

# Virtual Rehabilitation

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<http://engineeringworks.tamu.edu/2011/virtual-reality-for-high-tech-rehabilitation-2/>

# Why we care



# Outline of Content

- What is CAREN
- How does CAREN work
- Who it affects
- Cost and Benefit
- Other Applications
- The future of the prosthetics' field
- Conclusion, road ahead



# History of CAREN

- **C**omputer **A**ssisted **R**ehabilitation **E**nvironment
- 2003 - developed by Motek Medical
- 2006 - first clinical use in Israel
- 2007 – used in US



<http://www.motekmedical.com/sheba.html>

# How CAREN Works

Three overlapping projectors



180° view screen and surround sound

Dual treadmill with 6 degrees of freedom

<http://www.youtube.com/watch?v=ZCiGOWUPYZY>

<http://www.vizworld.com/2010/03/virtual-worlds-patient-rehabilitation/>

# Who Uses CAREN

- Wounded military personnel
- Sports and fitness athletes
- Orthopedic patients
- Neurological disorder patients
- Medical researchers



[http://bioproj.informe.com/gallery/main.php?g2\\_itemId=137](http://bioproj.informe.com/gallery/main.php?g2_itemId=137)  
<http://hollywoodhatesme.files.wordpress.com/2010/02/usain-bolt.jpg>  
<http://www.bouhammer.com/2008/10/27-marine-amputee-rejoins-battalion-returns-to-combat-after-near-death-experience/>

# Cost/Benefit

- Typical financial: \$250,000 - \$1.5 M
- Spatial Requirements: 23' X23' X20' (average size)
- Personnel Requirements: One computer operator
- Government grants, loans, etc.



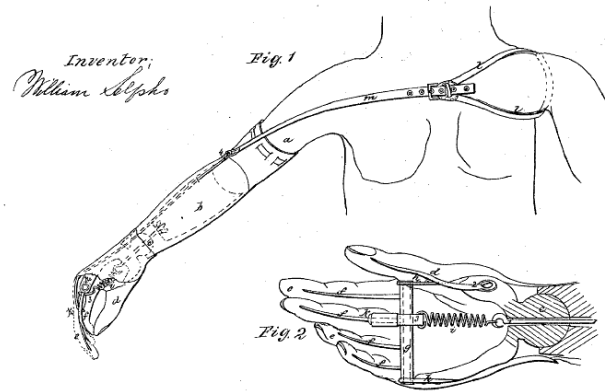
[http://medgadget.com/archives/2007/02/caren\\_virtual\\_r.html](http://medgadget.com/archives/2007/02/caren_virtual_r.html)

<http://www.thestrokefoundation.com/stroke-rehabilitation/294-glenrose-hospital-acquires-high-tech-virtual-reality-system-for-rehabilitation.html>

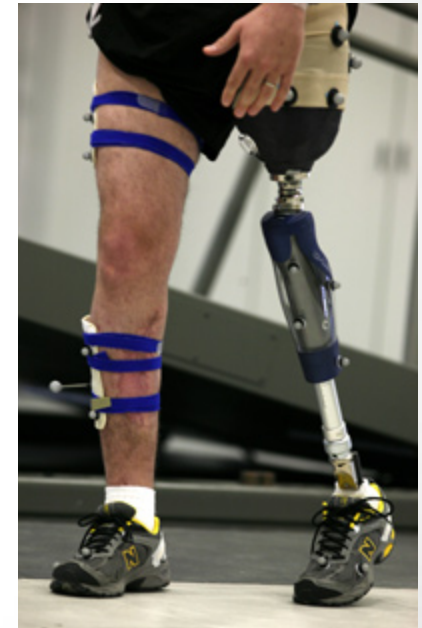


# How CAREN Helps Amputees

- Arm
  - Transradial
  - Transhumeral
- Leg
  - Transtibial
  - Transfemoral



<http://openprosthetics.ning.com/profiles/blogs/prosthetic-history-the>



<http://health.howstuffworks.com/medicine/modern/prosthetic-limb3.htm>

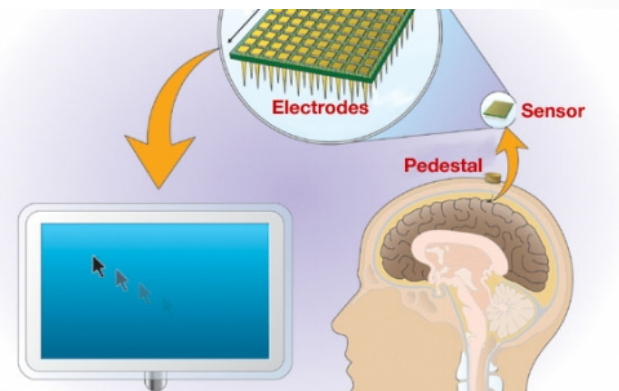


# The Future of Prosthetics

- Target Muscle Reinnervation (TMR)
  - Redirect dead end nerves to functional muscle
  - Sense muscular contraction with electrodes
- Neural Interfacing
  - Communicating with the nervous system
    - Dr. Miguel Nicolelis – Duke University
    - Dr. John Donoghue – Brown University



<http://www.thinkartificial.org/machine-interfaces/monkey-brain-makes-robot-walk/>



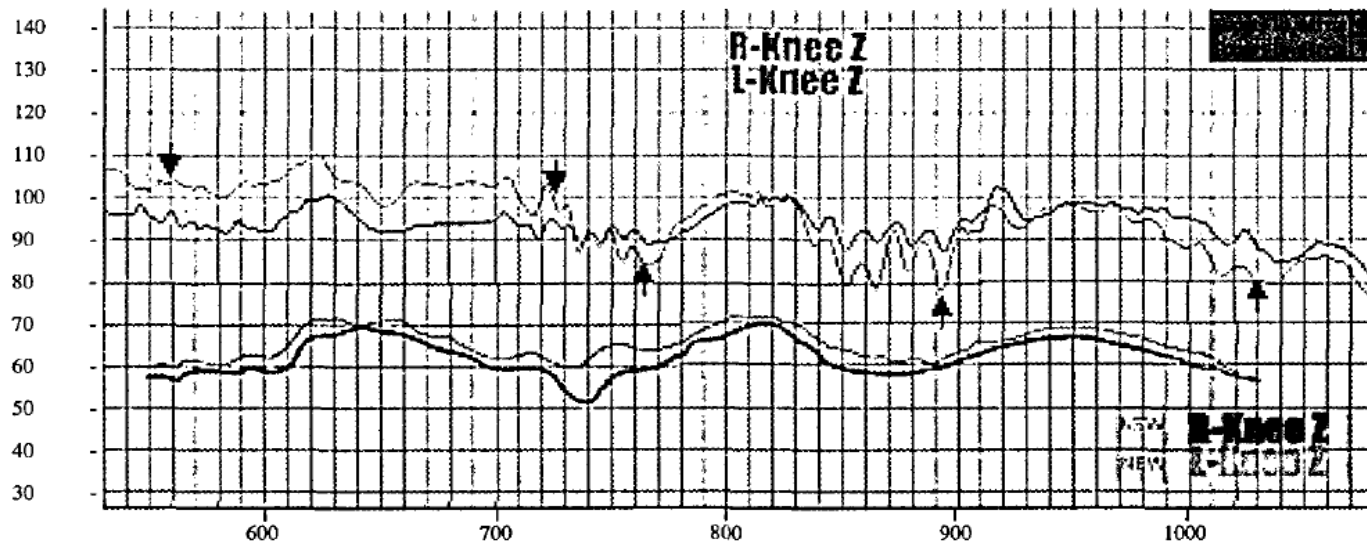
<http://www.gizmag.com/go/3503/>

# More Applications

- Has been used to develop special orthopedic shoes
- Natural environment instead of a lab one
- Can study each body part individually

*Computer assisted rehabilitation environment*

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# Psychological Application

- NICoe has purchased special version of CAREN
- Use in psychological rehabilitation
- Large portion of soldiers return with psychological problems
- phobias



**DEFENSE CENTERS  
OF EXCELLENCE**

For Psychological Health  
& Traumatic Brain Injury

<http://www.ncbi.nlm.nih.gov/pubmed/10538390>

# Concluding Thoughts

- Innovation change the way injured military personnel recuperate.
- The cost and benefit of CAREN systems.
- Other applications
  - Psychology
  - Orthopedic



# The Road Ahead

- Cost effectiveness as technology advances
- Advancement in prosthetics may cause CAREN to become obsolete .
- Virtual technology is advancing to consumer market.



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- <http://www.delphifaq.com/faq/household/f916.shtml>

# Questions ?

