# Robot Assistant for Promoting Crawling in Children at Risk of Cerebral Palsy: A User Interface Study

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## Cerebral Palsy and Development

Cerebral Palsy (CP) is caused by damage to the nervous system at or around the time of birth that impedes the flow of signals from the brain to muscles and from peripheral sensory systems to the brain.

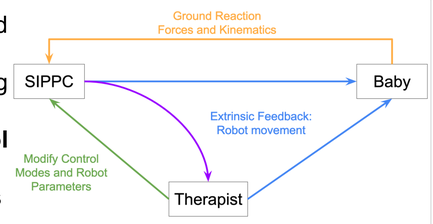
- Damage is non-progressive, and substantially reduces/delays the ability of the infant to perform exploratory movements and learn motor skills, including locomotion
- Delays in locomotor skills -> delays in cognitive skill development

## Self-Initiated Prone Progressive Crawler

- Supports the weight of the infant
- **Force Control**: acceleration is proportional to infant-generated forces
- **Discrete Control**: generate a movement of fixed magnitude
  - **Power Steering**: trigger with force/torque above threshold
  - **Suit Assist**: trigger with specific trunk/limb movements

User Interface: fine-grained control of the SIPPC

- Initiate session recording and individual trials
- Turn on/off **control modes**
- Adjust control parameters

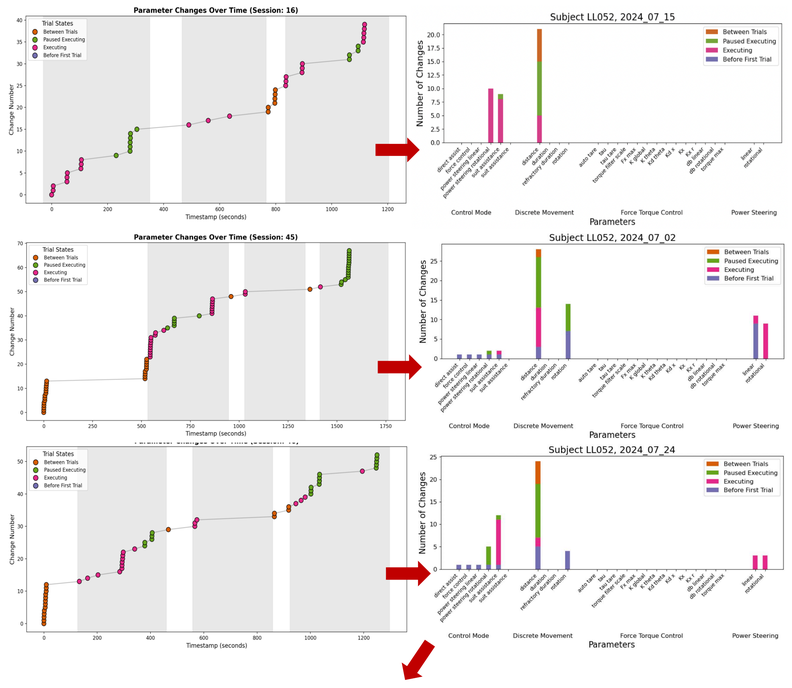



## Goals

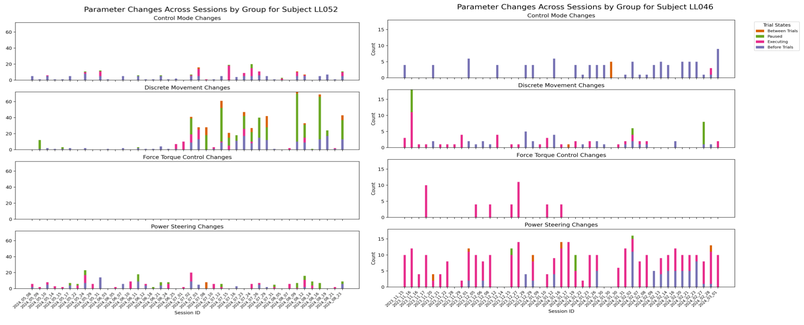
1. Analyze therapist's interactions with the user interface in order to determine:
   - What those patterns of interactions look like
   - What parameters are being adjusted
   - When parameters are being adjusted
2. Visualize that information graphically to better understand usage patterns so as to improve the efficiency of the interaction in the future

**http://www-symbiotic.cs.ou.edu/projects/cerebral_palsy**

## Parameter Changes: Single Sessions




## Parameter Changes: Longitudinal




## Therapists Adjustments Analysis

1. **Parameters Changed the Most:**
   - Control Mode: Suit Assistance with heuristic Rules and Power Steering Rotational
   - Discrete Movement: Linear and Rotational Distances
   - Power Steering: Linear and Rotational Thresholds

2. **Longitudinal Changes:**
   - Discrete movement changes increase in the middle of sessions
   - As infant gains skills, therapists attempt to challenge the infant by adjusting discrete movement parameters

**3. Adjustment Strategies:**
   - For both subjects, control mode configured ahead of time
   - For LL052, other parameters are configured ahead of time
   - For LL046, other parameters are configured during execution

## References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