DESIGNING HEALTHCARE ROBOTS FOR CHILDREN WITH SPECIAL NEEDS

Speaker: Ayanna Howard
Host: Gail Murphy
Dr. Ayanna M. Howard is the Professor and Linda J. and Mark C. Smith Chair in Bioengineering at the Georgia Institute of Technology. Her area of research is centered around the concept of humanized intelligence, the process of embedding human cognitive capability into the control path of autonomous systems. To date, her unique accomplishments include highlights in USA Today, Upscale, and TIME Magazine, as well as being MIT Technology Review top young innovator of 2003, NSBE Educator of the Year in 2009, and receiving the Georgia-Tech Outstanding Interdisciplinary Activities Award in 2013.

Dr. Gail Murphy is a Professor in the Department of Computer Science and Associate Dean (Research & Graduate Studies) in the Faculty of Science at the University of British Columbia. She is also a co-founder and Chief Scientist at Tasktop Technologies Incorporated. Her research interests are in software engineering with a particular interest in improving the productivity of knowledge workers, including software developers. Dr. Murphy’s group develops tools to aid with the evolution of large software systems and performs empirical studies to better understand how developers work and how software is developed.
Designing Healthcare Robots for Children with Special Needs

Ayanna Howard, Professor and Linda J. and Mark C. Smith Chair in Bioengineering at Georgia Tech
WHO IS DR. HOWARD?

Educator

Innovator

Rocket Scientist

Risk-Taker

Computer Scientist

Family Person

Mentor

Engineer
WHO IS DR. HOWARD?

• Worked at NASA/JPL for ~ 10yrs (Senior Robotics Researcher)
• Now – Full Professor at Georgia Tech in Electrical/Computer Eng.
• PhD EE from USC, BS from Brown University
• Founder/CTO of startup company (Zyrobotics)
Motivation

- Therapeutic play helps promote cognitive, social, and physical skill development in children.
- Due to a number of factors, there has been interest in finding alternative effective therapeutic devices.
- Intended for use in a range of environments, including hospitals, physical therapy centers, and homes.
Why Robots?

• Most children, including children with special needs, are attracted to robots.
• This natural affinity can be exploited, and the robot used as an interactive toy.
• Robots can provide repetitive and predictable interaction for therapy, education, …
Case Study: Children with CP

- 1 in 303 children in the U.S. are diagnosed with Cerebral Palsy (CP)
- These children typically participate in physical/occupational therapy interventions on a regular basis
- For such children, therapeutic play is the best form of physical therapy
  - Natural
  - Engaging
  - Long lasting
Child Cognitive Behavior

- With repetitive or monotonous conditions over time, performance decreases due to reduced arousal (Cooley and Morris, 1990)

- Generally, sustained attention improves with age

Courtesy of childrensmemorial.org
Child Movement Behavior

- Wide variation of movement profiles in children with CP
- Classify gross motor function using the Gross Motor Functional Classification System (GMFCS)

GMFCS II  
GMFCS IV
The Objective and Challenge

Interactive and Child-friendly

Repeatable and quantifiable metrics

Addresses both physical and cognitive needs of children
Exploring Play Therapy

• What has to be explored?
  – Understand, learn, participate in child’s play
  – Produce turn-taking play strategies
  – Monitor the child’s play and provide feedback

• Stage 1: Child-Led play
• Stage 2: Robot-Led play
The Play Scenario

- Physical and Virtual
- Therapy games (virtual reality, tablet-based, physical)
- Sensors used to evaluate users in real-time and in the comfort of their own homes
- Robot designed as physical playmate
POLL 2

2. What features of a play scenario do you think are most important?
   a. Fun for the child
   b. Has simple enough rules for the child to follow
   c. Doesn’t matter as long as it can help the child
Physical Therapy Metrics

• To provide feedback to the clinician, need to quantify rehabilitation measures
• Peabody Developmental Motor Scales – used to assess gross and fine motor skills
• Correlated upper-arm measures:
  – Range of Motion
  – Peak Velocity
  – Reaching Kinematics
    • Movement Time
    • Path Length
    • Movement Units
Interactive Robot Play Strategies
3. Do you think a robot should exhibit or have emotions?

a. Yes
b. No
c. I have watched movies about robots and like when they display emotions
Child-Robot Interactive Play Therapy
Concluding Thoughts ...

- As healthcare robotics becomes more advanced, how far can we push it? How far should we push it?
Mentoring Session:

Finding and Making the Most of an Undergraduate Research Experience

Ayanna:

Where do I start when it comes to finding an undergraduate research experience?
Mentoring Session:

Finding and Making the Most of an Undergraduate Research Experience

Let’s Review:

Where do I start when it comes to finding an undergraduate research experience?

Start thinking about:

- Why should I participate in a Research Experience?
- How do I find a Research Experience?
- When to apply for Research Experiences?
I would rather try an undergraduate research experience:

a. In the summer
b. During a school term
c. Both
d. Neither
WHERE TO DO UNDERGRADUATE RESEARCH

I am interested in an undergraduate research experience:

a. At my school
b. At a different school
c. In industry
d. Any of the above
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<th>DREU</th>
<th>CREU</th>
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<tr>
<td><strong>Time</strong></td>
<td>Summer (10 weeks)</td>
<td>Academic year plus optional summer</td>
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<td><strong>Target group</strong></td>
<td>Women, minorities, and students with disabilities</td>
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<td><strong>Stipend per student</strong></td>
<td>$7000 per summer; relocation travel assistance when appropriate.</td>
<td>$1,500 per semester and $4,000 during optional summer extension</td>
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<td><strong>Location</strong></td>
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<td>Student's institution</td>
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<td><strong>Team Work</strong></td>
<td>Varies</td>
<td>Encouraged in CS and CE. Expected on multidisciplinary projects.</td>
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<td><strong>Interdisciplinary</strong></td>
<td>Varies</td>
<td>Varies</td>
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<td><strong>Mentor</strong></td>
<td>Faculty</td>
<td>Faculty at home institution of student. At least two faculty, from different disciplines, for multidisciplinary projects.</td>
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<td><strong>Deadline</strong></td>
<td>February 15</td>
<td>May 18</td>
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<td><strong>Sponsor</strong></td>
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Resources

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Join our CRA-W mailing list, [CRA-W Updates](http://bit.ly/1McQCDd), by going to bit.ly/1McQCDd.

Follow [@CRAWomen](http://bit.ly/1McQCDd) to find out about upcoming events or programs.

Don’t forget to take the feedback survey!