

## A Computer Game based Approach for Increasing Fluency in the Speech of the Autistic Children

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**Abstract**--Autism is a complex developmental disability that typically appears during the first three years of life. This is the result of a neurological disorder that affects the functioning of human brain. Children diagnosed with autism often are self-absorbed and seem to exist in a private world where they are unable to successfully communicate and interact with others. Sometimes they have difficulties in developing speaking skills and understanding what others say to them. Lack of fluency in the speech is one of the most frequently found problems with autistic children. The traditional methods for increasing fluency were found to be monotonous and hence, not much successful during our three months of observations over the participants of Autism Welfare Foundation (AWF) at Dhaka. Therefore, we developed an interactive computer game for the autistic children for improving the fluency in their speech. Our game produced encouraging results over a participant during three months of observation. In this paper, we describe our project and the outcomes.

**Keywords**--Autism, e-Learning, Educational Games, and Human Factors.

### I. INTRODUCTION

Autism is considered to be the most common pervasive developmental problem. This is a neural disorder that affects multiple areas of development including social interaction. People diagnosed with autism very often demonstrate poor performances in verbal and non-verbal communications. In most of the cases, the signs of autism are seen in the very early age of their lives. Usually, a child begins to show signs of autism by the age of three, including signs that his or her verbal speech is not developing as normal for a child of his or her age. Autism spectrum disorders are found to affect as many as one out of every 150 eight-year-old children.

From January of 2010 to March of 2010, we conducted a pilot program at the Autism Welfare Foundation at Dhaka. We worked with a good number of participants diagnosed with autism and had problems in their speech. All of them were in the age range between 4 to 11 years old. From our observation, we chalked out the following major problems in their speech: 1) *Non-Response*, 2) *Low Voice*, 3) *Unintelligible Words*, 4) *Lack of Fluency*, 5) *Lack of the sense of Turn-Taking*, 6) *Wrong Answer*, 7) *Uneven language development*. For improving the fluency in their speech, we made a computer game where the player had to utter the names of the objects shown in the computer screen within a small period of time. We chose a participant who is a 10 years old girl and had problem

with her fluency. We worked with her for more than three months with our games with different difficulty levels got some encouraging results. In this paper we described our game, the experiments and the outcomes.

### II. RELATED WORKS

Autism was first described by Leo Kanner in 1943 (Wing, 1996b). It is now regarded as part of five disorders, collectively referred to as autism spectrum disorder (ASD) or pervasive development disorder (PDD). The five are autism, Asperger syndrome, pervasive development disorder not otherwise specified (PDD-NOS), Rett syndrome and childhood disintegrative disorder. Computer games have proved very powerful tools in this regard. *Rahman et al* developed a fully computerized game for increasing clarity in the speech of the autistic children [1]. *Sharmin et al* [2] tried to eliminate some shortcomings of the software proposed by *Rahman*[1] with the help of an human instructor. In this paper we concentrate on developing the fluency of autistic children who has already a rich vocabulary set but unable to pronounce a complete sentence effectively.

### III. OUR CONTRIBUTION

In this section, we introduce our interactive gaming software along with its user interface & architecture. We also discuss our experiment using this gaming software.

#### A. The Core Components of the game

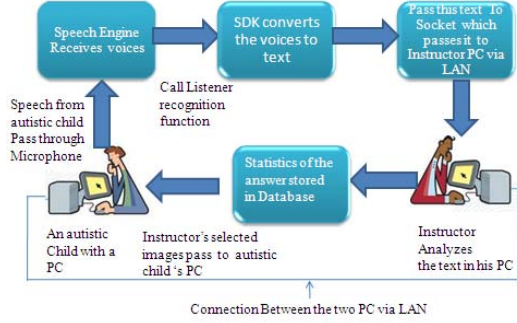
The main portion of the gaming software consists of the following parts: (1) Java Socket technology for connecting two computer. (2) Swing Component of Java for the design of front end. (3) MySQL Database for storing images and score. Some of the interesting features of our newly developed game are (a) Completely platform independent (i.e. compatible in all kind of operating system provided the compatible JDK is available), (b) Very easily extensible image database with click & update option etc.

#### B. Our Implemented Approach & Result

During our 3 months of intervention, we had used our gaming software in an incrementing manner of the difficulty level of the sentence (i.e. 2 words sentence or 3 words sentence etc) to improve the fluency level of the participant. We not only increased the difficulty levels of the sentence but also set some certain time limits to pronounce the sentence correctly & completely.

### 1) Experimental Setup

In Figure 1, we have illustrated the experimental setup that was used for improving the fluency in the speech of the autistic children. The instructor and the participant would use different computers connected by a LAN.



**Figure 1:** An overview of the experimental setup.

### 2) How to play the Game








First the instructor chose a set of images that could form a sentence and pass those to the participant's computer through LAN. The images would appear at the left of the screen and move toward the right until those finally vanished. We introduced this feature considering the fact that, this would give the autistic child more exciting gaming environment which in turn helps them to pronounce the complete sentence more quickly. We also introduced different difficulty levels determined by the number of words used in a sentence.

### 3) Experiments and Observed Results

Although the main target was to develop the fluency in the speech of the participants, we had to teach her some words first to enrich her vocabulary. Now, for developing fluency, our approach consisted of the following strategies.

- (1) Initially a single word appears in the screen.
- (2) Then a simulated sentence consists of two words.
- (3) Then a simulated sentence consists of three words.

Besides, we maintained also data regarding the time taken the autistic child to pronounce the words along with data of number of words they could pronounce in a single sentence. In Table 1, we illustrate a fraction of our data collected during our experiment.

Time Limit → Object	10 seconds	7 seconds	5 seconds
 Ball	✓	✓	✓
 Book	✓	✓	✓
 Tree	✓	✓	✓
 Computer + TV	Computer(X) Television(✓)	Computer(X) Television(✓)	Computer(X) Television(✓)
 Umbrella + Bicycle	Umbrella(✓) Bicycle(✓)	Umbrella(✓) Bicycle(✓)	Umbrella(✓) Bicycle(✓)
 Cat + Dog + Lion	Cat(✓) Dog(✓) Lion(✓)	Cat(✓) Dog(✓) Lion(✓)	Cat(✓) Dog(✓) Lion(X)
 Mango + Banana + Apple	Mango(✓) Banana(✓) Apple(✓)	Mango(✓) Banana(✓) Apple(X)	Mango(✓) Banana(X) Apple(✓)

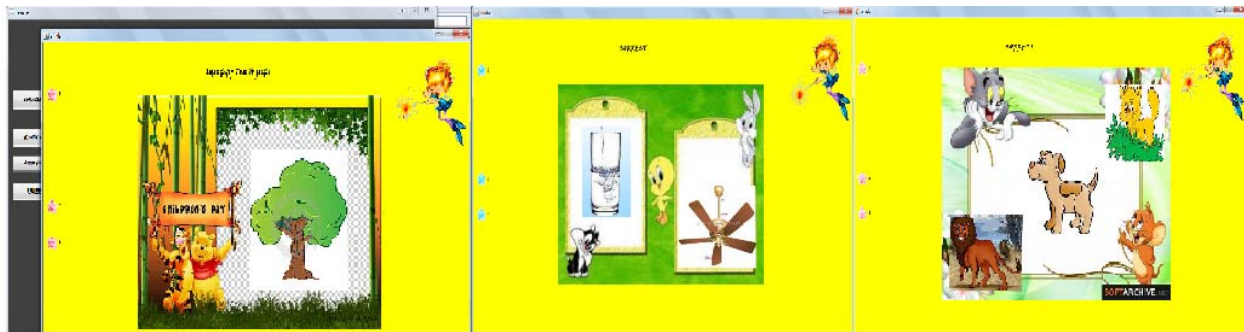
**Table 1.** Time taken by the autistic children at different level of difficulty of the sentence.

### IV. CONCLUSION

In our experiment, we motivated the participant to make fluent speech by our game environment. The initial success of this experiment encourages us to try for a complete computer-game based speech therapy for the autistic children. However, we need more experiments before introducing these to a larger scale. For the time being, we suggest our game therapy to be applied along with the tradition therapies for the best output.

### REFERENCES

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(a) User Interface for the instructor (b) A GUI with two objects at the autistic child's end (c) A GUI with three objects

**Figure 2:** Three sample screen shots of our game