

Study and Simulation of Human Movement

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Laboratory for the Study and Simulation of Human Movement

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Laboratory for the Study and Simulation of Human Movement

Study of Human Movement

- Build a database of functional movements performed by persons with and without disabilities
- Analyze data from motion capture using EMS and/or Optotrak, video data capture, electrical activity in muscles using EMG, and force/pressure data

Simulation of Human Movement

- Simulate movement by programming haptic devices to guide people in performing upper-extremity functional tasks

Applying Computer Vision to Analyze Human Functional Movements

Design a computer vision system with a goal of obtaining reliable segmental motion data, which can distinguish one individual from another and identify abnormal motion patterns.

- Identify phases of gait reliably. Compare gait patterns of individuals
- Analyzing upper extremity movements



A Gait Video

Using Computer Vision to Analyze Human Gait (Lawson, Vishnoi)

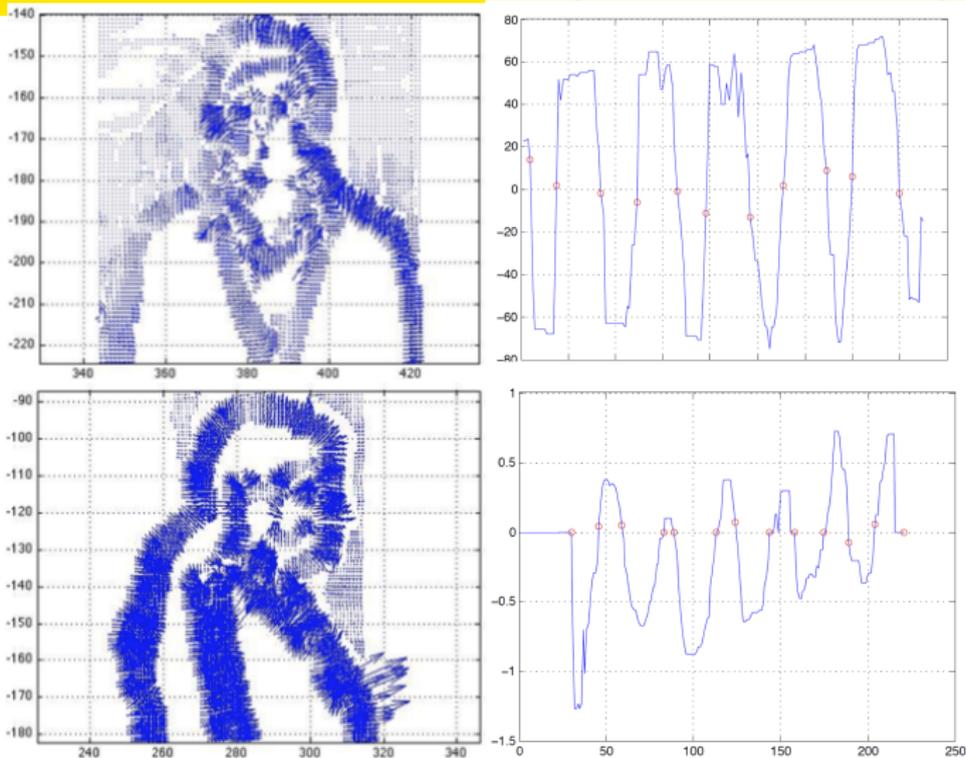
Mobility is fundamental for health and function and we are studying it.

Objectives

- Analyze human movement using a data capture method that is inexpensive, quantitative, sensitive and non-intrusive in natural environments
- Use these data to identify problems and develop new treatments



Identifying Phases of Gait Cycle (Lawson, Vishnoi)



Synchronized Gait Videos: **Same Person**

Two People

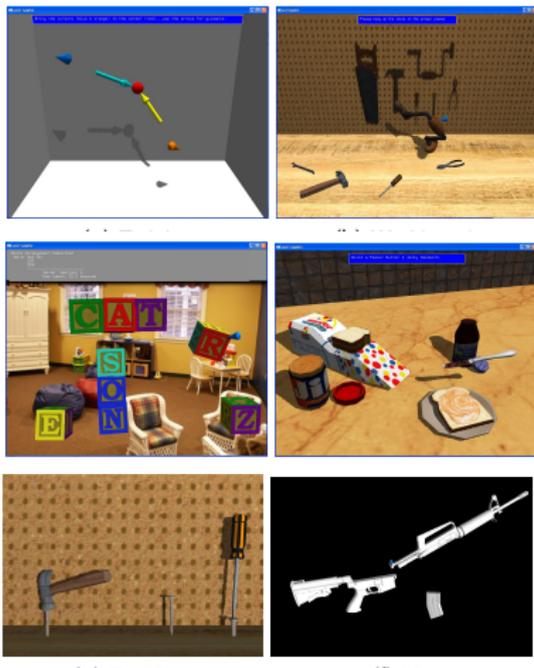
Using Haptics to Document Functional Movement in Persons with and without Disabilities (Narber)

Background

- Virtual reality has been applied to both the evaluation and treatment of persons with Traumatic Brain Injury (TBI)
- Haptics can be used to manipulate virtual objects
- We have used haptics to simulate fine-motor functional movements (e.g. writing)



Haptic Templates (Narber)



Haptic training task
Trajectories in the Workbench task
Making a sandwich task

	Cognitive			Motor	
	Associativity	Planning	Sequence	Move	Interact
WorkB	M	L	L	H	H
LetterB	H	H	M	M	M
Sand	M	H	H	M	L
Tool	H	M	M	L	M
M4	M	M	H	M	M

Haptic Testing

Objective

Determine whether normal individuals can improve their performance on two basic tasks: a fine motor manipulation and a word assembly task testing cognitive skill

Experiments and Findings

- 21 college students, aged 18 to 30, participated
- George Mason University IRB approved study
- The subjects were presented with the haptic training program
- After completing the training program, the subjects went through the **workbench cleaning** and **letter block spelling** simulations 3 times
- A statistically significant motor-learning effect found for the workbench cleaning simulation