NRI:INT Design and Development of a Social Robot to Gather Ecological Momentary Stress Data from Teens
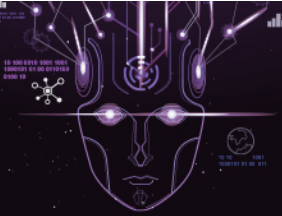
Elin A. Björling, Maya Çakmak, Emma Rose (University of Washington)
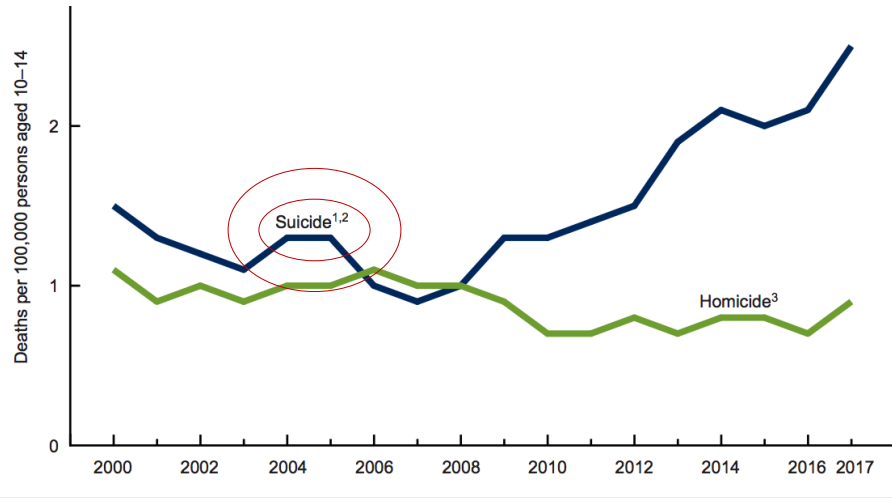
@elinbjorling

How might we design a social robot to measure and reduce stress in teens?

Teen Mental Health: **A Wicked Problem** Requiring Crosscutting Design Solution

Deaths per 100,000 persons aged 10–14

Suicide[1,2]

Homicide[3]

CDC

Are We Heading Toward a Suicide Crisis in America?

Why Are More American Teenagers Than Ever Suffering From Severe Anxiety?

Parents, therapists and schools are struggling to figure out whether helping anxious teenagers means protecting them or pushing them to face their fears.

By BENOIT DENIZET-LEWIS OCT. 11, 2017

YOUR HEALTH

Increased Hours Online Correlate With An Uptick In Teen Depression, Suicidal Thoughts

November 14, 2017 · 4:13 PM ET
Heard on All Things Considered

Fewer teens having sex, doing drugs but more are depressed

More teens are thinking about suicide, federal health officials say.

by Maggie Fox / Jun.15.2018 / 1:29 PM ET / Updated Jun.15.2018 / 1:33 PM ET

Problem Space: Increasing Stress – Decreasing Mental Health

- Teens experience more **chronic stress**, than other age groups[1].

- Adolescent brain is extremely **vulnerable** to the negative impact of stress[2].

- Stress is highly correlated with **depression** and **suicidal ideation**[2].

[1]American Psychological Association (2014)
[2]Eiland & Romeo (2013)
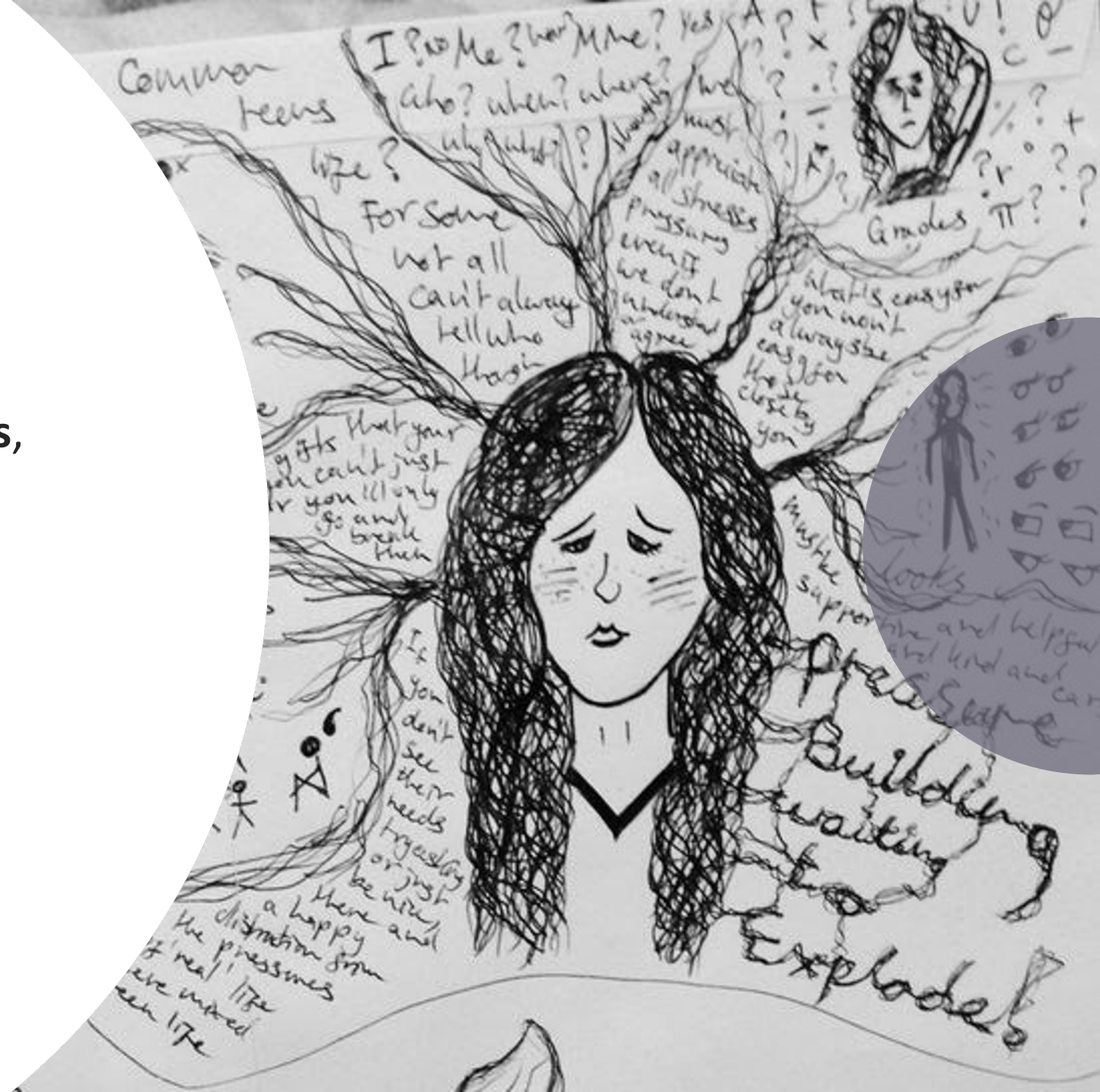
Problem Space: School Stress

- Teens report school as their **#1 stressor**[1]

- Schools in the U.S. are **under resourced**, underfunded, undertrained to manage teen mental health

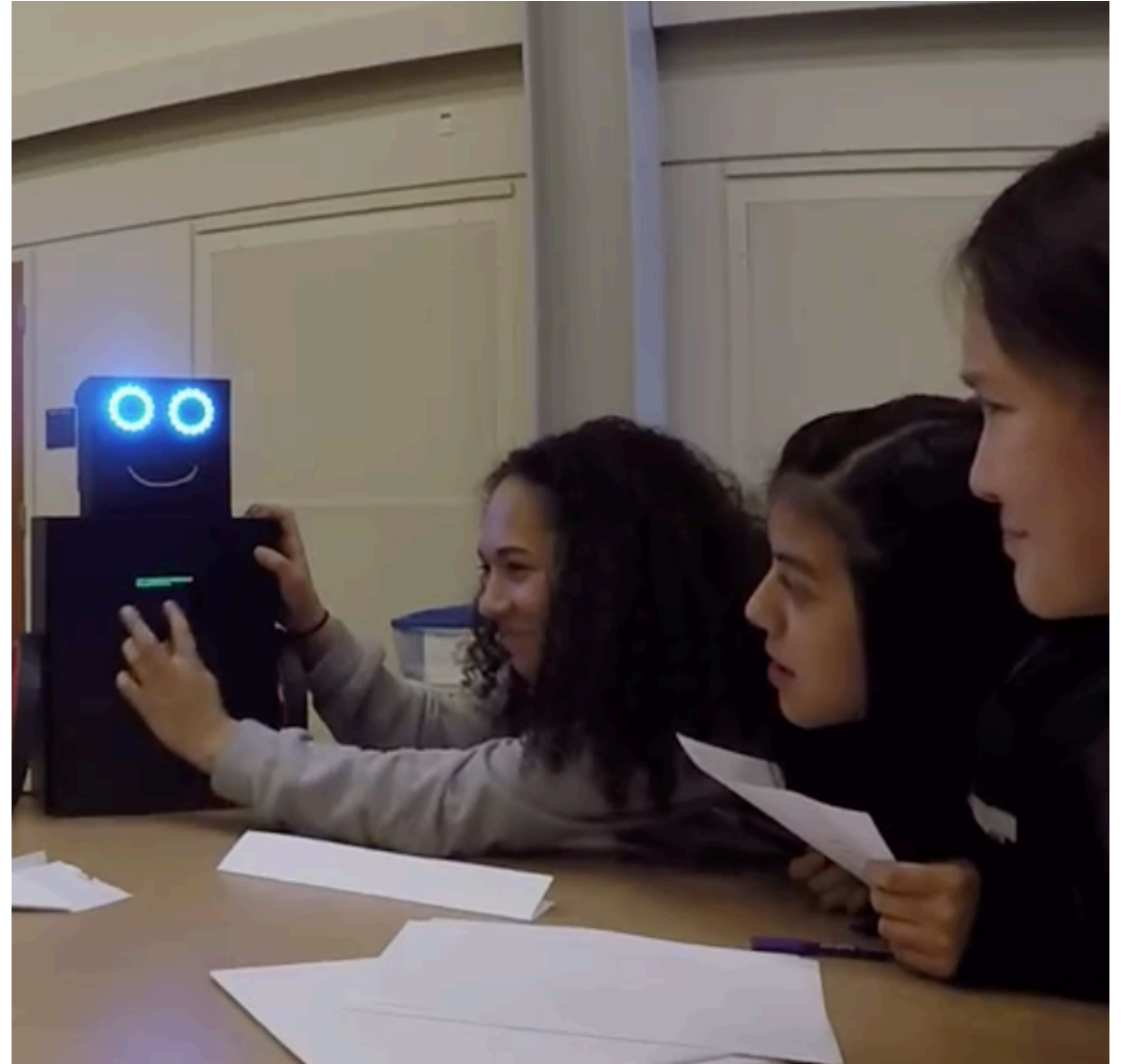- School communities are **unique** in their stressors

  [1]American Psychological Association (2014)

  [2]American College Health Association (2018)

Why a social robot for teens?

- An **engaging** data gatherer
- An inviting **social** interactions and conversations about stress
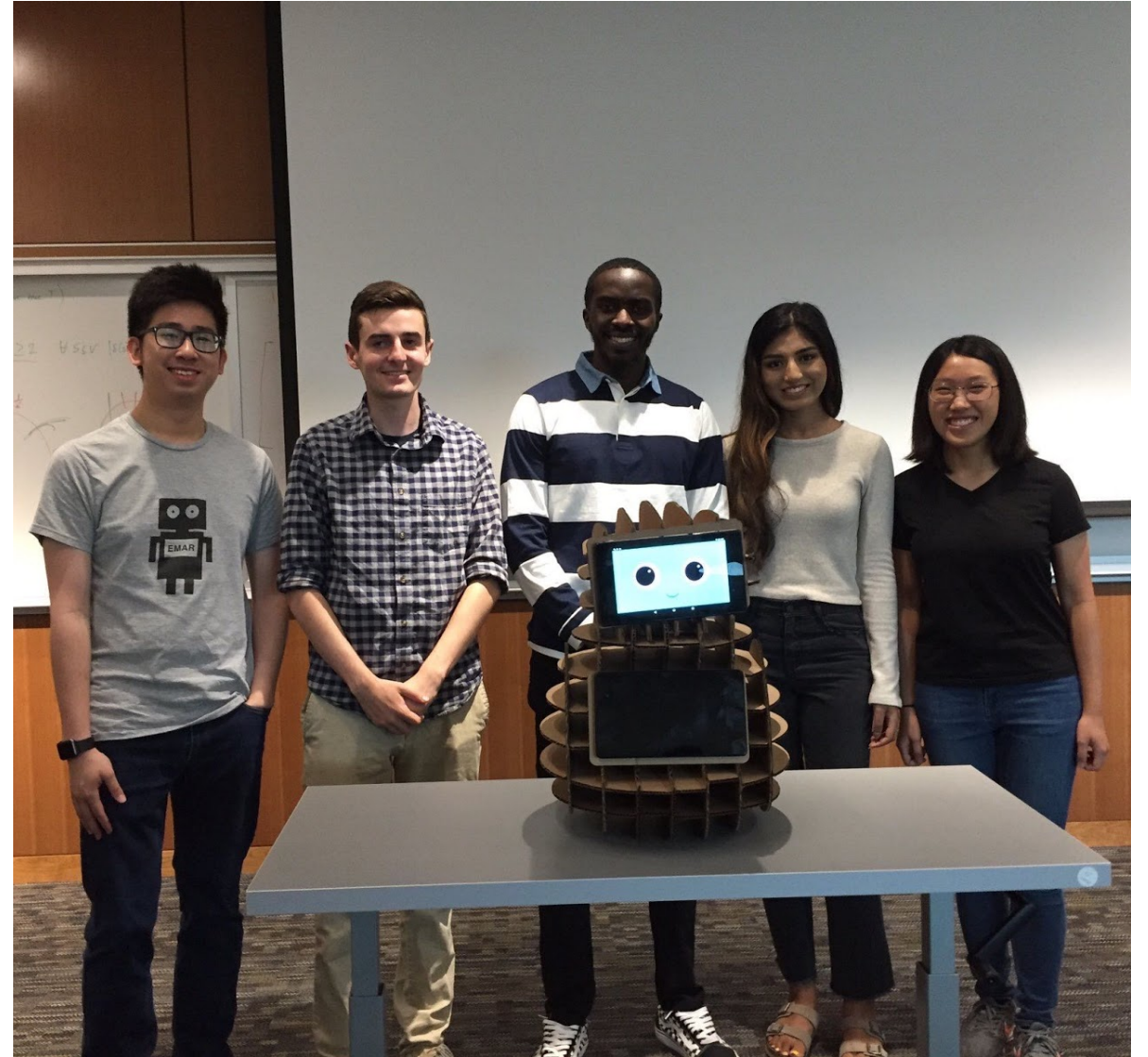- An **innovative** idea for a wicked problem

Project EMAR (Ecological Momentary Assessment Robot)

An interdisciplinary project to design, develop and deploy an engaging and customizable social robot to gather ecologically valid, teen stress and mood data, while delivering a micro-intervention.

Participatory Interaction Studies in the Wild

Teens Are:
- Collaborators
- Co-Designers
- Co-Researchers
- Robot Operators
- Interaction Witnesses

Our Research

- 10 studies
- 11 Seattle Area High Schools so far
- 360+ students and counting

Social Robot Design Challenge

- 7 schools and 81 teens who learned human-centered design and prototyped their own social robots to measure and address teen stress.

- Teens presented their robot designs at a public showcase to receive feedback from experts.

- **Finding: The incredibly diverse designs and behaviors demonstrated need for a customizable robot platform.**
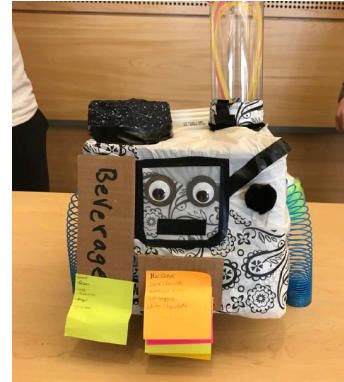
[Boom Boom]

[Lucy]
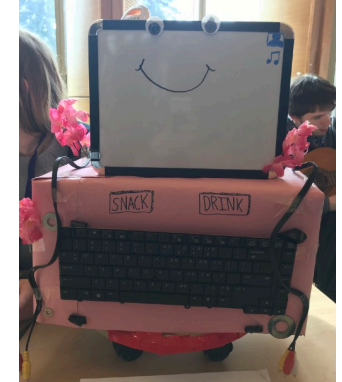
[Petunia]

[CARLBot]

[Joaquin Bartholomew III]

[Comfort Zone]

Exploring Teens as Robot Operators, Users and Witnesses in the Wild

- 62 teens (14-18) to determine robot verbal and physical behaviors using two types of robot platforms.

Findings:

- **Authenticity, emotional engagement, and imperfection were identified as key to teen-robot interactions.**

- **Head tilt conveys listening and empathy.**
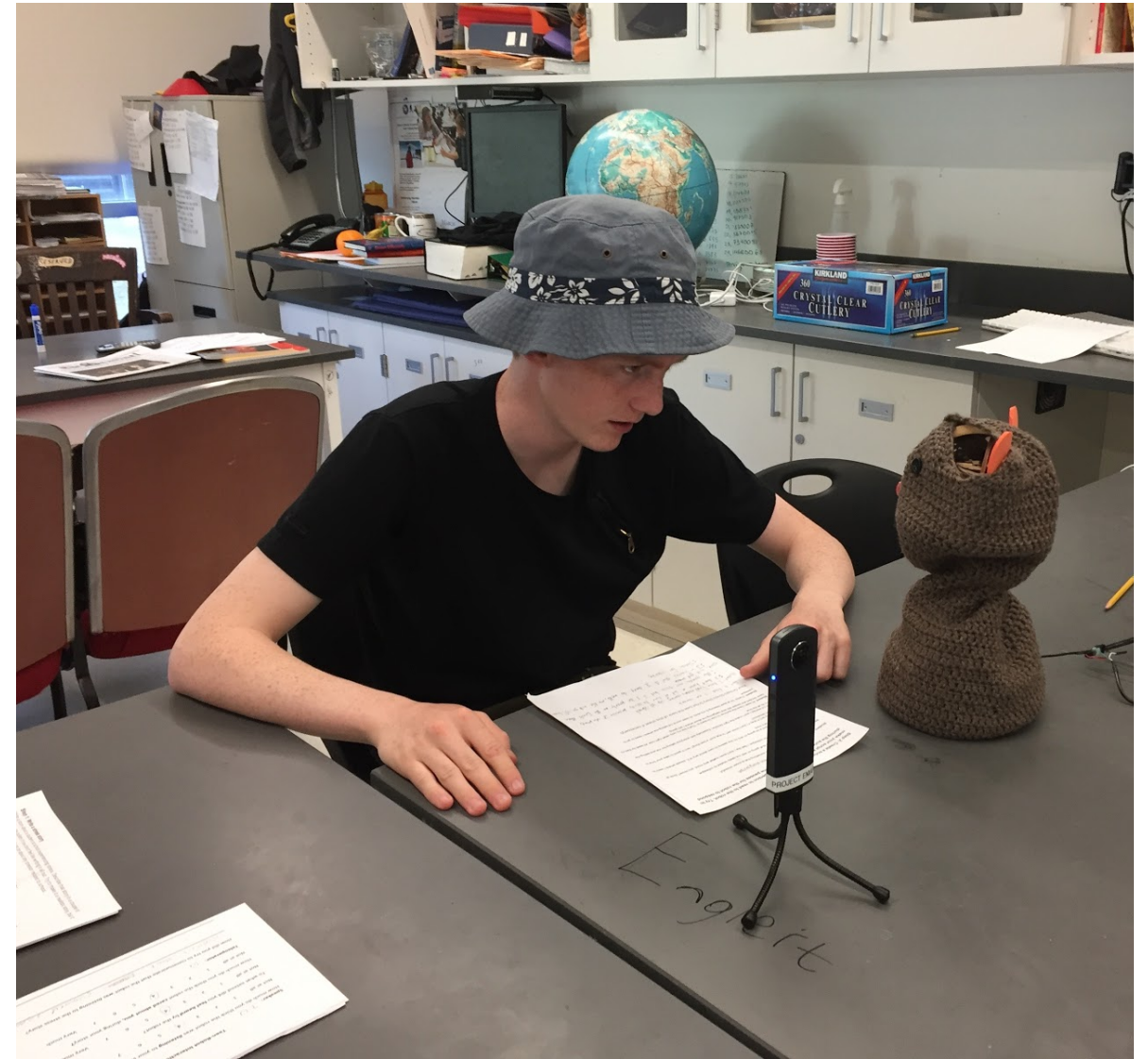
Designing a Collaborative VR Game for Teen-Robot Interactions

- 42 teens (14-17)

- co-designed an asymmetric VR game wherein teens collaborate to design a social robot & explore teen-robot interactions.

- **Finding: Teens shared positive emotions toward each other & the robot during gameplay.**

- **Expressed a desire for empathetic interactions with the robot**

Sharing Stress With a Robot: What Would a Robot Say?

- 36 undergraduates (19-22)
- Explored mechanical, by proxy, and emotional robot disclosure.
- **Finding: increased perceived stress predicted reduced human disclosure, user satisfaction, robot likability, and future robot use.**

A   B   C

Sharing Stressors with a Robot: What Platform Do Adolescents Prefer?

- 71 teens (14-19) each shared stress stories with EMAR in a physical, computer, and virtual reality settings.

- **Findings: Robot interactions were stress reducing.**

- **Most teens preferred the virtual reality setting, even though the physical robot was most stress reducing.**

Study findings inform design principles

Authenticity (researchers and robots)

Trust and Transparency

Teen-Centered (methods and robot)

Collaborative
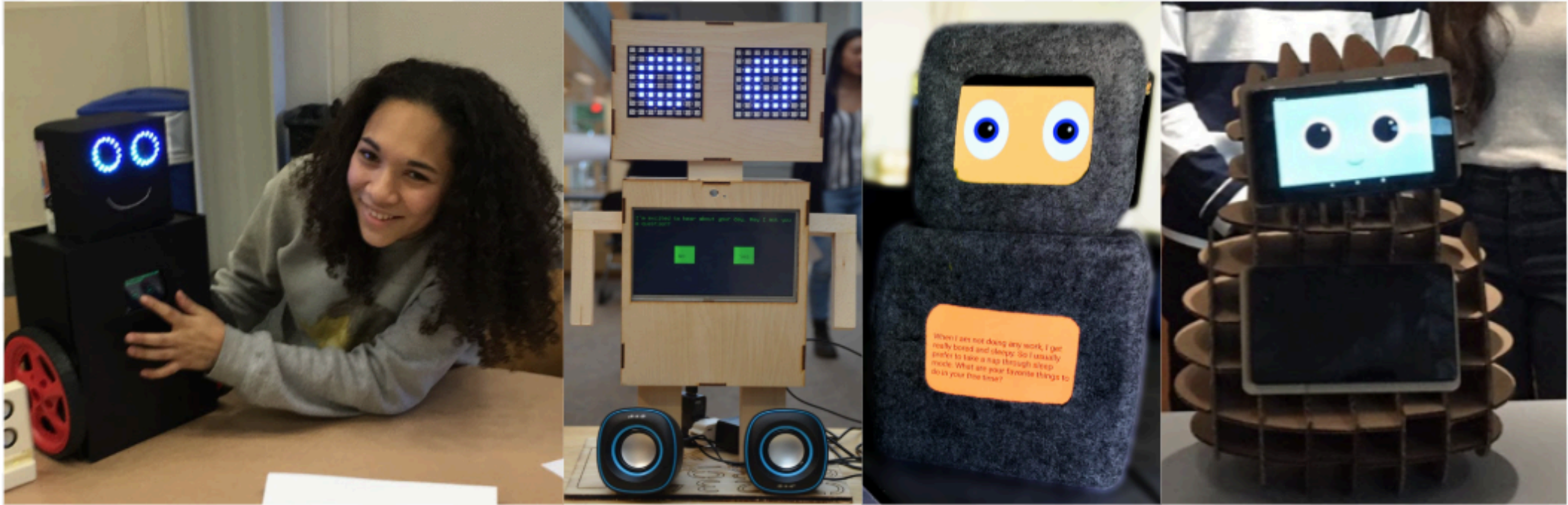
Study findings inform design robot requirements

- Boxy/Handmade
- Empathetic Interactions
- Big Eyes/Limited Talking/Head Tilt
- Movement but not mobility
- Choice for public and private interactions
- Locally networked device
- Anonymous interactions
- Programmable

Robot EMAR Specifications

Multimodal outputs and inputs are all end-user customizable:

- facial expression

- Voice/sound

- Lights (recently added)

- head movement

- speech communication

- text communication

Project EMAR: Broader Impacts

- **Teens are the future** roboticists, designers, and engineers.

- Novel, creative and **scalable solutions to support their mental health** are essential to the success of our future.

- As we explore mental health with teens we learn a lot about robot interactions and **requirements for operating in the wild**.
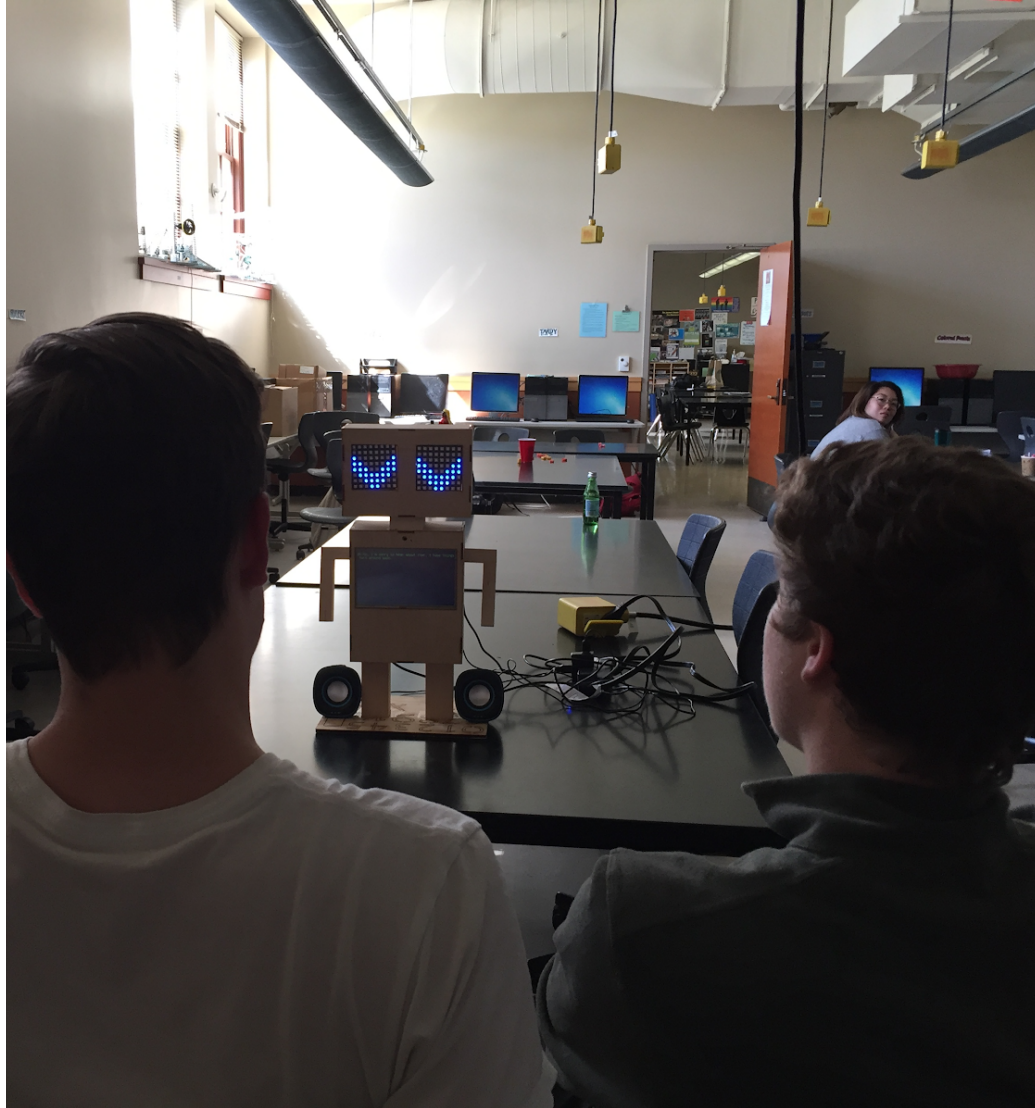
Project EMAR: Next Steps

- Currently conducting a Public Vs. Private study about robot interactions in the school.

- Hackathon to understand how EMAR may be abused/misused in schools

- Deployment of an autonomous EMAR into a public high school to explore usability, adoption, disruption and impact.

Thanks!

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W

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