Teaching Intelligible Speech to the Autistic Children by Interactive Computer Games

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ABSTRACT

Autism is considered to be a disorder of neural development which affects about 1 in every 150 kids. Specifically, some children with ASD are not fortunate enough to acquire the ability to communicate in their own language. Since speech is an important media of communication, socialization, and interaction with the world, these children need assistance while delivering speech to communicate to the world. Without proper speaking skills, these autistic children face difficulties in expressing their needs and emotions, too. Doctors, therapists, and special teachers usually help kids with autism to overcome many difficulties. However, the traditional methods of teaching clear speech to the autistic children suffer from being monotonous, laborious and not successful in many cases. Hence, we developed an interactive computer game which will be helpful to increase intelligibility in autistic children. During our five months of intervention with the autistic children of Autism Welfare Foundation (AWF) at Dhaka, we checked the effectiveness of this therapy and got some encouraging results.

Categories and Subject Descriptors

J.3 [Life and Medical Sciences]: Health;

J.4 [Social and Behavioral Sciences]: Psychology

I.2.1 [Applications and Expert Systems]: Medicine and Science

General Terms

e-Learning, Autism, Experimentation, and Human Factors.

Keywords

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

1. INTRODUCTION

Autism spectrum disorders (ASDs) are a group of neurodevelopment disorders characterized by core deficits in three domains: social interaction, communication, and repetitive or stereotypic behavior. People suffering from autism very often demonstrate a poor performance in social interactions. These problems are frequently seen in their speeches and physical gestures.

Due to the abnormal cerebral structure, the thinking pattern of the autistic children is quite different from the neurotypicals. They very often have a strong attraction to some particular persons, objects, tasks, places or environments. During our intervention for more than five months with the autistic children at Autism Welfare Foundation (AWF) located at Dhaka, Bangladesh, we observed this important feature among most of them. Some autistic children were found be attracted by the underwater objects, while some were found to be fond of vehicles or foods. Their attraction level is very intense and most of them do not feel comfortable if they are not dealing with something related to the things they like. Any effort on teaching an autistic child with something they are not interested in was proved to be unfruitful. Hence we found that the diversity in tastes should be considered with utmost care while designing a learning system for autistic children. There are many stages of speech and language problems. The stages are classified as (1) Non-Response, (2) Making Low Sounds in Response, (3) Making Unintelligible Sounds, (4) Making Delay in Answering Questions, (5) Answering Incorrectly with Articulate Words, (6) Difficulties in Making Correct Sentences with words, (7) Lacking the Sense of Turn Taking. In this paper we concentrate on the third stage stated above, *Making Unintelligible Sounds.* The term intelligibility refers to the proportion of a speaker's output that a listener can readily understand. Some of the autistic children suffer from speech intelligibility problem. Although they can sound loud enough, the audience cannot get the meaning of those.

Actually, there is no cure for autism. But there are some way and therapy that can help an autistic child to develop from the constraints. Computer game has proved very powerful tool in this regard [1][2]. *Rahman et al* [3] have discussed the background of the research in this field and developed a fully computerized game for increasing clarity in the speech of the autistic children, but there are certain shortcomings of this methodology. First of all, the synonyms of any particular word which is not stored in computer database can be recognized as an error although the autistic child has pronounced the right name of the object shown in the computer screen. Another problem of that Gaming Software is the adaptability, an autistic children who is either performing better or worse the object selection process which is actually done

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by the gaming software using randomization might help a very little bit for improving his or her intelligibility. Keeping all these things in mind we are motivated to design a system based on interactive computer game to enhance an autistic children's intelligibility in speech. So, in this paper we have discussed our new method that will try to eliminate the shortcomings of game suggested in [3].

2. OUR WORK

The game we developed here is much like the game that had discussed in [3].However the most important & distinguishing feature of our new game is that, the game is no more between an autistic child & a computer. Rather we have introduced a human instructor & another computer in our game that will communicate one to one with the autistic child via his or her computer. Main advantages of this new methodology is that an instructor can closely examine an autistic child, his or her behavior pattern & considering whether he or she is performing better or not, he or she (the instructor) can select the image to show on the screen of the participant. Besides, since we are using a human being besides computer, we can easily create a lot of thrill and entertainment for an autistic child while playing the game including clapping, celebrating etc. For space constraint, we are avoiding here the technical details of our implementation. However we show here a schematic diagram in Figure 1 which demonstrates our system.

The basic idea of this game is very simple. Various kind of interesting pictures selected by the instructor considering the behavioral pattern of the autistic child, come in the *Graphical User Interface(GUI)* one by one and the autistic child who can pronounce the name of the picture clearly will be detected by the speech engine. Then it will convert to the text in autistic child's computer and send the the instructor's computer connected via LAN & Java Socket technology. After receiving the message the instructor will analyze it whether it is correct or not. Based on his current result the instructor will select the new image for showing in the screen of the autistic child and in this way the game will continue. If the answer is correct, he or she will be shown a motivational animation the computer screen

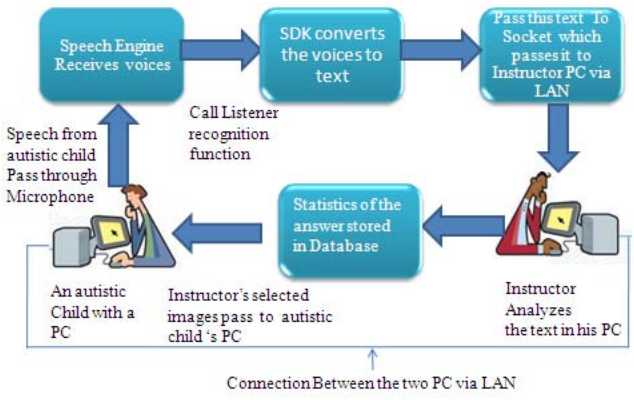

Figure 1: A Schematic Diagram of the Interactive Game

3. EXPERIMENTAL RESULT

In [3], Level-Wise Therapy that was seemed to be effective that time. However in that paper the authors had only shown our experimental result. There was no comparison of the procedure with others. In this paper we have tried to illustrate in Figure 2 how effective our new process in comparison with the process specified in [3] and Picture Exchange Method [4].

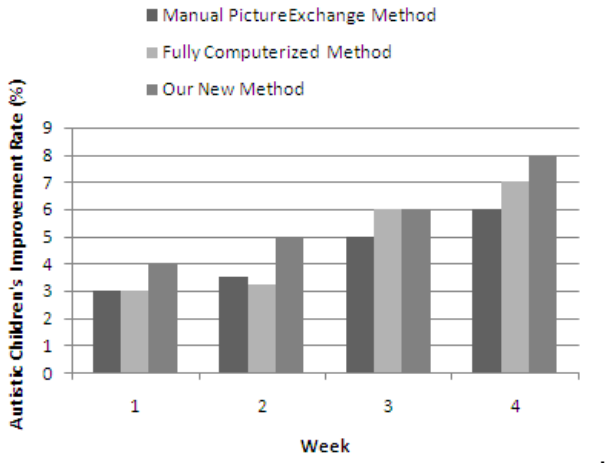

Figure 2: Comparison among Different Methods

In the Figure 2, we see that both the traditional "Picture Exchange" method and computer-based method produce gradual improvements; however our proposed method is faster than both of those as we have combined the benefit of both a human instructor's ability to judge and game environment generated by the computer. It is mentionable that the method described in [3] suffers from some fluctuation due to the reasons discussed previously.

4. FUTURE WORKS

The future works include the introduction of music and video in the experiment and trying to help children produce fluent complete sentences

5. REFERENCES

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