

## **A workshop to explore which toys/technologies best support the awareness and use of the assisting hand during arm/hand rehabilitation**

### **Workshop aim**

Through this workshop we explored the effectiveness of sensory feedback (audio, vision, or touch) on toys and devices in encouraging children with hemiparesis to use both of their hands during upper limb rehabilitation. Hemiparesis is a common consequence of cerebral palsy that results in impairment on one arm, referenced as “assisting arm”. We intended to get feedback in terms of engagement and usability from those who would be using these toys and devices: children and families.

### **Participants**

Two families attended the session, with a total of four parents and two children (aged 20 months and 3 years old). These families had previously participated in the therapy program at the REACH service at Evelina Children’s Hospital for children with or in risk of hemiplegia and were contacted through our clinical partners at the service who helped organizing the workshop.

### **Workshop organization**

The session was organized to last between 1 to 2 hours and each family was compensated with £50 for their participation. The workshop was contained within four different rooms. In a larger room we offered some ice-breaking group activities and some snacks and refreshments, so that children could rest in between sessions. In three smaller rooms we run individual activities where families were able to test and provide feedback on our technologies one-by-one, without distractions.

### **Group activity**

In this activity, families were able to choose from a set of different pre-made toy shapes (a dog, a robot, a boat, etc) and customize them to make them their own. This semi-structured activity favoured collaboration between families while allowing them to rest from the individual activities. Materials for customization were purchased to offer a variety of sensory feedback, including crayons with various colours, paper of different textures, pompoms, feathers, fabrics, etc. At the end of the workshop participants took their creations home.

### **Individual activities: exploring sensory feedback as a method to encourage awareness and to reward hand use**

Each family spent 15 minutes in each individual rooms, each associated to a different sensory channel (haptic, visual, auditory). In each room the child played in four activities presented sequentially, while the parent observed. Two of those activities were used to explore sensory feedback as a method to draw awareness to the assisting arm, and the other two to explore sensory feedback as a reward mechanism to encourage the use of the assisting arm. The session was video recorded (with written informed consent signed by the parents) to explore child reactions and feedback forms were given to the parents after each activity.

Room:	Haptic Room	Visual Room	Audio Room
<b>Activity 1:</b>	Parent touches assisting arm	Parent shows toy near assisting arm	Parent talks near assisting arm
<b>Activity 2:</b>	Child wears bracelet that vibrates when experimenter sends command	Child wears bracelet that lights up with colours when experimenter sends command	Child wears bracelet that plays a short melody when experimenter sends command
<b>Activity 3:</b>	Child is offered a toy that shakes when child plays with it	Child is offered a toy that illuminates with colours when child plays with it	Child is offered a toy that plays a melody when child plays with it
<b>Activity 4:</b>		Child is offered a toy that makes a character move on screen when child plays with it	Child is offered a toy that triggers laptop to make animal sounds when child plays with it

## Feedback forms

The workshop feedback forms were used to evaluate the parents' perception of child engagement and toy usability during the individual activities of the workshop. Parents were asked to answer 3 questions right each activity in the individual rooms:

Please state your level of agreement with the following statements	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
<b>S1: I think my child enjoyed this toy</b>					
<b>S2: I think my child would keep playing with this toy</b>					
<b>S3: I would use this toy during our rehab sessions at home</b>					

## Summary of outcomes

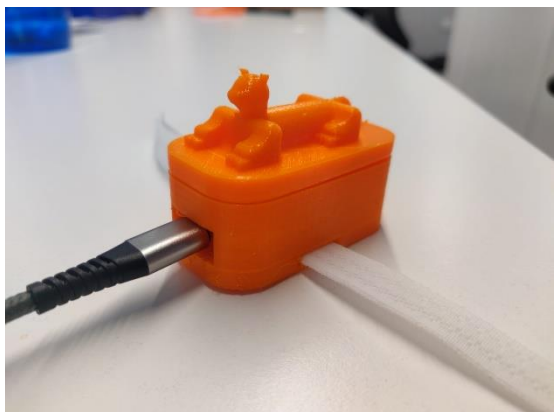
Both of the two children participating played with the presented toys with the assisting hand. There were however differences in their reactions and the parents' feedback to the different activities.



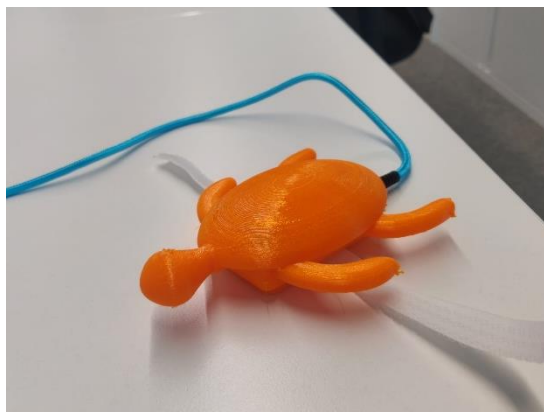
**Visual toy:** LEDs of different colours turn on when the experimenter sends a command while worn as bracelet (activity 2) or when the child moves the toy (activity 3)



**Screenshot of visual reward:** the ladybug moves around the screen when child moves the ladybug toy in the left picture (activity 4)



**Haptic toy:** it produces a soft vibration when the experimenter sends a command while worn as bracelet (activity 2) or when the child moves the toy (activity 3)



**Audio toy:** it plays a short melody when the experimenter sends a command while worn as bracelet (activity 2) or when the child moves the toy (activity 3). In activity 4, when moves a laptop will generate animal sounds.

The haptic toy seemed soothing for both children when worn as a bracelet and the vibration seemed an effective way of having them look at their assisting arm. The parents of both children reported to “agree” with the child liking this toy. However, when not worn as a bracelet while the family of the youngest child “strongly agreed” with them liking the toy, the family of the older child “disagreed” with the thought that their child would remain engaged by the toy, stating that the child could be more engaged if the toy could for example control a character on a game.

This outcome, which could be linked to the different in age, could also explain how the older child seemed more aware of the cause effect relationship between the visual toy motion and the ladybug

on the screen and with the (in general) lower levels of agreement with the statement “I think my child liked this toy” for the younger child in the visual activity.

The sound activity, specifically the activity where the animal noises were used seemed the one most enjoyed by the two children, with parents “strongly agreeing” with their child liking the toy. The parents of the older child additionally suggested that they believed that a more structured game using that feedback, where for example the turtle toy could “swim” to different locations on a mat (either vertical or horizontal to train different motions) and generate a different animal sound depending on the destination, would be engaging to their child.

In summary, haptic feedback may be an effective way of drawing awareness to the assisting arm, while visual cues and audio may work better as reward mechanisms. While the audio feedback seemed similarly engaging for both children, different visual feedback may work better for children of different age, with older children remaining more engaged with more complex cues that have a cause-effect relationship with the motions of their assisting arm.