January 29, 2026

Recent Advances in Intracortical Brain-Computer Interfaces

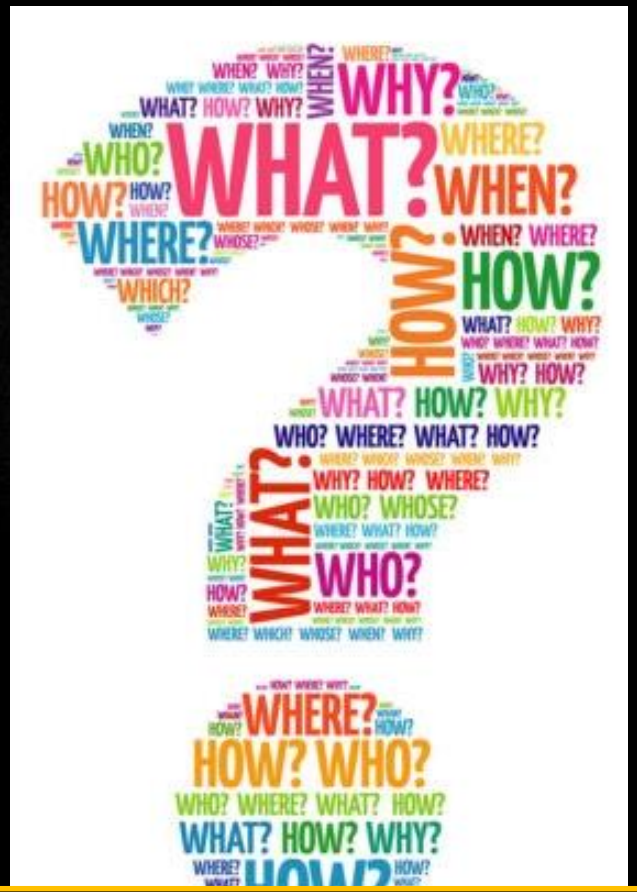
ENGR110/210
Perspectives in Assistive Technology



Frank Robert Willett
Stanford University
Neural Prosthetics Translational Laboratory

Questions, Comments, Suggestions, or Concerns?



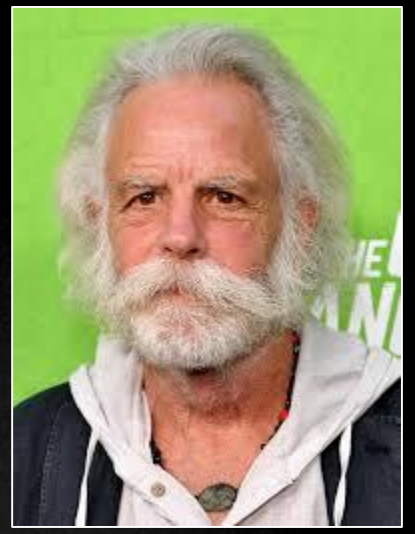


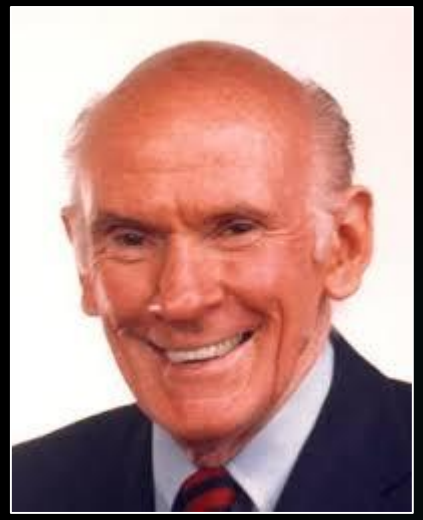


Asking a question is not a sign of weakness

Celebrities / Famous People I've Met

- Ted Kennedy
- Alan Cranston
- S I Hayakawa
- Ray Kurzweil
- Neil Young & Pegi Young
- Bob Weir (Grateful Dead)
- Mel Torme (Velvet Fog)
- Joe Simitian
- Muhammad Ali











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 3rd
- Assistive Robotics –
  Monroe Kennedy III, PhD - Thu, Feb 5th
- Mid-term Student Project Presentations –
  7 Teams - Thu, Feb 10th
- Field Trip to the Magical Bridge Playground –
  Olenka S. Villarreal - Thu, Feb 12th





Teams



- **K9 Consortium** - Treats for Nathan
- Second Team with No Name - Laptray Artwork Easel
- Third Team with No Name - Obstacle Detector 1
- Fourth Team with No Name - MBP Attractions 1
- Fifth Team with No Name - Obstacle Detector 2
- Sixth Team with No Name - Footshell Project
- Seventh Team with No Name - MBP Attractions 2

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 or Tori

Students working on Team Projects

- Decide on a cool team name
- Start preparing for Mid-Term Presentation and Report
- Weekly - Meet with me or Tori to 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

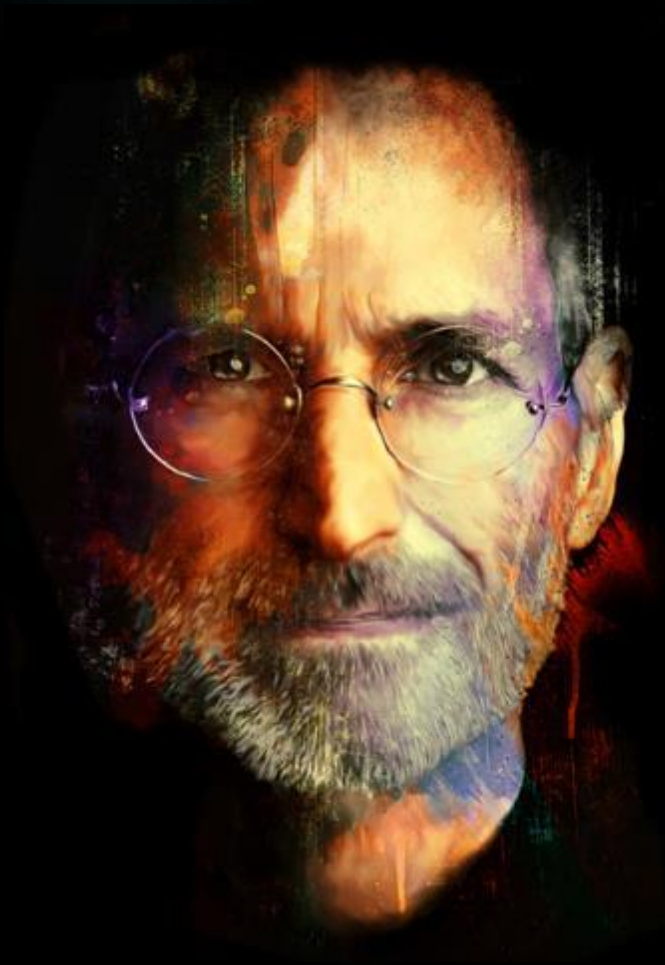
- Time is your team's most precious resource
- **12 days** until Mid-term Presentations - Tue, Feb 10th
- It is not too early to outline your presentation & report





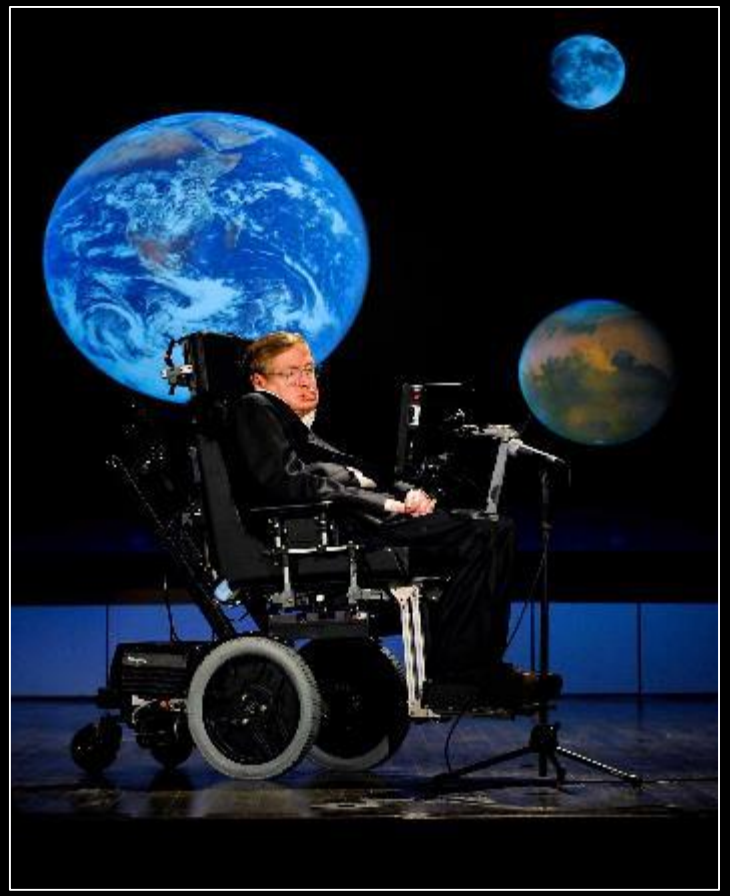
Steve Jobs' Quote

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

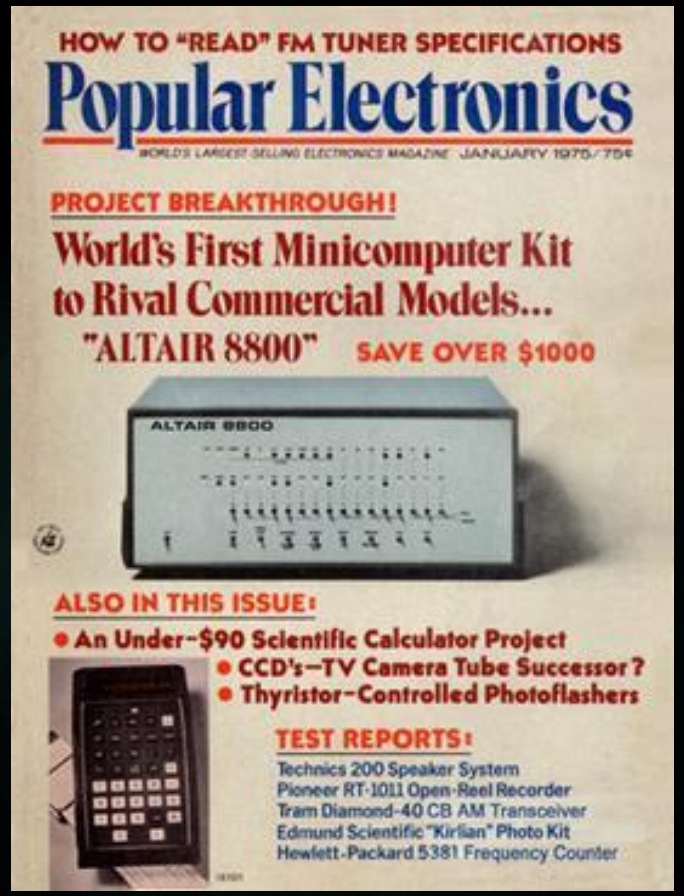


Stephen Hawking's AAC

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



Vintage Computer Technology - Altair 8800



51 years ago!



Vintage Computer Technology - IBM PC



Vintage Computer Technology - Apple][



What kind of man owns his own computer?

Ben Franklin

Vintage Computer Technology - Mac



Vintage Assistive Technology
Old Wheelchair Designs



Old Wheelchair Designs

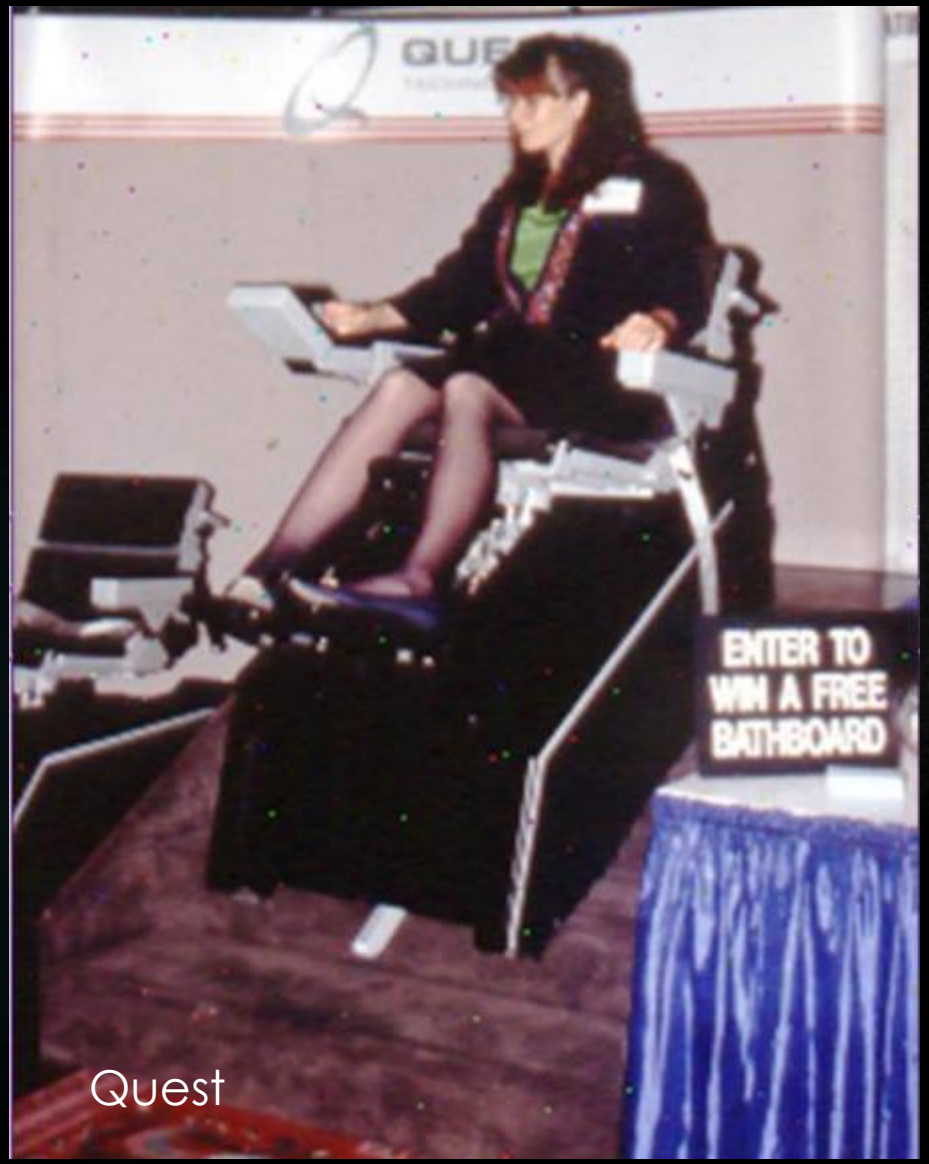


Old Wheelchair Designs





Old Wheelchair Designs

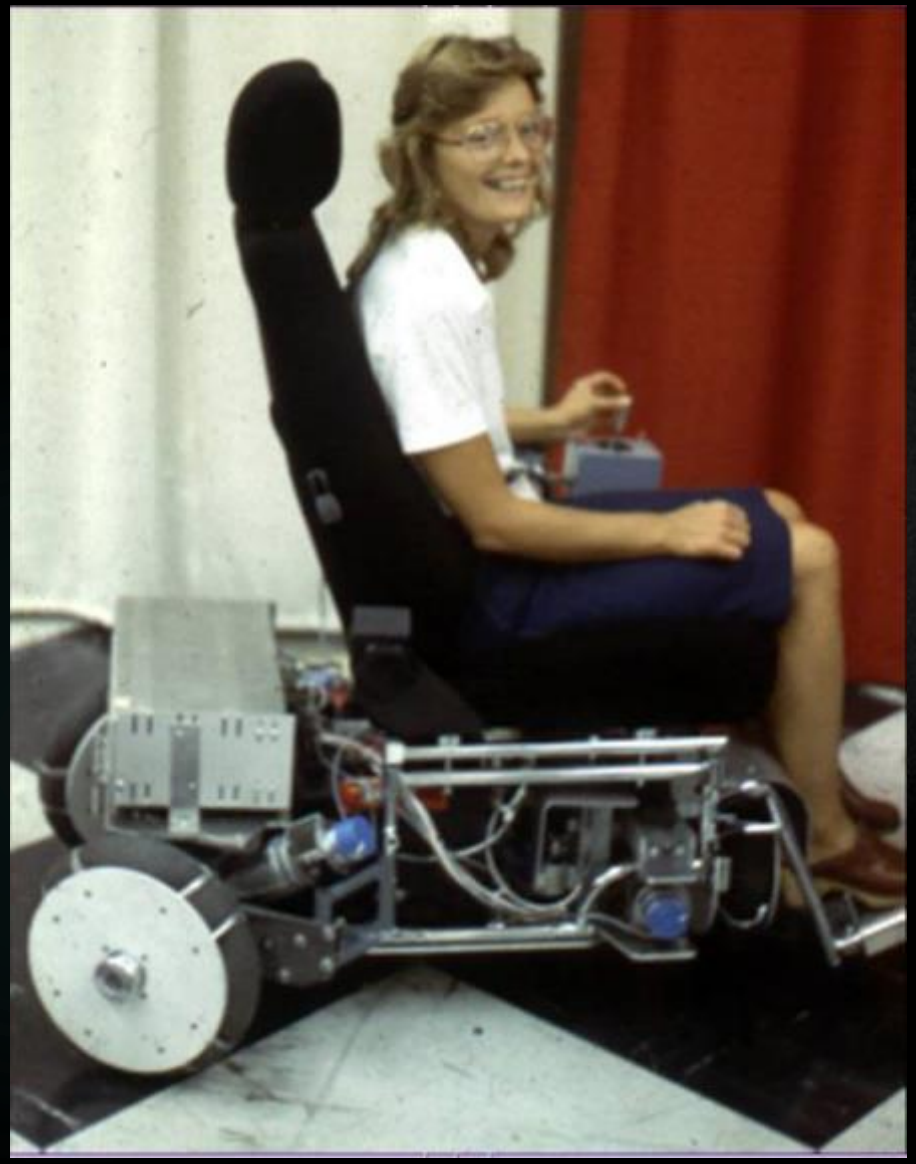


Quest



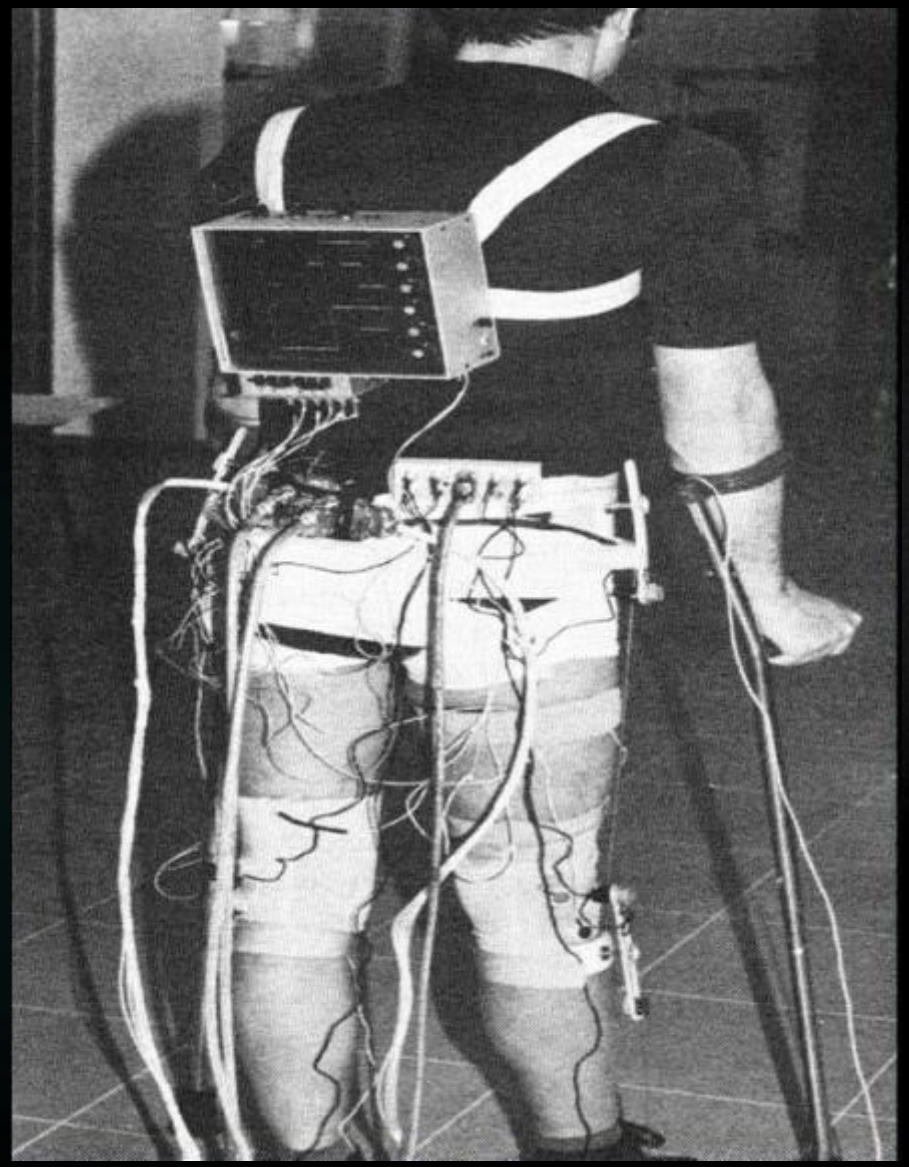
iBOT

Omni-directional Wheelchairs



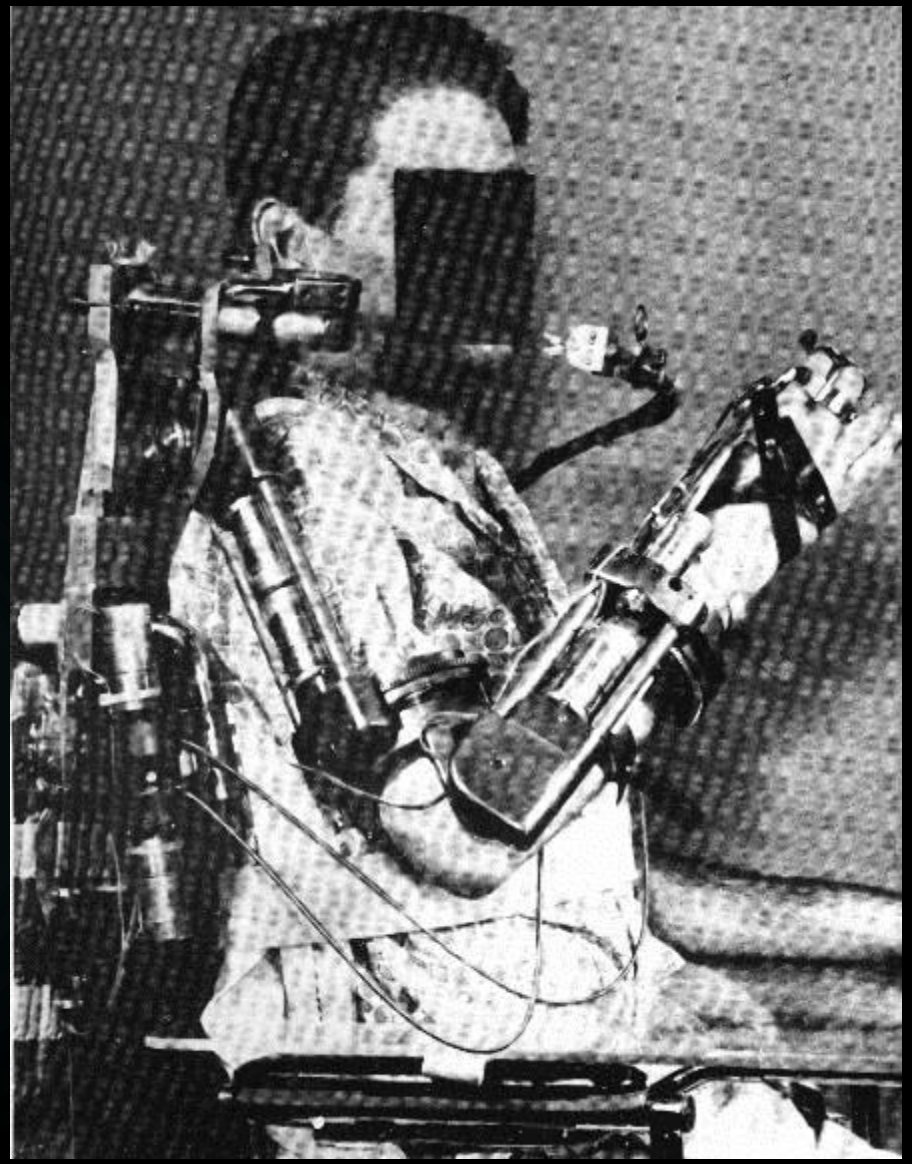


FES Walking

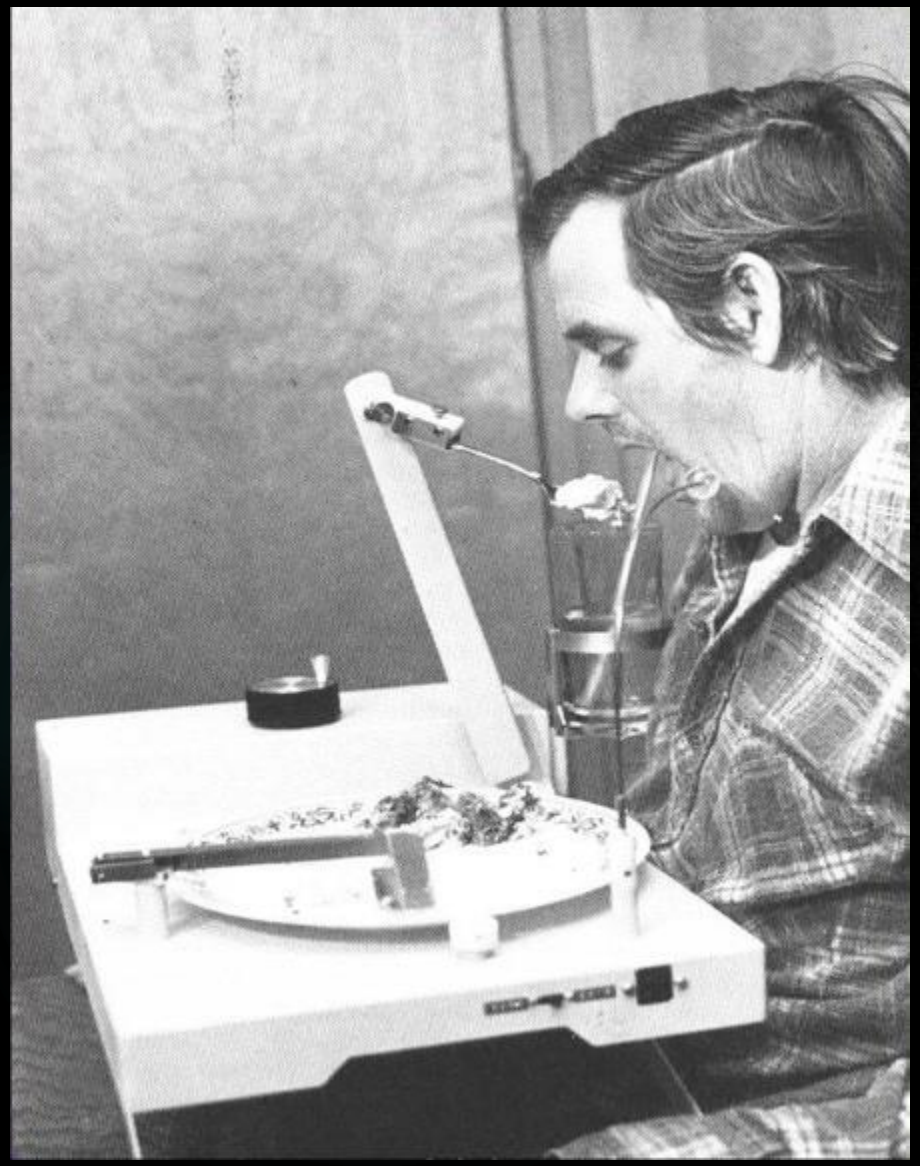


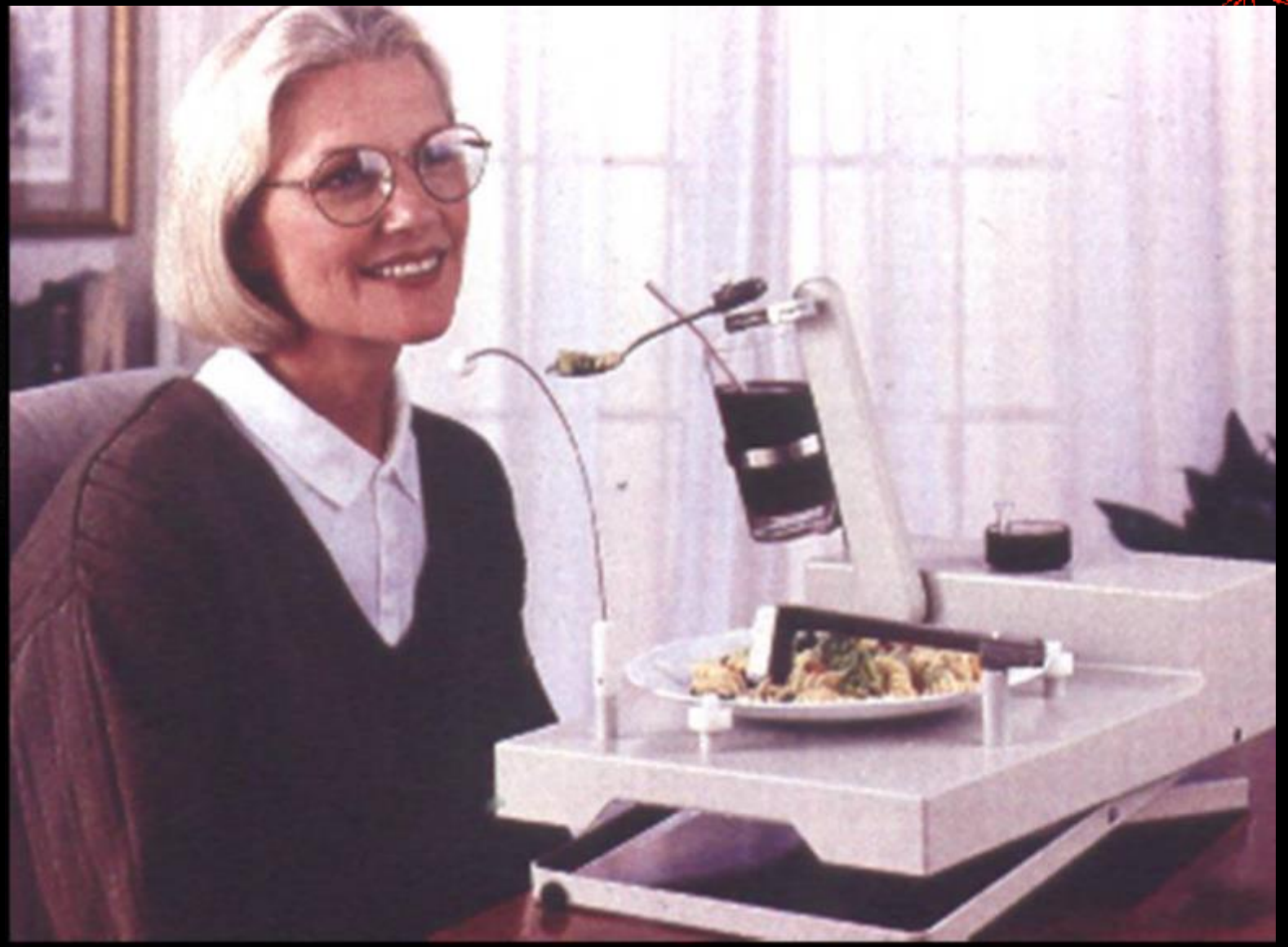


Chin Controlled Arm Exoskeleton

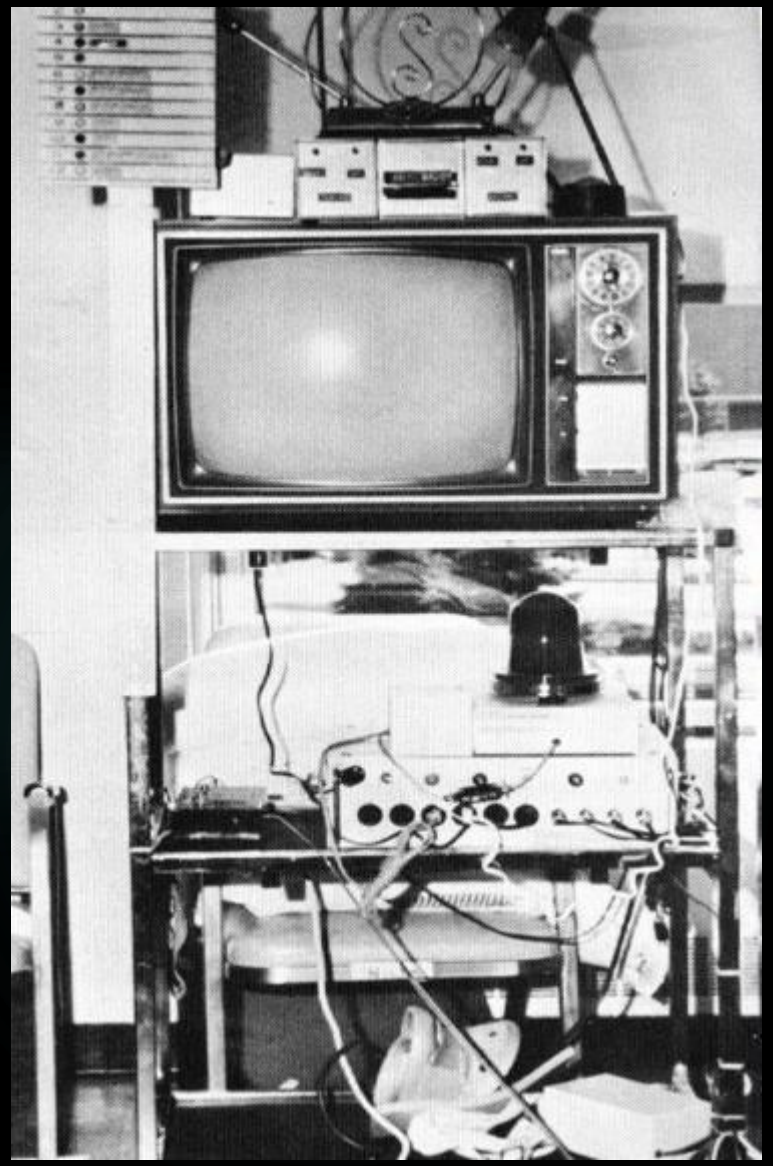


Robotic Feeding Aids





Early Environmental Control Systems





"Butler in a Box"

Eye Gaze Control

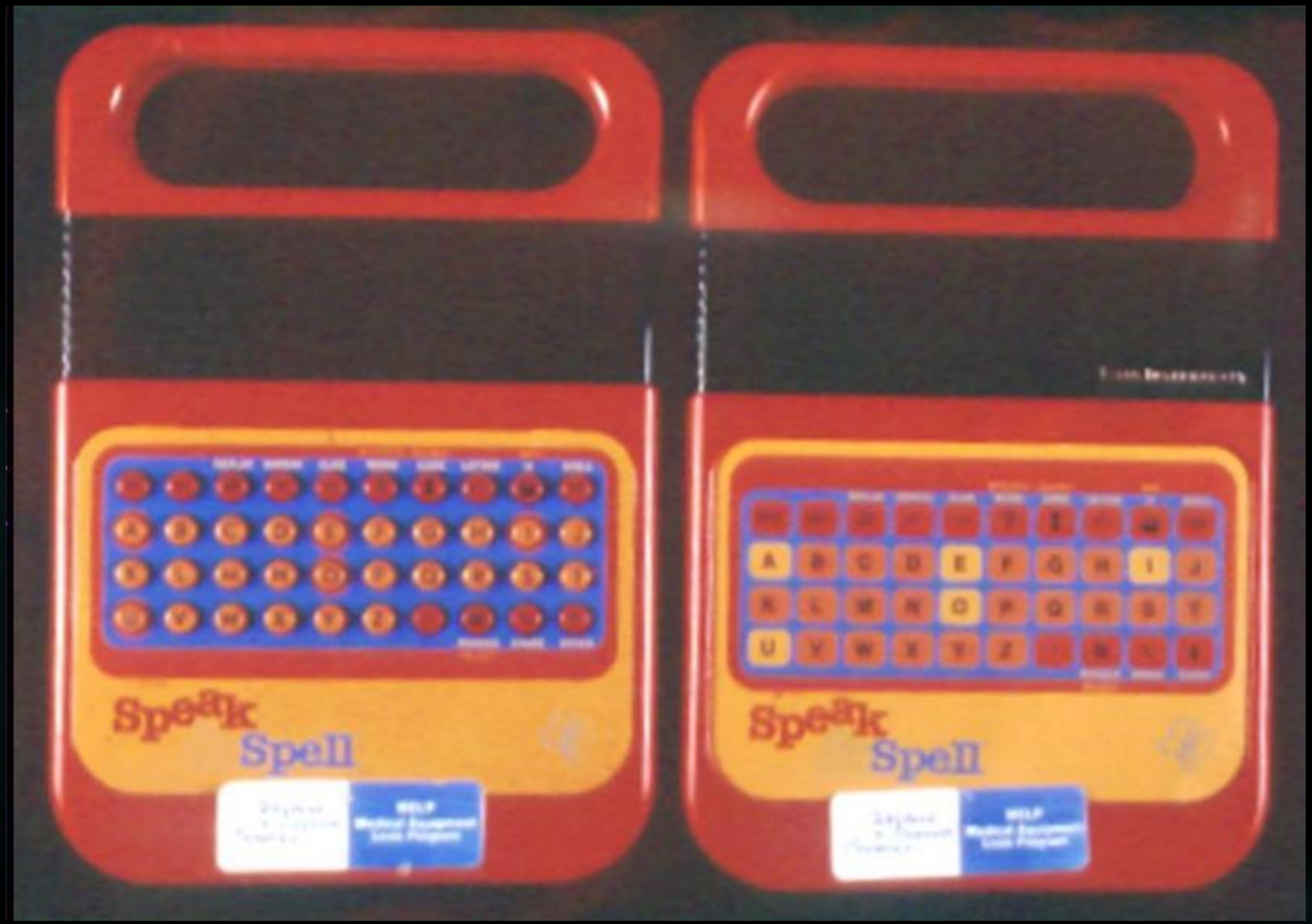




Augmented Communication System

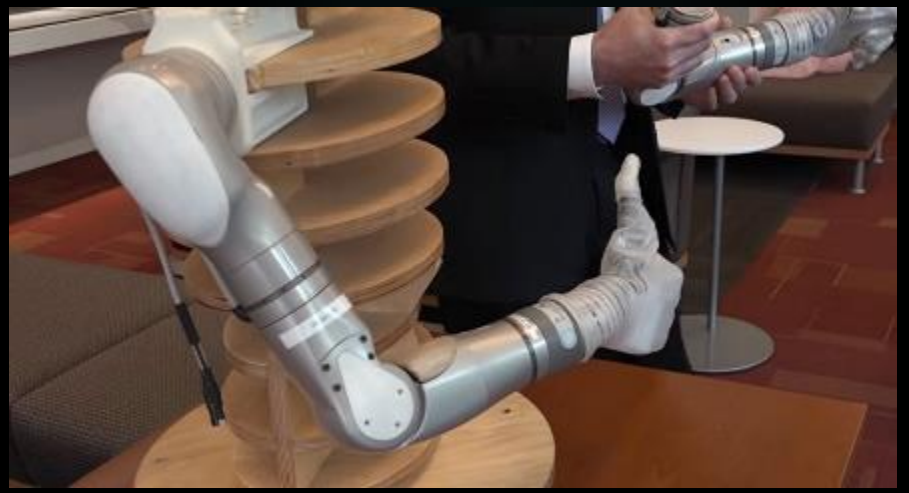


Augmented Communication System



Artificial Arm from 1560 - 1600





Peg Leg Bates



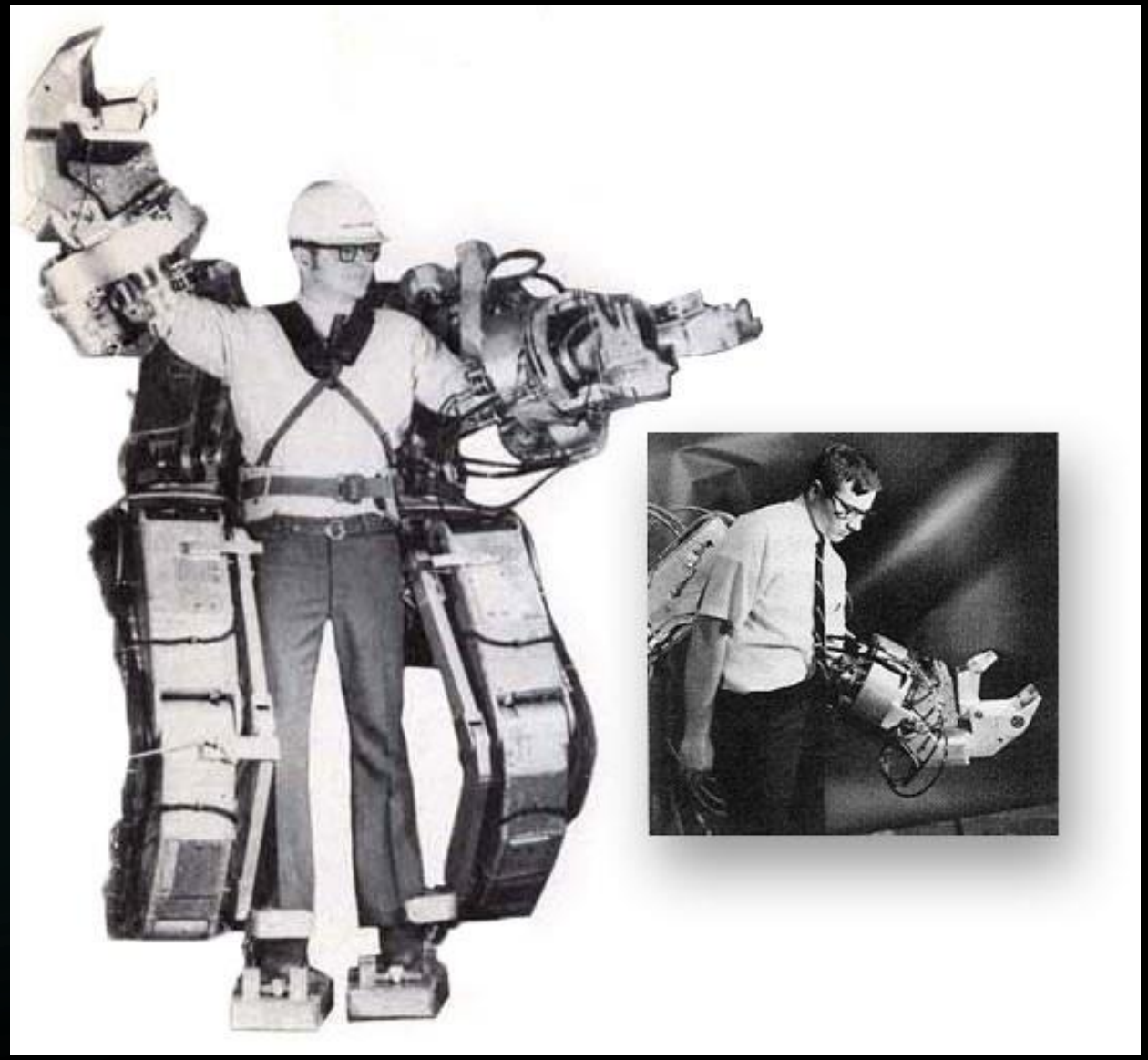


Wooden Prosthetic Legs



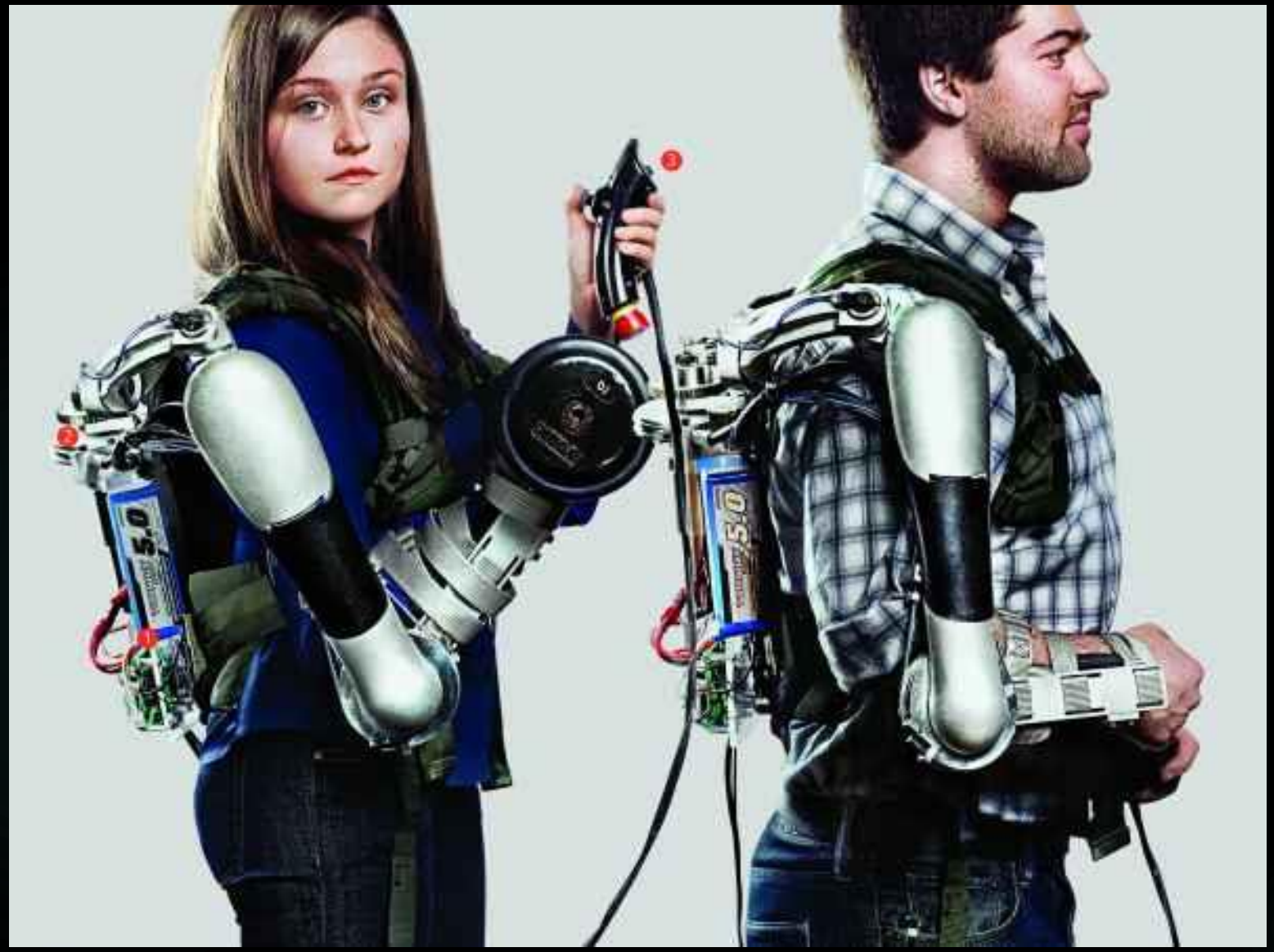


Hardiman Prototype - 1950s





Student Exoskeleton Arms



Ultimate Exoskeleton





Ultimate Hand Orthotic

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



Thanos' Infinity Gauntlet



Steampunk Professor Xavier Wheelchair Project



Video

Orange County Chopper

- Christopher & Dana Reeve Foundation

- Video



Tuesday, February 3rd



Thoughts on Assistive Robotics

Steve B. Cousins, PhD

Executive Director of The Stanford Robotics Center



Michelle Q. Wang Baldonado, PhD

Research Engineer at the Stanford Robotics Center

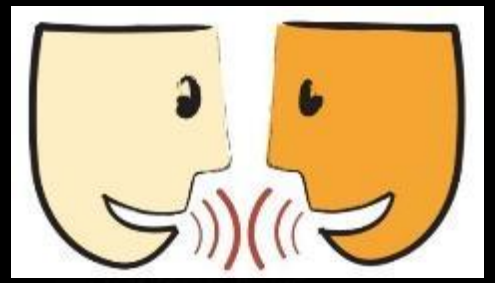
Today



Recent Advances in Intracortical Brain-Computer Interfaces

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Break Activities



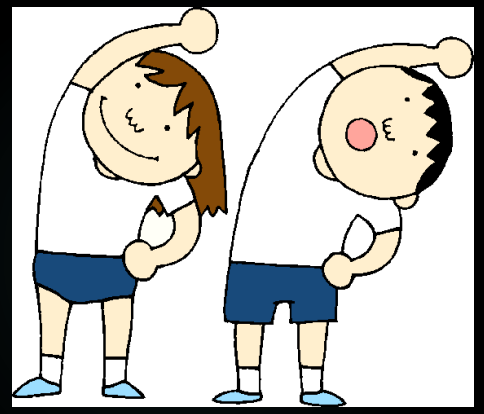




- Attendance sheet
- Stand up and stretch
- Take a bio-break
- Text message
- Web-surf
- Respond to email
- Talk with classmates
- Reflect on what was presented in class









Short Break



