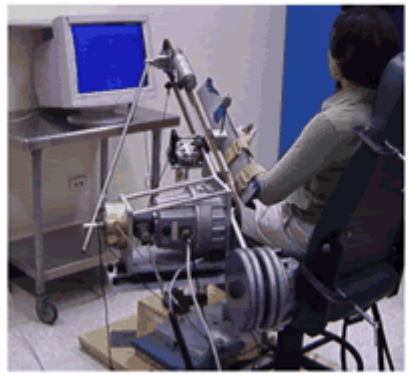
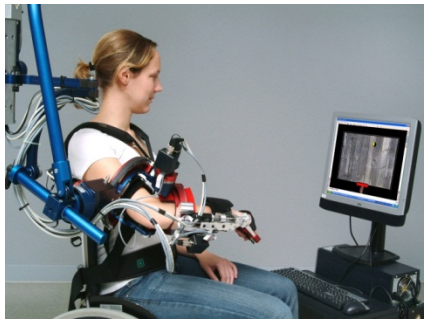
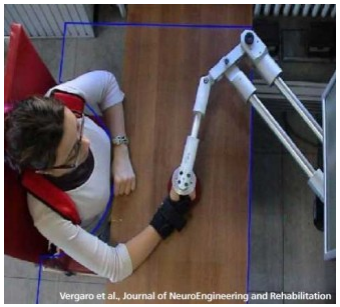
Robotics – upper extremity

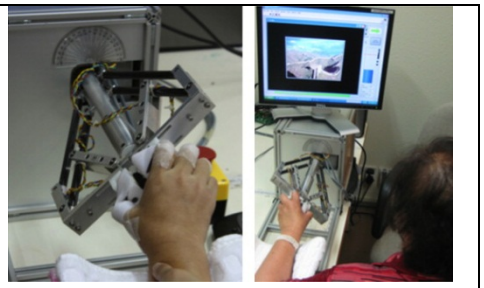
Device	Target	Motion Type	Feedback	Degree Of Freedom	Type Of Exercise	Design
Active Joint Brace for the Elbow	Proximal	Active assistance	Kinesthetic, proprioceptive, tactile and visual sensory.	N/A	Elbow flexion and extension in a set of functionally oriented tasks tailored to each subject' motor abilities.	Mobile exoskeleton EMG-controlled powered
ARMGuide	Proximal	Active-assisted	Graphical feedback of the hand position and feedback on the amount of motor assistance.	3	Reaching movements in different directions	Singly-actuated http://www.rehab.research.va.gov/jour/00/37/6/reink376.htm 
ARMin I and ARMin II	Proximal and distal	Passive and active	Visual and auditory	6 independently	Functional 3D workspace repetitive exercises	Exoskeleton http://cabrr.cua.edu/devicegallery.cf

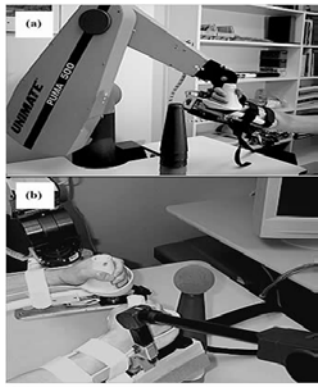
				actuated DOF and 1 coupled DOF		m 
BATRAC	Proximal	Passive	Auditory	N/A	Push and pull exercises in bilateral mode	End-effector http://medicalxpress.com/news/2011-09-rewiring-brain-regain.html 
BFIAMT	Proximal	Bilateral active passive, bilateral	Visual	N/A	Push and pull exercises.	End-effector

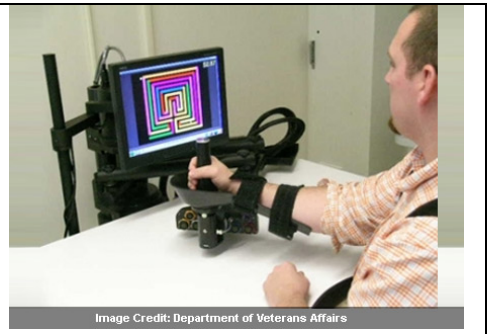
		reciprocal, bilateral passive, bilateral symmetric.				
Bilateral Forearm and Wrist Trainer	Distal	Passive, active.	N/A	1	Supination movement of forearm and dosiflexion/volarflexion of the wrist, bimanual, repetitive practice.	End-effector
Bi-Manu-Track	Distal	Passive-passive, passive-active, active-active.	Visual	1	Bilateral elbow pronation and supination, wrist flexion and extension in a mirror or parallel fashion.	End-effector http://www.reha-stim.de/cms/index.php?id=60 

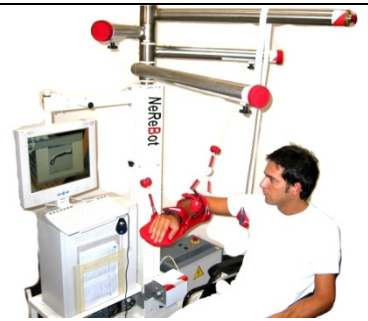
Braccio di Ferro	Proximal	Adaptive control of robot assistance	Visual position of the hand and target, haptic feedback.	2	Shoulder and elbow movement in horizontal plane in a goal directed activity.	Actuated http://www.redorbit.com/news/technology/1836376/robot_teaches_stroke_survivors/ 

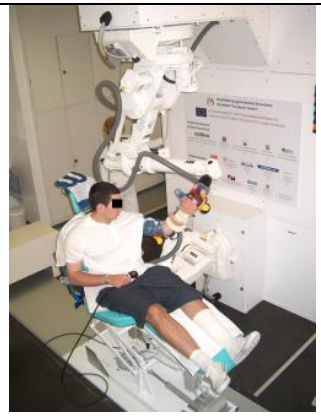
GENTLE/S	Proximal	Passive, active assisted or active.	Virtual reality haptic interface.	3	Hand to mouth movements, reaching movements.	Exoskeleton http://www.mimics.ethz.ch/index.php?page_id=2 
HandCare	Distal	Assisted	Visual	5	Opening and closing movements in a goal directed exercises.	End-effector
HapticKnob	Distal	Assisted, resistive	Interactive and intuitive visual feedback.	2	Grasping in coordination with pronation/supination of the forearm.	End-effector http://www.sciencedirect.com/science/article/pii/S0924424710000154

						
HWARD	Distal	Assisted, active assisted.	Visual and auditory.	3	Grasp and release movements in a virtual-environment (VR) setting.	Pneumatically actuated
L-EXOS	Proximal	Active assisted.	Force feedback, visual feedback , auditory cueing during tasks.	5	VR environment reaching, path following and free motion exercises.	Exoskeleton
MEMOS	Proximal	Active, passive, active-assisted, resistive.	Visual feedback of the current position of the handle was provided.	N/A	Elbow and shoulder exercises in a sequence point-to-point reaching movements in the horizontal plane.	Actuated, end-effector.
MIME	Proximal	Passive, active –assisted, active-constrained, bilateral modes	Feedback of the fraction of the movement completed or the time to complete was used to track and motivate performance.	6	Unilateral or bilateral shoulder and elbow movement in target reaching activities.	Exoskeleton

						http://www.rehab.research.va.gov/j  Figure 1. Subjects performing (a) unilateral and (b) bilateral movements with Mirror Image Movement Enabler system. our/06/43/5/lum.html
MIT-Manus	Proximal	Assisted	Visual, auditory, and tactile	2	Shoulder and elbow movement in horizontal plane, repetitive reaching exercises.	Exoskeleton http://www.techshout.com/science/2010/17/mit-manus-robot-assisted-therapy-may-help-stroke-patients-regain-function/

						 Image Credit: Department of Veterans Affairs
	Proximal and distal	Assisted, resistive, passive.		3	Abduction/adduction, flexion/extension, pronation/supination, vertical movements, grasping exercises.	Exoskeleton
NeReBot	Proximal	Assisted.	Visual and auditory.	3	Flexion and extension, pronation and supination, adduction and abduction, circular movements of shoulder and elbow.	Direct drive wire actuation, can be used in sitting or lying positions. http://www.mechatronics.it/index.php?lingua=ENG&pag=res&sub=att&id=16

						
Pneumatic Glove	Distal	Assisted, assist as needed.	Haptic, visual .	5	Grasp release tasks, digit extension with VR environment and real objects	Exoskeleton
RegoGo	Proximal	Passive, active, active assisted.	Visual and auditory.	N/A	Reaching objectives on the computer screen using elbow and shoulder joints, in 3 dimensions and on all spatial planes.	End-effector
REHAROB Therapeutic System	Proximal	Passive assistance	N/A	N/A	Shoulder and elbow physiotherapy, executing exercises slowly and with constant velocity in a high repetition number.	Exoskeleton http://www.a1tech.hu/reharob_en.htm

						
Robot-Assisted Individualized Finger Rehabilitation	Distal	Full passive, assisted.	N/A	N/A	Simulated grasping and releasing training, VR based recreational activity.	End -effector
T-WREX and Pneu-WREX	Proximal and distal	Passive (non-robotic) arm orthosis that provides support for the arm against gravity	Auditory and visual feedback, objective feedback of task performance at end of each game.	5	Functional exercises in 3D/Virtual environment tasks, repetitive.	Exoskeleton http://www.ric.org/research/centers/mars3/archives/mars-rerc/twrexdesc/

						
	Proximal	Assist as needed	Auditory and visual	4	Elbow flexion/extension, shoulder horizontal abduction/adduction, shoulder flexion/extension, and forward/backward translation , functional 3D tasks	Exoskeleton http://www.readcube.com/articles/10.1186/1743-0003-6-20