Huntington’s Disease: Gait Improvement as a Result of External Cues

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Inherited disease that causes progressive degeneration of nerve cells in the brain

It's bad...

We should cure it.

-Derek Shepherd
# Huntington’s Symptoms

## Physical
- Weight Loss
- Muscular Degeneration
- Lifetime reduced muscular strength
- Gait Impairment

## Mental
- Depression
- OCD
- Uncharacteristic mood swings
- Bipolar Disorder like symptoms

## Cognitive
- Difficulty with organization and prioritization
- Perseveration
- Learning Impairment
- Loss of impulse control
- Speech Impairment

## Juvenile
- Loss of acquired skills and knowledge
- Sharp drop in school performance
- Sudden increase in behavioral problems
- Sharp decrease in fine motor control
- Seizures
Impact of Huntington’s

- Normally onset in 30s or 40s
  - Can develop before age 20, juvenile emergence
- One in every 10,000 people are affected
  - Approximately 30,000 people currently in the U.S.
  - Another 200,000 are at risk of developing the condition
- Huntington’s is a dominant gene
  - This means that if one parent has it you have a 50% minimum of getting it
  - Increases to 75% if both parents carry the gene
  - Possible to be non-symptomatic carrier
- Currently medication exists to manage symptoms, but there is no cure, and no way to prevent decline in physical, mental, or behavioral states
Huntington’s Gait

- Hyperkinesia - increased extraneous movement
  - Chorea - Latin for “dance”
  - Overflexion of ankles
- Hypokinesia - less movement than expected
  - Decreased stride length
  - Slower step speed
- Primarily caused by damage to the basal ganglia which is responsible for integration and smoothing of motion signals
- Also result of muscular wasting associated with the disease
Delval, Krystkowiak, et al. performed a study examining gait initiation for patients with HD. The study looked at self determined vs cued gait initiation between patients with HD and healthy controls. Variables examined included COM wobble, Anticipatory Postural Adjustments (APA), and gait features. Determined that by signalling a person with HD to move, their gait initiation was smoother and took less time. Other studies have found that metronomic external cues have smoothed gait in HD.
Self Determined vs Cued Gait Analysis

First Step Speed comparison

APA Comparison
Center of pressure during gait initiation

Healthy GI COP

Mid-stage HD GI COP
Our Solution

- We propose a wearable headset that upon activation, such as a button press, randomly plays a chime to signal for the patient to walk and plays a consistent rhythm of cues.

- Based on previous research, this should smooth gait and make gait initiation easier for the patient and smooth out walking.

- The primary goal is to improve the quality of life of Huntington’s patients as cure research continues to progress.
Tricking the Brain
Methodology

Trial Setup

● Gather 10 patients with HD and 10 healthy controls
● Place markers across the body, mainly focusing on legs for gait modeling

Experiment

● Experiment is that the participant will determine when to walk, and then take 10 steps
● Each participant will do this twice, once with self-determination, and once while wearing our headset

Analysis

● Use motion analysis software to create and compare models between self-determined and device assisted trials
● Compare with existing literature to validate results
Funding and materials

- Need funds to rent motion lab or purchase the necessary equipment for one
- Patient recruitment
- Prototyping
- Graduate student pay
References


Questions?