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## Introduction

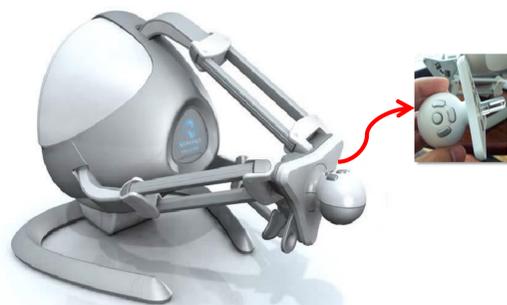
Children with disabilities miss opportunities for meaningful exploration of their environment. However, they have used robotic systems for manipulative play. One limitation with the systems is that the user cannot feel what the robot is touching, preventing them from sensing the properties of the objects. We propose to develop a robotic interface with **haptic feedback** and appropriate haptic feedback tasks and test them.

## Research question

Can creating haptic feedback in an interface for children with disabilities contribute to an enhancement in perception of objects and overall ability to perform manipulation tasks?

## Proposed methods and materials

- Target population**
- Inclusion:** children 5-8 years old with cerebral palsy within the IV and V level of the Gross Motor Classification System and level IV and V in the Manual Ability Classification System (MACS)
  - Exclusion:** Children with attention problems, vision, hearing, and severe cognitive impairments and non-English speakers
- Experimental Trials**
- In-lab trials:** 10 participants with cerebral palsy.
  - Usability trials:** 20 children with cerebral palsy + 20 adult clinician partners.

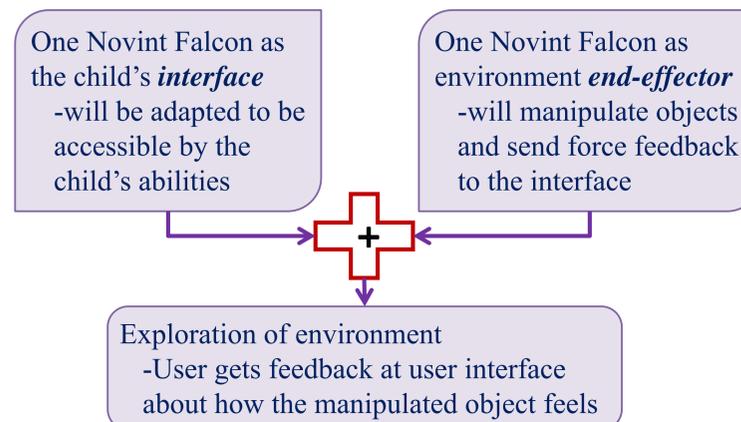


**Fig. 1:** 3-degree of freedom Novint Falcon (Novint Technologies, Rockville Centre, NY) with its detachable user interface shown on the right hand side

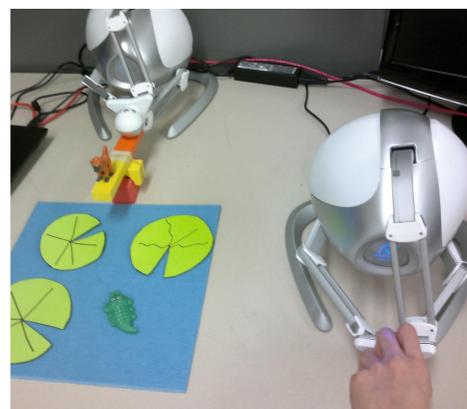
We are developing haptic tasks that begin with one degree of freedom movements and then complexity will be added to examine the texture, hardness/stiffness, weight, and contours. See Table 1 for example tasks

**Table 1:** sample tasks to be implemented

No. of dimensions needed	Haptic task
1D	Poking a <i>soft</i> vs. <i>hard</i> toy
2D	Lifting a <i>light</i> vs. <i>heavy</i> object
3D	Palpating a <i>curved</i> vs. <i>cubical</i> object

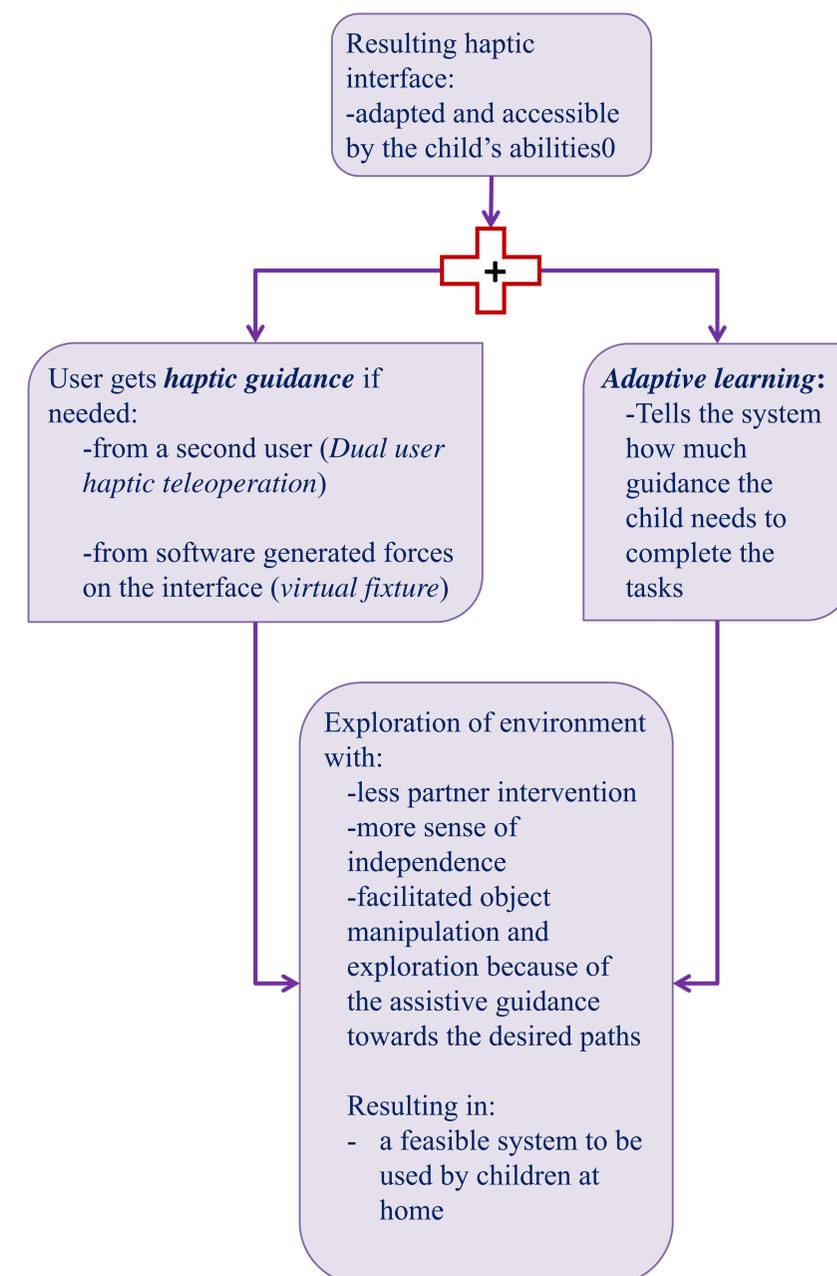


**Fig. 2:** showing the system set-up



**Fig. 3:** Experimental set-up: the left picture shows the **haptic interface** grasped by a child and the picture to the right is the robot **end-effector** in the environment manipulating an object

## How results will be used



**Fig. 4:** conceptualization of future work by adding more features to the resulting system