

## Chapter 25

# Improving Socialization and Emotion Recognition for Children with Autism Using a Smartphone App

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### ABSTRACT

*Smartphone apps are used with increased frequency to teach children a variety of skills and to supplement more traditional forms of instruction. In particular, children diagnosed with Autism Spectrum Disorder (ASD) could benefit from applications suited to help them build social emotional skills that could contribute to more successful social interactions. In the study, the authors first investigated and compiled a list of existing apps to see where gaps exist in topic coverage. From this survey of existing smartphone apps for children with ASD, they developed a new app called LEA (Learning Emotions with Autism) that challenges children to interact in a social setting by responding to emotional cues, and having other children determine the emotion that is expressed. This app provides a new context to help children focus their attention on facial cues in order to recognize and interpret emotions through supported peer interaction. In this chapter, the authors discuss how this app was designed and implemented. They also provide a tutorial on how to develop smartphone apps that can be used for ASD research.*

### INTRODUCTION AND MOTIVATION

One in 88 children in the United States has an Autism Spectrum Disorder (Centers for Disease Control, 2012), which is characterized by deficits in social communication and social interaction, and by the

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presence of repetitive and ritualistic behaviors that are present in early childhood and impair everyday functioning. Specifically related to social deficits, an individual with ASD may demonstrate impairments in social-emotional reciprocity, using and interpreting nonverbal communicative behaviors, and developing and maintaining relationships. These impairments may range in presentation and severity. Social functioning is a highly prioritized goal for individuals with ASD (Rogers & Dawson, 2010). Recently, clinicians, parents, and teachers have begun incorporating technology into intervention and educational plans to enhance social communication. In fact, Autism Speaks<sup>1</sup>, a leading national resource for information on ASD, lists over 200 mobile apps that may be appropriate for individuals with ASD, though very few studies have examined the efficacy of technological applications used to enhance social interactions (DiGennaro Reed, Hyman, & Hirst, 2011).

The adoption rate of mobile computing, in the form of smartphones popularized by Android and iPhone platforms, continues to increase and has recently passed the number of desktop computer sales (Gartner, 2013). Despite the growth and interest in mobile computing devices, few apps have been developed to directly improve social-emotional recognition and response within natural contexts including school, home, and social environments. Though the utility of these types of programs has not been established, apps offer promise to enhance social communication within social situations for which smart phones are already commonplace. Smartphone apps are used with increased frequency to teach children with ASD a variety of skills. In our research, we first investigated and compiled a list of existing apps to see where gaps exist in topic coverage. From this survey of existing smartphone apps geared towards children with ASD, we developed a new app that encourages children to interact in a social setting by responding to emotional cues, and having other children determine the emotion expressed by their peers. Our app, called LEA (Learning Emotions with Autism) provides a new context to help children learn about their emotions through peer interaction. This chapter summarizes the findings from our literature and tool survey, identifies a missing gap in current app offerings, and provides an introduction as to how others can create their own mobile app to initiate additional research within the field.

## **STATE OF THE ART IN MOBILE APPS FOR CHILDREN WITH ASD**

Children with ASD demonstrate poorer social attention when compared to typically developing children (Dawson et al., 2004). Further, previous research has indicated that children with ASD have difficulty recognizing emotions (Golan, Ashwin, Granader, McClintock, Day, Leggett, & Baron-Cohen, 2010; Kuusikko et al., 2009) that may be related to more severe social impairments (Borston et al., 2007, Downs & Smith, 2004). Studies suggest that individuals with ASD are less proficient and slower at matching emotional expressions (Bormann-Kischkel, Vilsmeier, & Baude, 1995; Celani et al., 1999; Hobson et al., 1988; Sawyer et al., 2012) and some individuals make abnormal social judgments based on facial processing (Adolphs, Sears, & Piven, 2001). Some children with ASD have been found to prefer visually examining geometric figures compared to social images (Pierce, Conant, Hazin, Stoner, Desmond, 2011). Further, individuals with ASD use different strategies and focus on different cues to recognize emotion than typically developing individuals (Downs & Smith, 2004; Hobson, Ouston, & Lee, 1988). For example, Klin et al. (2002), used eye tracking technology in social scenes to determine that individuals with ASD focus more on the mouth region of a face and less time on the eye region than age, gender, and cognitively matched peers, indicating an abnormal visual fixation pattern. A lack of social motivation may reduce attention to faces early in development of individuals with ASD (Dawson et al.,

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