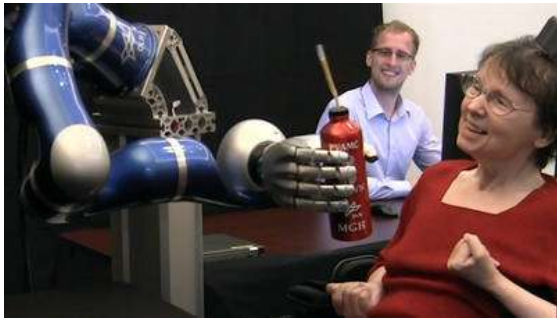




Assistive Robotics

Dave Jaffe

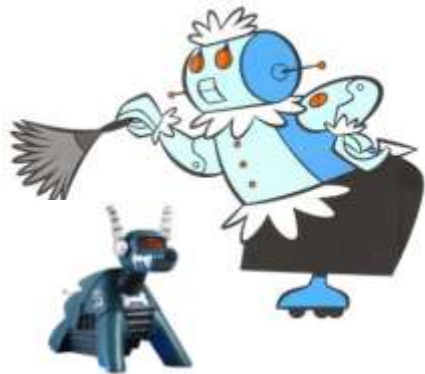




Agenda

- What is a robot?
- What is an assistive robot?
- Early assistive robots
- Assistive robots at VA
- Other assistive robots
- Summary
- Questions

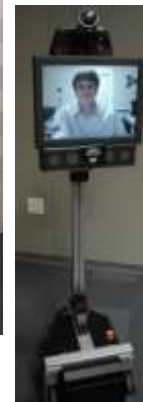




Some images of robots



- Stereo camera system on pan-tilt-head
- Chin joystick
- TFT display
- Mini joystick
- Tray with IR sensor surface
- Panning arm of TFT display
- Panning arm of manipulator



klaatu barada nikto

Robots

- **Industrial robots** – used in factories
- **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 neuro-rehabilitation
 - **Assistive robots** – compensates for lost function
 - **Home servant** – assists with socialization and manipulation tasks such as grasping, feeding, cooking, activities of daily living
 - **Physical assistant** – provides walking assistance, prosthetics, exoskeletons (wearable devices)
 - **Personal mobility** – cars, wheelchairs, transfer devices

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 older adults in the course of their daily living.

Activities of daily living include: bathing & showering, dressing, food preparation & eating, mobility, personal hygiene & grooming, housework, taking medications, managing money, shopping, communicating, using technology, pet care, child rearing, engaging in religious observances, working, playing, vacationing, exercising, reading, relaxing, socializing, pursuing and education, etc



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 older adults, 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



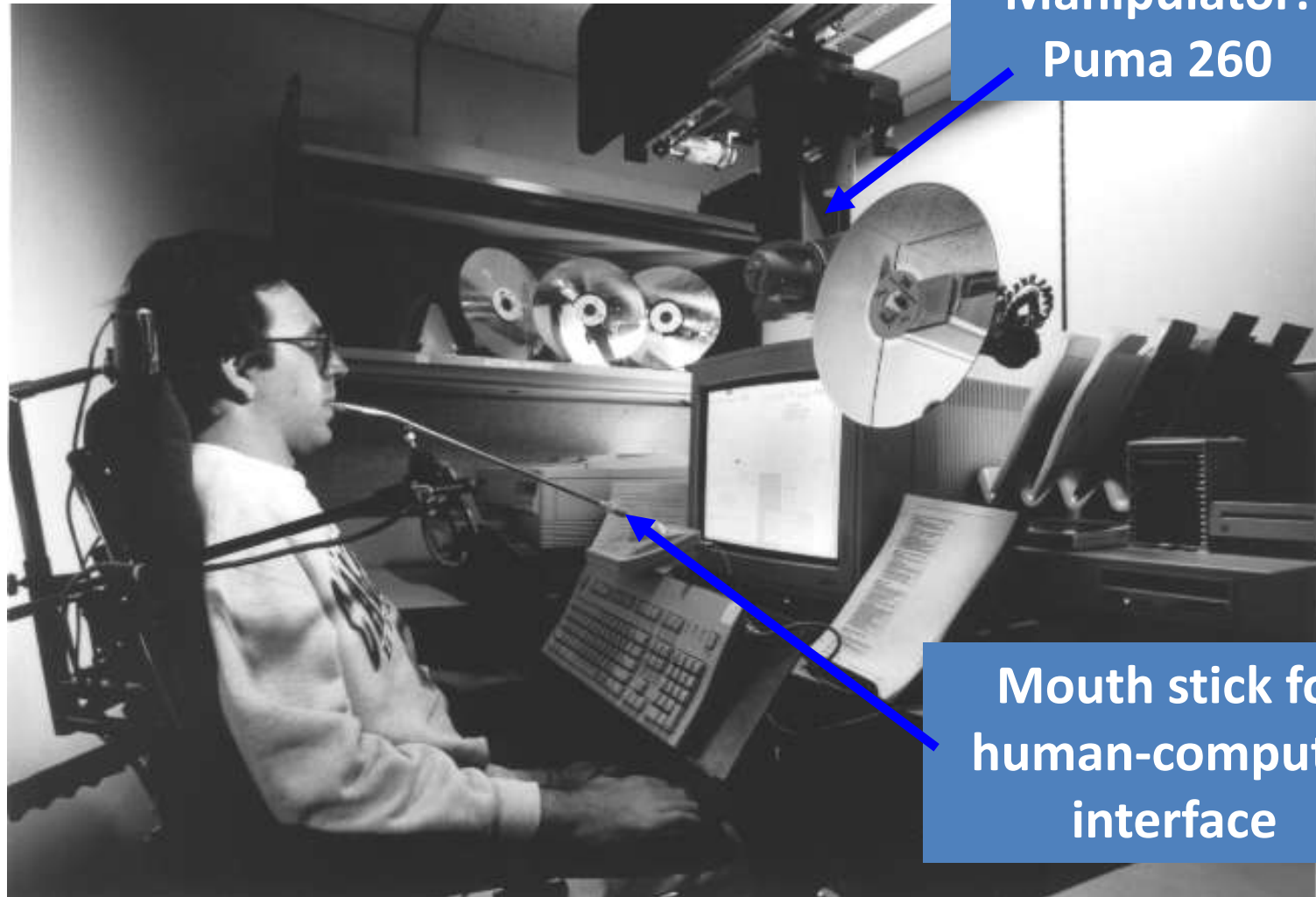
JHU / APL Robotic Workstation

VA / Stanford MoVar



DeVAR & ProVAR

Desktop Vocational Assistant Robot



**Manipulator:
Puma 260**

**Mouth stick for
human-computer
interface**

DeVAR & ProVAR

Desktop Vocational Assistant Robot



Robotic Arm Responds to Brain Waves



University of Toronto student Ryan Mintz and his team have created a robotic arm that responds to brain waves captured with their headset. [Link](#)

Jibo, “The World’s First Family Robot”



Jibo was designed to be an assistant, messenger, photographer, avatar, storyteller, and attentive companion that can help you live with greater independence and stay connected to those you love. [Link](#)

Hombot

Hombot is equipped with a camera for care workers to monitor residents, has smoke and gas detectors so it can warn about possible accidents and a receiver linked with sensors worn by residents that can issue a warning if the residents fall down.



A visitor watching an intelligent rehabilitation robot at the 9th China International Exhibition of Senior Care Rehabilitation Medicine and Health Care in Shanghai, May 26.

The use of robots is being considered for elderly care to cope with China's rapidly aging population and a shrinking workforce that includes care workers. [Link](#)

Luna



Luna is the first human size personal robot designed for everyday practical use. Luna can keep an eye out for older adults living on their own and help them to remain independent. [Link](#)

Robotic Drumming Prosthesis



This robotic drumming prosthesis has motors that power two drumsticks. One is controlled by muscle sensors, the other is autonomous. Jason Barnes can now flex his muscles to send signals to a computer, which tightens or loosens his drumstick. [Link](#)

ALIZ-E Nao Robot



A four-and-a-half year study shows social robots are helping children with diabetes accept their condition and be more confident about their futures. [Link](#)

Robots4Autism



Zeno R-25 is a revolutionary humanoid robot that engages children with autism faster than traditional therapy and intrinsically motivates them to learn. The goal is to augment traditional therapy by improving a child's ability to use social behaviors in natural contexts now and into adulthood. [Link](#)

Kaspar, the social robot



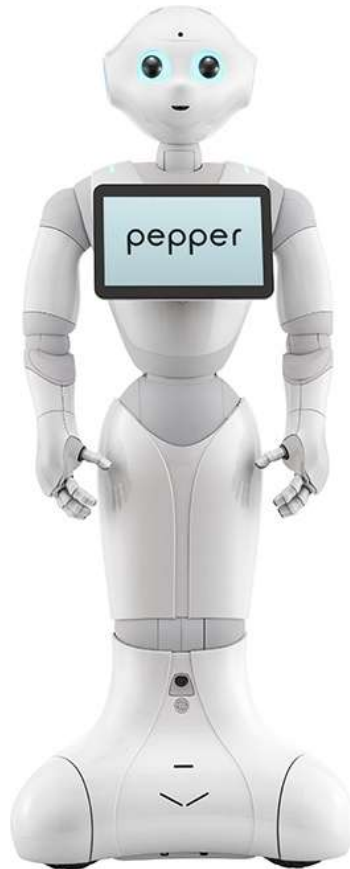
KASPAR is a child-sized humanoid robot designed to help teachers and parents support children with autism. [Link](#)

Panasonic Manufactures Robot for Eldercare



Panasonic has developed a nursing-care robot that helps the elderly walk or get out of bed. [Link](#)

Pepper



Japanese mobile carrier SoftBank recently introduced a robot named Pepper. The cooing, gesturing, laser-guided robot moves around freely on wheels much like other robots. However, the voice-enabled robot can react to heartfelt emotions as well. [Link](#)

Autonomous, Self-Steering Robot Cane



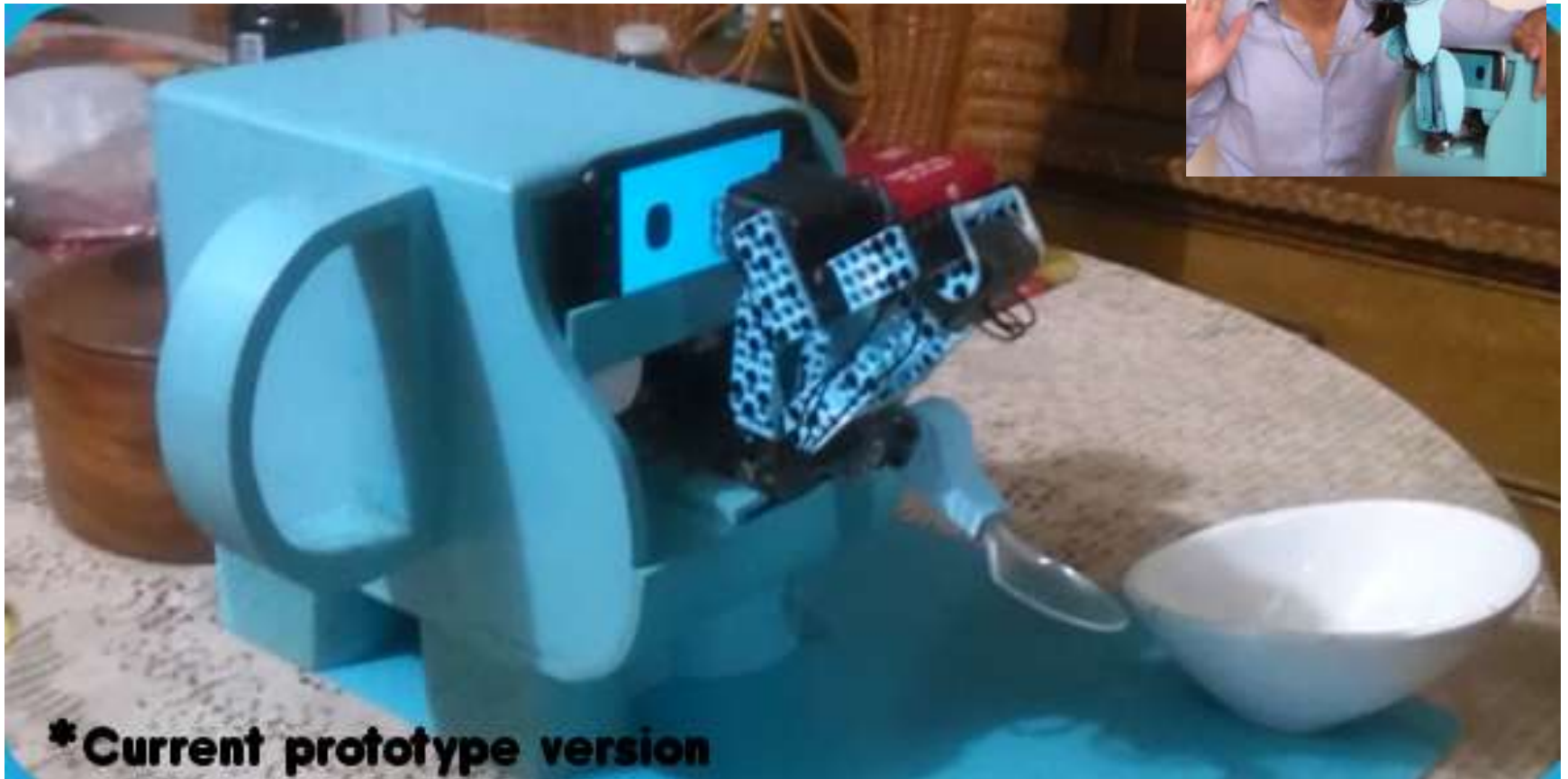
A co-robotic cane developed at the University of Arkansas at Little Rock promises to make life easier for blind people to navigate. The cameras detect obstacles in the user's path and provide audio feedback to facilitate safe travel. In addition, the cane provides guidance via a rolling tip that points in the proper direction. [Link](#)

Soft Robot



This Carnegie Mellon project adapted robotic technology to meet the needs of older adults and people with disabilities, such as washing and feeding. [Link](#)

HelloSpoon



***Current prototype version**

HelloSpoon is an assistive device technology developed for those who are unable to feed themselves. [Link](#)

Here's That Extra Pair of Robot Arms You've Always Wanted



Supernumerary Robotic Limbs (SRLs) are robotic limbs that, when worn, give you more limbs than you'd normally have. [Link](#)

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Supernumerary Robotic Fingers



This MIT project added two large fingers to a glove. It lets users do things like hold an object with a couple of fingers while using the others to perform another job such as adding salt to a cup of liquid or opening the top of a jar. [Link](#)

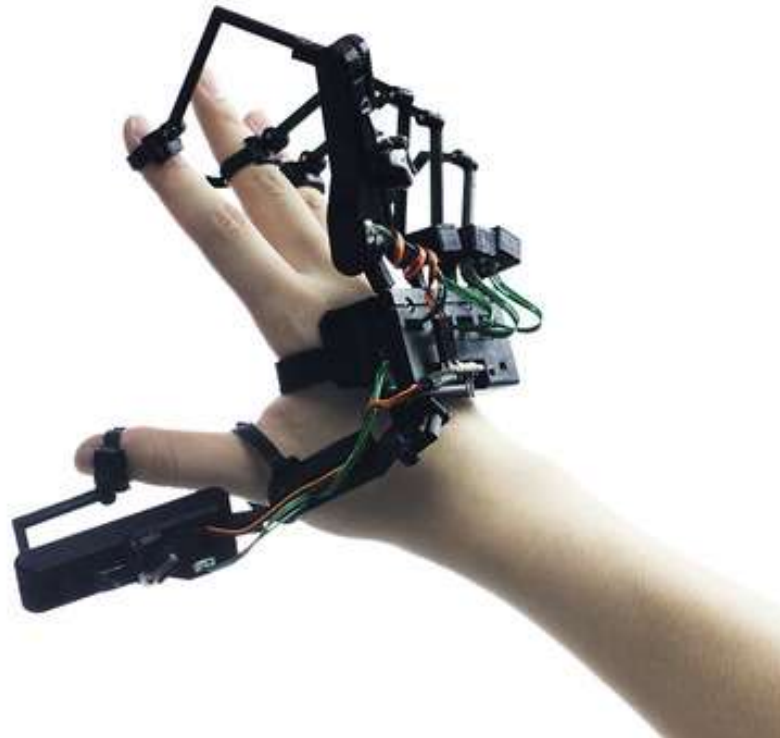
RoboGlove



RoboGlove is essentially a wearable exoskeleton gripping tool. It addresses repetitive stress syndrome by reducing the amount of stress involved in an action or process.

[Link](#)

DexmoF2



China's Dexta Robotics has created an exoskeleton for hands to allow gamers to touch the digital world. The Dexmo is a mechanical exoskeleton system that features force feedback, rotational sensors, and injection molded parts. Applications include medical rehabilitation. [Link](#)

Project Daniel



Not Impossible Labs used a 3D printer to create custom prosthetics for people like Daniel. The results may be crude compared to commercial solutions, but the cost is considerably lower, making it practical for third-world countries. [Link](#)

NASA Exoskeleton



The X1 is essentially a robot that detects the user's movements and augments them.

[Link](#)

Honda Walking Assist Device



A variation of Honda's Walking Assist Device is being used in hospitals to assist in rehabilitation - is intended to help patients re-learn how to walk. [Link](#)

Honda Walking Assist Device with Bodyweight Support



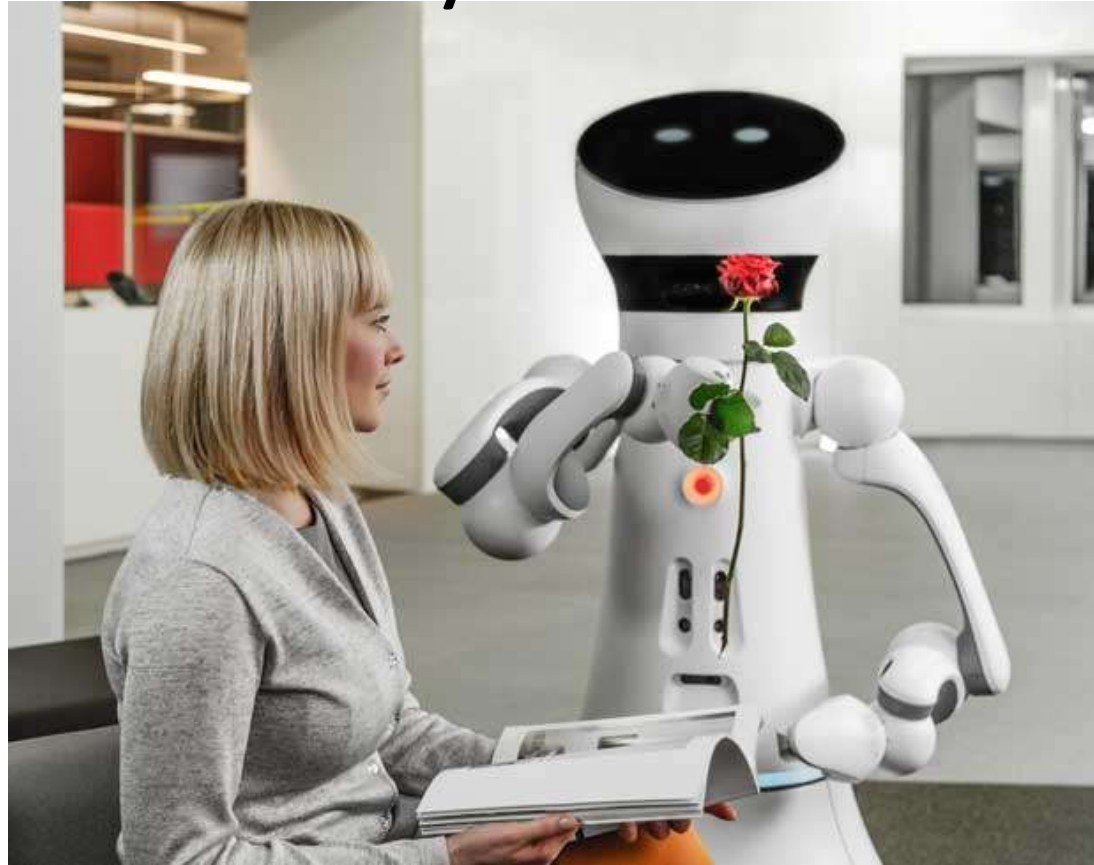
The legs support your body when you crouch and give little tugs on your feet when you walk, making bipedal mobility less of a strain. [Link](#)

Honda U3-X



Marketed as a mobility device, the U3-X lets you hop on and zip around a room simply by shifting your body weight. The more you lean, the faster you go. [Link](#)

Robot Servant We All Want but Probably Can't Afford



After two decades of refinement, the Care-O-bot 4 robot is constructed out of five modules: base, torso, arms, sensor ring, and head. Each one of these modules can be swapped out depending on what you want the robot to do (and what your budget is).

[Link](#)

Personal Assistant for Limbless Teenager



Roboticians created a personal assistant to help Joanne O'Riordan, born without limbs, pick up small everyday items. [Link](#)

Budgee Personal Shopping Robot



Budgee, the robot assistant, can carry 50 pounds and run up to 10 hours on a charge, and it has sensors on the front and side to avoid obstacles. [Link](#)

Mobiserv



Mobiserv developed a social companion robot – an autonomous robot, containing processing power, data storage capability, various sensors, machine learning / experience gathering / adaptation, a touch screen, speech synthesis, and speech recognition. [Link](#)

Keithbot



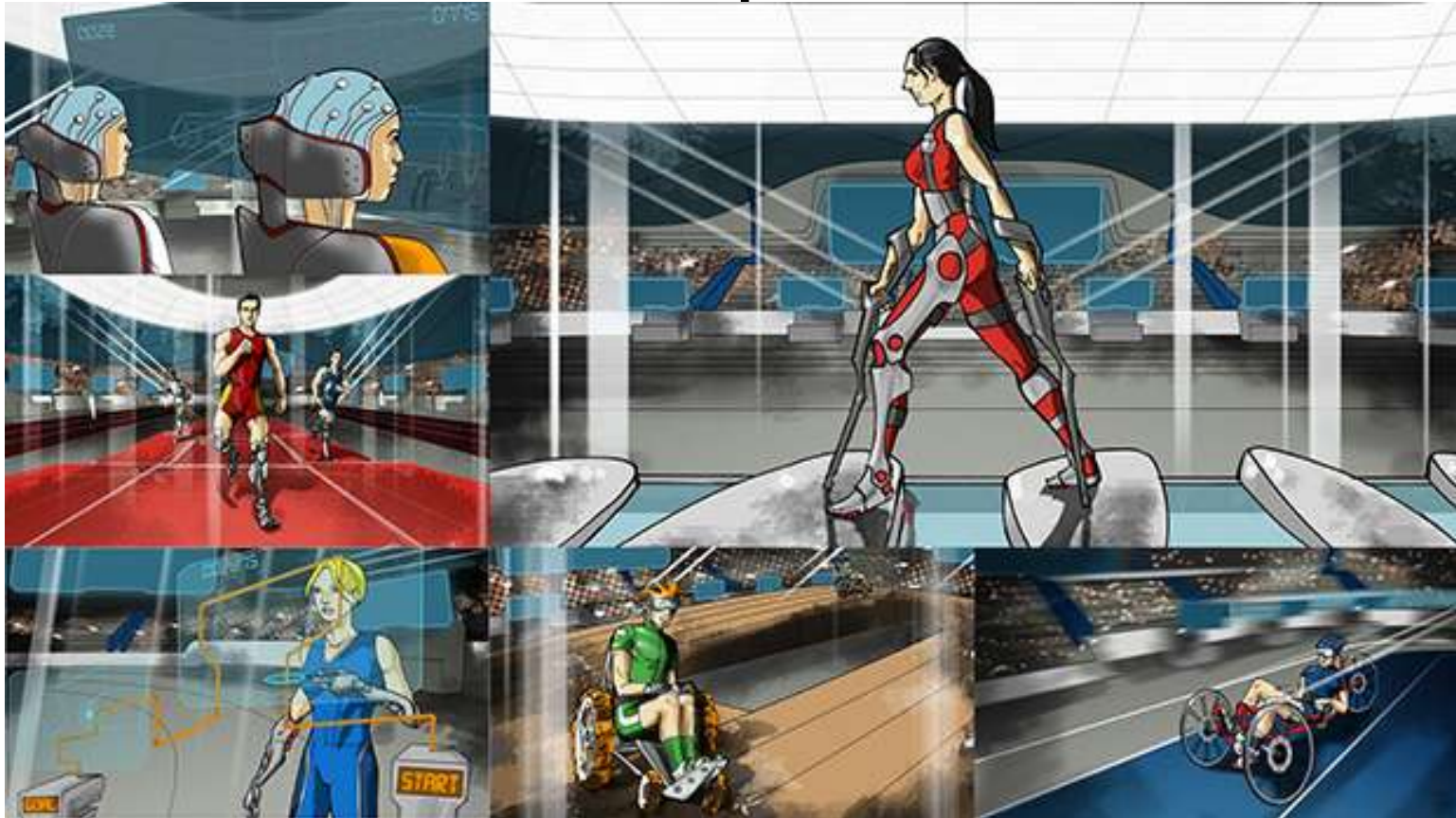
An injury that left one Kennard student unable to walk, isn't keeping him out of the classroom. 15-year-old Keith Griffin was hurt at basketball game, but with the help of a robot, he won't miss any time in school. [Link](#)

Exoskeleton Lets Paralyzed Veteran Walk Again



Army Sgt. Dan Rose is the second paralyzed US military veteran to own a motorized exoskeleton from Ekso Bionics. [Link](#)

“Cybathlon” Invites Parathletes to Compete



Cybathlon 2016 is a championship for robot-assisted parathletes, and it sounds awesome. If some part of your body is assisted or moved by external power—for example, a robotic prosthetic or an exoskeleton - you can compete. [Link](#)

Summary

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

Time for Questions?



End the Class

