

January 30, 2025

The Design and Control of Exoskeletons for Rehabilitation



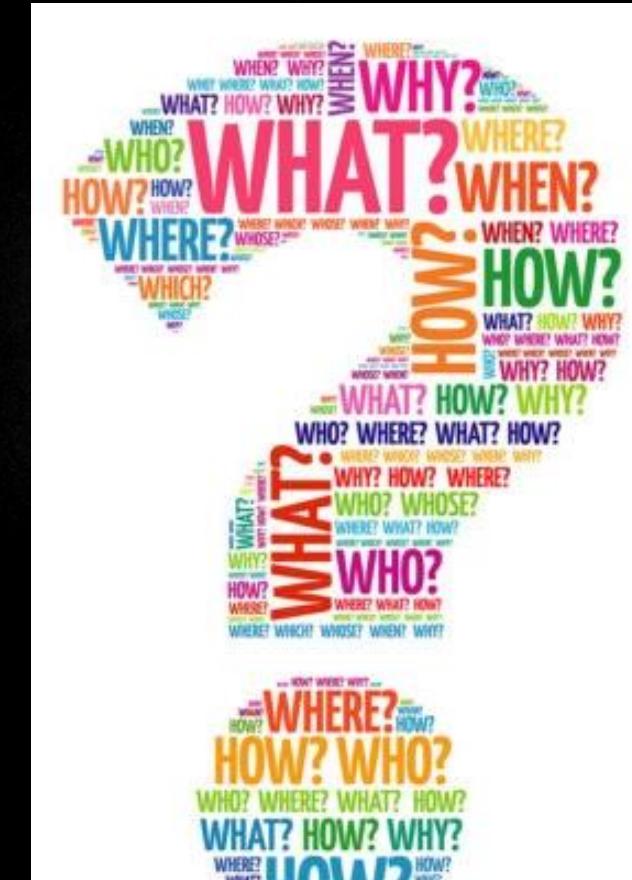
ENGR110/210

Perspectives in Assistive Technology



Katherine Strausser, PhD
Ekso Bionics
Technical Lead, Exoskeletons

Questions, Comments, Suggestions, or Concerns?



Asking a question is not a sign of weakness

Celebrities / Famous People



- Lady Gaga
- Pope Francis
- Donald Trump
- Bill Clinton
- Kobe Bryant
- Emmitt Smith
- Britany Spears
- Simone Biles
- Ted Kennedy
- Alan Cranston
- S I Hayakawa
- Ray Kurzweil
- Neil Young & Pegi Young
- Bob Weir (Grateful Dead)
- Mel Torme
- Joe Simitian

Missed Lectures - Emailed Instructions



- ▶ Make up missed class sessions promptly by reviewing class session webpage (slides and links), viewing camcorder video on YouTube, and meeting with me.



Upcoming class sessions



- ▶ Thoughts on Assistive Robotics –
Steve B. Cousins, PhD - Tue, Feb 4th
- ▶ Assistive Robotics –
Monroe Kennedy III, PhD - Thu, Feb 6th
- ▶ Field Trip to the Magical Bridge Playground –
Olenka S. Villarreal – Tue, Feb 11th
- ▶ Mid-term Student Project Presentations –
9 Teams – Thu, Feb 13th



Teams



- ▶ **First Team with No Name** - Universal Water Bottle & Phone Holder
- ▶ Radiant Rollers - Enhanced Visibility
- ▶ Paw Patrol - Laptray Artwork Easel
- ▶ IP68 - Rain Shield
- ▶ Simple Stash - Laptop Storage
- ▶ Water Wizards - Water Bottle Opener
- ▶ **Sixth Team with No Name** - Accessible and Inclusive Playground
- ▶ **Seventh Team with No Name** - Accessible and Inclusive Playground
- ▶ Scoop Squad - Poop Management

Team Activities



- ▶ Work as a team together on all activities
- ▶ Understand the Problem / Challenge - search web for existing products
- ▶ Brainstorm possible solutions
- ▶ Evaluate design concepts with Pugh Chart
- ▶ Sketch ideas & **fabricate low-cost prototypes**
- ▶ **Discuss & demonstrate concepts & prototypes with the project suggestor**
- ▶ **Receive and analyze their feedback and suggestions**
- ▶ Redesign and fabricate a refined prototype
- ▶ Iterate this process until the end of the quarter
- ▶ Take photos of team activities
- ▶ Report your project progress as a team
- ▶ Meet with me, Mathilda, Lance

Students working on Team Projects



- ▶ Decide on a cool team name
- ▶ Start preparing for Mid-Term Presentation and Report
- ▶ Weekly - Meet with me, Mathilda, Lance report on project progress
- ▶ Submit progress reports
- ▶ Read Week in Review emailings
- ▶ **Do not hesitate to ask questions about your project direction**



Students working on Team Projects



- ▶ Connect with project partner
- ▶ “Understand the Problem”
- ▶ Brainstorming
- ▶ Select Design Concept(s)
- ▶ Sketches, low resolution prototypes
- ▶ Prepare for **Mid-Term Presentation** and **Report**
- ▶ Contact me if you have questions about your project direction
- ▶ Weekly - Meet with me to report on project progress or email update
- ▶ **Team budget = \$200**
- ▶ Submit progress reports



Reminder - Work with Diligence



- ▶ Time is your team's most precious resource
- ▶ **14 days** until Mid-term Presentations - Thu, Feb 13th
- ▶ It is not too early to outline your presentation & report



Steve Jobs' Quote

- ▶ "Things don't have to change the world to be important."



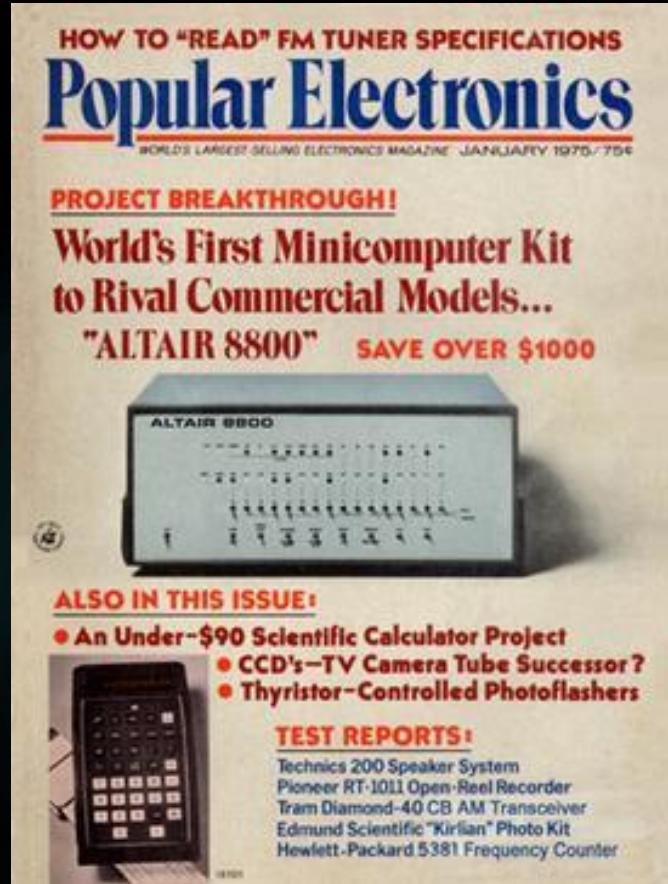
Stephen Hawking's AAC



- ▶ Assistive Context-Aware Toolkit
- ▶ Scanning on-screen keyboard
- ▶ Cheek muscle sensor and blink sensor on glasses
- ▶ Thumb switch
- ▶ Predictive text
- ▶ Speech synthesizer



Vintage Computer Technology - Altair 8800



50 years ago!

Vintage Computer Technology - IBM PC



Vintage Computer Technology - Apple][



What kind of man owns his own computer?

It's a wise man who owns an Apple.

Apple, the computer worth not waiting for.

on your desk — is a computer that answers only to you... Apple Computer. It's less expensive than timesharing. More dependable than distributed processing. Far more flexible than centralized EDP. And, at less than \$2500 (as shown), downright affordable.

Visit your local computer store.

Apple Computer, Inc.

10260 Bandley Drive, Cupertino, CA 95014

apple computer

What kind of man owns his own computer?

Ben Franklin

Vintage Computer Technology - Mac

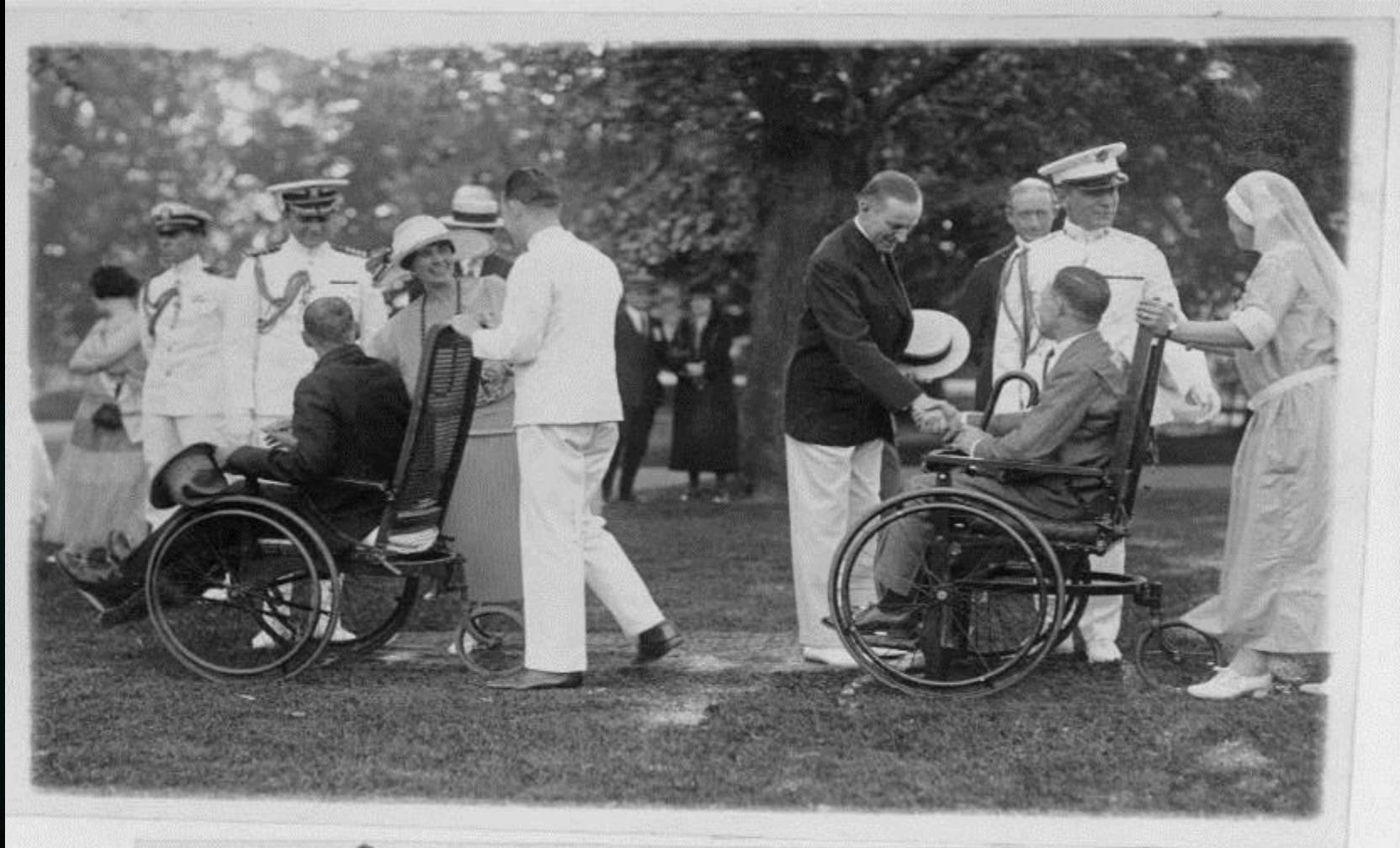


Vintage Assistive Technology

Old Wheelchair Designs



Old Wheelchair Designs



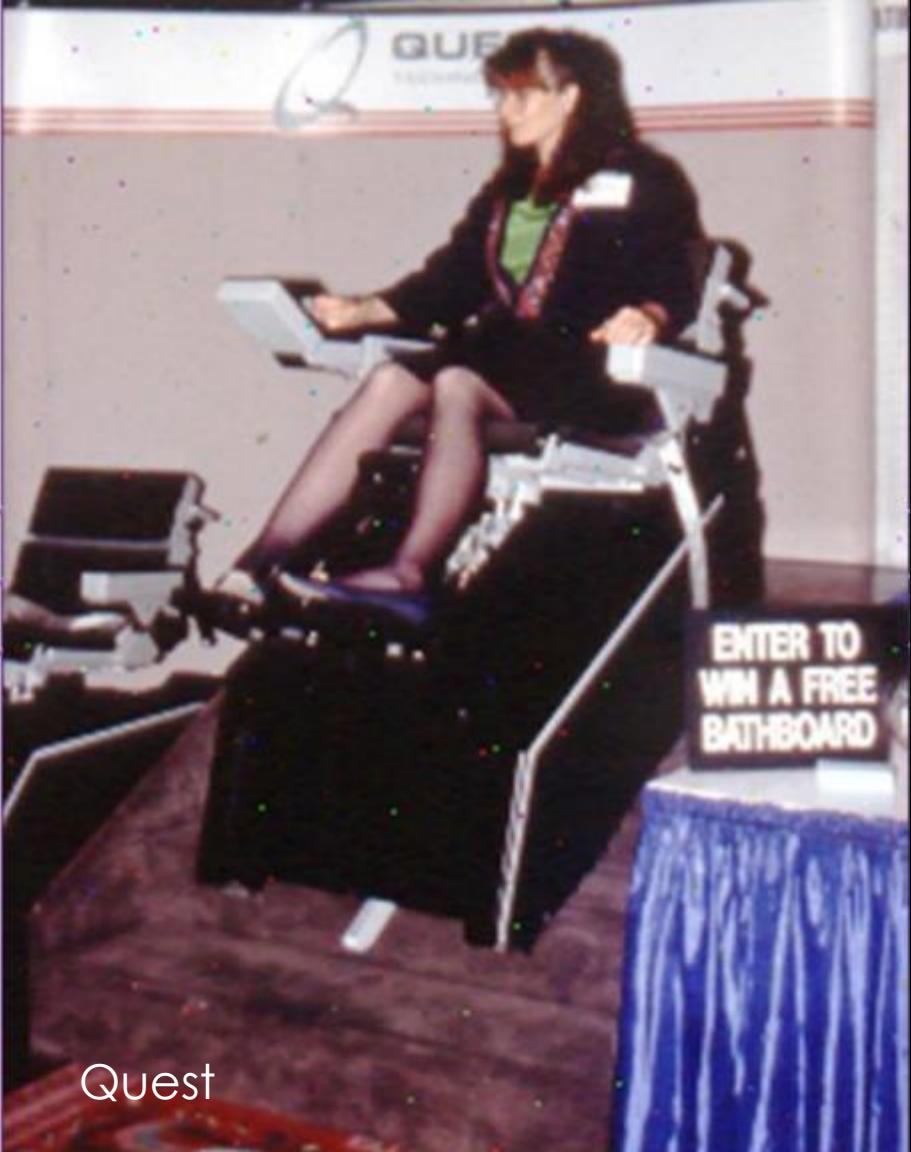
Garden party for Wounded men at the
White House 6/5/24 30963



Old Wheelchair Designs



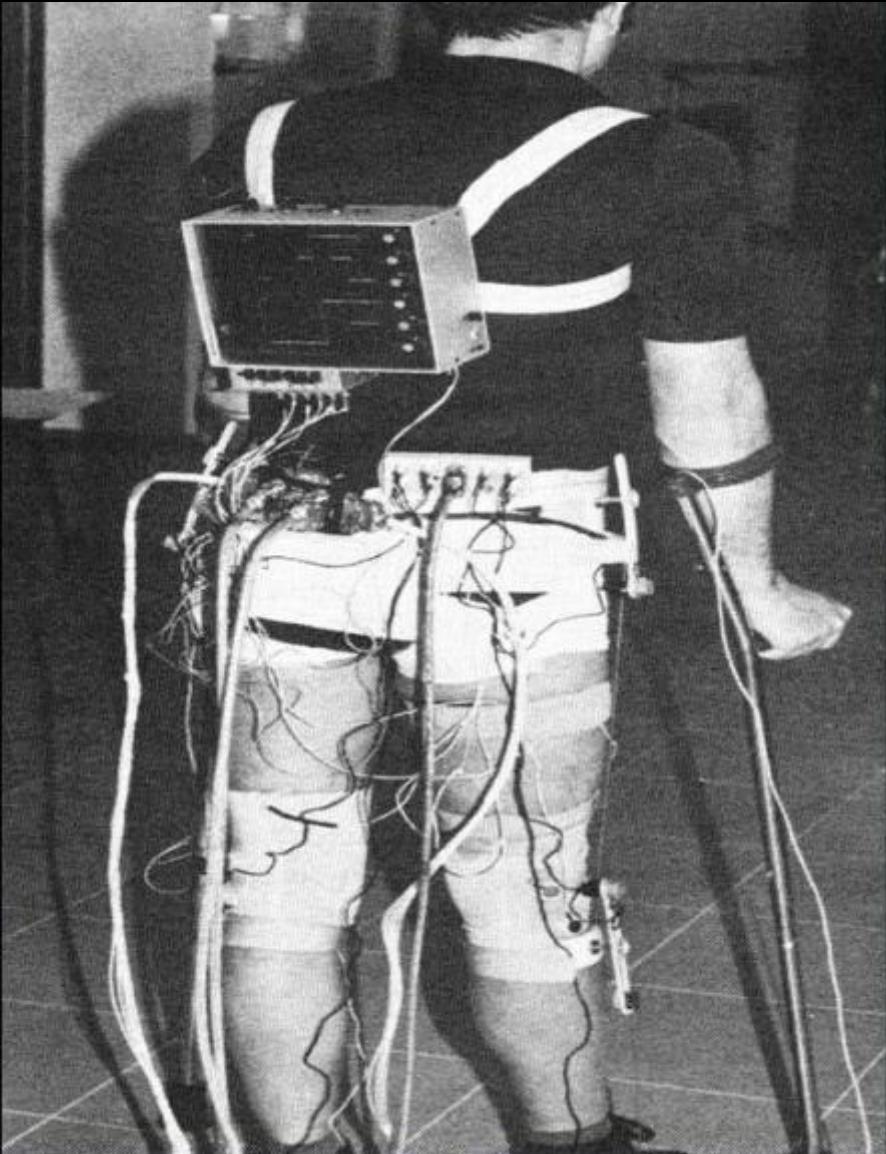
Old Wheelchair Designs



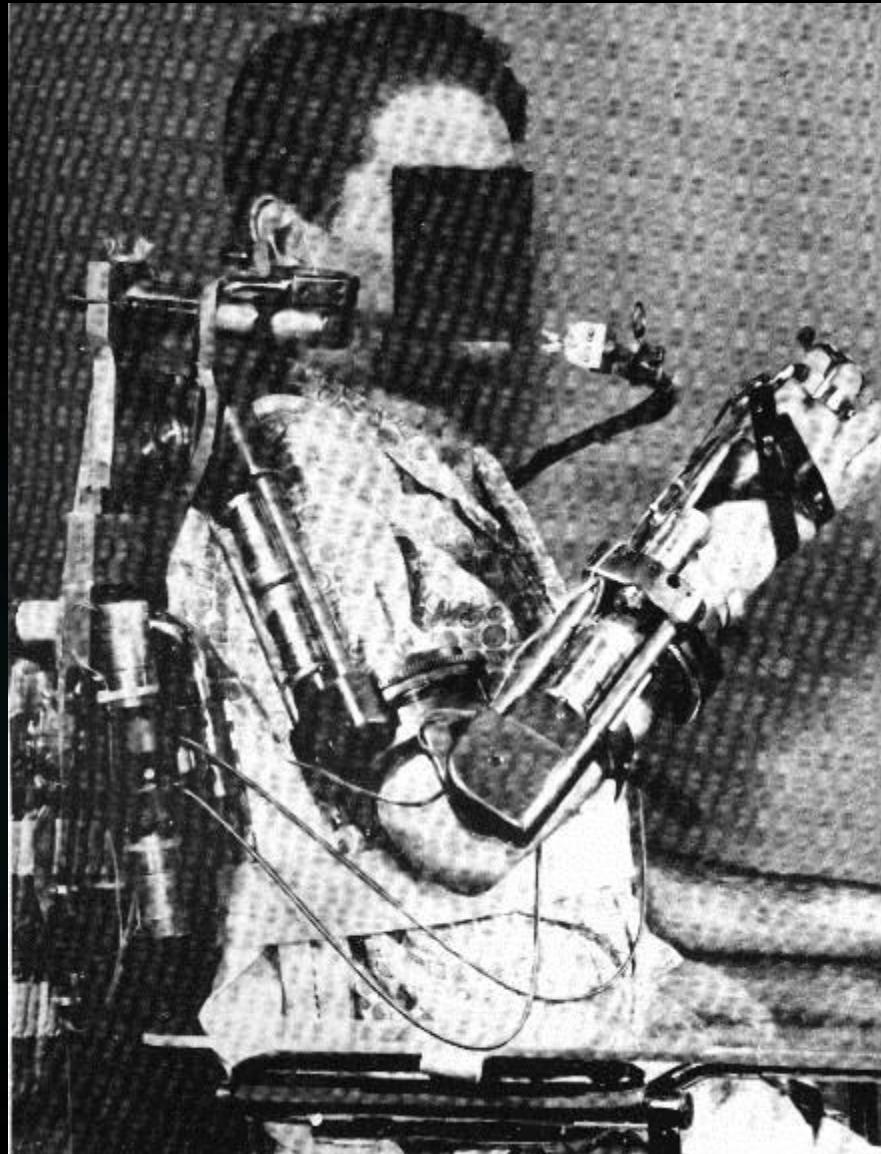
Omni-directional Wheelchairs



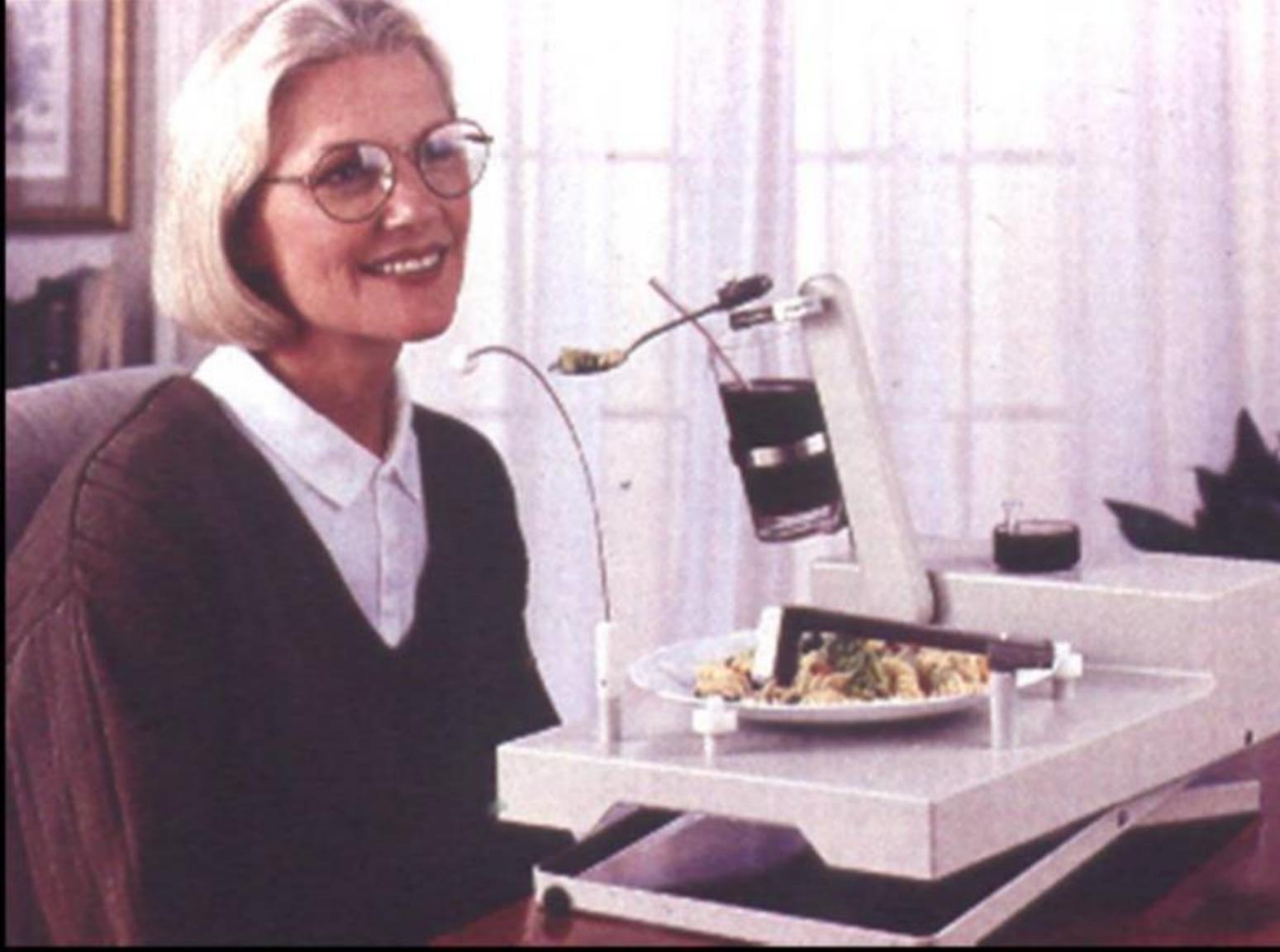
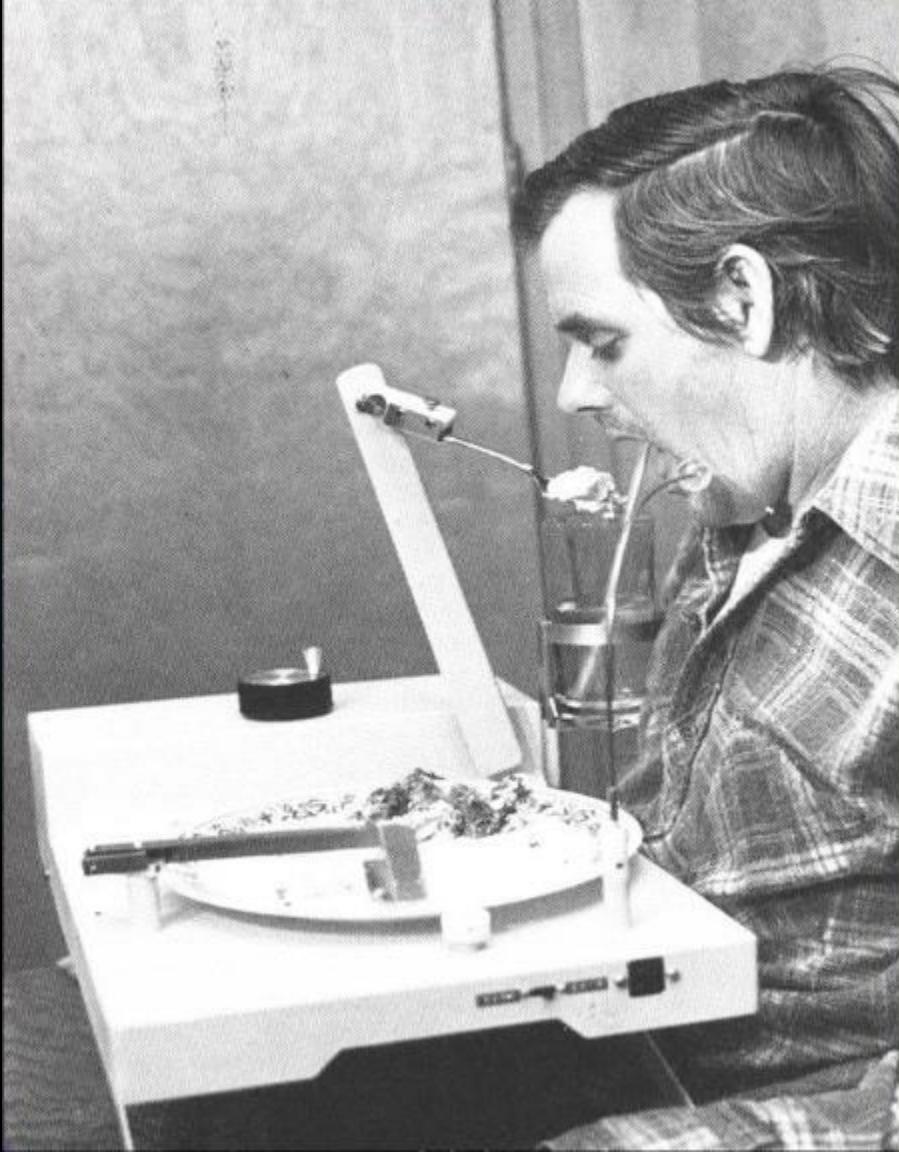
FES Walking



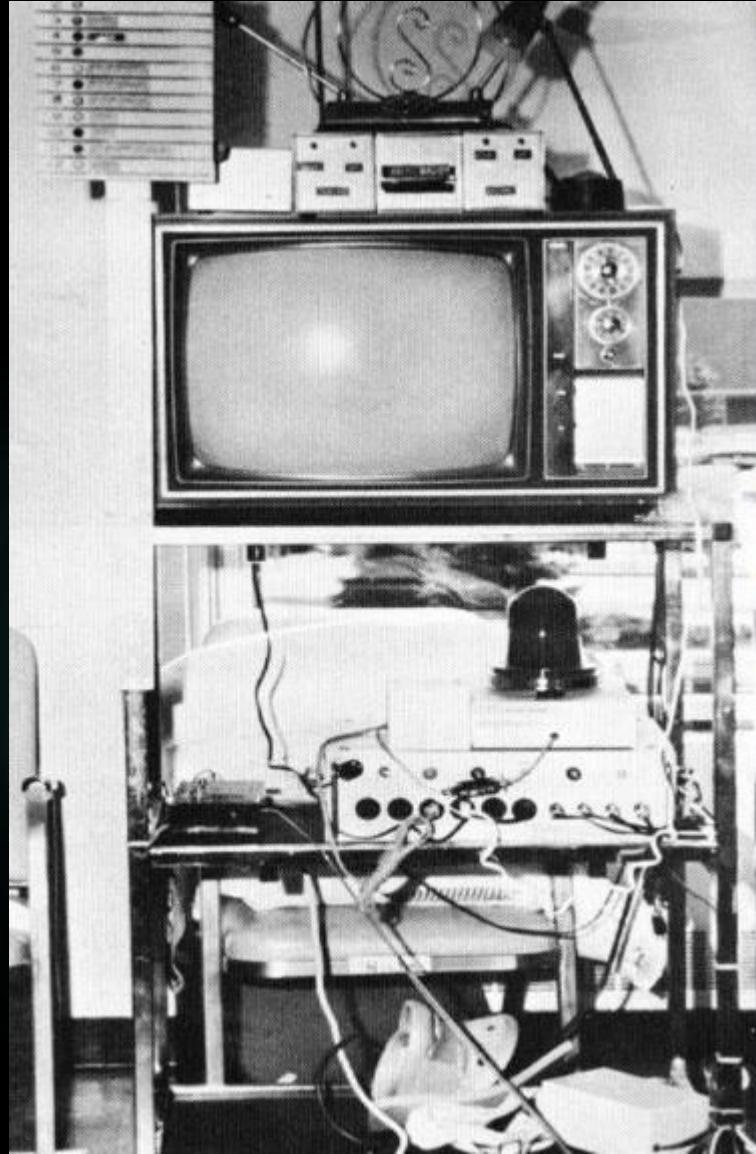
Chin Controlled Arm Exoskeleton



Robotic Feeding Aids



Early Environmental Control Systems



"Butler in a Box"

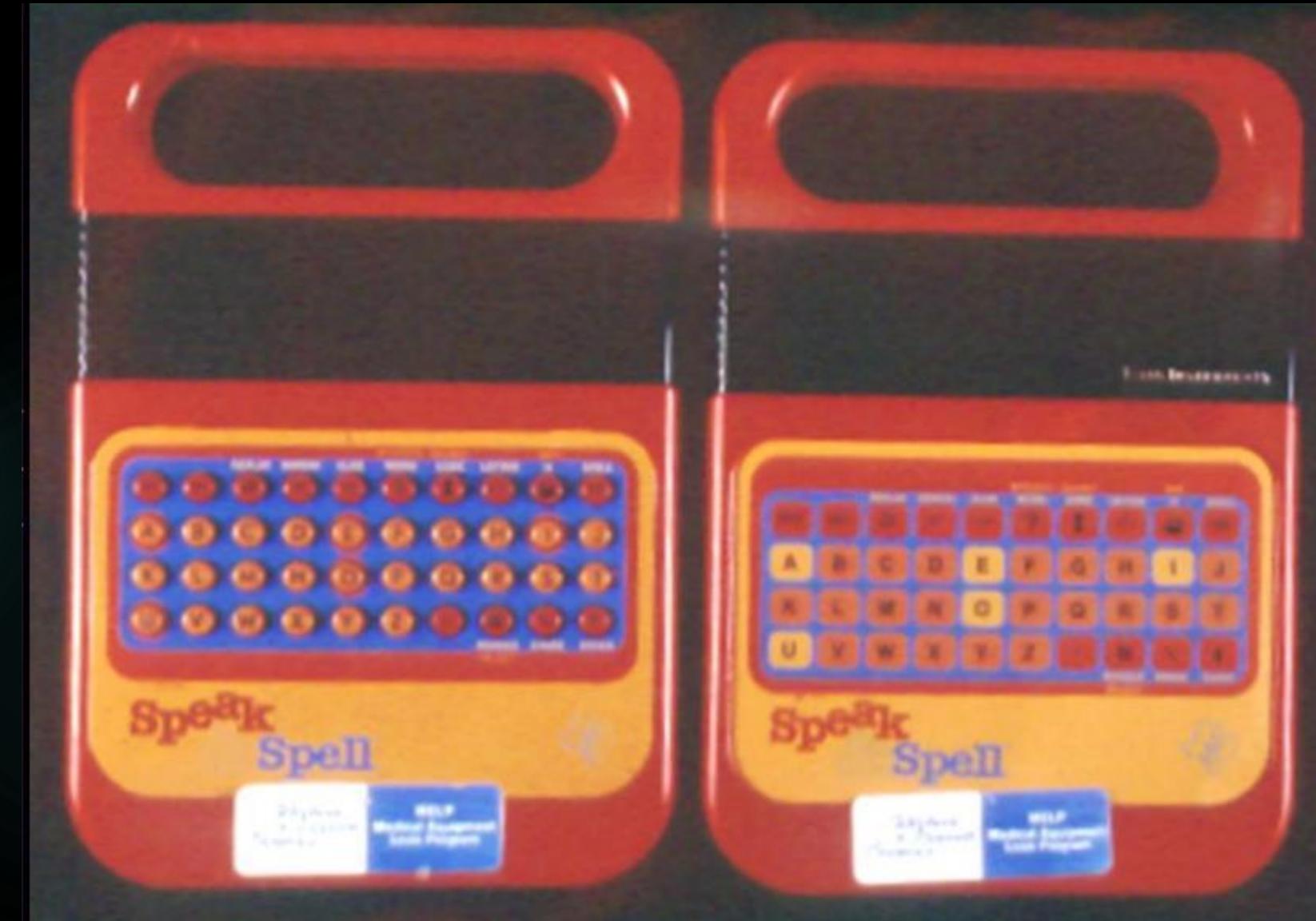
Eye Gaze Control



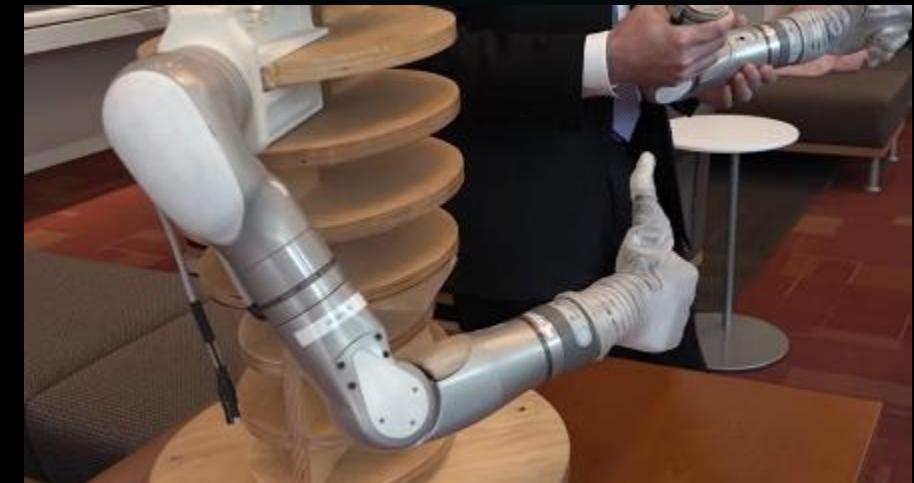
Augmented Communication System



Augmented Communication System



Artificial Arm from 1560 - 1600



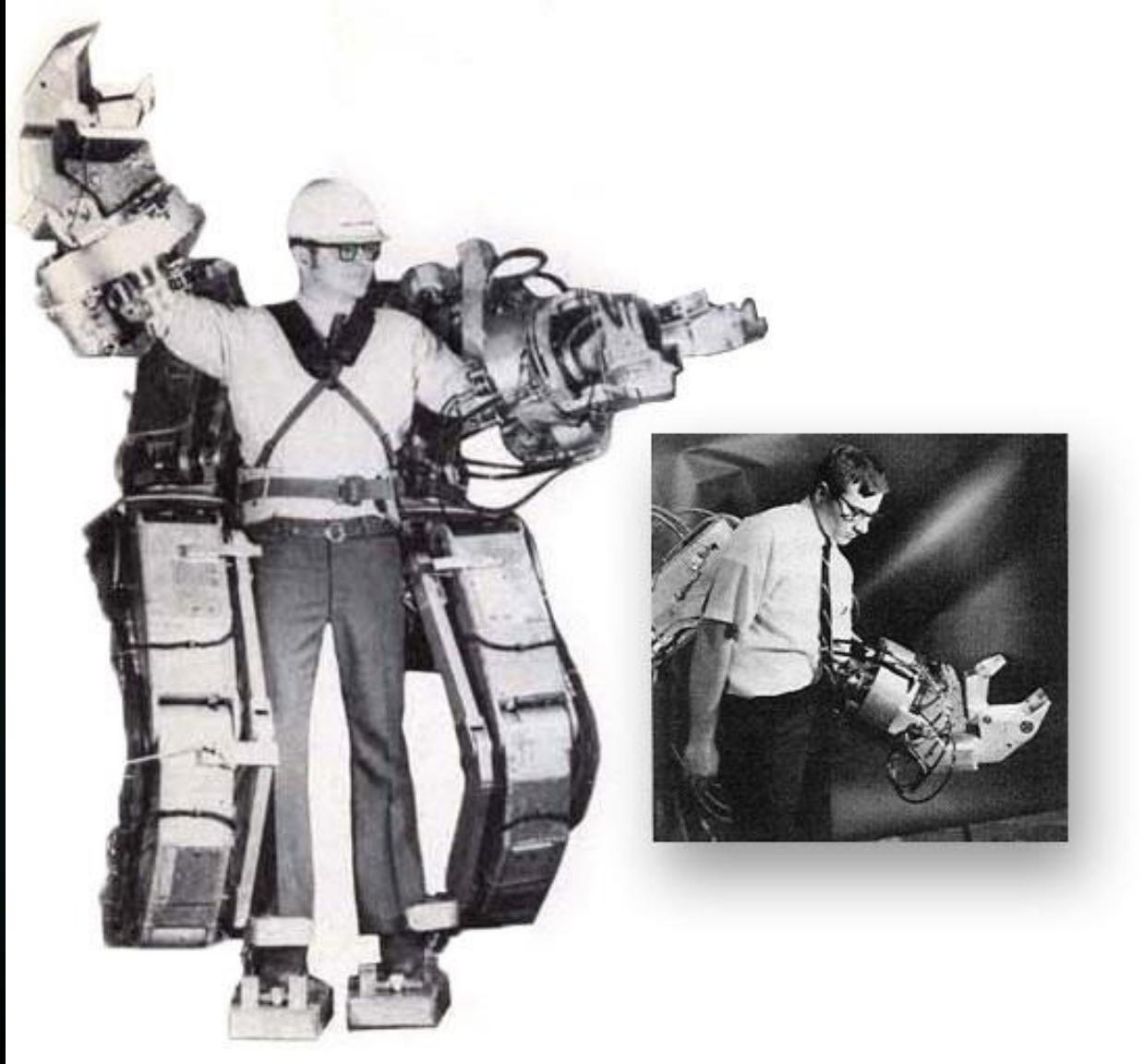
Peg Leg Bates



Wooden Prosthetic Legs



Hardiman Prototype - 1950s



Student Exoskeleton Arms



Ultimate Exoskeleton



Ultimate Hand Orthotic



Space,
Time,
Reality,
Mind,
Soul,
and
Power.



Thanos' Infinity Gauntlet



Steampunk Professor Xavier Wheelchair Project



[Video](#)

Steam Punk Professor Xavier's Wheelchair
By: Daniel Valdez
<http://www.smeeon.com/>

Orange County Chopper



- ▶ Christopher & Dana Reeve Foundation
- ▶ [Video](#)



Tuesday, February 4th



Thoughts on Assistive Robotics

Steve B. Cousins, PhD

Executive Director of The Stanford Robotics Center

Today



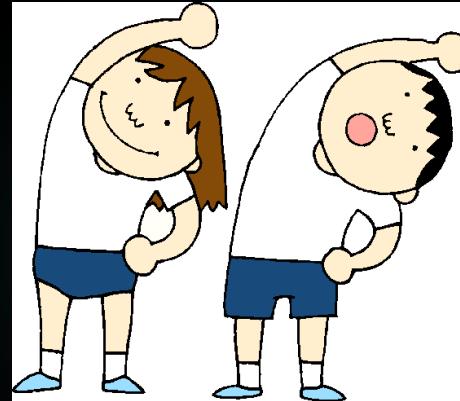
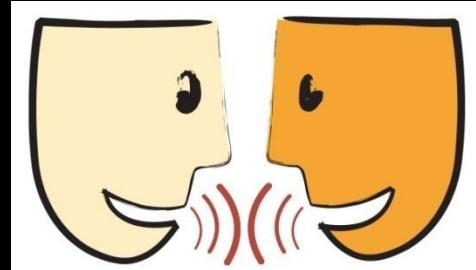
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Ekso Bionics – Technical Lead, Exoskeletons



Break Activities

- ▶ Attendance sheet
- ▶ Stand up and stretch
- ▶ Take a bio-break
- ▶ Text message
- ▶ Web-surf
- ▶ Respond to email
- ▶ Talk with classmates
- ▶ Reflect on what was presented in class



Short Break

