

Pitch Variations amongst Mild and Moderate Mentally Impaired Person

Kamakshi
Department of Software Engineering
ITM University
Gurgaon, India

Sumanlata Gautam
Department of Computer Science Engineering
ITM University
Gurgaon, India

Abstract: Speech is an expression of thoughts which is performed by interacting with people. As every technique in this world it has its own drawbacks, which includes inability to understand the sound or perceive it either from listener end or disruptive atypical speech generation at the speaker end.

In life we encounter number of people who are mentally unstable. In addition to the issues faced in performing basic work like confident walking public behavior and presentation, they may also suffer heavily with the speech stigma. While they speak they often sound like noise and are not understandable. Mental retardation is a relative term. Its meaning depends on the requisites of a society. A society of well grown and groomed people demands presence of intelligence and intellectualism, they search for person's social behavior to decide if a person is mentally impaired or not. This study is an attempt to find the differences and observe the pattern of pitch variation in 2 main categories of Mental retardation i.e. Mild mental retardation and moderate mental retardation.

Keywords: speech; mental retardation; spectrum analysis; pitch variation;

1. INTRODUCTION

For years there has been a setback in the field of Speech processing. There have been very few concerned researches going on to analyze and betterment of speech produced by mental patient. Researches are now more focused on to understand the root cause and brain damage which causes Speech impairment along with mental illness.

Our day to day routine, our work life, personal expressions and gratitude, needs and necessities all revolves around how we communicate it to others, and the answer lies as through interactions and speech. This requirement has made Speech as most powerful tool human have to influence and share their plans for any task.

Discussing a bit about speech production, it is created by the vibes which are created by collision of air pushed from lungs to the glottal muscles situated in our glottis or say mouth through the vocal cord.

Here we will not discuss about people who may have injured glottis or vocal cords but those people in the society which we come across who are not able to communicate efficiently due to multiple mental reasons which affects their lives. Major reasons include incapability to form a meaningful sentence or providing intone to words with special meaning, issues with speaking in an understandable format and accent or crooked pitch produced by them. In general if we talk about a normal growing person without mental illness, for adults, average pitch fluctuates through 85 Hz – 155 Hz (male) and 165 Hz – 255 Hz (female).[1] Likewise, pitch for child remains till 500 Hz.

2. MILD AND MODERATE MENTAL RETARDATION

Determining the percentage or measures of a person's retardation is not possible, as it varies with all the physical, mental, social, emotional and natural conditions. For instance, a person might be understandable to someone which would present him less retard however the same person may not be understandable to other person, so he will be considered highly retard by the other person. Surveys have given an estimate that 85 % of mental [2] patients are least severely retarded, or can be categorized into mild group. Carving and understanding the facts and truth of the mentally impairment people, it is found that population categorized under mild MR have an IQ scores amid fifty to seventy-five. They can live with self-sufficiency and independently, with the support provided by community.

Whereas the remaining 10% of population [3] which is suffering an ailment of severe mental problem is categorized as moderately retarded. They are usually suspected to obtain an IQ score which may be in middle of thirty five – fifty five. Possibly they are often found to be able to carry out only selfcare tasks with moderate supervision.

They typically acquire communication skills in childhood and they are able to live and perform daily routine tasks with totally supervised environment such as group home to stay in league with community. A moderately retarded person finds it more difficult to explain his thoughts than a Mild retarded person.

It becomes difficult for a mentally impaired person to maintain good rate of speech and ends up with [4] a slow rate odd articulation of sentences spoken. Prosodic features in their speech tends to be monotonous. The major obstruction in their expressiveness is the inability to learn remember and

determine apt and specific words to present a meaningful thought, which also results into syntactical mistakes as well. This discussion is in precedence to the various types and classifications of speech disorders which a person (typically developing or mentally retarded person) may have.

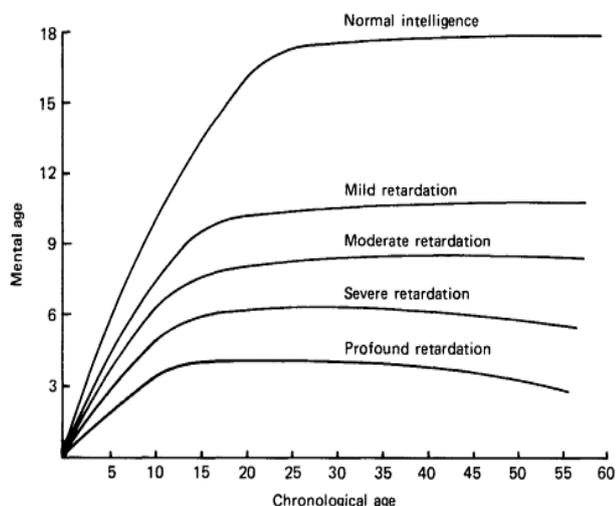


Figure 1. Mental age growth curves corresponding to normal intelligence & to the 4 levels of retardation

From ages it has been misinterpreted that Mental Retardation is same as Autism. [5] There is huge amount of dissimilarity between both of them. The sufferers of mental impedance, dearth the ability to perform routine tasks. Their intellectual, intelligence and behavioral capabilities are below the standards to live an independent life.

Autistic people are fully capable of performing all tasks and live an independent lifestyle however they pose problem in speaking.

Other than the disorders developed from childhood we may come across with another phenomenon i.e. Aphasia. In this, once the language is developed, [6] person may still fall into loss of language disorder. Predominantly adults are majorly sufferers of this language disorder. Aphasia may develop brusquely to anyone without prior disorders. Strokes are one of the key reason for Aphasia disease. Aphasia can be categorized as fluent and non-fluent.

The first Category of Fluent Aphasia speakers would not wobble or speak indifferently but they unknowingly face problems of low speech content and meaningless sentences. They are mostly unable to repeat the words and follow visual cues.

The non-fluent category of Aphasia is of higher concerns. It relates to a person's ability to utter words. One takes many pauses [7] and lots of time to utter words. Though their comprehension is surprisingly good but their omission of words makes it really hard to understand.

To reach to the depth of this knowledge area, and searching for new aspects with high precision, accuracy and sensitivity, multiple activities are performed like conducting discussions, research and experimenting and analytic groups are formed.

3. CAUSE

Low IQ scores and limitations in adaptive skills are hallmarks of mental retardation. Aggression, which sometimes leads them to hurt themselves and also such mood disorders are sometimes associated with the disability. The severity of the symptoms and the age at which they first appear depends on the cause of disorder of impairment. MR Children at mild levels reach to the developmental marks suggestively delayed. If the root of impairment is [8] chromosomal or other genetic disorders, it is often apparent from infancy.

Injuries and illness from childhood are prime reasons why one may suddenly acquire speech disorder. Once easy the skills of learning and adapting suddenly becomes challenging or impossible to master. Mental retardation causes remain unknown and mystery in around 35% cases.

The slums and poverty stricken population of children is most affected with the mental illness. As it is hard for them to find healthy living conditions and support from society, moreover malnutrition and lack of medical attention they are totally ignored with any symptoms or taken care if they develop retardation.

4. EXPERIMENT

Comparative study has been performed to observe the pitch variation in Moderate mentally retarded group and Mild mentally retarded group. Aim is to compare possible differences between them.

There variety of methods and tools for speech processing for the estimation of pitch and analyzing the spectrum. We have conducted our research using PRAAT tool and analyzed speech of each and every sample using the same tool. The samples were converted to Mono file for better results.

4.1 Participants

Speakers were enlisted from a mental retardation school located in Rohtak. A total of 12 samples were recorded. 6 sample each of Mild MR and Moderate MR. We had taken all the necessary permissions from school and parents of the children and the session was conducted in the supervision of their parents and people taking care of them.

Table 1. Database of MR speakers

Group name	No of samples
Mild MR	6
Moderate MR	6
Total samples	12

4.2 Procedure

A meditation room with silent and minimal noise was arranged for the purpose of best recordings. Preferably fans and air conditioners were also switched off. Sony Professional recorder was used to record speech samples at 16 bit PCM and 44 kHz sampling rate. We found many people suffering from different categories of MR: mild MR, moderate MR, severe MR, and profound MR. But we have in-cooperated mild and moderate MR people to participate in the experiment.

5. RESULTS

5.1 Spectrum and Pitch Analysis

We have analyzed all the samples to calculate the pitch of audios. Figure2 displays the spectrum analysis of mild and moderate MR speakers. In part (A) if we look at the waveform of Mild MR there is fluency of speaking words. Whereas in part (B) the waveform is quite different, there is a lot of pauses between the words also the speaker is taking time in speaking them.

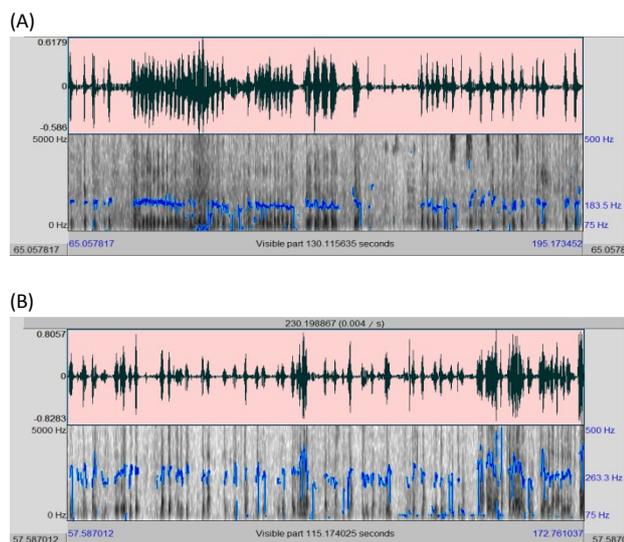


Figure2. Spectrum analysis of MR speakers (A) mild MR (B) moderate MR

The Pitch of mild MR person is comparably adjacent to those who are not having any impairment during the person's development. On the other hand the Pitch of moderate MR is very high in comparison to Mild MR.

5.2 Pitch variation

Values of pitch of all MR participants have been calculated using tool Praat. There is pattern observed in Mild and Moderate MR.

5.2.1. Mild MR

In mild MR the pitch of speaker is ranging from 120-180 approximately

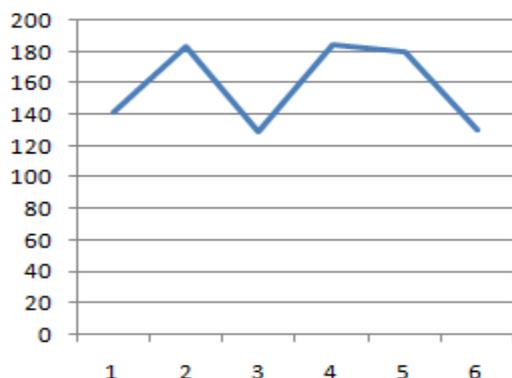


Figure 3. Pitch variation in adults suffering from mild MR

5.2.2. Moderate MR

In moderate MR the pitch variation is seen from 210 -270 approximately which is quite in comparison with mild MR.

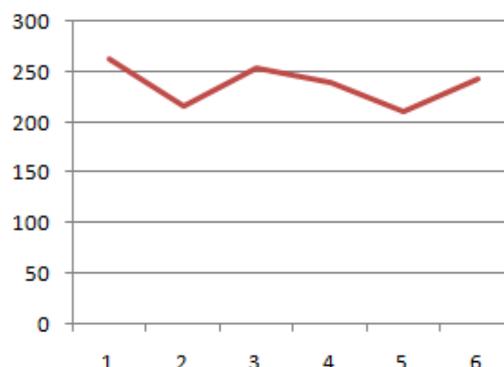


Figure 4. Pitch variation in adults suffering from moderate MR

5.2.3. Comparison between Mild and Moderate MR

Above figure shows the comparison of pitch rate for both the groups of Mild and Moderate mentally retarded Adults. We found that the pitch of adults with Moderate MR is higher than that of Mild MR

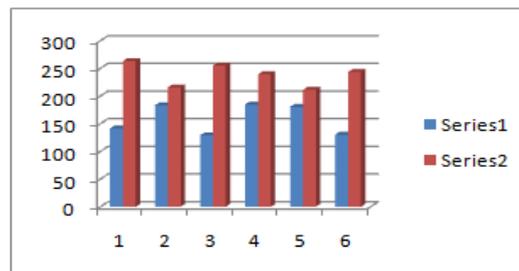


Figure 5. Comparison between Mild & Moderate MR (series1: mild MR, series 2: moderate MR)

Table 2. : Mean pitch of adults for both groups

Group	Average pitch (Hz)
Mild MR	158.4
Moderate MR	237.9

Results reveal that there is major difference mean pitch of mild MR and moderate MR .Mean pitch of Mild MR is low that that of moderate MR

6. TREATMENT AND PREVENTION

Musical therapies, extracurricular activities and social programs can help a lot in [9] treating people suffering from neurological-disorders.

The level of training depends on the degree of retardation. Mild MR can often acquire the skills needed to live independently. Moderate to profoundly retarded individuals usually require supervised community living.

Family support is very important in curing and helping mental retardation. A warm, supportive and homely environment is essential to help them.

7. FUTURE WORK

In Future the Speech of persons suffering from neurological disorder must be focused with nature of pitch variation and real cause behind the disorder. On the basis of pitch values we have attempted to present speech analysis and pitch variation but other than that fields regarding, intonation, time duration and rate of speech are key areas which still needs great focus.

8. ACKNOWLEDGMENTS

Thanking with deep gratitude to all the participants of the recording procedure I would like to extend my cordial respect to all the people who have evidenced their care to me by supporting and supervising all through my project.

My extreme respects to my guide Sumanlata Gautam for her constant and critical reviews which encouraged me to execute this paper. The in-depth insight of the system demonstrated by her helped me throughout this paper.

Lastly thanks to the schools for showing a new aspect of children with special abilities and providing permissions for conducting the research.

9. REFERENCES

[1] M. Benzeguiba, R. De Mori, O. Deroo, S. Dupon, T. Erbes, D. Jouvét, L. Fissore, P. Laface, A. Mertins, C. Ri s, R. R ose, V . Tyagi, C. Wel lekens, L. L. 1993. "Automatic Speech Recognition and Speech Variability: a Review"

[2] PC Gupta, Anjali Mathur, "Predicting the Class of a Mentally Disabled Patient to Check the level of Mental Retardation by using Feed Forward Back Propagation Neural Network", International Journal of Computer Applications, Volume 41, March 2012

[3] X. Wu and Y. Yan. "Speaker adaptation using constrained Transformation", IEEE Trans. on Speech and Audio Processing, 12(2):168-174, March 2004.

[4] Buschmann A, Jooss B, Rupp A, et al: "Children with developmental language delay at 24 months of age: results of a diagnostic work-up", Tavel, P. 2007 Modeling and Simulation Design. AK Peters Ltd.

[5] N. Evelyn Thayamani, Dr M. Parimala Fathima, Dr S. Mohan, Volume 2, Issue 6, June 2013, "Articulation and Reflection in Learning Process", Global Research Analysis(GRA)

[6] Elizabeth Bates, Elizabeth Bates, Brian MacWhinney, Cross Linguistic Research in Aphasia. Brain and Language, 41, 123-148, 1991.

[7] Dorothy Charles, Christopher Olm, John Powers, Sharon Ash, David J Irwin, Corey T McMillan, Katya Rascovsky, Murray Grossman, "Grammatical comprehension deficits in non-fluent/grammatical primary progressive aphasia", J Neurol Neurosurg Psychiatry, Sept 2013

[8] Birgitta Winnepeninckx, Liesbeth Rooms and R. Frank Kooy, " MENTAL RETARDATION: A REVIEW OF THE GENETIC CAUSES" The British Journal of Developmental Disabilities, Vol. 49, Part 1, JANUARY 2003

[9] "Speech Disorders – Children", The New York Times, May 2015.