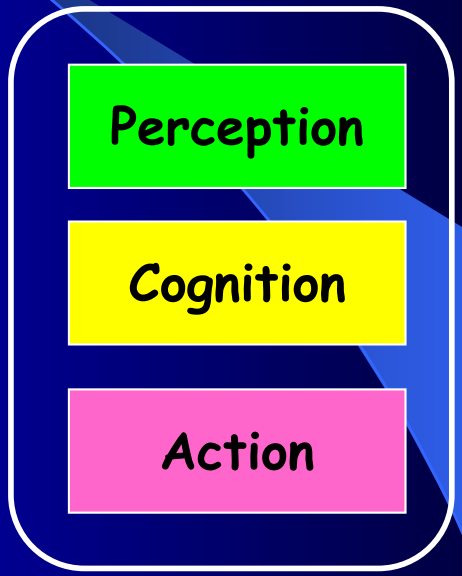
Camera
Sonar
Laser range-finders



Planning
Scheduling
Machine Learning

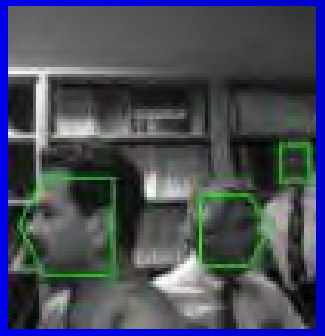


Manipulation
Locomotion
Navigation

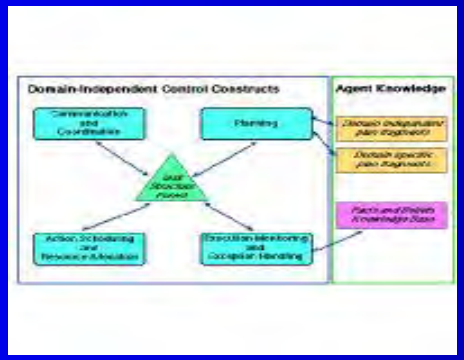


Robotics

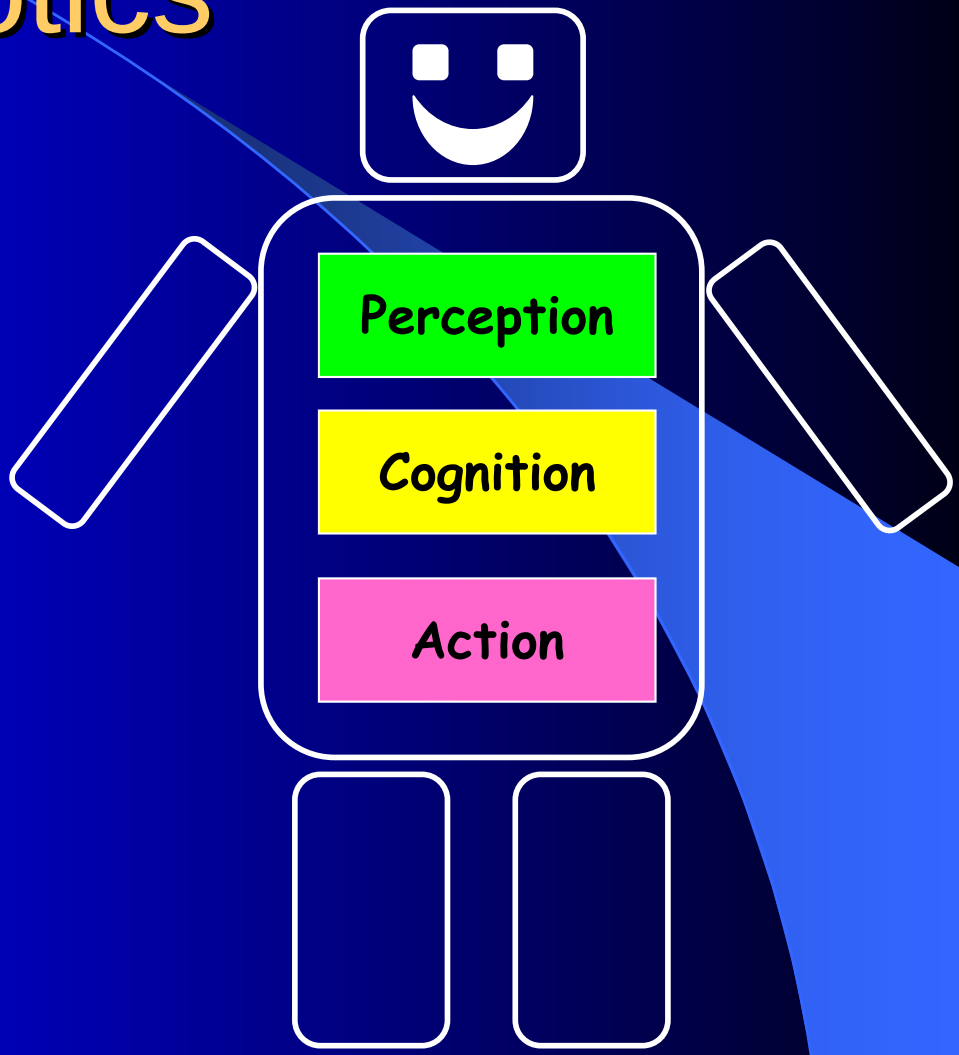
Camera
Sonar
Laser range-finders



Planning
Scheduling
Machine Learning

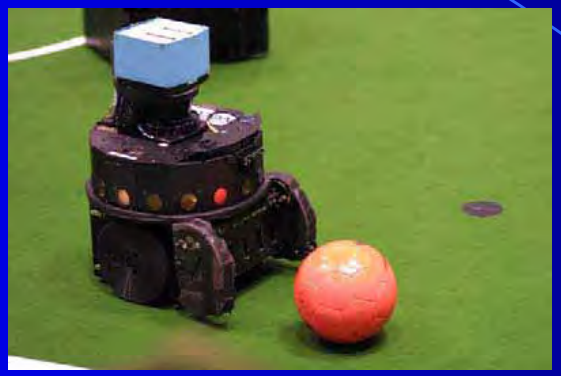


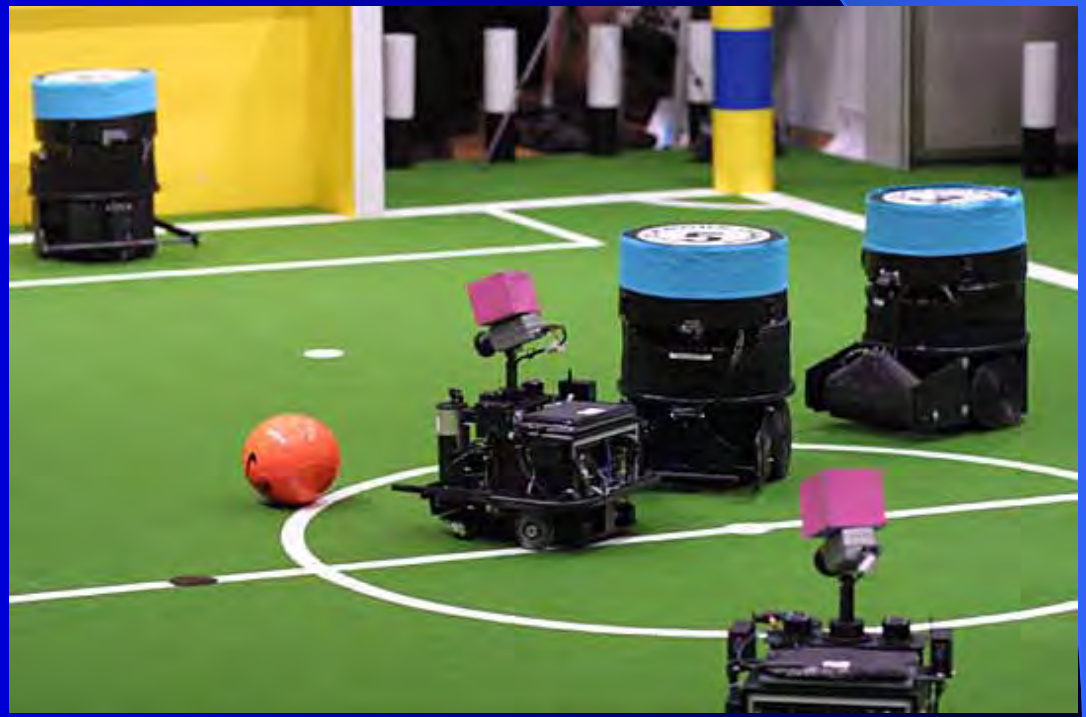
Manipulation
Locomotion
Navigation



Robotics

Robots that can play soccer: Sports + Computer Science



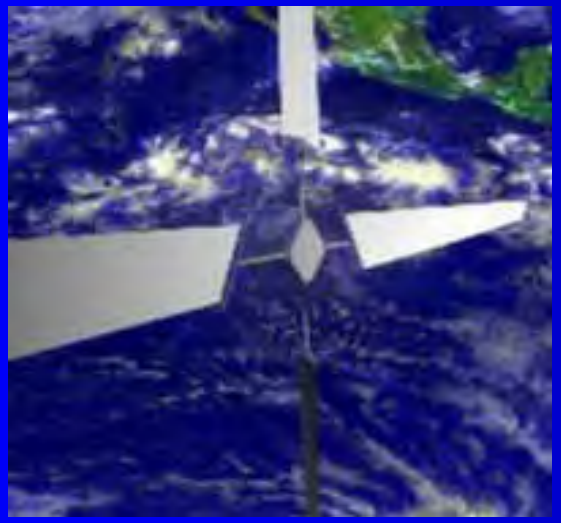


RoboCup

Robots in Space:
Astronomy + Computer Science

Lunar rover

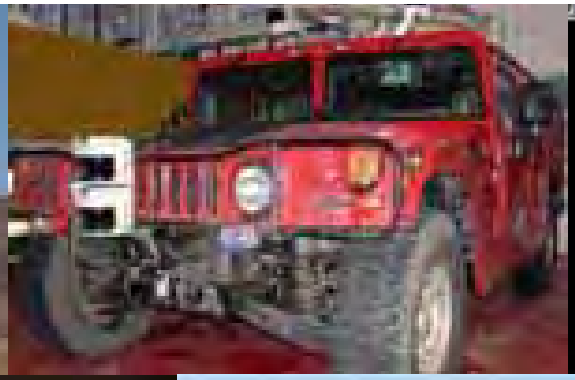
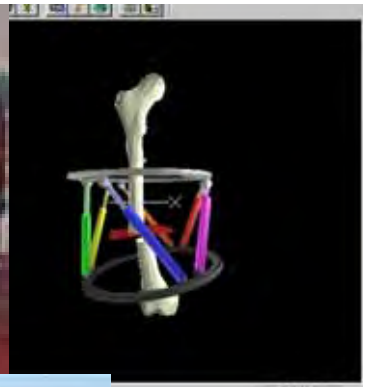
Mars



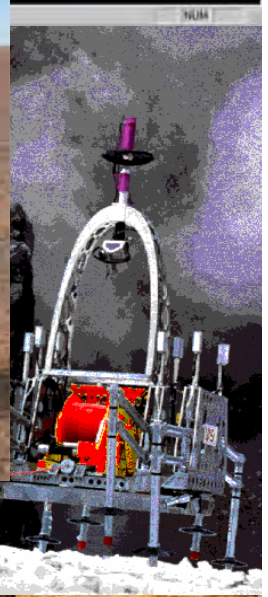
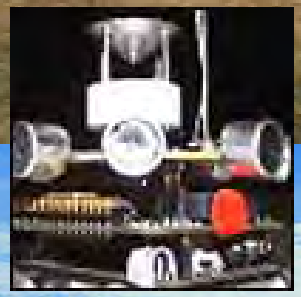
Solar sail

Lunar Ice Discovery







These only represent the tip of the Iceberg of interesting applications of computer science. Some others include:

-using computers to make music
-using computers to predict economic changes
-cryptography (secret codes)
-internet applications (search engines, websites)

If you would like to learn more about anything you've just seen, don't hesitate to ask, or email us at

women@scs.cmu.edu

http://women.cs.cmu.edu

Graduate Level

Adapt Successful strategies:

1. Outreach

RoadShow aimed at undergraduates

2. Rational Admissions Criteria

De-emphasize prior CS degree

3. Effective Entry Routes

Buffer year, tailored advising, research

4. Professional Community Women@IT

Who We Are

Ariadna Font Llitjos
PhD Language Technologies

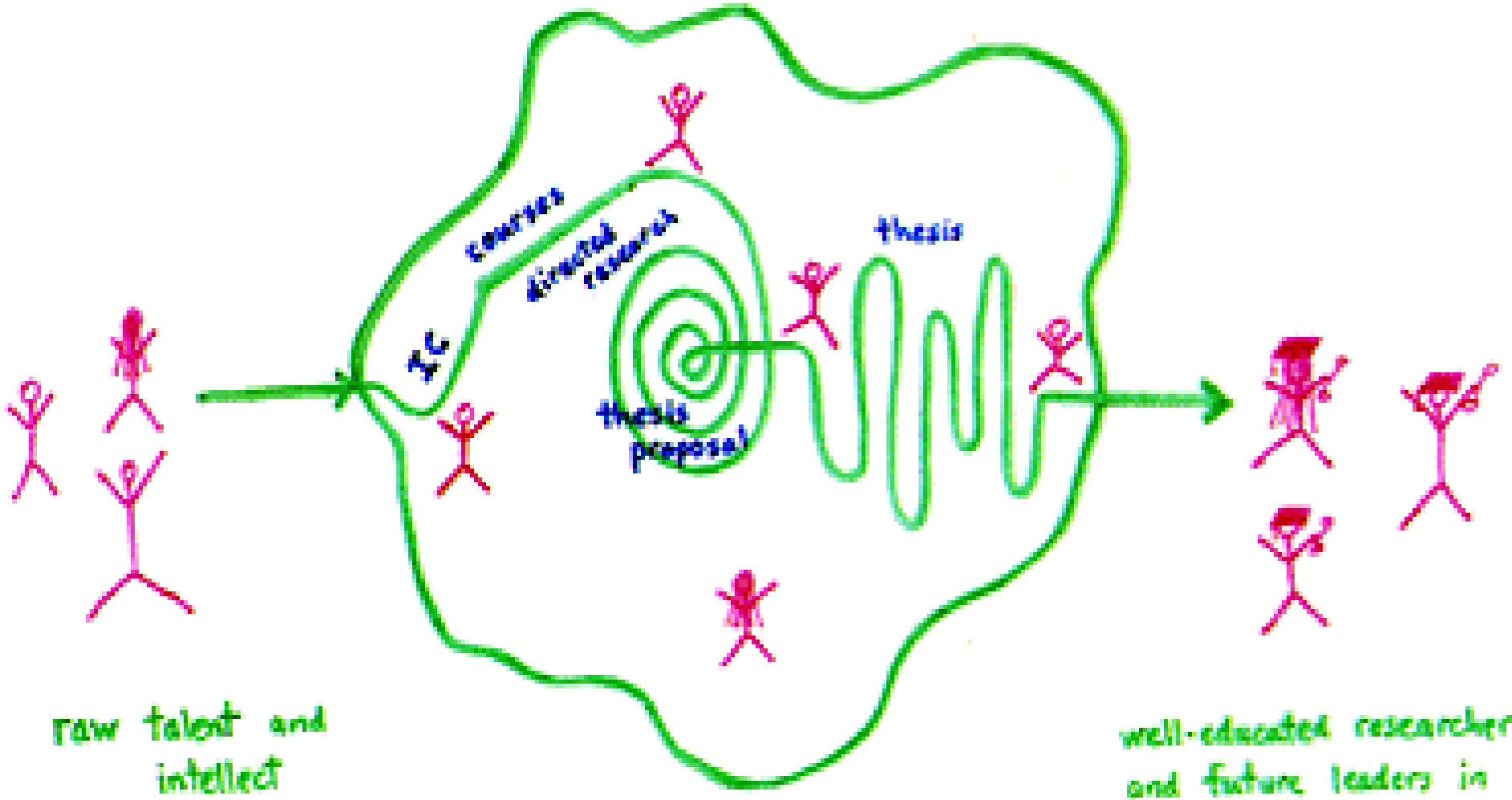
Gita Sukthankar
PhD Robotics

Tina Bennett
PhD Language Technologies

Xuejing Chen
PhD Computer Science

Ting Shih
Masters in
Information
Technology

The Ph.D. Program



Computer Science Areas

Artificial Intelligence

- Machine Learning
- Human Language Technologies
  - Speech
  - Machine Translation
  - Information Retrieval
- Vision
- Computer Music
- Robotics
  - Multi-agent Planning and Execution
  - Robot Learning
- Data Mining

Systems and Languages

- Computer Systems
- Computer Architecture
- Programming Languages
- Graphics
- Databases
- Parallel and Distributed Systems
- Networking
- Security
- Software Engineering
- Formal Methods
- Operating Systems

Interdisciplinary Research

- Computational Neuroscience
- Computational Biology
- Human-Computer Interaction

Theory

- Algorithms
- Complexity Theory
- Semantics

Using CS to study the brain

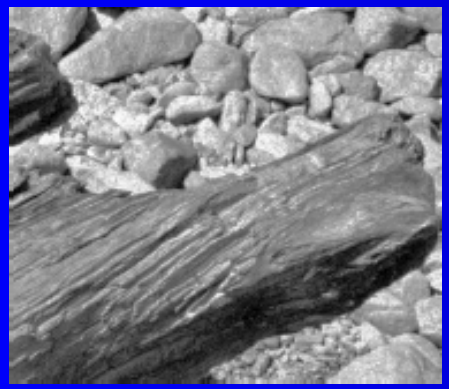
Xuejing Chen

Center for Neural Basis of Cognition

Computer Science Department

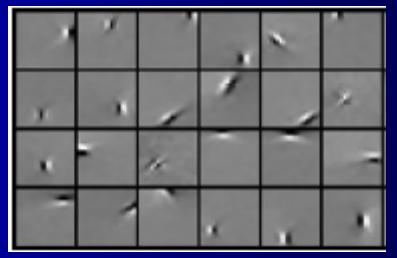
Huh? Using CS to study the brain?

- Algorithmic/Math tools:
  - Probabilistic models
  - Information theory
  - Machine learning
- Simulating theories



Visual Input

Model



Neuron responses

Undergraduate Research

- How will you know that graduate school is for you?
- Answer:
  - Do an undergraduate research program!
  - It's the best way to learn about current research, decide whether you want to continue to graduate school, and get the recommendations you'll need to be accepted.
- Informal:
  - Email professors to find out whether they have undergraduate research projects and if their labs are hiring for the summer.
- Formal:
  - Apply to a more structured undergraduate research program.

The world is yours ~
choose where you want to land

Postscript

Culture and Participation in Computing: 4 Case Studies

WESTERN CULTURES

Case Study 1: Undergraduate CS at Carnegie Mellon University

Case Study 2: The Software Industry: Agile Software Development

EASTERN CULTURES

Case Study 3: Jewish and Arab Israeli High School Advanced Placement (AP) CS Classes.

Case Study 4: Undergraduate CS at Carnegie Mellon-Qatar

Culture and Environment as Determinants of Women's Participation in Computing

Lenore Blum, CS Carnegie Mellon
Carol Frieze, SCS Carnegie Mellon
Orit Hazzan, Dept. of Education in Technology & Science Technion
M. Bernardine Dias, Robotics Carnegie Mellon

This paper presents a ***cultural perspective*** towards **thinking about, and acting on, issues concerning women and computer science** and related fields. We posit and demonstrate that the notion of a gender divide in how men and women relate to computing, traditionally attributed to gender differences, is largely a result of cultural and environmental conditions. Indeed, **the reasons for women entering – or not entering – the field of computer science have *little* to do with *gender* and a *lot* to do with *environment* and *culture* as well as the *perception* of the field. Appropriate outreach, education and interventions in the *micro-culture* can have broad impact, increasing participation in computing and creating environments where both men and women can flourish. This argument is illustrated by specific case studies.**

Case Study 1: The Undergraduate CS Program at Carnegie Mellon

Case Study 2: The Software Industry

This case study illustrates how the culture inspired by ***agile software development methods*** [Cockburn, 2001] enables women to gain new and better positions in the high-tech industry in general, and in software development teams, in particular.

Manifesto for Agile Software Development

•We are uncovering better ways of developing software by doing it and helping others do it.

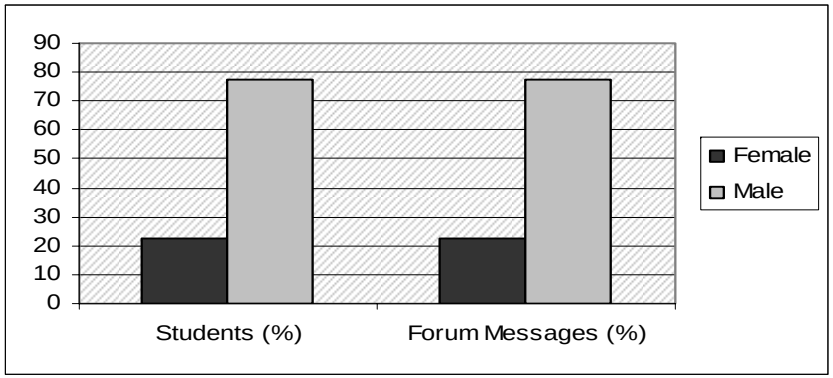
Through this work we have come to value:

- **Individuals and interactions** over **processes and tools**
- **Working software** over **comprehensive documentation**
- **Customer collaboration** over **contract negotiation**
- **Responding to change** over **following a plan**

That is, while there is value in the items on the right, we value the items on the left more

.

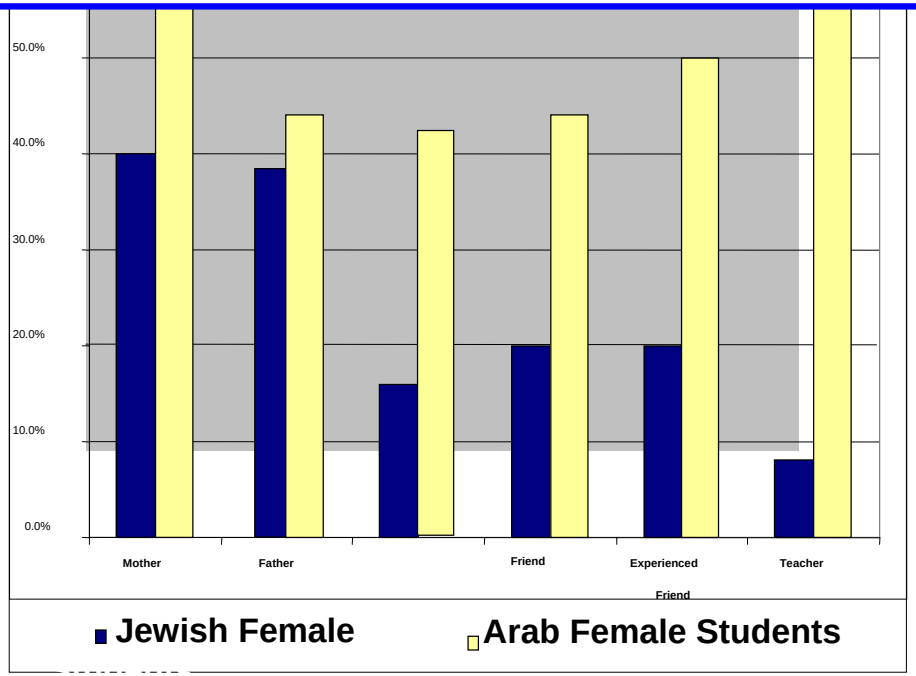
Females and males' communicative behavior in agile teams



Case Study 3: Jewish and Arab Israeli High School Advanced Placement (AP) CS Classes.

Most Jewish and Arab students in Israel attend separate educational systems with similar curricula in most subjects. Specifically, the AP CS classes are all coed, the syllabus is identical in both systems and the only differences are in the teaching language and the language of the matriculation exam. **In the Jewish sector 28% of the students were female, in the Arab sector 61% were;** that is, while female high school students in the Jewish sector are under represented in AP CS classes, they are highly represented in the Arab sector.

Percentages of females' encouragement by others



Mother, Father, Sibling, Friend, Experienced Friend, Teacher

Case Study 4: Undergraduate CS at Carnegie Mellon-Qatar

In the fall 2004, Carnegie Mellon opened a campus in Qatar offering an undergraduate major in CS with the same curriculum as its campus in Pittsburgh. In the cultural context of this paper, we can already present some interesting observations, particularly since **women outnumber men in the Qatar CS program.**

Preliminary observations indicate that Qatar Arab students' perceptions of CS and of women's ability in math/science studies align with many of observations from our case studies of the Israeli-Arab AP CS classes and of the new micro-culture at CMU-Pgh.

Women students completed the sentence **"I chose to learn computer science because" with "It has to do with logic", "I loved computers since I was a kid"**, and **"Computer science is important in every domain of life".** Family and teachers were the most important influencers for all students, men and women, in their decision to study computer science.

Surveyed women students overwhelmingly disagreed with the statement: "In my country, an equal number of men and women choose to study computer science." The reasons were surprising, elaborated as follows: "I believe in my country females feel that computer science is more important; men go to engineering and business field[s]" and "Women are [represented] more than men because they are 'more genius' than men".

CONCLUSION

Whether referring to attitudes within larger cultures, such as the Israeli and Qatari-Arab sub-cultures, or a micro-culture, such as the computing culture of a specific undergraduate department, **we hope to have illustrated the impact of *culture and environment* as determinants of women's choices and participation in computing.**

We have offered evidence for an alternative model of thinking about *gender issues rooted in the dynamics of culture* rather than the self-limiting, and often misleading, oppositional model of gender differences. Our work leads to various questions, two of which have clear implication for constructive and effective action are:

- **How might thinking about culture (as opposed to gender) help us understand and impact women's and girls' (and boys') choices of CS and computing related careers?**
- **What can these different cultures learn from each other with regards to CS education?**

Thank you!

For more information, please visit the Women@SCS website:

http://women.cs.cmu.edu/