What Is Computing?
Bridging the Gap Between Teenagers’ Perceptions and Graduate Students’ Experiences

http://www.georgiacomputes.org

Supported by NSF BPC #0634629
An Alliance of Georgia Institute of Technology, CEISMC (Center for Education Integrating Science, Mathematics, and Computing), Georgia Department of Education, Girl Scout Council of Northwest Georgia, and the University System of Georgia
“We need a dramatic change in how computing is perceived.”

“Students avoid computing because of their perceptions of it as boring, tedious, asocial, and irrelevant.”

“We propose the expansion of a statewide, vertical alliance to… support women and minorities pursuing careers in contextualized computing from pre-high-school, through high-school, undergraduate, and graduate education.”
Road Map

• Research Questions

• What We Did
  • Interviews with Teens
  • Interviews with Graduate Students

• Bridging the Gap

• Future (Past) Work

• Future (Future) Work
Research Questions

1. What are teenagers’ current practices surrounding their use of computers, the Internet, and technology in their informal, everyday lives?

2. What are teenagers’ perceptions of computer science and computing related fields and do they see themselves pursuing degrees or careers in these disciplines?

3. What are graduate students’ experiences in HCI and HCC and what factors motivated them to pursue these degrees?
What is Computing?

The systematic study of algorithmic processes that describe and transform information: their theory, analysis, design, efficiency, implementation, and application.

- 1989 ACM Report

What is Computing?

RESEARCHER: What is the difference between designing technology and computer programming?

"Designing technology uses touch screen while computer programming has to use a mouse."

- Catherine, 12

Goal-oriented activity requiring, benefiting from, or creating computers.

- 2005 ACM/IEEE Report

Study of computational processes and devices.

– ICER website

Computer science with a special emphasis on the consequences of computing technologies and how those consequences drive innovation and research.

– Mark Guzdial’s Amazon blog

"Designing technology uses touch screen while computer programming has to use a mouse."

“Designing technology uses touch screen while computer programming has to use a mouse.”

Sarita Yardi, Amy Bruckman
School of Interactive Computing, Georgia Tech
ICER, Sep 15, 2007
What we did

- Interviewed 13 local Atlanta teenagers
- Interviewed 22 graduate students in Human-Computer Interaction (HCI) and Human-Centered Computing (HCC) programs at Georgia Tech

<table>
<thead>
<tr>
<th>INTERVIEWS</th>
<th>Male</th>
<th>Female</th>
<th>Minority</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teenagers</td>
<td>5 (38%)</td>
<td>8 (62%)</td>
<td>3 (23%)</td>
<td>13</td>
</tr>
<tr>
<td>Graduate Students</td>
<td>12 (55%)</td>
<td>10 (45%)</td>
<td>9 (41%)</td>
<td>22</td>
</tr>
</tbody>
</table>

- Observed 60+ teens
  - high school digital media club (all minority)
  - girl scout technology program (all female)

- Taught HCI course to 10 teens (5 female, 9 minority)

- Administered computer attitudes surveys to 26 teens (12 female, 24 minority)
Data Analysis

• Used Weft QDA software tool for analysis of textual data
• Uploaded interview transcripts
• Coded by marking - highlighting – passages of text
• Generated a coding framework – themes - based on markings
• Recoded passages using common key themes
• Grouped passages by themes
Round 1: Interviewing Teenagers

• What do you like to do on the computer?
• How often do you get online?
• What do you do when you are online?
• Would you want to take classes in computer science?
• Would you want a job using computers?
Perception #1: Using the Internet and technology is fun

- 87% of 12-17 year olds are online
- Internet use jumps…
  ...from 60% in the 6th grade
  ...to 82% in the 7th grade
  ...to 94% in the 12th grade

RESEARCHER: If you could learn something new on the computer, what would it be?

- “Probably like Garage-Band. I think it’s cool how you can make music.”
- “Editing videos and stuff.”
- “iTunes and Photobooth are really cool.”
- “I would want to learn how to fix the Internet.”
Perception #2: CS != Internet

I think it’s a language. . . like different languages in computers and making a computer, like, change the sound or the visual stuff, like the different colors or something… I know to be a computer scientist you have to be a problem solver ‘cause you have to change things in CS to make colors different. (Rich, 13)

Operating systems and web applications and like the skeleton of everything that goes in your computer. It’s not necessarily what it looks like but like how it works. (Angie, 14)

My family is really stupid when they use computers. They break a lot. I wish I knew how to fix them so we wouldn’t have to spend as much money for people to fix them. Literally, we got a new computer over Christmas and it broke like four days later… I think we just got a virus. I wish I knew more about actual computers so I could fix them.

RESEARCHER: What do you mean by actual computers?

Like not just the Internet, ‘cause that’s where I spend all my time. (Paula, 15)
Perception #3: CS is Boring

I decided in like 7th grade I wanted to work for Google, just because I love the company’s philosophy… I mean, I’m interested in all sorts of things like PR, or HR, I don’t know. I don’t think I want to be a programmer because it’s too tedious and I don’t think I could do that, sitting in front of a screen all day, just looking at the typed stuff, I don’t do well. (Tanya, 15)

I didn’t really find it very fun because I mean they basically made us do boring stuff like draw big, small circles and like big circles and they didn’t exactly explain what was going to happen and stuff. (Dan, 12)

interviews with teenagers
Perception #4: CS is Antisocial

I mean, most of the people I know have the capacity to know about computers as I do. I think a big part of it has to do with, um, like more of a social thing. . . I definitely see the people in the technology group as being anti-social when they were younger. . . . Now they’re just as social as everybody else because in high school everybody’s pretty much accepted. . . (Jen, 16)

I’m more of a people person. (Marcus, 15)
Perception #5: CS is Hard

[CS] is hard… I mean it’s not anything easy, when I did AP, I was struggling within the first three weeks. The boys, they are fine, they can program, what would take me like 2 months to do, they can do in 3 weeks.”

RESEARCHER: Why do you think that is?

Well I don’t know but Colin has been building computers since he was like yay high. For me, I was just ‘oh look, a computer, wow, the Internet, look how fast it connects’.

…

My dad he promised me a car if I signed up for Computer Science and I did CS 1 and never got a car but I fell in love with it so I did CS 2 and then I went into AP for a whole semester and then I decided that I didn’t like AP so I did an Independent Study, which I’m doing now.
Round 2: Interviewing Graduate Students

1. What factors motivated students to pursue degrees and careers in HCI and HCC?

2. Did they have any anecdotes and stories from their childhood and teenage years that suggested an early interest in or predisposition towards these fields?

3. Did they have any advice for us in how to design an effective HCI curriculum for teenagers? In particular:
   (a) what would be the important skills that teenagers should learn?
   (b) What would be an effective way to teach these skills?
   (c) What project topics would be exciting or motivating for teenagers?
Experience #1: Real-World Relevance

I guess a lot of times in CS I realized I was different from other people in the way I was thinking, a lot of people think things are cool just for existing. For me, the issue was who would use it? In a lot of CS classes, something new would be presented and most people’s question was ‘how does it work?’ Mine was ‘what is it useful for?’

I followed automobile designs, as a kid I subscribed to auto magazines and looked at the cool shapes. Around the same time, Apple was getting notoriety for design. Apple was a big influence... I took an art class my senior year, but it didn’t dawn on me I could do it for a living until year two.
Experience #2: Interdisciplinary

I was a total nerd growing up... I was always into the visual aesthetics of things. I found myself doing more and more development, more programming.

HCI was kind of a cool way to help me balance my design skills and programming, it was a cool merging of art and technology. I started to see the art behind computing and I definitely saw art behind visual functionality.

HCI lets you do a whole lot of things, I guess I was always interested in a lot of areas. There is a wide variety of opportunities. It’s always fun. It’s always on the cutting edge. There are always interesting things going on.
Experience #3: Games

I’ve always been into video games, which were what got me into the computer. When I was in 4th grade, I was like the local software dealer. I’d have a list of games and would trade one copy for another copy with the other kids.

I think, also, like just games was a huge bridge for me, I started out playing Atari games and Nintendo games and saw that people had commodore games and Nintendo 64. You had to know how to run your floppy drives to play those games, once I did that and once I had a computer, I learned about word processing and how to use a printer.
Experience #4: Role Models

[As a kid], my mom gave me books on computers, a ‘kids intro to computing’ text. It told you a lot about how computers worked. It was a well done book and sparked my interest in computers. As a kid, it was new to me, I didn’t have access to a computer.

I remember arguing with my dad - I was kind of a rotten kid - because we didn’t have a modem and didn’t have service. I knew about the Internet and my friends had the Internet. . . I should be able to just plug it in and type in something.

I always had an inclination towards computers, probably because of my dad.
Experience #5: Creative

Legos were a big part of my childhood. Whenever I accomplished something significant my parents would get me a Lego set and I would build something new. Eventually I amassed a huge collection of Legos. . . That got me interested in the idea of building 3d objects that I wouldn’t be able to make in real life. From there I started messing around with 3d animation on the computer and building things.

It wasn’t only about the ideas, but the process of creating something. I wanted to be a carpenter. CS was only thing with science that involved creating something.

I’ve always enjoyed making things. . . I always enjoyed making things and not just Lego making things. I used to experiment with Play-Doh. . . I would experiment with what would make it last a long time.
## Comparing Perceptions and Experiences

### Reasons for Teenagers’ Lack of Interest in CS (n=13)

<table>
<thead>
<tr>
<th>Reason</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boring</td>
<td>9</td>
</tr>
<tr>
<td>Hard</td>
<td>7</td>
</tr>
<tr>
<td>Antisocial</td>
<td>5</td>
</tr>
<tr>
<td>Lacking Creativity</td>
<td>4</td>
</tr>
<tr>
<td>Tedious</td>
<td>3</td>
</tr>
</tbody>
</table>

### Graduate Students’ Reasons for Studying HCl or HCC (n=22)

<table>
<thead>
<tr>
<th>Reason</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-World Relevance</td>
<td>18</td>
</tr>
<tr>
<td>Interdisciplinary Field of Study</td>
<td>12</td>
</tr>
<tr>
<td>Opportunity for Creativity</td>
<td>5</td>
</tr>
<tr>
<td>Early Role Models</td>
<td>5</td>
</tr>
<tr>
<td>Interest in Games (Video, Console, Computer)</td>
<td>3</td>
</tr>
</tbody>
</table>

*Interviews with grad students*
Bridging the Gap

I think it has to be lots of small movements... when I think about my friends who are the ones that have the capacity to learn really fast and could easily do this, they just choose not to.

It has to be on a smaller scale, a required computer course at school, an introduction to all the neat things on the web, like a regular update on what’s going on. Like ‘hey, a podcast just came out, you might want to check this out’.

You can’t just have one course and be done with it because it changes so fast. -Mandy, 15

Advice for Teaching HCI (n=22)

<table>
<thead>
<tr>
<th>Advice</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects Should Be Fun</td>
<td>8</td>
</tr>
<tr>
<td>Pull From Multiple Disciplines</td>
<td>7</td>
</tr>
<tr>
<td>Use Multimedia</td>
<td>6</td>
</tr>
<tr>
<td>Integrate Games</td>
<td>5</td>
</tr>
<tr>
<td>Provide Opportunities for Creativity</td>
<td>3</td>
</tr>
</tbody>
</table>
Broadening Participation Through an HCI Curriculum

Designing a Touchscreen Digital Desktop
Summer 2007
http://www.ischool.berkeley.edu/~yardi/HCI_Guide.pdf
Pass the Potatoes

Fall 2007 - ?

Facebook tool that enables users to:
(1) create their own Facebook projects, known as “potatoes”
(2) share or “pass” them with friends
(3) rate one another’s creations
(4) display them to a public audience

• Allow any Facebook user to create their own Facebook applications
• Usable by non-programmers
• Don’t need technical skills and resources to set up a server space, write the appropriate code to access the Facebook API, and write the calls to access the available functions
• Seamlessly integrate an environment for creative expression, engagement, interaction, and sharing with Facebook’s existing socially networked community
Future Directions

Methodological Limitations

• We didn’t talk to traditional CS students
• Speaking to multiple communities with different notions of computing
• HCI is not the same as CS
• We did not teach computer science or computer programming

Open Questions

• Are there universally important computing skills? If so, what are they?
• What *isn’t* considered computing?
• Are there *degrees* of computing that are important for different students?
Thank you

Sarita Yardi, yardi@cc.gatech.edu
Amy Bruckman, asb@cc.gatech.edu

http://www.georgiacomputes.org
http://www.cc.gatech.edu/~yardi