

Prosthetics: Direct Coupling

Spring 2015

Reid Simmons
Illah Nourbakhsh

Review...

- Why are exoskeletal legs better than a power wheelchair?







Key Challenges

- Mechanics
- Sensing
- HR connection and communication
- Joint autonomy

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- Mechanics
 - Elasticity, rigidity and resilience
 - Series elastic actuation
 - Feedback-driven adjustable elasticity motors
- Sensing
- HR connection and communication
- Joint autonomy



Key Challenges

- Mechanics
- Sensing
 - Tactile sensing
- HR connection and communication
- Joint autonomy

- Biomimetic tactile sensing Syntouch
- Deformation-based visual sensing



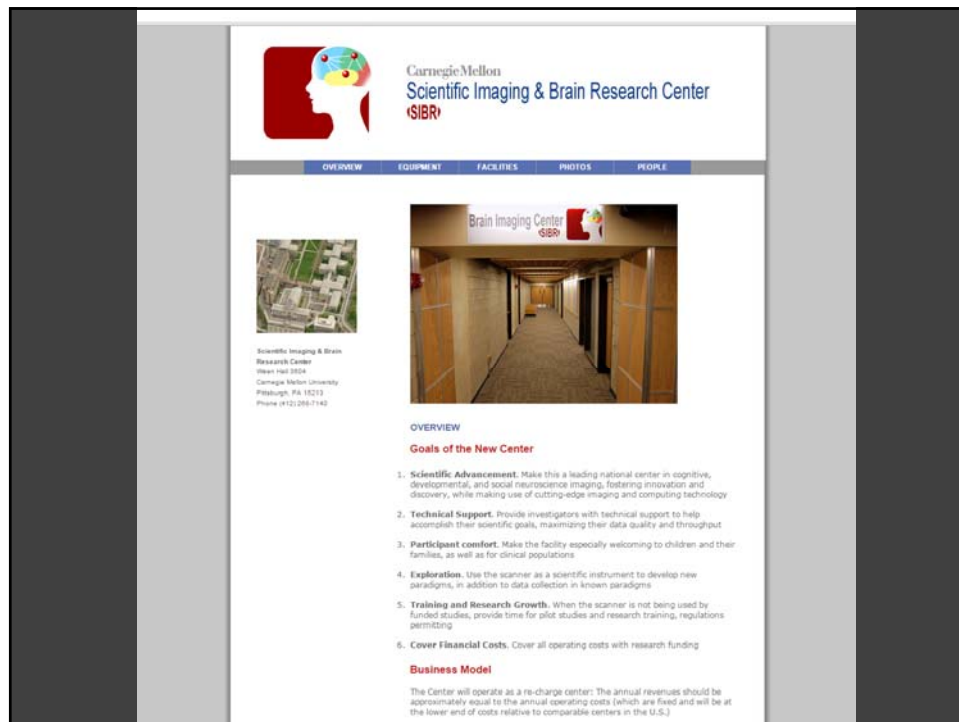
Key Challenges

- Human-Robot Coupling
 - Direct implantation of electrodes in the Motor cortex
 - Useful for brain stem stroke, spinal injury, Lou Gehrig's
 - Must have functional cortex
 - Fails over time: foreign substances!
 - Noninvasive neural sensing (fMRI, EEG)
 - Targeted Muscle reinnervation (TMR)
 - Multiple simultaneous control lines! Shoulder example
 - Then EMG sensing at the muscle!



Key Challenges

- Human-Robot Coupling
 - Direct implantation of electrodes in the Motor cortex
 - Noninvasive neural sensing (fMRI, EEG)
 - Thought recognition: Marcel Just & Tom Mitchell
 - Targeted Muscle reinnervation (TMR)



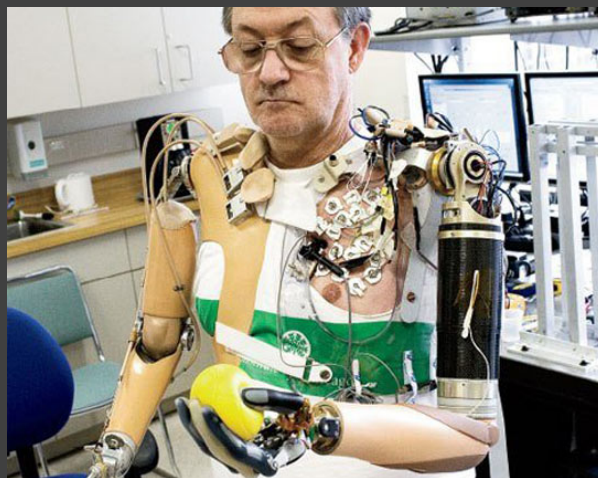
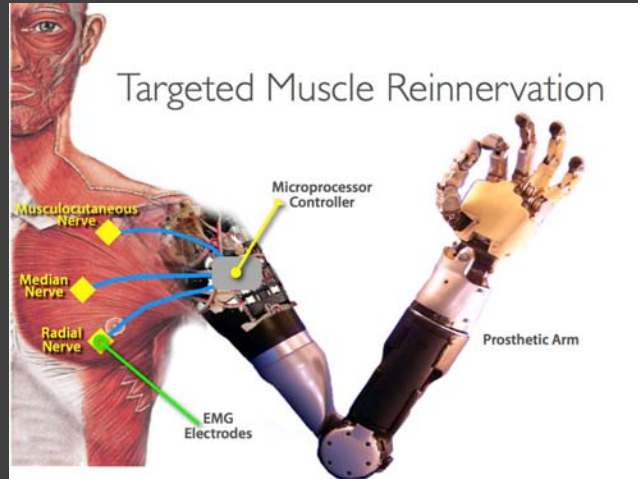
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 - Adjusting dynamics: Microprocessors in knees for above-knee amputees
 - Hydraulic fluid knee brake with stance control, swing control



Prosthetics - future

- - Control line limitations
- - Foreign body rejections
- + Shared autonomy relationships