

Motivation:

Autism Spectrum Disorders (ASD) are developmental disabilities characterized by difficulties with social interactions, impairment in verbal and/or nonverbal communication, and the development of repetitive, unusual, or highly-specialized interests. The main symptoms of ASD are particular social and language problems. Often, children with ASDs will have delays developing spoken language. Currently, language delays are the symptom that most commonly captures the attention of parents or pediatricians and, consequently, children are infrequently diagnosed before the age of 3 or 4 years. Recent estimates for all ASDs combined tend to fall between 20 and 80 per 10,000. [1] Unquestionably, there are more children being diagnosed with ASD today than ever before. This, in and of itself, presents a major public health challenge.

We hypothesize that some individuals on the autism spectrum exhibit a bias towards using visual instead of verbal mental representations for various tasks. This "thinking in pictures" form of cognition has been introspectively reported by many individuals on the autism spectrum, such as Temple Grandin, a high-functioning adult with autism who has written several books touching on this notion.[2] We believe, the adaptive keyboard with its dynamic display keys can augment communication in non-verbal children with autism disorder spectrum. The dynamic display feature of the keys enable programming contextual visual cues that can augment communication. A collection of visual cues and natural language processing algorithms work in combination to allow a child to communicate with peers and adults.

Idea:

- The Microsoft Adaptive Keyboard, with its programmable display and capacitive touch screen, enables an image based input system. In doing so, it provides children with language challenges, a visual input mechanism for communication.
- PiX-C allows definition of relevant contexts which the child might find the need to express or communicate about.
 - The keys of the adaptive keyboard are populated with images. These images are grouped to represent people, objects and actions within the selected context. The contexts and the related images can be customized to a child’s unique social environment.
 - The combination of images selected by the child allows Natural Language Generation, which enables them to express themselves or communicate with others.



Working:

- PiX-C uses the auxiliary touch display of the Adaptive Keyboard to provide the child with the means to pick the context she wants to talk about.
- Based on the context chosen, the keys display appropriate images. The child then selects a combination of images which represent her thoughts.
- PiX-C enables parents/caregivers to add new sentences and related image sequences. This improves personalization for the child.
- The PiX-C system interprets these pictures into equivalent words and generates a fully formed sentence.

Future Work:

Currently PiX-C works with specific contexts and their fixed set of associated images. This can be greatly improved by leveraging the capacitive touch screen on the keyboard to provide a gesture based input mechanism that can dynamically trigger retrieval of appropriate images.

The PiX-C system can provide audio cues which can augment the visual input mechanism.

The PiX-C system can be enhanced to have speech output which can complement the current textual output system.

References:

[1.] Fact Sheet at the Center for Autism and Developmental Disabilities, John Hopkins School of Public health (<http://www.jhsph.edu/cadde/Facts/autism.html>)

[2.] Visual thinking in Autism, Design and Intelligence Lab, School of Interactive Computing, Georgia Tech (<http://www.dilab.gatech.edu/vita.html>)