Research Proposal

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Title:	Xylo-Bot: An Automated Music Teaching Robot Platform for Children with Autism and Beyond
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Background

Autism is a general term used to describe a spectrum of complex developmental brain disorders causing qualitative impairments in social interaction and results in repetitive and stereotyped behaviors. Currently one in every 88 children in the United States are diagnosed with ASD and government statistics suggest the prevalence rate of ASD is increasing 10-17 percent annually [?]. Children with ASD experience deficits in appropriate verbal and nonverbal communication skills including motor control, emotional facial expressions, and eye gaze attention [?]. Currently, clinical work such as Applied Behavior Analysis (ABA) [?, ?] has focused on teaching individuals with ASD appropriate social skills in an effort to make them more successful in social situations [?]. With the concern of the growing number of children diagnosed with ASD, there is a high demand for finding alternative solutions such as innovative computer technologies and/or robotics to facilitate autism therapy. Therefore, research into how to design and use modern technology that would result in clinically robust methodologies for autism intervention is vital.

In social human interaction, non-verbal facial behaviors (e.g. facial expressions, gaze direction, and head pose orientation, etc.) convey important information between individuals. For instance, during an interactive conversation, the peer may regulate their facial activities and gaze directions actively to indicate the interests or boredom. However, the majority of individuals with ASD show the lack of exploiting and understanding these cues to communicate with others. These limiting factors have made crucial difficulties for individuals with ASD to illustrate their emotions, feelings and also interact with other human beings. Studies have shown that individuals with autism are much interested to interact with machines (e.g. computers,

iPad, robots, etc.) than humans [**?**]. In this regard, in the last decade several studies have been conducted to employ machines in therapy sessions and examine the behavioral responses of people with autism. These studies have assisted researchers to better understand, model and improve the social skills of individuals on the autism spectrum.

This proposal presents the hypothesis and potential methodology of a study that aimed to design a entertaining humanoid-robot music therapy/lesson-like sessions for capturing, modeling and enhancing the social skills of children with Autism. In particular we mainly focus on gaze direction and joint attention modeling and analysis and investigate how the ASD and Typically Developing (TD) children employ their gaze for interacting with the robot.

Research question

Now state explicitly the hypothesis you aim to test. Make references to the items listed in the Reference section that back up your arguments for why this is a reasonable hypothesis to test, for example the work of Knuth [1]. Explain what you expect will be accomplished by undertaking this particular project. Moreover, is it likely to have any other applications?

Method

In this section you should outline how you intend to go about accomplishing the aims you have set in the previous section. Try to break your grand aims down into small, achievable tasks. Try to estimate how long you will spend on each task, and draw up a timetable for each sub-task.

Software and Hardware Requirements

Outline what your specific requirements will be with regard to software and hardware, but note that any special requests might need to be approved by your supervisor and the Head of Department.

Overall, you should aim to produce roughly a two page document (and certainly no more than four pages) outlining your plan for the year.

References

[1] D. E. Knuth. *The TEX book.* Addison-Wesley, Reading, Massachusetts, 1984.

[2] L. Lamport. *LATEX : A Document Preparation System.* Addison-Wesley, Reading, Massachusetts, 1986.

[3] Ken Wessen, Preparing a thesis using LATEX , private communication, 1994.

[4] L. Lamport. Document Production: Visual or Logical, *Notices of the Amer. Maths. Soc.*, Vol. 34, 1987, pp. 621-624.