Background

Advancements in Upper-limb Prostheses
- Multiple degrees of freedom
- Software integration
- Multiple inputs for control

Reinnervation Surgeries

Upper-limb Prostheses Rejection Rates
- Passive 39%
- Body-powered 26%
- Myoelectric 23% [2]

Current Evaluation Procedures
- Box and Blocks [3]
  - Fails to give robust information
- Clinical assessments
  - Expensive, inconsistent, time intensive

Objectives

Long-term
- Use limb and eye tracking technologies to provide a more sensitive measure of prosthetic limb use with and without sensory feedback [4]

Current project
- Establish normative eye tracking data from able-bodied subjects on 2 functional tasks
  - Simple enough to gather data from
  - Complex enough to emulate day-to-day movements

Supplementary project
- Preliminary comparison of eye movements of prosthetic users to those of able-bodied participants

Methods

Equipment
- Binocular 60 Hz mobile Eye-tracker
- 120 Hz Motion tracker with 12 IR cameras

Participants
- 20 able-bodied (complete)
- 6 prosthetic users (in progress)

Protocol
- 20 repetitions of 2 daily living tasks under 3 conditions (120 trials)

Results

Normative Eye Behavior

Cups Task - Normalized Fixation Time (%)

Look-ahead Fixations

Prosthetic User Eye Behavior

Normative vs Prosthetic User Eye Behavior

Conclusions

1. When moving objects in sequence, able-bodied individuals exhibit prominent look-ahead fixations
2. Able-bodied individuals spend little, if any, time fixating on their own hand
3. Prosthetic users do not exhibit strong look-ahead fixations, and spend significant time fixating on their terminal device, especially during object transport

Future Directions

Complete data collection from prosthetic users, including some with increased sensory feedback from specialized prostheses

Data collection from able-bodied participants using a specialized sensorimotor bypass prosthesis

Potential data collection from individuals experiencing other sensorimotor neurological deficits

References