

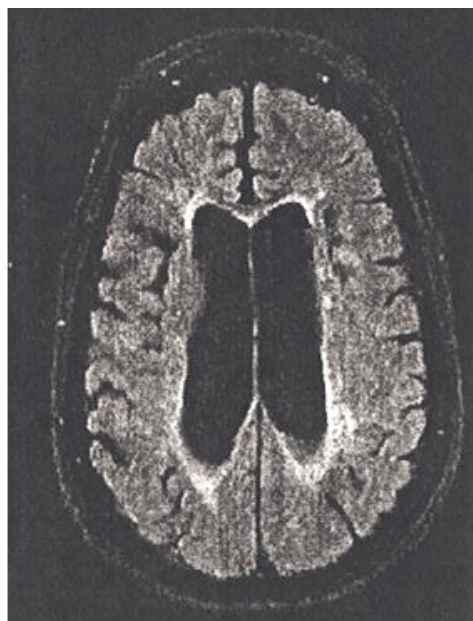
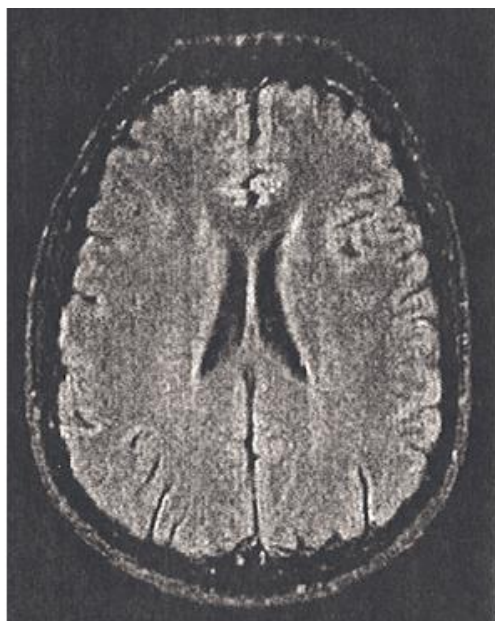
# Project A: Isometric Force Assessment of the Upper Extremity in Multiple Sclerosis vs. Healthy Subjects

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Hussain, A., et al., Investigation of isometric strength and control of the upper-extremity in Multiple Sclerosis (Submitted), 2013.

# Multiple Sclerosis

Damage to myelin in brain and spinal cord disrupts ability of parts of the NS to communicate and as a consequence causes loss of sensory and motor function.



Healthy vs MS

## Main symptoms of Multiple sclerosis

### Central:

- Fatigue
- Cognitive impairment
- Depression
- Unstable mood

### Visual:

- Nystagmus
- Optic neuritis
- Diplopia

### Speech:

- Dysarthria

### Throat:

- Dysphagia

### Musculoskeletal:

- Weakness
- Spasms
- Ataxia

### Sensation:

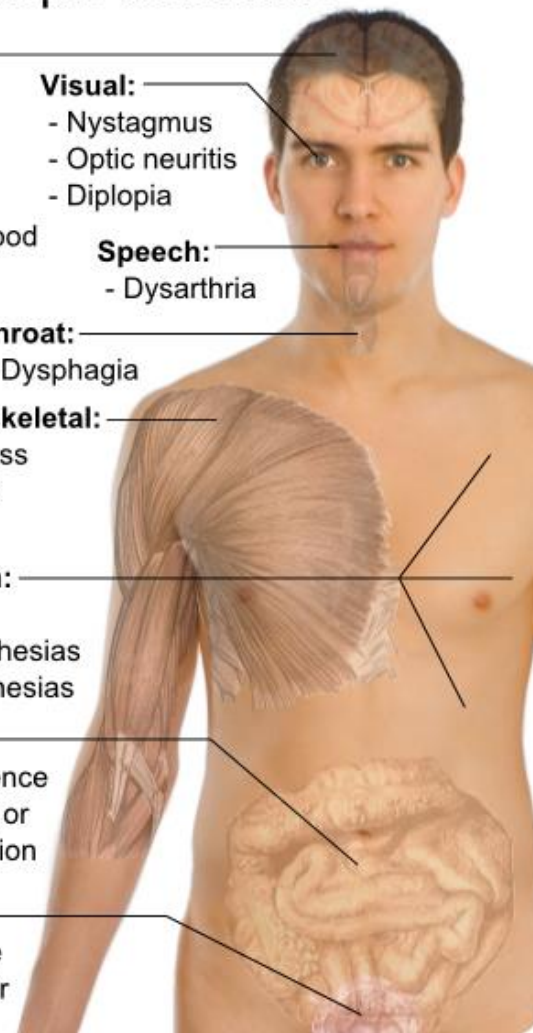
- Pain
- Hypoesthesias
- Paraesthesias

### Bowel:

- Incontinence
- Diarrhea or constipation

### Urinary:

- Incontinence
- Frequency or retention



# Sensorimotor Assessment

Isometric force assessment:

- Simple and objective way to measure force
- To explore force control and strength

Participants:

- 2 MS subjects (ARAT scores: 32 and 57)
- 2 Semi-healthy subjects

# Setup

maintain 25% of maximum force/torque in the specified directions

## Conditions:

Up

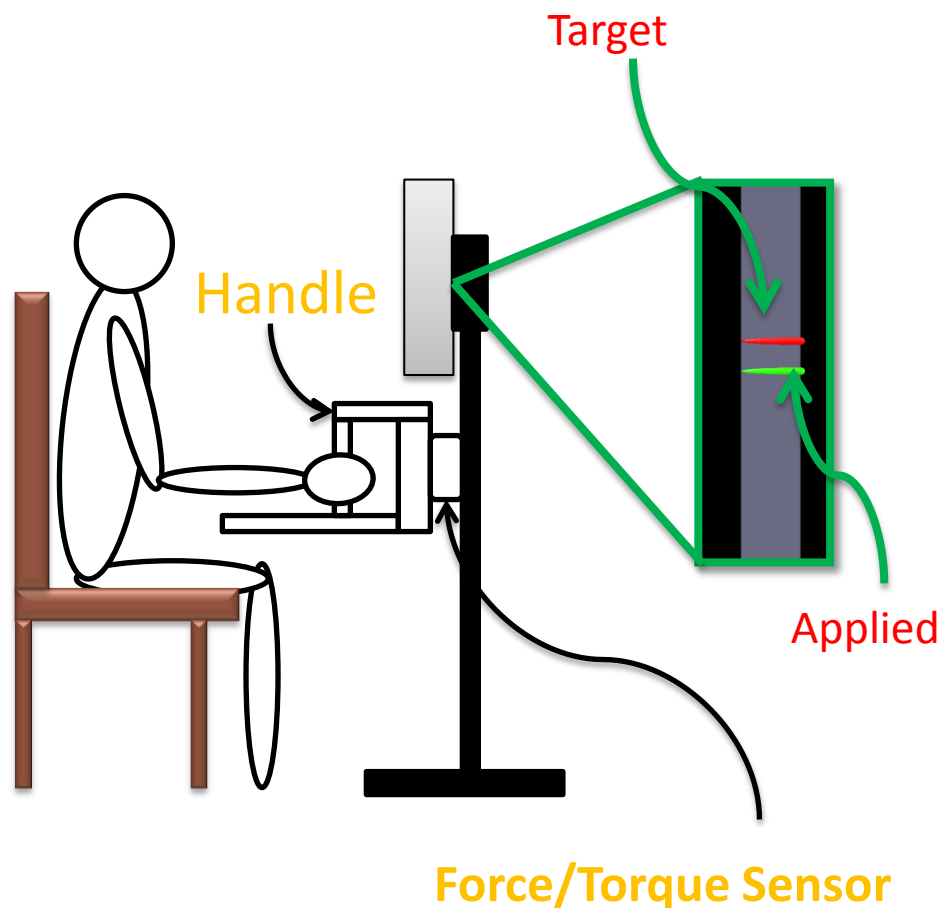
Down

Push

Pull

Pronation

Supination

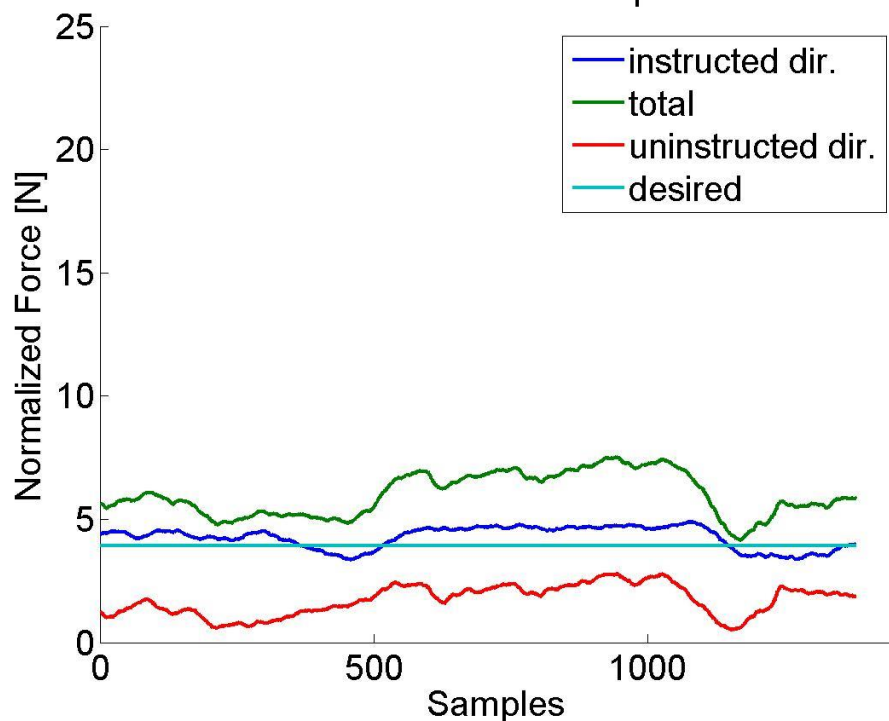


# Measures

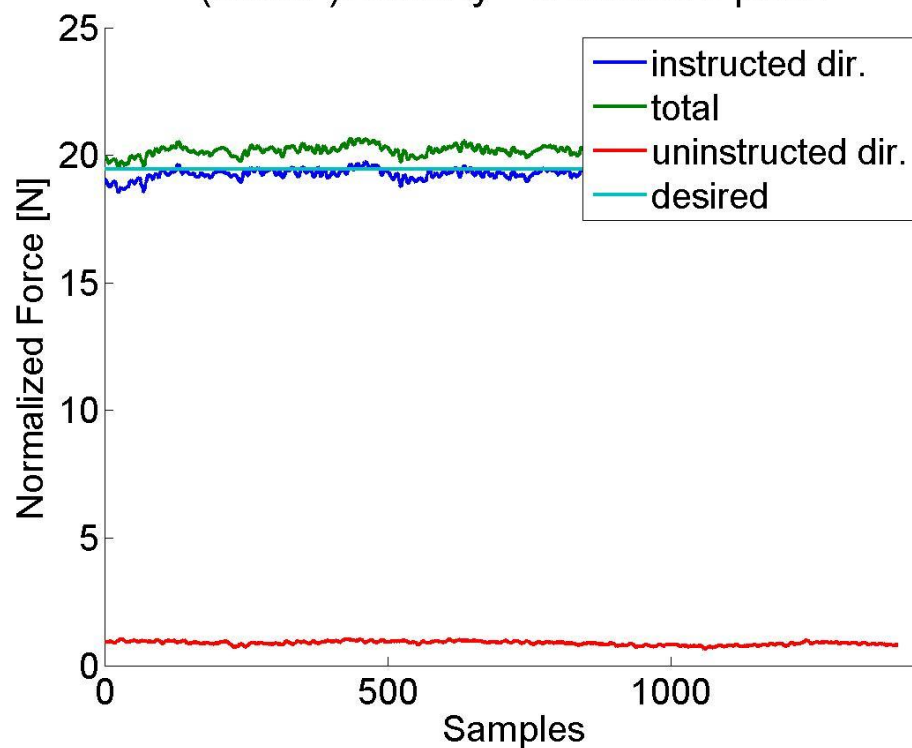
- Maximum Force
- Performance (Force Error RMS)
- Aiming dexterity (Force directional error, Torque error)
- “Control frequency” (Spectral bandwidth)
- Regularity (Multiscale entropy, Costa et al. 2005)

# Forces over time, healthy vs MS

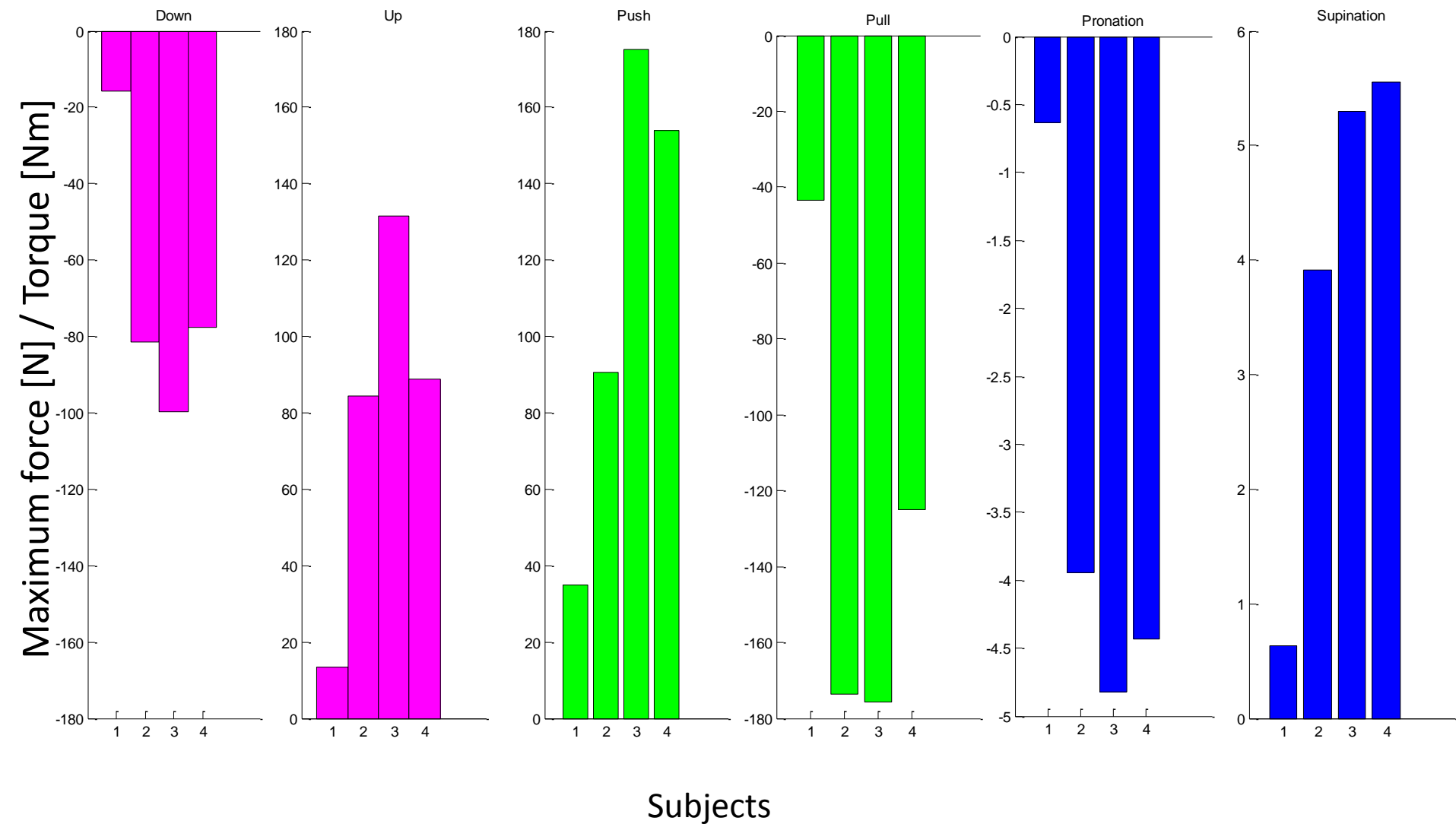
Patient - Direction: push



(Semi-)Healthy - Direction: push

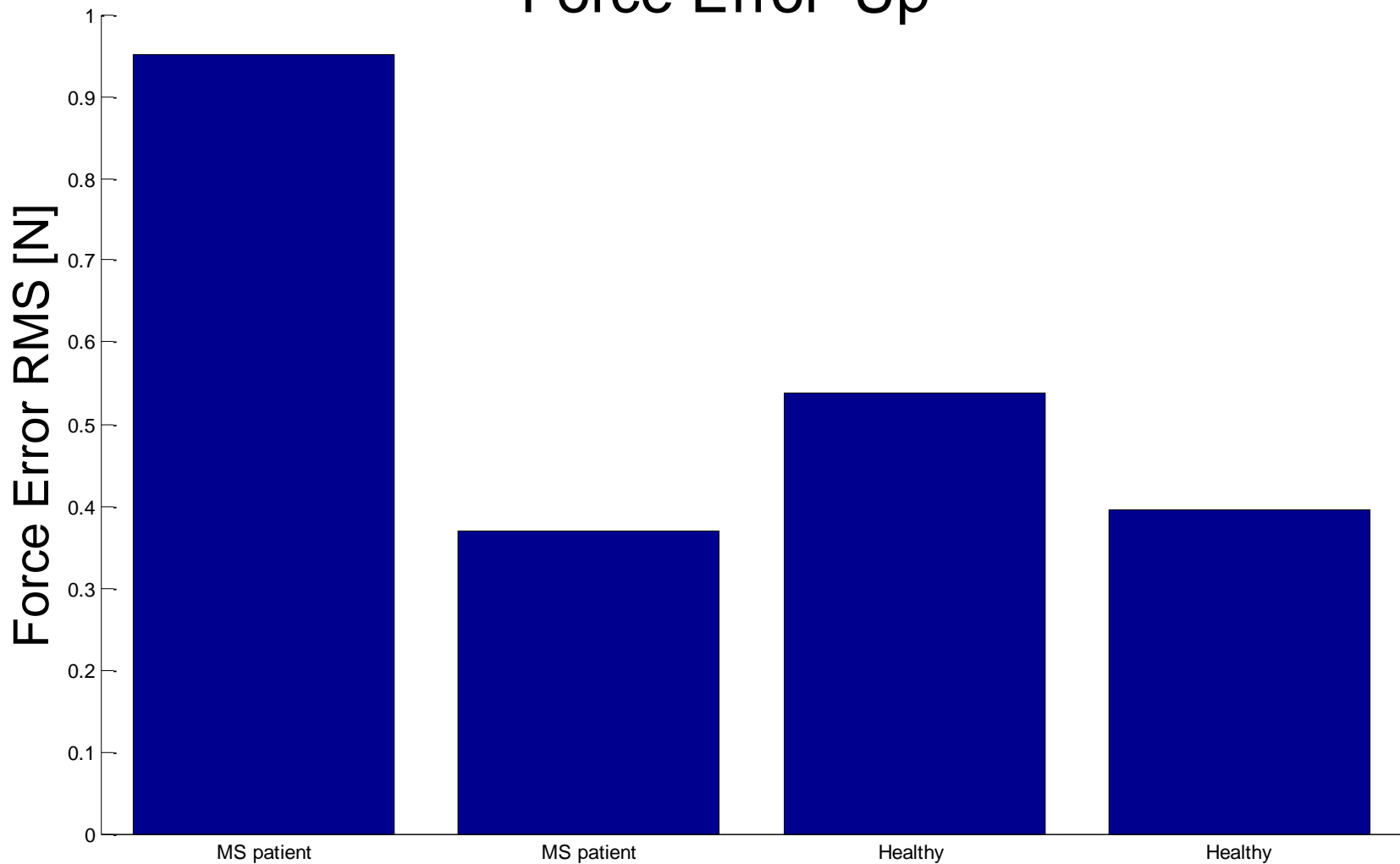


# Maximum Force



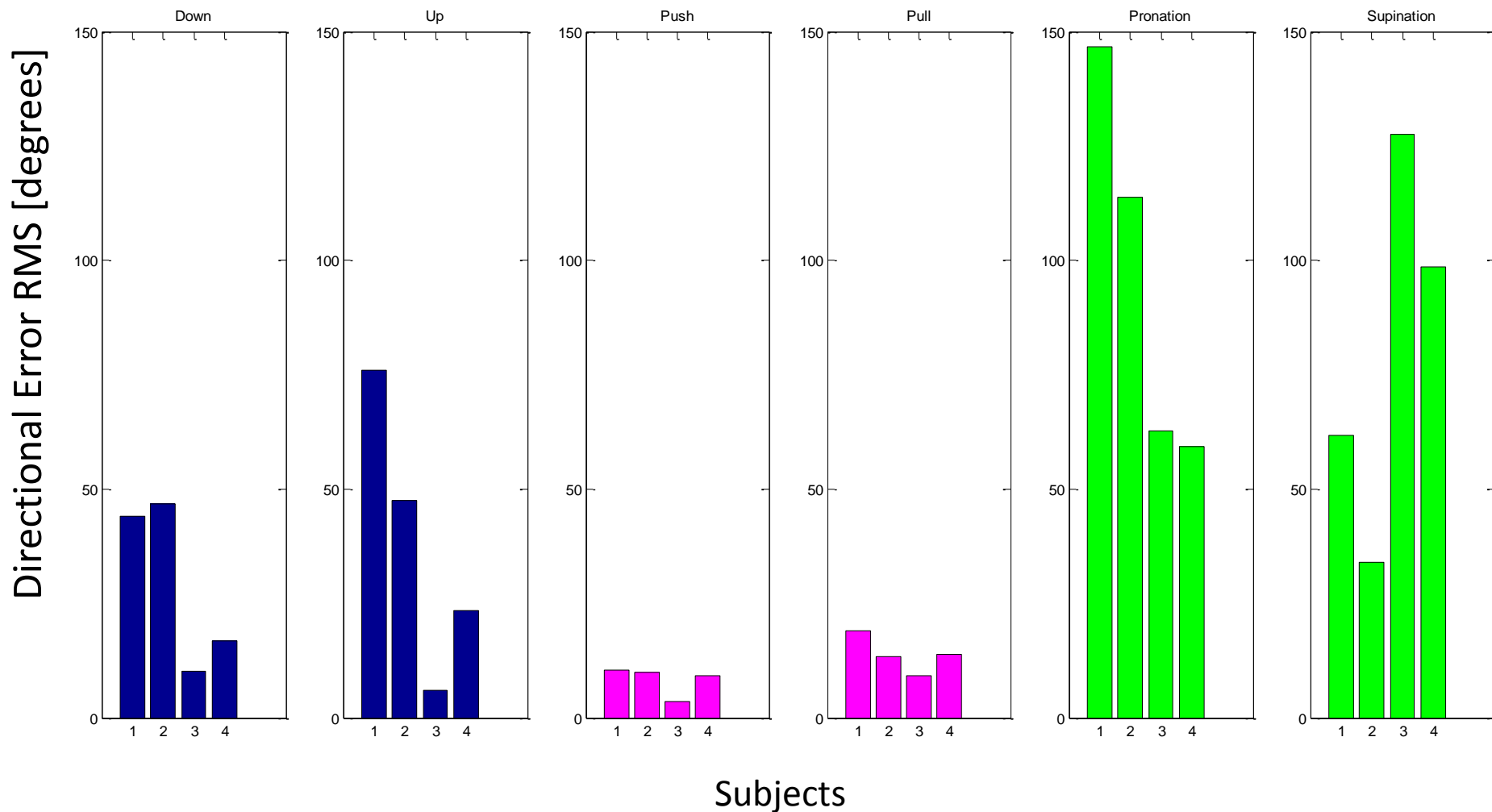
# Performance (Force Error)

Force Error 'Up'

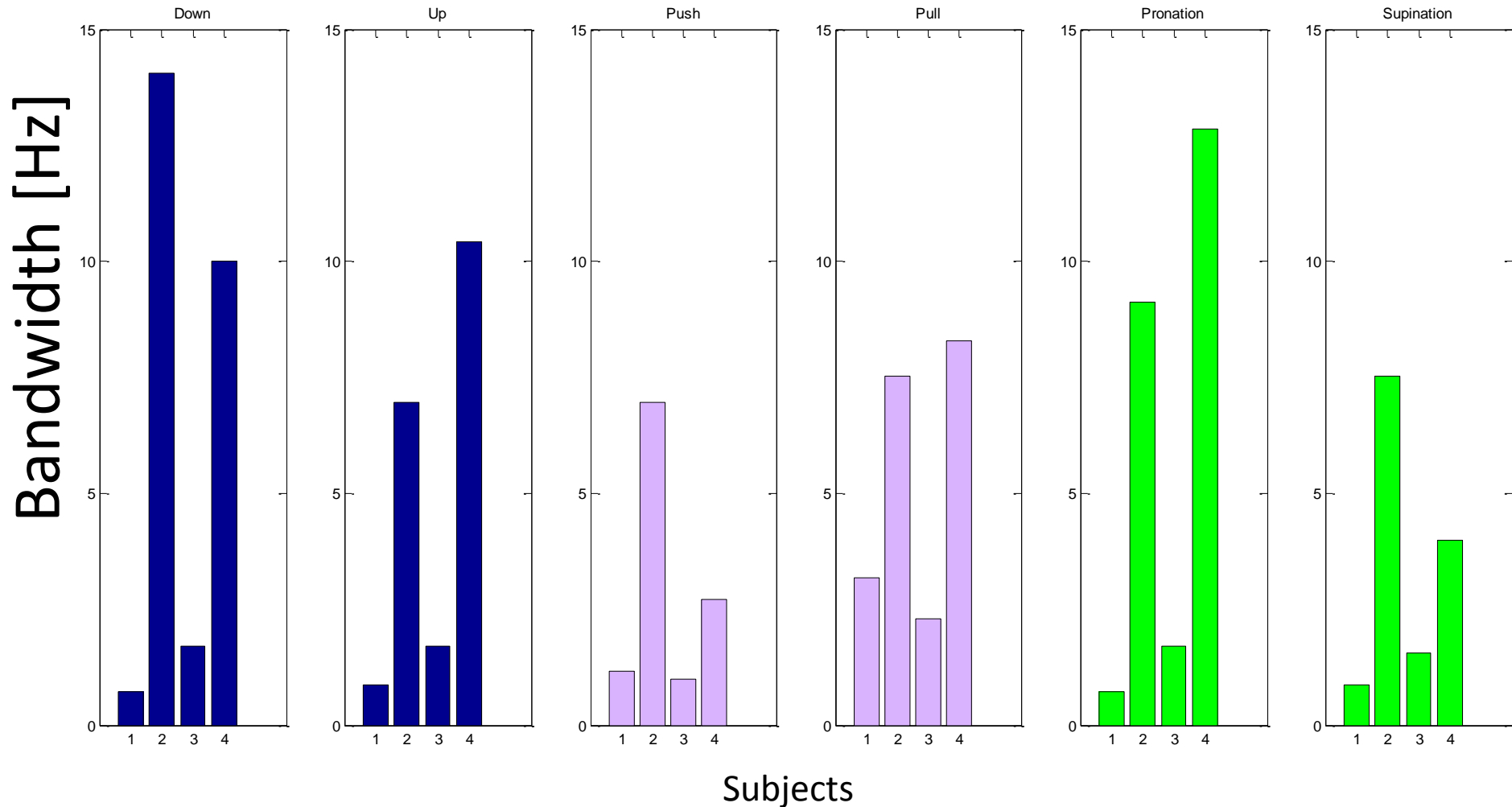




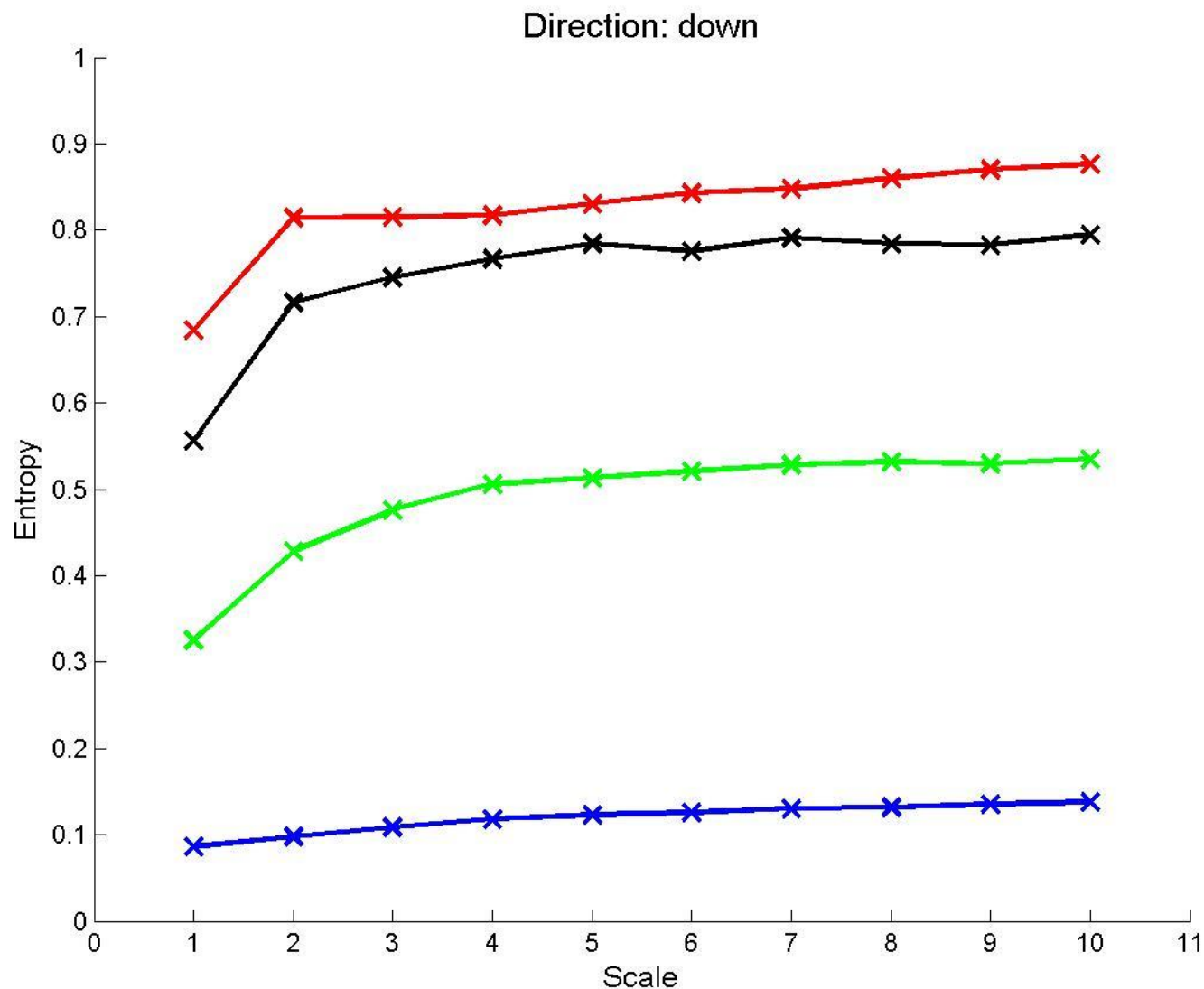
# Force directional error



# Spectral bandwidth



# Multiscale Entropy



## In conclusion:

- A lot of options with a simple setup
  - Metrics need to be validated with larger population and clinical measures
  - Measure should be easy interpretable for a clinician
- 
- For isometric force assessment, the table should probably not move.