

February 19, 2013

ENGR110/210

Perspectives in Assistive Technology



David L. Jaffe, MS



Professor Drew Nelson



Krystal Le

Questions?



Mid-term presentation
comments?

Mid-term presentation comments

The comments included multiple suggestions about significance of the problem, importance of involving users, prototyping early, keeping the design simple, fabrication advice, and desire to see final result.

1. Were comments and advice useful, fair, unexpected?
2. Single or multiple suggestions on the same issue?
3. How do you integrate them into your project work?
 - Misinterpretation of what you presented
 - Ignore or pursue?
4. Questions?

Items

1. Mid-term reports – email by the end of today
2. Assignment 2 for students working on team projects
3. Sign up for a ride to Motion & Gait Analysis Lab next Tuesday
4. All students working on projects – arrange to meet with me

Student Projects

- Cautions – 3 weeks to go
 - How much to bite off?
 - Project goal
 - Moving the process forward
- Think about
 - Final presentation and report
 - Continue to send updates, including photos

Thursday

Assistive Technology Faire

10 Vendors:

[VisionEdge Reading Aid](#)

[North Coast Medical](#)

[6dot™](#)

[Lightwriter](#)

[Parents Helping Parents iTECH Center](#)

[AT Exchange](#)

[Podna Rover](#)

[Scheiman Rebuild Fitness](#)

[Service Dog Tutor](#)

[Vital Link Medical Alert Systems](#)



Review all the offerings with someone in the class who is not on your project team.

Today



Allison M. Okamura, PhD and
David L. Jaffe, MS



Assistive and Movement Therapy Robotics

Assistive Robotics

Dave Jaffe

Agenda

- What is a robot?
- What is an assistive robot?
- Early assistive robots
- Assistive robots at VA
- Other assistive robots
- Robots in the news
- Summary

- Short break

- Movement Therapy Robots – Prof Allison M. Okamura

- Final questions

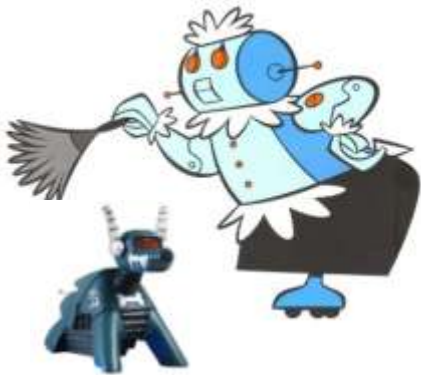
Robots

- **Industrial robots**
- **Medical robots** – referred to as a medical device
 - **Surgical robots** – hip replacement, surgical master-slave manipulation
 - **Movement Therapy Robots** – provides diagnosis, trains, restores function, used in neurorehabilitation
 - **Assistive robots** – compensates for lost function
 - **Mobile servant** – assists with manipulation tasks such as grasping, feeding, cooking, activities of daily living, etc
 - **Physical assistant** – provides walking assistance, prosthetics, exoskeletons (wearable devices)
 - **Personal mobility** – cars, wheelchairs, transfer devices

What is a robot?

What image comes to mind when you think of a robot?

Some images of robots



klaatu barada nikto

What abilities define a robot?

Which of these are required characteristics of a robot?

Ability to move – legs, wheels, fly, burrow, swim, orbit

Ability to sense – eyes, ears, other inputs

Ability to manipulate – arms, hands, fingers, bumpers

Ability to mimic – appearance, perform human tasks

Ability to communicate – expressions, sounds, voice, digital, analog

Ability to think – brain, mechanical mechanism, computer, self-awareness

Ability to operate – remotely, program control, autonomously

Ability to react and respond to different situations

Ability to do something useful

Can a software program be considered a robot?

Is Siri a robot?

What is assistive robotics?

My definition: An **assistive** robot is a device that can sense, process sensory information, and perform actions that benefit people with disabilities and seniors.

Users of assistive robotics

	Prevalence	Potential users
Spinal cord injury:	90,000	90,000
Cerebral palsy:	500,000	50,000
Rheumatoid arthritis:	2,100,000	20,000
Other:		
Frail elderly		
ALS, MD, MS, stroke, temporary impairment, amputees, etc.		

[Stanger CA (1996) Cawley MF, Demographics of rehabilitation robotics users. *Technology and Disability* 5, pp. 125-137.]

Early assistive robots



Rancho Golden Arm

Early assistive robots



JHU / APL Robotic Workstation

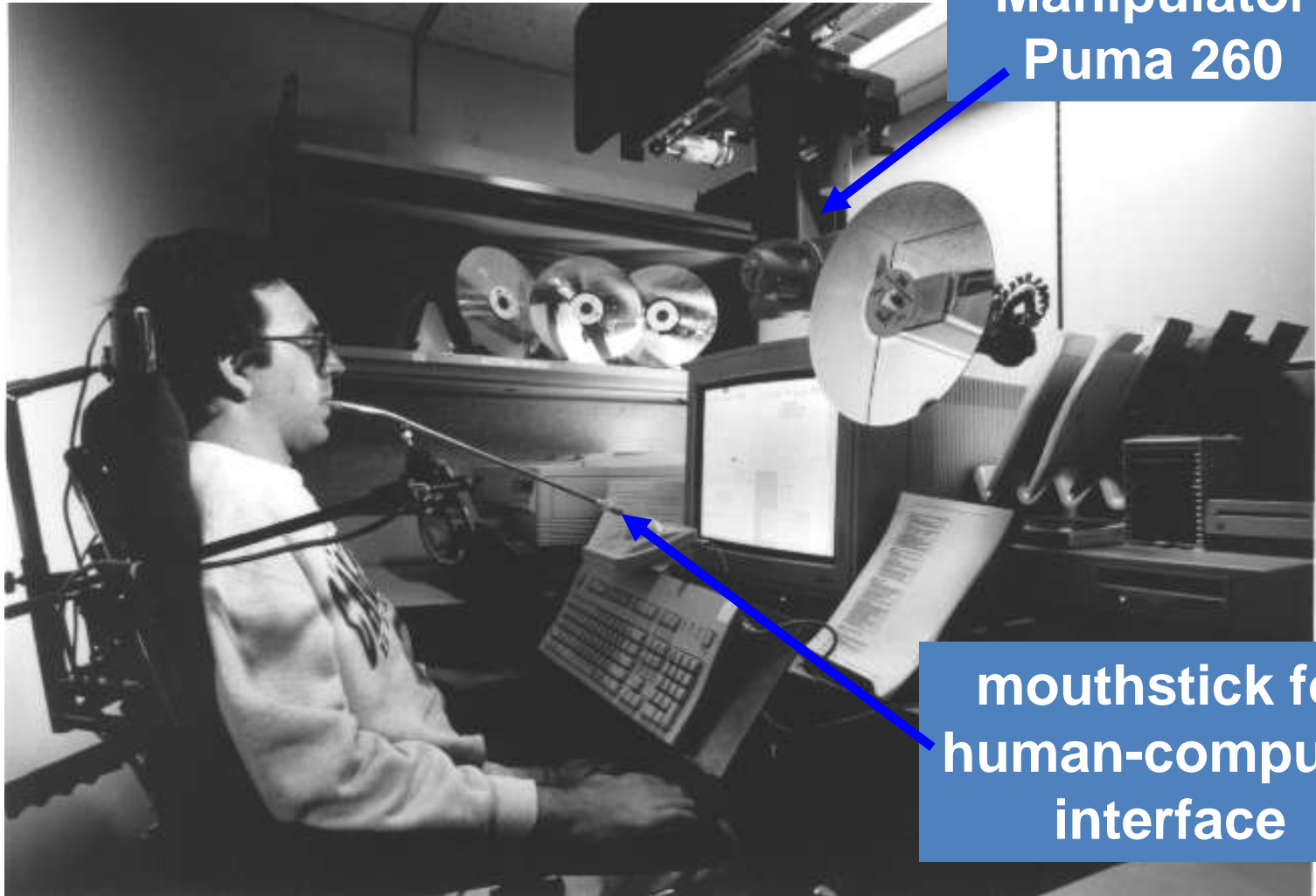
Assistive robotics at VA

VA / Stanford MoVar



DeVAR & ProVAR

Desktop Vocational Assistant Robot



**Manipulator
Puma 260**

**mouthstick for
human-computer
interface**

DeVAR & ProVAR

Desktop Vocational Assistant Robot



Other assistive robotics

Handy-1

- CP users
- Single-switch input
- Modules for:
 - Feeding
 - Cosmetics
 - Face-hygiene



[Link](#)

MANUS Wheelchair Robot

- 5-dof, belt-drives
- Grounded actuators
- Keypad / display input



Raptor Wheelchair Robot

- 4-dof
- Motors in links
- No encoders
- Joystick control
- Over-torque clutches
- Commercialized 2001
- Applied Resources, Corp.



Weston Wheelchair Arm

- R&D at University of Bath, UK
- Inexpensive arm
- Also designed a workstation version



[Link](#)

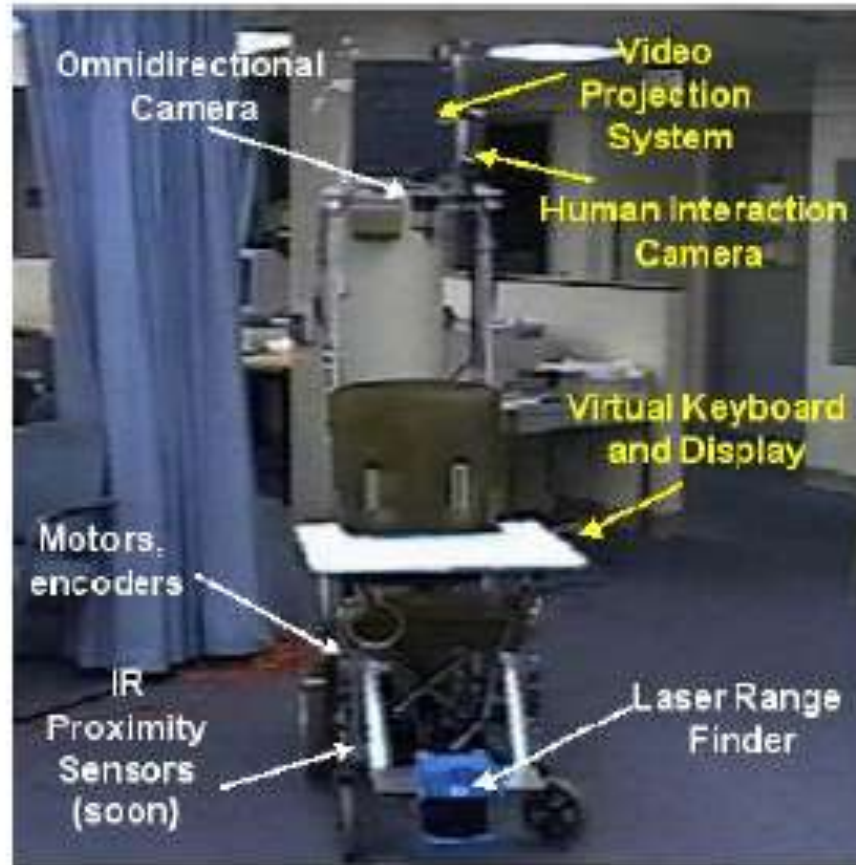
Hephaestus Navigation

- Builds on NavChair, University of Minnesota
- Ultrasonic, IR, and tactile sensors
- Add-on kit for any wheelchair



[Link](#)

SmartChair Navigation



[Link](#)

Wheelesley

- Eye-tracking (EOG) interface
- Single-switch scanning input
- Vision system navigation
- 12 infrared sensors
- 4 ultrasonic range sensors
- 2 shaft encoders
- Instrumented front bumper



[Link](#)

Walking Assist Robot

- Guido (PamAid)
- Wheels, not motorized
- Steering motorized
- Range sensors in front



[Link](#)

Robots in the news



PR2 Can Now Fetch You a Sandwich from Subway

[Link](#)



Willow Garage's PR2 robot can fold clothes, set a table, and bake cookies.

[Link](#)



eLEGS: Wearable, Artificially Intelligent, Bionic Device

[Link](#)



Exoskeleton Technology Helps Paraplegic Student Walk Again

[Link](#)



Robosoldier

[Link](#)



Glove that Vibrates Fingertip Could Improve One's Sense of Touch

[Link](#)



Ready for the robot revolution?

[Link](#)



Panasonic's Hospi-Rimo robot tends to patients

[Link](#)



Hair-washing robot leaves your hair silky-smooth

[Link](#)



Bed Mode



Shown with the back rest up



The wheelchair separated from the bed

Panasonic's Robotic Bed transforms into wheelchair

[Link](#)



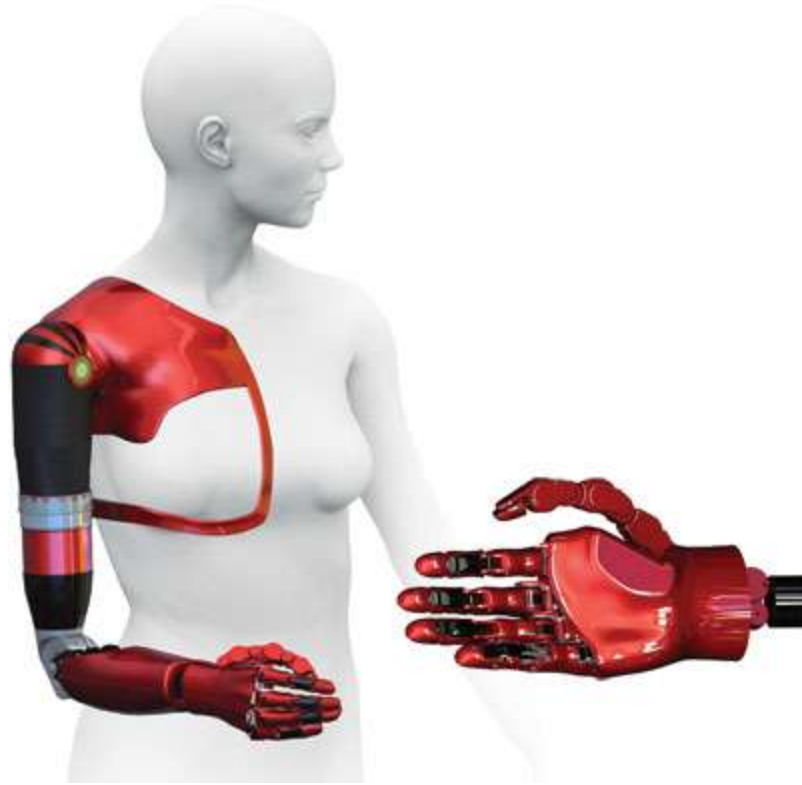
Development of a Powered Transfemoral Prosthesis

[Link](#)



The Revolution Will Be Prosthetized - DARPA

[Link](#)



The Revolution Will Be Prosthetized – JHU/APL

[Link](#)



Giant teddy bear robot can pick you off the floor

[Link](#)



Babyloid: Therapeutic Baby Robot for the Elderly

[Link](#)



Humanoid Robots: STEM Vehicles Today, Classroom Assistants Tomorrow

[Link](#)

Summary

- Robots come in many forms
- Robots can be used in many ways to help people with disabilities
- Lots of research being pursued, resulting in one-of-a-kind prototypes
- Few assistive robots in common use today
- High cost and uncertain benefit are major barriers to their widespread adoption

Short Break

