TouchView: Cognitive Assistance for MPS Children

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Abstract

Developmental disabilities such as Mucopoly-saccharidoses (MPS) require minute-to-minute, burdening care on the part of the parents. Often, one of the parents has to be dedicated 100%, 24/7 to support and sustain their child's life. To enhance children's cognitive ability in expressing some of their desires, we designed a simple DVD controller in a specific form factor suitable to MPS children. Our design was participatory, allowing one family with MPS children to provide guidelines. TouchView is intended to provide intuitive way for MPS children to express their wishes and desires of watching a particular movie.

Keywords

Touchpad, MPS children, pervasive, cognitive assistance, cognitive enhancement

ACM Classification Keywords

H5.2. [User Interfaces]: User-centered design.

Introduction

Parents have responsibilities to take care of their children. In the case of children with degenerative cognitive diseases, parental care is more than simply attending to the children, it entails constant and careful reading and guessing of the children's intentions and needs. In this project, we describe an intuitive interface

system that enhances the cognitive ability of MPS children in expressing their needs. This, in turn, improves the children's quality of life, and reduces their parents' efforts of care.

Mucopolysaccharidoses Characteristics

MPS is a genetic lysosomal storage disease (LSD) caused by the body's inability to produce specific enzymes [1]. This may cause progressive damage throughout the body, including respiratory system and central nervous system [1]. Indications of the MPS are cognitive impairment, gargoyle-like facial features and bone and joint abnormalities.

Cognitive Enhancement

MPS children are not able to represent their demands through speech. In order to convey an expression, they react to the only language they are capable of, which is abnormal activities, such as shacking, biting and touching. Interactions by MPS children with objects that they may recognize are therefore impossible unless, somehow, the objects are adapted to respond to such abnormal interaction modalities.

TouchView for DVD Control

In this project, a multi-slot DVD changer has been used. MPS children spend part of their leisure watching DVD movies. When attempting to select a movie, they cannot be aware of exactly what they want to watch using traditional remote controller usually equipped with tiny buttons. We designed and developed a touch-pad, we call TouchView, to improve the cognitive process[1] in interacting with objects. TouchView provides the following enhancements: (1) Perception:

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[1] The process of cognition can be divided into five parts: perception, attention, understanding, memory & reasoning [2]

Designed actual size/shape slots (approx 5"x7") to represent movies, instead of the tiny buttons on the remote controller, (2) Attention: Provided actual DVD cover insert to attract children's interest by its colorful and distinguished design, (3) Understanding: When the pressure sensor attached behind the cover insert is pressed, TouchView sends a packet of its slot number to the DVD player. Then the DVD player, which is fitted with a Bluetooth receiver that communicates with TouchView, will play the selected movie, an action that would reinforces to the child a linkage between the slot and the movie, and (4) Memory and Reasoning: Movies were watched based on the child's demand through image representation. We found that image-based self-access is a promising approach for cognitive enhancement as figure 1 shows.

figure 1. Engineering prototype of TouchView .

Discussion with a volunteer family

Based on the initial prototype and its demonstration, a feedback and discussion with one volunteer family led

to the formation of new requirements for improving the system and its usability. We captured all the important new requirements to be considered in developing the next version of the prototype (Version 2.0) as follows:

- The form factor should be changed to allow for a more ubiquitous and distributed concept. Current device includes 6 DVD placeholders plated into one large frame with one controller as figure1 shows. The new requirement is to shrink, replicate and embed the controller and to package it into the commercially available DVD cases.

- It was required to bypass the Play button on DVD menus. That is for those DVD's that start into a menu, which requires an additional Play command, an auto play was required.

- Next version TouchView needs to ignore multiple touches and shakings that is multiple consecutive touches, presses and shakings should have the same effect of one selection.

- Electric components and devices have to be packaged safely inside the DVD case. That is they should be placed away from the edges of the case, and the case should be sealed rightly. This is important because selecting a DVD by MPS children is likely to entail biting the case edges.

- To improve MPS children's usability, we need to investigate the possibility of multimodal sensor combinations: Pressure sensor only, Accelerometer only, and Pressure sensor + Accelerometer. We needed to allow the parents to program the interface to change the sensing modality configuration and their levels of sensitivity.

Conceptual Design of TouchView 2.0

We designed the next version of the prototype that meets all new requirements. Figure 2 conceptualize an installation procedure of TouchView 2.0 equipped with a multimodal sensor platform.

figure 2. Single-slot TouchView installation.

Ongoing Work

To utilize our preliminary result, we are re-designing our prototype by making each DVD case a stand alone, single-slot TouchView. This increases ubiquity and allows for much more flexible interactions. Single-slot TouchView will be shown on the finished poster.

Reference

[1] National MPS Society, http://www.mpssociety.org/

[2] Bostrom et al. Cognitive Enhancement: Methods, Ethics, Regulatory. Future of Humanity Institute, 2009