Mi.L.A: multilingual and multifaceted mobile interactive applications for children with autism

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Abstract. In this paper we present the initial stages of a project entitled Minority Language Applications (Mi.L.A) which aims to facilitate material for children with autism in a multilingual setting using interactive multimedia that increase both the awareness as well as the access to information for patients who need it. Pilot testing the applications with three children within the autism spectrum shows favorable initial results. The children would interact with the applications successfully and gain from the sessions in terms of communication skills as well as improved verbal and visual cues.

Keywords: mobile applications, autism, disabilities, multilingual.

1. Introduction

In recent years, there is a growing interest in the area of technology and autism. Researchers have attempted to study many aspects of technology in order to address their potential value in supporting their education. In promoting the independence of the child, the iPod Touch has been used to train Autistic Spectrum Disorder (ASD) children in how to structure their leisure time independently, and without any aid from an adult (Carlile, Reeve, Reeve, & Debar, 2013). Other studies have

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used computer programs to successfully provide an activity schedule for ASD children (Stromer, Kimball, Kinney, & Taylor, 2006). Although there has been an increase in the use of technology in treating ASD, we recognize that there is lack of applications that cater for children with autism for minority languages (note: we refer to the term 'minority language' in the sense of a language that received little attention in translated applications). A child with autism should not have to (and is often not able to) receive therapy in a second language.

From an extensive search, there are no mobile applications developed for most minority languages for ASD. The population with ASD in minority languages are dealt with as follows: the first option is to use specialized ASD digital tools that are available in common foreign languages; most often English. The second option is to use non-specialized language learning digital tools in the native language. These generic tools are not specialized for individuals with ASD and provide limited assistance or have a reverse effect in that they can damage, frighten or hinder the development process of the individual. A third option is to classify ASD patients as invalids and confining them to be neglected. We present the Mi.L.A initiative. The acronym from the Greek 'μίλα' (pronounced milá) literally means 'speak'. Project Mi.L.A involves creating assistive software (mostly mobile applications) to educate children with disabilities, starting with autism for minority languages with interactive, specialized multimedia content. Specifically, the project aims to:

- create applications targeting minority languages, facilitating parents and therapists with tools required to help children, especially where there are limited resources for therapy: "[a] computer can spend much more time with a patient than a specialist and in a more comfortable, familiar environment" (Edwards, 2014, p. 13);

- give children with autism the chance to experience accessing traditional culture and stories which other children are exposed to through books or storytelling by their parents (Cyprus Interaction Lab, 2014).

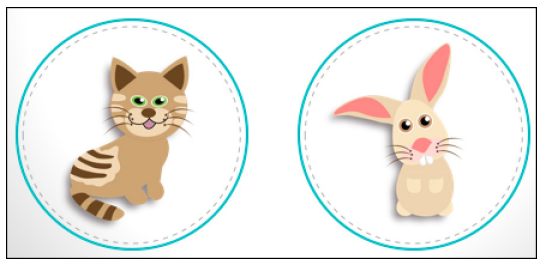
The paper continues to present the applications created for patients within the ASD spectrum and presents pilot testing with positive results.

2. Method

In this section, we present the prototypes applications in the Mi.L.A collection. All software developed for the Mi.L.A initiative undergo severe specialized scrutiny

before they are released. In order to ensure the quality and suitability of the content of the applications, a User-Centric Design (UCD) process is enforced and every element must pass testing (See Figure 1).

Figure 1. Children with ASD would confuse the two animals; scrutiny uncovered that the animals' whiskers were similar and were subsequently changed



2.1. Object identification

A common exercise for individuals with autism is that of identifying objects they would come across daily (Granpeesheh, Tarbox, & Dixon, 2009). In this part of the software, the child is presented visually with a series of objects and asked (verbally and textually) to identify which of the images the object corresponds to. The child then needs to select by touching the correct object. If the child selects correctly, then a short commendation is given and the next object identification question appears.

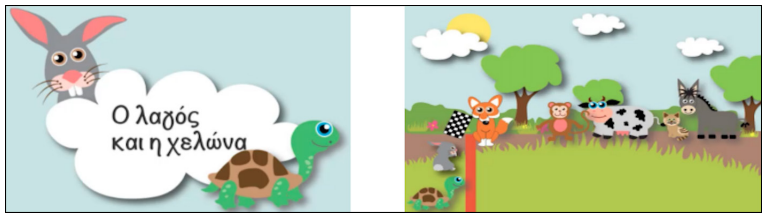
2.2. Sound identification

A common exercise for individuals with autism and especially children is identifying sounds they come across on a daily basis (O'Connor, 2012). These include sounds of everyday life. In this part of the software, the child is presented visually with a series of sounds and asked (only verbally) to identify which of the images the sound corresponds to.

2.3. Stories

A part of the culture that children with ASD usually miss is that of traditional children stories. In Mi.L.A, traditional stories are recorded and presented in a sensory friendly way to the children, with animations and audio (See Figure 2).

Figure 2. 'The hare and the tortoise' tale



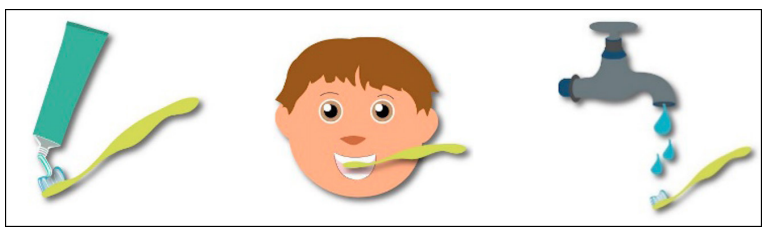
2.4. Songs

Singing and listening to songs is important in the development of a child. In the field of ASD it is even more important because it aids the development of speech (Gold, Wigram, & Elefant, 2010). Traditional and popular songs are available on the applications with a sensory appropriate visual stimulation in the form of animations to enhance understanding of the songs and increase cognitive attendance.

2.5. Self-care

A very common need of children with ASD is to learn how to take care of themselves (Kern, Wakeford, & Aldridge, 2007). As part of Mi.L.A we developed self-care stories, which will be based on the theory of "Social Stories", a well-documented tool in teaching social behaviors to children with ASD. A narrated story is paired with specially designed animations in order to teach the child these basic daily routines (see Figure 3).

Figure 3. Three stages in self-care video with voice over, teaching the child with ASD the process of brushing his/her teeth

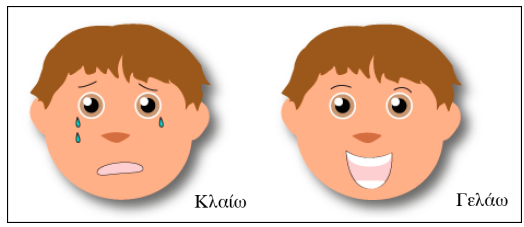


2.6. Expressions

It is well documented that children with ASD have difficulties understanding the emotional cues from people (Shamsuddin & Yussof, 2013). Extensive training can

help the child better understand these expressions and thus have a better social interaction. Mi.L.A has a simple game in which the child will learn to discriminate between several expressions (see Figure 4).

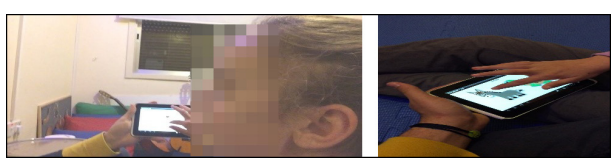
Figure 4. Expressions children with Autism may not recognize: crying and laughing



3. Initial testing

We tested the usability and investigated some effects of our application with three children diagnosed with autism by a developmental pediatrician. Each child received a one-hour therapy session weekly for five weeks. The aim of the pilot study was to study the acceptance of the mobile applications to the children with autism and to report early findings on its use and learnability. The test participants' profiles are as follows (names have been changed). Sheryl is an eight-year-old female diagnosed with Rett Syndrome and has limited speech and non-verbal communication skills. Mary is a ten-year-old female with limited communication and presents echolalia and stereotypical behaviors. During therapies and at home she favors playing with tablets. Jay is a 13-year-old male with low developed speech and attention span. There exists hyperactivity and aggression caused by lack of people interactivity skills. A stationary camera in the room recorded interaction both when the child was alone, as well as the session with a therapist. The children initially interacted with the application during the first session with the aid of the therapist, proceeding in future sessions to independently working with the application if able to.

Figure 5. (Left) Sheryl, disgnosed with Rett Syndrome, diverting attention from the tablet; (Right) Mary, with echolalia and stereotypical behavior, selecting the animal on level 2



Sheryl has shown an interest in tablets in previous sessions but has severe difficulty in eye-hand coordination. During the first interaction with the game, she avoided eye contact with the tablet several times (see Figure 5) but completed the game with assistance. Even though during the initial contact with the game she lacked interest, on the second session, she walked into the room and situated herself next to the table where the tablet was lying. Her speech was until now limited to a few vowel sounds and saying, "Yes". When interacting with the game, she exclaimed, "where is it?". Mary needed full assistance in keeping attention to the game engaging eye contact with the screen (see Figure 5) and pointing to the animals, during the first two sessions. After 4 sessions, she could engage in short intervals to point to two to three animals. During the game Jay kept engaged with the application for the whole duration of both stage 1 and 2 of the game. In later sessions, the child asked for the game by saying "Pad, Animals". Overall, all of the children participating in the evaluation of the applications showed positive responses interacting to various degrees and showing an interest in the game.

4. Conclusions and future developments

In this paper we presented the Mi.L.A initiative which deals with developing applications to assist people with disabilities in minority languages. All the applications are customized to not only the language of the target audience but also the specific culture. Using visual analysis, different metrics can be introduced from the study in order to be recorded in the longitudinal studies. By expanding the network of users, we will accumulate large data sets to produce user models and a better understanding of ASD.

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