Amit Verma


# INTRODUCTION TO EVOLUTION OF FREEDOM IN SPEECH & EXPRESSION

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# CHAPTER 1

# STUDENT LIFE DEVELOPMENT THROUGH FREE SPEECH: AN OVERVIEW

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**ABSTRACT:**

Without the freedom to express oneself, there are no secure rights. The right to free expression is essential for defending all other rights. Student freedom of speech is a crucial cornerstone of societal freedom of speech. Without valuing and safeguarding free speech for students, our society will not appreciate and preserve free speech. Schools must act as the fundamental cradles of our democracy and serve as models for the proper use of rights, including the right to free expression, in a democratic society. We cannot expect kids to spend the majority of their waking hours in settings where there are no significant protections for the right to free expression and then graduate as adults equipped to exercise and defend such freedoms. Students who practice their free speech rights in school are more likely to grow up to be adults who are prepared to do the same in a civil democracy. The continued development of student free speech rights in the United States is discussed in this article, which also offers a brief summary of free speech legislation and a discussion of student speech regulations at public K–12 and higher education institutions. a manual for using the Tinker test in practice; institutions; a discussion of how the laws governing student speech at public institutions of learning are still evolving; an examination of press freedom in public educational settings; findings about the development of student expression.

**KEYWORDS:**

Appreciate, Democratic Society, Freedom of Speech, Legislation.

## INTRODUCTION

Strong protections for individualized political and religious speech are the basis of the First Amendment free speech rights guaranteed by the U.S. Constitution. communication that is political or religious is fiercely protected since historically, censorship has mostly targeted these categories of communication. Government officials have always felt the urge to use their positions of authority to stifle criticism and prevent the dissemination of ideas or information that would pose a danger to the ruling political or religious system. Speakers have the right to voice their opinions, and it is up to the audience not to the government to choose what is accurate and deserving of being repeated. It is wise that the First Amendment offers extensive free speech rights. However, when one person's right to free expression endangers the safety or rights of others, those rights cannot be absolute.

The most stringent protection of free speech would not protect a man falsely shouting fire in a theatre and causing a panic," Justice Holmes said in the case of Schenck v. United States [1], [2]. The Court generally forbids content-based censorship within an evolving hierarchy of First Amendment protections, with political and religious speech receiving the greatest protections, commercial speech receiving less stringent protection, and obscenity not being covered by constitutional protection. According to the U.S. Constitution, the Court recognizes freedom of speech as a basic right. Government representatives may only restrict fundamental rights, including speech that is guaranteed by the constitution, if they can show that the restrictions are required to advance a compelling purpose and are specifically tailored

to that goal. However, the Court has also acknowledged that officials from the government may impose reasonable time, place, and manner restrictions on speech when those restrictions are neutral in terms of content, serve a significant public interest, and leave adequate room for alternative forms of communication. The Court has also acknowledged the need for various standards for various communication channels. In contrast to print media, the Court has, for instance, permitted stricter limits on general broadcast broadcasts. The Court has also acknowledged that different contexts require different protections, vehemently defending free speech in traditional open public forums like public streets and parks while allowing stricter regulations in venues with specific uses, like public business meetings, as long as these limitations are justified by the situation and are not just an excuse to curtail protected speech. Public forums include both open forums, like public parks and streets, as well as limited open forums, like public educational institutions [3], [4].

They also include closed forums, such meetings on national security or other topics that are legally allowed to be discussed without direct public participation. There are times when appropriate restrictions on speech are required to protect the public forum's ability to serve its intended functions. When these limitations serve significant public interests, they do not discriminate against speakers based on their political or religious beliefs, and they provide acceptable alternatives for free speech, they do not violate the First Amendment. The protection of free speech serves not just the interests of the individual, but also the improvement of society's political, intellectual, and cultural development through the open exchange of ideas. Innovative and fruitful ideas thrive in a free atmosphere where the only constraints these ideas face are the scrutiny of public discourse and the logic of an informed and free populace. Similar to this, it is best to disprove notions that could endanger the community in public discussion.

**Student Speaking in K–12 Public Schools:**

Public K–12 schools have frequently been the site of free speech disputes, and the Supreme Court has addressed how to strike the right balance between people's constitutional rights to free expression and valid institutional requirements. In Tinker v. Des Moines 1969, the Supreme Court discussed the extent of students' free speech rights in public educational institutions, laying the groundwork for student expression. In Tinker v. Des Moines, Mary Beth Tinker, a student at a public school, was disciplined by administrators for donning a black armband in opposition to war. Tinker v. Des Moines, 1969, at 505, held that school officials may only restrict student political speech if they can demonstrate that doing so would "materially and substantially interfere with the requirements of appropriate discipline in the operation of the school." Where there is neither a finding nor a showing that engaging in the prohibited conduct meets this standard, punishments violate students' free speech rights. It can scarcely be maintained that either children or teachers give up their constitutional rights to freedom of speech or expression at the schoolhouse gate, the Supreme Court said in Tinker v. Des Moines in 1969. Students in school and out of school are 'persons' under our Constitution," the court ruled.

## DISCUSSION

They have inherent rights that the State is obligated to uphold, just as they are obligated to uphold their own duties to the State. Even though the Court acknowledged that students have a fundamental right to free speech, it also emphasized how crucial it is to teach kids tolerability and civility. According to the Court in According to Fraser's ruling in Bethel School District v., public schools "must cultivate the habits and manners of courtesy, adding that this must include respect for opposing political and religious viewpoints, even if the opinions expressed may not be widely shared. The Court has emphasized the associated obligation of practicing civility in expressing one's thoughts while acknowledging students'

rights to free speech. According to the Court, "In fact, the 'basic values indispensable to the survival of a democratic political system' disfavor the use of terms of discourse substantially insulting or highly dangerous to others. It is undoubtedly "the work of the schools " to instill these principles. In a democratic society, differing opinions are accepted, and courts have acknowledged that civil debate is the proper forum for expressing one's personal opinions as well as opposition to those of others. The Court has also made a distinction between student expression in forums sponsored and regulated by public schools, as in Bethel v. Fraser and Hazelwood v. Kuhlmeier, and individual student speech, as in Tinker v. Des Moines. The Supreme Court ruled in Hazelwood that "educators do not violate the First Amendment by exercising editorial control over the style and content of student speech in school-sponsored expressive activities so long as their actions are reasonably related to legitimate pedagogical concerns. Additionally, the Court argued that student speech in forums sponsored by public schools can be distinguishable from student speech in other forums because sponsored speech by school's entails "expressive activities that students, parents, and members of the public might reasonably perceive to bear the imprimatur." When taken as a whole, the Supreme Court's rulings suggest that student speech in public schools typically falls into two categories: student speech involving individual student expression, as in Tinker [5], [6].

Des Moines, and student speech in forums sponsored by public schools, as in Bethel v. Fraser and Hazelwood. Kuhlmeier. According to the ruling in Tinker, school administrators must demonstrate that a student's speech would "materially and substantially interfere with the requirements of appropriate discipline in the operation of the school" 4 in order to legally restrict that student's speech. If school administrators cannot demonstrate that the speech materially and substantially impedes appropriate discipline in the operation, they may nevertheless impose reasonable time, place, and manner limits on student expressive activities. School officials typically have much more latitude to impose speech restrictions on students when it comes to forums that are sponsored by public schools, such as convocations, plays, athletic competitions, school newspapers, and other expressive activities that attendees might reasonably perceive as bearing the "imprimatur of the school. If the platform for speech is supported by the institution or is ostensibly seen as having its seal of approval, Student expression can be restricted based on showing a valid educational justification for doing so, as in Bethel v. Fraser 1986, 6855 and Hazelwood v. Kuhlmeier.

**Student Speaking in Open-Access Universities:**

Children in K–12 public schools were involved in the facts that led to the Court's ruling in Tinker v. Des Moines in 1969. However, the Supreme Court made it clear in Healy v. James that the free speech rights recognized in Tinker applied even more forcefully to public university campuses: We first point out that state schools and universities are not exempt from the First Amendment's reach. It's hard to argue that at the schoolhouse gate, either students or teachers give up their constitutional rights to freedom of speech or expression." Tinker, from 1969. The First Amendment rights must always be enforced "in light of the special characteristics of the. environment, as Justice Fortas made plain in Tinker. Additionally, this Court has long acknowledged the need for affirming the comprehensive authority of the States and of school officials, consistent with fundamental constitutional safeguards, to prescribe and control conduct in the schools" where state-operated educational institutions are concerned. The precedents of this Court, however, do not allow for A university campus is the best venue to trade ideas. Free speech rights must be rigorously protected for adults in public institutions of higher education because they are the center of the marketplace of ideas and academic freedom. This is because free speech rights are already strongly protected for children in K–12 public schools. Therefore, it follows logically that the Court's decision in Tinker, which upholds free speech rights in public K–12 schools,

also applies and does so with much more force to public higher education institutions, as the Court confirmed in its ruling in Healy. The Court's rulings in Bethel.

Fraser and Hazelwood v. Kuhlmeier, however, do not automatically apply to public higher education institutions. The Fraser and Hazelwood rulings by the Supreme Court were obviously intended at K–12 public schools that had minor students. in the audience Lower courts nonetheless continue to apply the Fraser/Hazelwood legal principles to situations involving both students and teachers who are contesting speech restrictions in school-sponsored forums. These cases, which are based on Fraser/Hazelwood, recognize the ability to control school-sponsored speech much more broadly than individual speech and only call for school officials to provide a valid educational justification for any speech restrictions in school-sponsored forums. University officials must, however, give adult students and faculty members more latitude because they are not minors. Take, for instance, indecent speech, which is prohibited for minors but constitutionally protected for adults. This is especially true when the indecent expression is not legitimately subject to reasonable time, place, and manner restrictions and genuinely involves the communication of sexually explicit material.

**Practical Use of the Tinker Test:**

In cases involving student political speech, school officials may only censor it if they can prove it would "materially and substantially interfere with the requirements of appropriate discipline in the operation of the school, according to the Court's decision in that case. Furthermore, "the prohibition cannot be sustained where there is no finding and no showing that engaging in the forbidden conduct fits this requirement. The Court's Tinker test is used to distinguish between student speech that is protected by the First Amendment and student speech that is prohibited by and subject to disciplinary action by the school. It stipulates that there must be "material and substantial" interference. By defining this standard, the Court gave school administrators a guideline to use when determining whether it was legal to simply allow the student's speech in question or to try to intervene to prevent a material and substantial" interference with school discipline and operations.

When school authorities can adhere to the criteria stated in Tinker, intervention by them is acceptable. But how precisely do school administrators draw the line between protected and unprotected student speech, and what must they do to pass the Tinker test? Consider a continuum with permitted speech at one end and forbidden speech at the other to help you respond to this question. expression that is obviously protected by the First Amendment, such as genuine political and religious expression that does not interfere with the maintenance of necessary order or the operation of the school, is at the protected speech end of the spectrum. The communication that is obviously unprotected, such as obscenity, slander, terroristic threats, and other blatantly unprotected student expression that directly endangers safety, discipline, or academic operations, is at the other end of the spectrum. Making decisions on student speech that blatantly lies at either extreme of this spectrum is simple for school officials. IT The most difficult circumstances for school administrators to decide whether to allow the speech or to interfere in are those that are closer to the middle of this continuum [7], [8].In order to help judges and school administrators reach conclusions that are more in the middle of this continuum, the Court created the Tinker standard. But The Tinker standard is not a bright-line test, but it is a helpful general test to utilize in determining whether the speech is protected. Bright-line tests draw a boundary between behavior that is allowed and not allowed. For instance, a speed limit sign will have a bright-line test indicating that speeds exceeding 55 mph are illegal while speeds of 55 mph or less are permitted.

The Tinker test serves as a benchmark in the continuum that must be evaluated in the particular context in which the speech happens rather than being a bright-line test. Due to this, the Tinker test behaves more like a speed restriction sign that demands a speed that is

reasonable and prudent under the circumstances for administrative ease, it can appear desirable to establish a clear-cut standard for what speech is acceptable and unacceptable, such as a list of acceptable and unacceptable expressive behavior. Of course, the issue is that in human conversations, context and tone play a crucial role. The same actions and words could be acceptable in some situations but obviously incorrect in others. Students would soon come up with inventive methods around the mentioned bans since the human mind is simply too creative to be restrained inside the confines of such a limited list. When straightforward measures are possible, such assessing a car's speed or applying laws based on the campus's property lines, bright-line tests can be highly beneficial. However, a clear-cut test A clear-cut test for speech would be too rigid and basic to control the nuanced dynamics of interpersonal interactions. Furthermore, such a strict standard would probably yield results that ran counter to justice and common sense, punishing some speech that should not be penalized and clearly not allowing other speech. Instead, the Tinker test calls for a reasonable analysis of the facts and circumstances in each situation to decide whether they bring the in-progress speech closer to protected or unlawful speech.

However, a careful study of Tinker and related cases does offer some helpful advice on how to apply the Tinker test. School administrators must demonstrate more than a wish to prevent the unpleasantness, discomfort, or minor disagreements and disturbances that typically result from the voicing of unpopular opinions in order to justify restricting individual student speech. Additionally, unsubstantiated rumor or an amorphous, undifferentiated fear of disruption will not be acceptable. Tinker v. Des Moines 1969, at 50913, states that when challenged, school administrators must be able to provide facts and circumstances that would persuade a reasonable person that a serious and substantial interference was likely. As was already mentioned, the Tinker test does not require school administrators to demonstrate that there was a disruption and does not mandate that they wait for the disruption to happen before acting. The Tinker test requires school officials to demonstrate through evidence of facts and circumstances that they reasonably anticipated a material and substantial interference with appropriate discipline in the operation of the school in order to justify restricting otherwise protected student speech [9], [10].

## CONCLUSION

When taken as a whole, the Court's decisions show that, in public educational institutions, student speech typically falls into one of two categories: either it involves individual student expression, as in Tinker v. Des Moines 1969, or it occurs in forums organized by the school, as in Bethel v. Fraser 1986 and Hazelwood v. Kuhlmeier 1988. According to the ruling in Tinker, school administrators must demonstrate that a student's speech would "materially and substantially interfere with the requirements of appropriate discipline in the operation of the school in order to legally restrict that student's speech. Although school administrators may impose reasonable limitations on any expressive activities, they cannot prove that the speech " School authorities typically have far more leeway to restrict student expression when it comes to speaking in forums sponsored by public schools and other expressive activities that students and community members may legitimately regard as bearing the "imprimatur of the school." Student expression can be restricted if there is a valid educational justification for doing so, such as in cases when the forum for expression is sponsored by the school or is ostensibly seen as bearing the school's seal, as in Fraser and Hazelwood. For example, the need to educate civility, restrict statements that are incompatible with valid educational goals, teach professional responsibility, etc. are all acceptable educational justifications for speech restrictions in forums sponsored by schools.

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# CHAPTER 2

# ARABIC BROADCAST SPEECH RECOGNITION USING SPEECH ATTRIBUTE

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**ABSTRACT:**

In order to improve the classification accuracy of fundamental speech units in the Industrial Internet of Things, we provide an alternative model to Arabic speech recognitions in this study. With this method, the automated speech attribute transcription framework is integrated with both top-down and bottom-up information. is a brand-new group of lattice-based speech recognition systems built on precise speech attribute detection. Convolutional neural networks and feed-forward neural networks, two cutting-edge deep neural networks, were employed to identify attribute audio features after being pretrained using a stack of limited Boltzmann machines. The Buckwalter code for Arabic transcription is used to train these attribute detectors using a data-driven methodology for Arabic voice data. The detectors operate by extracting details of the human speech production process from the voice dataset by identifying Arabic's phonologically unique articulatory traits based on manner and location of articulation. The study's findings, which are presented in terms of average equal error rates, suggest that the-based attribute model regularly beats the model. In comparison to the model, attribute detectors with lower the improving the way of articulation by 10.42% and the location of articulation by 13.11%.

**KEYWORDS:**

Arabic Transcription, Articulation, Speech Recognition, Transcription.

## INTRODUCTION

The information and communication technology revolution has had a significant impact on industrial operations and products. To handle the terabytes of data generated by sensors, actuators, industrial management systems, and other applications, the industries significantly rely on tools driven by machine learning models and algorithms. Because of their size and diversity, these data necessitate the use of developed models and algorithms for analysis and administration. Using data analytics and its applications, such as voice recognition, the Industrial Internet of Things refers to a collection of robots, robotics, cognitive technologies, and computers that are used for intelligent industrial processes. Modern automated speech recognition systems often rely on a pattern matching strategy that models spoken utterances as collections of stochastic patterns. The literature uses top-down and bottom-up methodologies. A single, compact probabilistic finite state network with phones, lexicon, grammar nodes, and their connecting arcs as well as acoustic hidden Markov model states with emission probabilities produced by Gaussian mixture models is typically produced using top-down approaches .A bottom-up methodology known as automatic speech attribute transcription first identifies a group of speech attribute cues before integrating them to provide linguistic validations [1], [2].

The articulatory-based phonological characteristics from earlier ASAT system research are used in a brand-new detection-based framework. ASAT has been researched further and used to a number of tasks, including spoken language recognition, continuous phoneme recognition, cross-language attribute identification and phoneme recognition, and rescoring of word lattices generated by cutting-edge HMM systems. Speech attributes are the terms

used to describe the speech cues identified by Satyricon years have seen significant progress in neural network techniques, particularly in the training of densely linked, generative deep belief networks with several hidden layers. The fundamental idea behind the DBN training algorithm is to first initialize each layer's weights greedily in an entirely unsupervised manner by processing each pair of layers as a restricted Boltzmann machine, and then fine-tune all the weights collectively to further increase likelihood. A hierarchy of nonlinear feature detectors that can identify intricate statistical patterns in data is what the resultant DBN looks like. The weights of deep neural networks with several hidden layers may be initialized using the same pretraining approach for classification tasks. Then, using labelled data, the weights in the whole may be adjusted. have been shown to be useful tools for a variety of tasks, including the coding and classification of voice, audio, text, and picture data.

The main concept was to build acoustic models for ASR based on and other deep learning methods. For instance, the newly suggested context-independent hybrid architectures for phoneme recognition have shown a substantial performance. In comparison to the difficult conversational speech transcription tasks, a recent acoustic model, the context-dependent proposed in, has been successfully applied to large vocabulary speech recognition tasks and can reduce word error rate by up to one third. The work's primary objective is to enhance the current Arabic recognition system. We must enhance the system's constituent parts in order to improve the whole system. This is accomplished by specifying speech articulatory features in terms of manner and place that can capture Arabic language variations; implementing a model for detecting speech attributes of articulation using deep learning approaches; the model satisfying the Arabic articulatory feature paradigm; and finally investigating performance of the model and applying to the phone lattice rescoring for spathes remaining sections of the essay are structured as follows [3], [4].

The foundation for Ilott and the use of industrial AI for voice recognition in Ilott ecosystems are introduced in this section. It focuses on knowledge integrated with Arabic speech attributes that has to be handled across the whole lifespan of the AI in an Ilott system. Better Industrial AI lifecycles, from concept to implementation to operation, would result from taking this into account. The three primary parts of the technique are an ASR engine, which creates a lattice of competing hypotheses, an attribute-based front end, which creates relevant information based on phonology, and a lattice rescoring module. The latter module's function is to merge the acoustic likelihoods generated by the ASR engine with the outputs from the attribute-based module. The voice signal is used as the input for the automated speech recognition module, which converts it to a string of words. The acoustic model and linguistic model are the two categories of probabilistic models that make up the ASR module. The voice input is converted into a list of potential phoneme sequences during the AM phase. The phonemes are then put together using a pronunciation dictionary to form potential words. When it comes to the LM phase, it makes use of existing linguistic information to assess each and every prospective word sequence. The most likely matches of the voice input are then found by searching through all possible word sequences using a powerful algorithm.

The decoding or search issue is the process of selecting the optimal word sequence from a spoken input. The well-known Viterbi algorithm may be used to get the answer. It is important to note that most modern ASR systems often use two-pass decoding, where two language models are used, as opposed to one-pass decoding. Fast decoding techniques are utilized to provide a nonoptimal search and a word lattice or -best list in the first decoding run. The -best list or word lattice is searched for words during the second decoding run, which uses sophisticated but somewhat slow decoding algorithms. This is because the adapted in the second-pass decoding is a more sophisticated but slower model, while the employed in the first pass is a well-structured model with limited tolerance of latency, in which a substantially pruned n-gram model is used to form the decoder graph. The

hypotheses created in the first pass are rescored using a more complicated LM in the second. In this study, we modify neural network-based language models to rescore hypotheses for the second-pass Lamothe operate by concatenating the representations to learn a distributed representation of words together with the probability function of word sequences. Each word is encoded using a one-hot representation since the input is constructed based on a set length history. The shared word feature layer and the typical hidden hyperbolic tangent layer are the two hidden layers in this model [5], [6].

## DISCUSSION

Here, the three articulatory dimensions of manner, location, and voicing are used to present the Arabic speech features of interest before describing the detectors' implementation in more depth. With hundreds of millions of native speakers and tens of millions of second language learners, Arabic is one of the most frequently spoken languages in the world. The twenty-eight-letter language has its own pronunciation, spelling, and grammatical norms. Letters are used to represent consonants and long vowels, whereas diacritical marks are used to represent short vowels. In contrast to the short vowel, where the diacritic marks appear just after the letter, the markings for consonants are applied above or below the letter. Consonant letters are categorized according to where certain speech sounds are articulated, how they are articulated, and how they are voiced. Phonological characteristics or acoustic-phonetic speech properties are the terms used to describe it. The location and method of articulation rely on how and where the sound is produced in the vocal tract in terms of the human speech production system. On the other hand, voicing is the characteristic that depicts the vibration of the vocal cords that produces voiced and unvoiced speech sounds.

The fact that each letter in Arabic correlates to a single phoneme, as opposed to certain other languages, like English, where the same letter may correspond to many phonemes, is a significant feature of Arabic as a phonetic language. In order to represent the phonetic transcription, one must use a technique that significantly depends on the intricate spelling and pronunciation system of the target language. International Phonetic Alphabet code and Speech Assessment Methods Phonetic Alphabet code are the two phonetic alphabets that are most often used in speech technology. The aforementioned codes are often used for several languages, which means they are universal and independent of any single language. The Buckwalter code, which was created for Arabic phonetic transcription, is the third code. The widely used Arabic transcription technique for extracting, storing, and expressing Arabic text is called the Buckwalter. It is a precise transcription that abides by language spelling norms and replaces a one-to-one mapping with a highly variable nature to contain all the necessary details for a proper pronunciation. In this work, the Buckwalter code is used for it.

The phoneme matrix mapping of the equivalent Arabic consonants using Buckwalter transliteration. It indicates articulation location, articulation style, and articulation voicing. In specifically, Arabic contains twenty-eight consonants: two nasals, one lateral, one trill, eight plosives, thirteen fricatives, one affricate, and two semi-vowels. It also has three long vowels and three short vowels. The chart's top line illustrates the location of articulation, from the lips, which are the closest to the listener, to the furthest position. The way of articulation specifying the degree of shutting of the articulators is expressed in the far-left column. The vocal tract's component elements that are used to produce various spoken utterances are often referred to as the articulators. There are four possible outcomes for this: if the airflow is completely blocked, if the airflow is blocked and then released into a fricative, if the airflow is restricted but allowed to pass, and if the airflow is smooth. Single libeling’s core tenet is that every characteristic corresponds with a single label, and this is more relevant to Arabic. The probability measure is generated during the detection task such that the observation belongs to a certain attribute class. The automated speech attribute transcription framework is one method for identifying speech attributes.

It uses a bottom-up structure and data-driven modelling as its foundation. By examining a speech segment to maintain a phonetical feature property, the aim of this analysis is to provide a confidence score or posterior probability. Each attribute extractor operates frame-by-frame and produces probabilities in accordance with the target class, nontarget class, and any additional models, if applicable. These output probabilities ought to sum up to one in total. Due to two factors, such difficult judgements made by the attribute detectors are not significant at this early level. The first is that the detectors' output is used to create a new feature vector. Concatenating all of these posterior probabilities from each target class accomplishes this. The benefit is that these posterior vectors may subsequently be used as a high-level feature in other components of the system. By delegating the decision-making process to other system components, the second effectively modifies the risk parameters and embeds extra information for decision-making. Early efforts at speech attribute identification propose adopting the ASAT architecture with two subsystems in the literature. A bank of attribute detectors in the first subsystem produces outputs in the form of confidence scores, whilst evidence merging in the later subsystem turns low-level features into high-level features. The outputs from the extractors are then concatenated to create a new vector in the block that follows. Shallow artificial neural networks with cross-entropy cost function and SoftMax output layer are used to train each of the attribute detectors. Obtaining the posterior probability of the speech frame is the goal.

A novel method for attribute detector modelling models each new layer of higher-level features using a deep neural network that has been pretrained using a stack of restricted Boltzmann machines. In specifically, a single DNN is used to train all attribute detectors, resulting in a posterior probability vector after the SoftMax layer. The vector lists all probabilities and links them to the target, nontarget, and other attribute classes. The primary drawback of this approach is how it compares the maximum probability for one class to those for other classes. Instead of producing posterior probabilities for each attribute detector for the three attribute classes, it represents single-label detector instead. In spite of this constraint, the model claims that its performance on the job of recognizing foreign accents has improved. A single DNN that models all attribute extractors and produces the output as a confidence score has recently been used by researchers in to expand on the concept of the work in. Additionally, the output SoftMax layer is compensated with a sigmoid layer, and the cross-entropy cost function is adjusted using a mean square error function [7], [8].

The authors said that the sigmoid units in the output layer of the neural network are the outcome of the posterior scores, which determine the presence of every single attribute with a value between 0 and 1. In this study, Arabic speech qualities are detected as a single-label classification issue using the technique given by. The concatenated context of voice frames serves as the input vector for the DNNs during the training phase. The annotation from the dataset is used to create the output label vector, which is expressed as a binary vector. This vector's length corresponds to the number of distinct attribute classes. The related attribute class is indicated with one and zero in the output vector, respectively, since the annotation in data transcription of an attribute would be either "feature present" or "feature absent." The label vector is fitted with the output sigmoid units using the MSE cost function. The single-label detection is computed in the testing phase so that the data are given to the DNN and produce the confidence scores on the output layer. The final scores are then sent into other system modules as inputs. Consider, for example, that a binary vector of labels and a training sample of dimension are denoted by pairs in the training set. As such, the number of classes is shown. The goal of the learning system is to train a single-label classifier, which means that each data point must be allocated to a single class using a binary vector of labels to assign samples to distinct classes.

As previously mentioned, this study models two different kinds of Arabic speech articulatory attribute detectors: manner and location. These two categories of characteristics each have their own DNN models. A layer-wise RBM pretraining deep neural network and a one-dimensional convolutional neural network associated with fully connected layers are the two topologies of DNN that are being studied. Module for Lattice Rescoring The rescoring algorithm's goal is to arc-by-arc integrate the confidence ratings produced by the detection-based module into the phone lattice. Rescoring is carried out as a linear combination of the phoneme posterior probability logarithm and the log-likelihood acoustic score produced by the baseline ASR system. It represents the last phase of this research, which tests whether DBN-DNN-boosted accuracy may enhance ASR performance.

This is accomplished by incorporating the data produced at the phoneme posterior probability output of the DBN-DNN phoneme classifier into an already-existing ASR system using the phone lattice rescoring technique. In order to include articulatorily motivated information into the ASR system, a multistage decoding algorithm is modified. A speech decoder first produces a range of conflicting speech hypotheses. After then, a rescoring technique is utilized to reran these hypotheses using new data that wasn't included in the decoding process. In this study, the lattice structure depicts the syntactic restrictions of the language employed during recognition. The graph has nodes, arcs, and is straight, acyclic, and weighted. The arcs, on the other hand, include the symbol together with the score information, in which every arc corresponds to a recognized phone or word. The timing information is integrated in the nodes, meaning that temporal bounds are supplied by the bounding nodes of the arcs.

Two well-known rescoring paradigms in the literature are Minimum Bayes risk rescoring and ROVER. The anticipated Lowenstein distance is used by the objective cost function of the MBR rescoring method to reran the string hypotheses produced by the speech decoder. On the other hand, ROVER is a frequently used technology that creates a confusion network by a multiple string alignment. Then, a vote process is used to determine which hypothesis is the best. As long as the various systems have equivalent performance, complexity, and error patterns, this strategy may sometimes result in a large performance boost. The decoding technique based on a generalized confidence score suggested in served as inspiration for the rescoring algorithm utilized in this study, which includes scores given by the detection module into the speech lattice. In specifically, the following formula may be used to combine disparate sources of information, where shows the system's collection of acoustic parameters, is the combined system's set of acoustic parameters, are various independent sources, are independent of one another, are normalization constants, and are the interpolation weights.

Care must be given since the exponentially weighted components that were multiplied above form a weighted sum in the logarithmic space. Since is assumed to be 1, the interpolation weights must all add up to 1 in the work that is being delivered. Additionally, each arc's log-likelihood acoustic score and the combined output of the speech attribute detector that corresponds to the arc phone label are merged to create the weighted total on an arc-by-arc basis. For phone lattices, the linear combination happens at the phone level such that each arc in the lattice corresponds to a phone in the string hypothesis. The rescoring formula is written as, assuming that the updated log-likelihood value is represented as for the specified arc. In where and are the interpolation weights for the log-likelihood score and the phone-level score, respectively, and are the log-likelihood of the arc.  reflects the phone-level score, which is determined at the conclusion of each phone.

The experimental design and the findings on attribute detection are covered in the sections that follow. Lattice rescoring results for phone recognition are also shown. Due to the significant feature vector overlap in the input feature space between those retrieved for distinct phonemic or phonetic classes, previous research has used neural networks with more

than one hidden layer for speech applications. According to, there is a significant overlap in formant frequencies for various vowel sounds produced by various speakers. Bhattacharyya distance distributions between 39-dimensional MFCCs for the bilabial class and 39-dimensional MFCCs for the alveolar class are also fairly tiny, according to the findings of. According to this, voice data may be found on or close to a nonlinear manifold. In this study, we customized neural networks with various hidden layer counts for our trials. The Arabic Multi-Genre Broadcast, the second iteration of the Multi-Genre Broadcast, served as the platform for all experiments. The British Broadcasting Corporation donated the data for the MGB challenge 2015 to test the automated transcribing of a selection of BBC programmed. The programmed were grouped into 8 categories, including advice, children's, comedy, competition, documentary, drama, events, and news, with the intention of spanning the many broadcast TV genres. For acoustic modelling, the training data were limited to more than 2,000 concerts.

The 47 indicates in the development data are. Using recordings from the Al Jazeera TV station, the Arabic MGB, employed in this study, is a controlled assessment of Arabic voice to text transcription and supervised word alignment. The QCRI Advanced Transcription System was used to crawl a total of around 3,000 hours of television programmed, with running times between three and forty-five minutes. Only those programmed having transcription on their Arabic website were utilized for further alignment in this study. Out of the Arabic MGB training set, 600 sentences were extracted to create a cross-validation set. The remaining sentences were then utilized as training data. The MGB assessment data were evaluated. Buckwalter format was employed for the transcription of the data. Additionally, a voice activity detection -based automated alignment of speech corpora is employed in this study to determine the temporal limit of each phoneme in the Arabic MGB. The speech file is used as the input for the VAD algorithm, which finds all accessible pauses and their locations.

When there are no gaps found, the voice file is considered to have no repetition and to have the correct phoneme sequence. This method of filtering out all voice files with pauses is repeated for all speech files. The MGB corpus contains phoneme transcriptions, as was described above. The way or place transcription was required in order to train attribute detectors, and these were retrieved from the phoneme transcriptions. Using mapping tables, we translated phoneme transcription into appropriate way or location attribute transcription. Plosives, affricates, fricatives, nasals, laterals, trills, and semi-vowels were employed in the study that was given, along with labial, labiodental, interdental, alveolar, palatal, velar, uvular, pharyngeal, and glottal as the locations for articulation. Any noise or unidentified sound occurrences are included in the class "other" that is further specified. The Arabic MGB training data, totaling more than 40 hours and 10.2 hours of transcription by four distinct annotators, was used to train the ASR baseline system. Applying speed and volume perturbation added to these data resulted in a three-fold increase in the training frame count to around 120 hours. The Kaldi repository was utilized to create the code recipe that was used. 250 hours of training data from the training set, which consists of 500 episodes, were used to train the baseline system. This system employs a common multiphases decoding method called Mel-frequency cestrum coefficients. A GMM with 5,000 tied states and 100 K total Gaussians is used in the first run.

These models were trained using features transformed using maximum likelihood linear regression. The minimal phone error criteria is used to train a DNN with four hidden layers and 1024 neurons per layer for the second pass. On the normalized text of the sample data text, a tri-gram language model is trained over the course of 250 hours. Additionally, MFCCs were created utilizing a 23-channel Mel filter bank from 0 to 8 kHz in conjunction with spectral analysis. A Hamming window of 25 MS and a frame shift of 10 MS were used to

create the cepstral analysis, which included computing the zeroth cepstral coefficient and 12 MFCC features for each frame. A 39-dimensional feature vector was created by concatenating the static cepstral with the first- and second-time derivatives of the cepstral. On a 10-hour verbatim transcribed development set, the following baseline results were reported: 34% for the nonoverlap speech and 73% for the overlap speech.

To address the issue of attribute detection, two varieties of neural networks were examined. Simple feed-forward neural networks with constrained Boltzmann machine pretraining make up the first deep network, while convolutional neural networks make up the second. Using the Arabic MGB training data, all experiments are run under the context-dependent DNN to estimate attribute posterior probabilities per speech frame. A 45-dimensional mean-normalized log-filter bank feature vector with up to second-order derivatives and a context window of 11 frames makes up the input feature vector for which has a 495-dimensional input vector. There are exactly 16 output classes for manner and 9 for location. Additionally, both DNNs have the "other" output class added to them in order to find potentially unlabeled frames. Twenty DBN-DNN topologies of 512 and 1024 units each were examined. The number of hidden layers varied from one to ten. With stacked restricted Boltzmann machines and layer-by-layer generative pretraining, all topologies are initiated. Contrastive divergence with one step of Markov chain Monte Carlo sampling serves as the pretraining procedure. The first RBM was trained with an initial learning rate of 0.01 and has Gaussian-Bernoulli units. The following RBMs have 0.4 learning rate and 0.4 Bernoulli-Bernoulli units.

The final output sigmoid layer was concatenated with the DNN after stacking all the layers and pretraining the weights on the input data. The number of classes that are in charge of producing the attribute output scores and the number of output units are related. With a learning rate of 0.008, mini-batch stochastic gradient descent is used to fine-tune the final weight training. One mini-batch consists of 128 observations. During fine-tuning, the mean square error goal function was optimized. All sigmoid hidden units were used in the DNN. The speech community is utilized as the basis for all settings and parameters. The second is a 1D convolutional neural network structure that trains to recognize Arabic voice characteristics using feature maps as an input. These feature maps consist of first- and second-order derivatives of 40-dimensional log-Mel filter bank features, with a context window size of 11 frames. In total, we apply 1D convolution mapping along the frequency axis to the input feature maps. Convolutional and max-pooling layers as well as one to ten fully linked hidden layers with 512 or 1024 sigmoid units each make up the CNN. We optimize the mean square error cost function, which is similar to how DBN-DNN settings are done for CNN. Each speech frame in the output layer generates sigmoid output "posterior" scores for every characteristic, totaling. Each of the 128 feature maps in the CNN's convolutional layer has a size of 33 frequency bands, which means that they were created by convolving each input feature map with a filter size of. The output of the overall convolutional layer is then down-sampled to a size that is three times smaller by the max-pooling layer, which outputs the maximum values across a nonoverlapping window that includes the outputs of every three frequency bands in each feature map. The fully linked feed-forward portion of the CNN receives its input from the output of the max-pooling layer after that. The speech community is utilized to adjust and configure every aspect of CNN [9], [10].

## CONCLUSION

In this study, we have shown that two models built on state-of-the-art deep neural networks can recognize Arabic voice articulatory attributes with excellent accuracy. These are feed-forward and convolutional neural networks that have been pre-trained using a stack of

restricted Boltzmann machines. Arabic attribute detection should be regarded as a single-label detection issue. The Arabic MGB dataset has been used for all tests. Furthermore, a detection-based ASR programmed has found utility for phone lattice rescoring. Some long-standing issues are now given fresh life, including voice recognition from a phoneme lattice and from phonological parsing. In order to determine the DNN model parameters that would provide the maximum accuracy, several tests have been carried out. Additionally, average equal error rate was used as a measurement to examine the impact of the quantity of concealed completely linked layers and units. It may be concluded that CNN-trained articulatory detectors perform better than DBN-DNN models in terms of method and location. The CNNs provide a large error decrease for manner compared to place when compared to the DBN-DNNs.

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# CHAPTER 3

# INTRODUCTION TO EXPRESSION OF PEDIATRIC MELODY'S SYNDROME

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**ABSTRACT:**

As a rare condition, pediatric myelodysplastic syndrome is poorly understood in terms of the molecular changes that underlie its onset and progression to acute myeloid leukemia. The catalytic component of Polycom repressive complex is called Enhancer of Zester Homolog 2. It is a histone methyltransferase that specifically targets histone 3's lysine. The silence of genes essential in basic physiological functions including cell growth and differentiation is often linked to this methylation. Only a few investigations, all of which were conducted on adult patients, have examined the status of expression in individuals with. The objective of this research was to examine the expression of in pediatric patients and its relationships to karyotypes and the development of acute myeloid leukemia. We carried out the first investigation on expression in young patients. Three categories of expression in patients low, middle, and high could be distinguished based on the levels of expression in 42 patients and 17 pediatric donors in good health. Patients with normal karyotypes were included in the intermediate level, those with monosomy and del were included in the low level, and those with trisomy 8 and del were included in the high level.

**KEYWORDS:**

Chromosomal, Epigenetic, Hematological, Neoplasms.

## INTRODUCTION

A heterogeneous set of clonal hematological neoplasms with a variety of genetic and epigenetic changes make up the myelodysplastic syndrome. Ineffective hematopoiesis, dysplasia's, peripheral cytopenia's, and a higher risk of developing acute myeloid leukemia are the main clinical features. is thought to affect individuals, especially the elderly. Less than 5% of pediatric hematologic malignancies are pediatric, making it an uncommon illness. In 50–70% of instances in pediatric patients, clonal cytogenetic abnormalities might be seen. Monosomy 7 and del are the most prevalent chromosomal abnormalities. An essential component of therapeutic therapy now includes the cytogenetic analysis of a bone marrow sample from MDS patients. However, some patients have karyotypes that are normal. In order to predict prognosis, it is crucial to molecularly characterize the genetic and epigenetic changes linked to the development of the illness. Since is the condition that responds best to treatment with medications that block methylation, investigations on adult patients have provided the majority of information regarding the disease's molecular changes. These studies have also shown the significance of epigenetic changes in pathogenesis. Epigenetic changes control gene expression, which gives them significant biological functions. methylation and chromatin modification are the two basic epigenetic changes, and they are usually linked to transcriptional gene suppression. Polycom Group proteins are recognized as traditional participants in epigenetic control among chromatin modifiers [1], [2].

The initiation Polycom repressive complex 2 and the maintenance Polycom repressive complex 1 are the two fundamental complexes found in Pg. proteins. A histone methyltransferase called Enhancer of Zester Homolog 2 is involved. It is the catalytic subunit of PCR2, which silences target genes involved in a variety of biological processes including

cell cycle, cell proliferation, and differentiation, by tri-methylating histone 3 at lysine 27 using a SET domain at its C-terminus. Pg. proteins have crucial roles in controlling epigenetic regulation, stem cell differentiation and pluripotency, as well as aberrant gene expression during malignant transformation. Numerous cancer types, including prostate, breast, bladder, ovarian, lung, liver, gastric esophagus, pancreatic, melanoma, and osteosarcoma, typically exhibit overexpression o. Higher proliferation and a worse prognosis are associated with its overexpression in solid tumors. Accordingly, there are findings that indicate plays a crucial role in the development of cancer, and an epigenetic therapy that pharmacologically targets may provide a unique strategy for the treatment of specific cancers. Investigations into biological roles in various tumor cells are ongoing. Both EZH2 overexpression and loss-of-function mutations in MDS and AML show that these genes may have dual roles as tumor suppressors and oncogenes, respectively. Only a few research have examined the level of EZH2 expression in MDS patients. Adult patients participated in these trials. For the first time, Xu and coworkers examined the Polycom expression genes, including EZH2. According to this research, the EZH2 gene is often overexpressed in MDS and is a sign of poor prognosis. However, Cabrera and colleagues found that EZH2 was under expressed and that it was connected to MDS's poor prognosis and chromosome 7 abnormalities [3], [4].

The EZH2 gene may be implicated in the pathophysiology of changes, according to the activities of EZH2 and its localization to the key area for malignant myeloid diseases. There haven't been any studies up to this point that demonstrate expression in young patients. Thus, the objective of this research was to examine the expression of the gene in pediatric patients in relation to their connection with karyotypes, MDS subtypes, and progression from MDS to AML, providing new insights into the pathophysiology of pediatrics Misesteem 2007 and 2016, 42 individuals with pediatric had their bone marrow cells taken. The patients ranged in age from 5 months to 18 years, with 27 males and 15 girls. The patients' conditions were determined at the National Cancer Institute and Martagon Gustier Institute of Pediatrics and Child Development hospitals' hematology/oncology units in Rio de Janeiro, Brazil. The updated criteria from Hasle and colleagues, 2003 and 2016, were used for diagnosis and classification. Refractory childhood cytopenia was diagnosed in 22 kids, refractory anemia with excess blasts in 15, and refractory anemia with excess blasts in transformation in 5. None of the patients had ever received treatment for cancer. pediatrics bone marrow transplant donors, whose average age was 12 years, provided healthy bone marrow samples. The National Cancer Institute's Ethics Committee gave its approval to this research, and all operations carried out in accordance with resolution of the Health National Committee followed the bioethics norm.42 pediatrics MDS patients' bone marrow cells were cultured in RPMI 1640 with 20% fetal calf serum for 24 hours at 37°C to determine their karyotypes. Calcemic was pumped into cell cultures during the last hour of incubation, reaching a final concentration of 0.05 g/milk Following the usual methods for cell collection, the cells were fixed in a 3:1 mixture of methanol and acetic acid. Banding using GTG was done.

According to the International System for Cytogenetic Nomenclature, 2016; chromosomes were identified and organized. To validate the del with the allelic loss of fluorescence "in situ" hybridization studies were carried out using a dual color probe for chromosome 11 in accordance with the manufacturer's procedure. We made use of cytogenetic culture material. Real-Time Quantitative PCR Analysis of Gene Expression. Real-time quantitative polymerase chain reaction analyses of m level variations in 42 pediatrics patients with primary MDS and 17 healthy pediatrics controls were performed. 42 pediatrics MDS patients and 17 healthy volunteers had their total mRNA extracted using Life Technologies' Trizell reagent in accordance with the manufacturer's instructions and kept at 70°C. To eliminate genomic contamination, two micrograms of total RNA were subjected to genomic digestion using DNase amplification grade I. Using Life Technologies' Superscript II Reverse

Transcriptase and Oligo-dT18 kits, the RNA was reverse-transcribed into complementary. The Rotor-Gene SYBR Green PCR Kit was used in 10 l of reactions, with a final concentration of 1; 0.5 M of each forward and reverse primer; and 2.5 l of finished, five-fold diluted. In a Rotor Gene Q thermocycler, reactions were conducted in 45 cycles of 20 seconds at 95°C, 30 seconds at 60°C, and 30 seconds at 72°C. The hot-start stage step was 10 minutes at 95°C. The efficiency of the PCR, the specificity of the amplification, and the generation of primer dimers were all assessed using the dissociation curve. For normalization, B-actin mRNA levels were utilized as the standard.

The sequence of primers used was as follows. The CT technique was used to determine the relative expression levels of the gene. The Mann-Whitney test was used to determine the statistical difference between the expression of in pediatric patients and donors. Additionally, this test was used to compare karyotypes, age groups, MDS subtypes, and EZH2 expression in donors and low, intermediate, and high expression patients. The Kruskal-Walli's test was performed to confirm the statistical difference between three groups that were classified as low, middle, and high in terms of EZH2 expression. We also used the chi-square test with Yates adjustment to analyses the levels of EZH2 expression and the progression of the illness [5], [6]. Fisher's exact test was used to determine how the low expression group and high expression group differed. In all studies, a value of was deemed significant.

## DISCUSSION

A statistically significant study was performed on the relative expression levels of the EZH-2 gene in 42 pediatrics patients with primary MDS compared to controls, which revealed a greater expression. There was no statistically significant difference between the relative expression levels in the 22 patients categorized as initial stage and the 20 patients classified as advanced stage MDS subtypes. According to the Mann-Whitney test, there was no statistically significant difference in the relative amounts of expression between individuals with normal karyotypes and those with aberrant karyotypes. The distribution of EZH2 expression levels in patients and donors is clearly found to be diverse, while the distribution of expression levels in controls is more homogenous, which is quite important to remark. This finding allowed for the definition of three different expression groups. Quartiles served as the mathematical foundation for this investigation. According to Zarb, 2010, we selected the median as the central measure and quartiles as the dispersion measures since the distribution of expression in patients is skewed.

The median was determined to be 1.8. Between the first and third quartiles are 1 and 2.85, respectively. We categories patients' levels expression into three groups: low, middle, and high. We also utilized the median and quartiles for the donors in order to compare the expression of patients and donors. According to the classes of expression, the median among healthy persons was with low level expression being 0.2, intermediate level being 1.61, and high expression being. The levels of EZH2 expression in donors and the groups with low intermediate and high expression were significantly different. It was able to propose a scale of EZH2 expression, with patients with EZH2 expression falling within the real intervals being categorized in the low group, representing the intermediate group, and representing the high group. The number of patients in each group is as follows: and. The relationship between expression levels and certain karyotypic patterns was then examined. Our findings demonstrated that low level EZH2 expression included patients with monosomy 7 and del, high level EZH2 expression included patients with trisomy 8 and del, and intermediate level expression included individuals with normal karyotypes. According to the Kruskal-Walli's test, we saw a significant difference between these groups. It is significant to note that the scale of EZH2 expression indicated in this study may be used to classify karyotypes. To be more explicit, neither patients with trisomy 8 and del nor patients with monosomy 7 and del were in the high expression group or the low expression group, respectively.

It's also crucial to note that while we discovered additional karyotypes we only evaluated normal karyotypes, monosomy 7 and del, and trisomy 8 and del, due to the prevalence of these cytogenetic groups among patients. We also looked at the three groups of EZH2 expression's relative expression levels and the progression of the illness. In the low expression group, 100% of cases exhibited disease progression; in the intermediate expression group, 4.4% of patients showed disease evolution; and in the high expression group, 63.63% of patients showed evolution from MDS to AML. We checked if this finding had statistical significance using the chi-square test with Yates adjustment. It is noteworthy to notice that, according to Fisher's exact test, there is no statistically significant difference between the low expression group and the high expression group. This finding is significant because it shows that the development from occurs in both the low expression group and the high expression group. Moreover, given that all of the patients under study had disease evolution, our finding tends to indicate that the low expression group had a higher probability of developing.

Our findings imply that this expression scale in pediatrics might help us better comprehend the transition from [7], [8]. Due to the disease's rarity, extreme variability, and complexity, the molecular an etiology of pediatrics MDS is still poorly understood. Few studies have examined EZH2 expression in up to this point. Using qtr.-PCR, Xu and associates assessed the expression of the gene in bone marrow samples from 54 adult MDS patients. The elevated expression of EZH2, as well as BMI1 and RING1, two other Polycom genes, was confirmed by the scientists in these individuals. It's important to note that trisomy 8 was the predominant numerical chromosomal aberration in this investigation, whereas changes to chromosome 7 were not found. According to the authors' theories, elevated expression of Polycom genes, particularly EZH2, is a factor in MDS patients' poor prognoses. On the other hand, Cabrero and associates investigated EZH2 expression in 78 adult MDS patients.

This study found that patients with monosomy 7 and 7q deletion on chromosome 7 had significantly lower levels of expression than controls, diploid patients, and people with other chromosomal abnormalities. In this investigation under expression and chromosome 7 abnormalities were linked to a poor prognosis.  patients were used in McGraw and colleagues' immunohistochemical study of protein expression. When compared to individuals without these chromosomal abnormalities, it was shown that expression was significantly lower in patients with chromosome and del. The chromosomal loss of which results in reduced EZH2 expression in and is linked to shorter survival and higher transformation, was shown by and colleagues. Rashida and colleagues demonstrated, however, that deletion stimulates the growth of while attenuating its propensity for leukemic transition. Thus, it is feasible to observe that research on the function of EZH2 in MDS in adult patients is still debatable. We carried out the first investigation on EZH2 expression in young MDS patients. Between the sick group and the control group, there was a statistically significant difference in the expression of in our research. Both patients and controls had EZH2 expression distributions that ranged from 0.03 to 12.8 and 0.71 to 1.93, respectively.

As a result, the EZH2 expression pattern seen in patients is more diverse than it is in controls. Using the median as the primary metric for the research, it was feasible to distinguish three separate groups of expression based on this discovery. These findings point to an expression scale for EZH2 in pediatrics Moshe we analyzed the expression levels of in pediatrics MDS patients and the progression of the disease, we found that 100% of the patients in the low expression group had disease progression, 4.34% of patients in the intermediate expression group had disease progression, and 63.63% of patients in the high expression group had progression from MDS to AML. This outcome was noteworthy. Thus, as a biomarker of disease progression, our findings imply that abnormal EZH2 expression is related to leukemic transition. It is significant to note that both low and high levels of expression were linked to

the development of leukemia; however, low expression was more strongly linked to the transition from MDS to AML than high expression Graw and colleagues proposed the EZH2 protein analysis by immunohistochemistry may be a molecular tool for differentiating disease outcome or transformation risk with regard to the progression from MDS to AML.

We also noted the significance of EZH2 expression findings in MDS in our investigation. Therefore, research based on EZH2 expression may be applicable to clinical settings and may be used as a separate laboratory test in conjunction with real-time quantitative polymerase chain reaction. Increasing numbers of studies have shown that participates in a variety of biological processes and exhibits a variety of ways of action. These findings demonstrated that the clinical significance of aberrant expression on the development of is nuanced and may be influenced by other factors, such as the existence of a particular chromosomal defect. This theory might be strengthened by the fact that distinct cytogenetic aberrations in are connected with various molecular evolution pathways. Based on these findings, more research involving more patients is required to define the signaling pathways in the three groups of expression. The molecular pathways connected to have been discussed in few publications. By lowering H3K27me3, Xu and colleagues showed that genomic loss of EZH2 contributes to the HOX gene clusters' upregulation in MDS. Numerous cancer forms have been reported to overexpress. In comparison to tumor cells where p15INK4B is not methylated, it was shown that was overexpressed in MDS tumor cells linked to methylation of the tumor suppressor gene cyclin dependent kinase inhibitor 2B.

Other Pg. genes did not show this connection between and p15INK4B, indicating that EZH2 is involved in the methylation of the gene. Pediatric MDS patients' p15INK4B and p16INK4A were found to be methylated, indicating that these genes may be crucial in the progression of MDS into AML. In a recent thorough meta-analysis, Ye and Li showed how crucial p15INK4B is to the onset, progression, and poor prognosis of MDS.A positive feedback process between My and exists in prostate cancer, wherein My overexpression is linked to increased and may also cause My overexpression. A transcription factor called My controls cell division. By suppressing the expression of microRNAs, it has been recognized as a significant role in the rise of EZH2 expression. Overexpression of My and is linked to the onset and progression of prostate cancer. Cooperation between My and has also been shown in other tumors, such as medulloblastomas, where greater My levels were linked to higher EZH2 levels. Pharmacological EZH2 blocking is one prospective treatment option for aggressive medulloblastoma. In hematological neoplasms, c-My deregulated expression is mediated by a variety of processes, including chromosomal rearrangements, amplification, and epigenetic pathways. It has been reported that c-My increases EZH2 expression in AML. Hematological neoplasms also show a correlation between c-My dysregulation and EZH2 overexpression, as seen in solid tumors.

The comic gene is found in region q24 on chromosome 8. In this work, we found a correlation between trisomy 8 and EZH2 overexpression, which is linked to illness evolution. Trisomy 8 cells in MDS had earlier been reported to contain intrachromosomal c-My amplification. Therefore, it is probable that c-My and EZH2 overexpression work together in the pathogenesis of MDS, particularly during the transition to AML, much as in other forms of malignancy. Cancer development has been linked to an imbalance between Polycom and Tri thorax expressions, according to research. Typically, Pg. proteins keep the suppression of gene expression in place whereas Tragi proteins have the opposite effect. The KMT2A gene, a significant member of the Tragi family and implicated in the pathophysiology of pediatrics acute leukemia, is found in region q23 on chromosome. Leukemia an etiology may be linked to abnormalities in the ratio of Pg. to Tragi. In our research, we discovered a connection between del, which involves the deletion of the allele, and an excess. Our findings imply that an imbalance between the expression of the and genes may have a role in the development of

the illness in this instance. The abnormal expression of EZH2 in cancer cells may be the consequence of many pathways linked to a poor prognosis and disease progression. Therefore, further research is required to fully comprehend the processes behind the low and high levels of EZH2 expression throughout the pathogenesis of MDS.A growing body of research indicates that the chromatin master regulator EZH2 is implicated in the aberrant transcriptome in cancer cells. Since EZH2 is a powerful target for cancer treatment, pre-clinical and clinical research on EZH2 inhibitors has been conducted. However, as shown in previous research, the EZH2 may operate as an oncogene and a tumor suppressor in MDS and AML. Additionally, it is shown that EZH2 has two distinct roles in the same illness, acting at various stages of AML. Potential therapeutic ramifications stem from this dual role. When analyzing the EZH2 expression in pediatrics MDS patients, it is also possible to suggest that EZH2 has a dual function. This finding has clinical implications for the course of the disease as well as for the selection of the best course of treatment, underscoring the significance of including additional laboratory tests to evaluate the EZH2 expression. More investigations are required to corroborate our findings and the pertinent role of EZH2 in the pathogenesis of pediatrics MDS since our research was the first to evaluate the relationship between abnormal expression of EZH2 and karyotypes and disease progress in pediatric patients with MDS [9], [10].

## CONCLUSION

We carried out the first investigation on EZH2 expression in young MDS patients. It was feasible to categories patients into three categories based on the EZH2 expression levels in healthy pediatrics donors and patients: low, middle, and high. Patients with normal karyotypes were included in the intermediate level, those with monosomy 7 and del were included in the low level, and those with trisomy 8 and del were included in the high level. It was significant to see that EZH2 expression levels both low and high were related to the progression of leukemia. However, compared to the high expression, the low expression demonstrated a greater connection with the development from MDS to AML. With a focus on the aberrant expression of EZH2, our findings provide fresh understandings of the pathophysiology of pediatrics MDS. These findings also indicate a scale of measurement for EZH2 expression in pediatrics MDS, where aberrant EZH2 expression may be a possible biomarker of disease progression.

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# CHAPTER 4

# ANALYSIS ON THE FREEDOM OF SPEECH IN GOVERNMENT SCIENCE

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**ABSTRACT:**

Hundreds of articles, books, and reports on the ethical issues surrounding industry-funded science have been published since the early 1990s by researchers, academics, journalists, and professional organizations. These works address issues like conflicts of interest, the withholding of data and findings, ghostwriting, and the infringement of intellectual property laws. Government science has garnered remarkably little attention up until lately, despite fifteen years of investigative spotlighting on privatized science. Three significant books The Republican War on Science by Chris Mooney, Scientific Integrity in Policy Making by the Union of Concerned Scientists, and Undermining Science by Seth Shulman have brought to light some of the ethical issues that can arise in government science, including restrictions on free speech, politicization of scientific advisory panels, conflicts of interest, and bias.

**KEYWORDS:**

Administration, Legal Repercussions, President George, Politicization.

## INTRODUCTION

Mooney claims that the administration of President George W. Bush has made an effort to silence government scientists' opinions on issues related to climate change. James E. Hansen, director of the Goddard Institute for Space Studies at the National Aeronautics and Space Administration stated that his planned lectures, papers, media appearances, and online posts were being reviewed by public affairs personnel. Hansen said that officials were attempting to edit material that he intended to make public. Hansen's public remarks were not given extra scrutiny, according to officials who refuted this assertion, noting that all scientists must have their media interviews vetted by public relations staff members to ensure consistency with administration policy statements. In response, Hansen said that the government was attempting to intimidate him and that it had used comparable measures to obstruct the public's access to other experts' studies on global warming. Under the Bush administration, issues with free expression have also arisen for other scientists working for the US federal government. In order to further a political goal, government officials reduced or ignored public health data, according to former Surgeon General Richard Carmona, who testified before congressional investigators. Additionally, he stated that the administration would not permit him to address the public on a variety of health-related policy topics, such as stem cell research, emergency contraception, sex education, and global health. Politically motivated papers on global warming have also been prepared by administration officials for the Environmental Protection Agency [1], [2].

Important concerns regarding the ethics of government science are raised by Hansen's altercation with Bush Administration representatives. Should government scientists enjoy the same freedom of expression as university scientists? What if any speech limitations are applicable to government science? This article will address these issues and make the case that government scientists should be able to speak freely, but that the government may place some limitations on speech in order to guarantee that research adheres to ethical standards and that public policy statements are consistent. To prevent weakening governmental science,

any speech limitations must be enforced wisely and judiciously. One of the fundamental principles of science is freedom of expression. John Stuart Mill, a philosopher and economist who lived in the nineteenth century, made a significant analysis on the value of free speech in public discourse. According to Mill, spirited discussion incorporating divergent viewpoints leads to advancement in society and science. People need to be free to think and speak in order to develop diverse points of view. If the majority utilizes its influence to stifle minority views, progress cannot be made. Similar justifications for free speech in scientific investigation have been provided by several other intellectuals, including Karl Popper, Paul Feyerabend, and Philip Kacheri will be helpful to make a distinction between various sorts of restrictions that the government could apply before talking about constraints on the freedom of expression in science.

Funding constraints differ from publishing restrictions which encompass public discussion and distribution in terms of morality, law, and politics. In societies where there is not enough money to finance every excellent activity, financial restrictions are inevitable. Peer review panels are used by government organizations to choose which research proposals should be financed. Researchers are still allowed to carry out their study using finances from alternative sources, such as a private corporation, institution, or private foundation, even if they are denied funding by a federal agency. However, restrictions on publishing represent a more significant challenge to the right to free expression. Because publishing is essential to science, denying someone the freedom to express their views in a public setting represents a substantial violation of their right to free speech. The right to free speech is essential for scientists since it allows them to address issues publicly as well as informally with their colleagues and the general public. This essay will concentrate on financing limits since restrictions on publishing can have a considerably bigger influence on research than financial restrictions [3], [4].

The academic model and the corporate/military model are the two fundamental types of free expression in research. In the US, academic scientists are able to express themselves with unparalleled freedom. In the majority of schools and universities, scientists have very little administrative monitoring or control when it comes to publishing articles or papers, expressing political beliefs, debating contentious concepts in class, or speaking to the media. Academic scientists are generally allowed to say or publish whatever they choose as long as they don't engage in defamation, treason, fraud, sexual harassment, or other prohibited speech. Academic freedom has been zealously protected by groups that represent university professors, such as the American Association of University Professors. The AAUP supports academics who experience some difficulty expressing their academic freedom, looks into organizations that are allegedly interfering with it, and censures organizations that it finds to have done so. Not all researchers enjoy the same level of autonomy as academic employees. Private sector scientists must likewise contend with communication limitations.

Research and development are seen by businesses as sensitive business information that is shielded by trade secret rules. Additionally, agreements allowing the business the right to possess intellectual property and to control the release of research results are typically required of both employees and contractors. Scientists employed by the government to conduct classified research are prohibited from disseminating their findings to the general public. Information that poses a serious danger to national security may be classified by US government entities. People who publicly disclose secret research without authorization risk severe legal repercussions. Access to classified material is restricted to those with the proper security clearance on a need-to-know basis. Which of these two models ought to be used for government science that isn't classified? Examining the function of government science in society will be helpful in providing an answer to this query. Like all state personnel, government scientists have a duty to uphold public trust and act in the public interest. The US

government's Standards of Ethical Conduct for Employees of the Executive Branch list fourteen different moral obligations for federal employees, such as abiding by American laws and regulations, not abusing their position for personal gain, and refraining from engaging in conflicts of interest that could interfere with the performance of their official duties [5], [6]. The public interest is served by scientists in a number of distinct ways. First, government scientists carry out important research, frequently in specialties or topics with limited support from business, such public health, environmental health, and fundamental studies in the physical or biological sciences.

## DISCUSSION

Government science aids in the fundamental comprehension of several disciplines and frequently leads to useful applications in the realms of engineering, computer technology, agriculture, medicine, and other applied sciences. Government science also contributes to the development of legislative ideas, regulatory suggestions, and policy recommendations. Second, Congress, federal and state agencies, as well as the general public, receive professional counsel from government scientists. Since government scientists are not formally affiliated with any one private interest or political philosophy, their advice is typically more impartial and trustworthy than that of scientists who work for industry or political interest organizations. For instance, while making choices on whether to approve new medications, the Food and Drug Administration frequently consults with pharmaceutical firms, trade associations, and patient advocacy organizations. The FDA also requires input from scientists who are unaffected by these economic and political biases in order to make fair and impartial choices. Third, government scientists inform the public on scientific topics that have an impact on public policy, such pollution, infectious illnesses, drug misuse, crime prevention, and drug safety. Public education is provided by government scientists through lectures, educational websites, best-selling publications, and media engagements. Additionally, through lecturing, guiding, and supervising graduate students and post-doctoral students, government scientists contribute to the training of the next generation of scientists.

Government scientists must be allowed to connect with other researchers and the general public without fear of censorship, intimidation, or retaliation in order to carry out these many tasks successfully. For the right to free expression in government research, there are several justifications. First, as was already said, the right to free expression is crucial for doing research. Limiting communication has a substantial influence on scientific activity and can be harmful to the research environment. Even if the government simply imposes speech restrictions on prominent scientists like James Hansen, these acts may nonetheless change the behavior of less well-known scientists. Scientists may practice various forms of self-censorship, such as softening and qualifying the conclusions and recommendations in their publications or skipping some types of research, if they are aware of the potential repercussions of publishing or discussing ideas that conflict with administration policies. Second, the ability to speak freely is crucial for giving knowledgeable counsel. Speech restrictions can make it more difficult to develop and apply well-informed, unbiased expert judgements regarding contentious matters of public policy.

Decisions made by the government may be affected negatively by issues with competence in the areas of public policy, health, the economy, and the environment. For instance, the FDA may not sufficiently safeguard the public from the negative consequences of a medicine if it acts on biased or incompetent advice concerning the drug. Third, the right to free expression is crucial for enlightening the public about scientific matters that have political repercussions. People need to hear multiple viewpoints, not simply the perspective favored by the present government, in order to generate informed and persuasive judgements about policy matters. Limitations on free speech can reduce the range of viewpoints that the general public can access. Fourth, allowing government scientists to speak freely helps organizations attract and

keep top researchers who might choose not to work for the government if they are concerned about restrictions on their right to free speech. Fifth, just like all other US residents, US government scientists have constitutionally guaranteed freedom of expression rights. They shouldn't be forced to decide between using their rights and serving in the government. People may agree to restrict their rights to free speech when working for private businesses, but not when working for the government, where free expression should be supported rather than restricted.

**Speech Restrictions in Government Science:**

Despite the fact that these five arguments provide a compelling case for providing government scientists complete freedom of expression, there are valid arguments in favor of imposing minimum constraints on their ability to communicate for certain, well-defined goals. First off, scientists working for the government frequently have access to private research projects, personnel issues, and human subjects research that is confidential. Government scientists shouldn't be allowed to reveal secret knowledge without authorization. Government scientists working under the auspices of a Cooperative Research and Development Agreement with a private company, for instance, should not divulge sensitive information about the company's products. This CRADA is for the development and testing of a medical product. Second, the government's reputation may suffer since government scientists typically disclose their institutional ties when publishing studies or giving speeches. Public faith in government research will be harmed if a government scientist publishes a paper that has serious factual, philosophical, or methodological mistakes.

Thus, government publications or presentations should have some sort of quality control, such internal peer review. Third, when a government scientist speaks to the media, the general public or even journalists might believe that the scientist is speaking on behalf of the government when, in fact, the scientist is merely offering his or her own view. The public may get confused if a scientist presents a viewpoint that is contrary to accepted wisdom. It is appropriate to let public relations departments to examine government scientists' contacts with the media in order to reduce misunderstanding and to make it possible for an administration to provide consistent policy statements. The goal of such a review should be to allow the administration to prepare a response to the scientist's interview rather than to prevent the scientists from speaking to the media.

These are all sound justifications for limiting the speech of government scientists in certain circumstances, but they must be used with care and caution to prevent the detrimental effects of speech limitations outlined previously. For instance, submissions should not be rejected or delayed because of factors that are not scientific. Administrators in charge of internal review should safeguard it against outside pressures, such as those that are ideological, political, or otherwise unrelated to scientific peer review. Additionally, the media shouldn't be utilized to silence viewpoints that differ from those of the administration. Scientists should be permitted to address the media as long as they qualify their statements with caveats. A scientist should make it clear that the views or opinions he offers are entirely his own and do not represent the government or one of its agencies if he has not been given permission to speak on behalf of the government or one of its agencies. Government representatives may look at a scientist's media appearances to plan a response to his ideas, but they may not stop him from expressing them. Similar regulations are in place at the majority of government organizations, along with procedures for handling employee complaints, such as Ombudsmen and Equal Employment Opportunity officials. However, issues have developed as a result of federal agencies' inconsistent application of these regulations. Hansen, for instance, claimed that NASA officials had intimidated him and dissuaded him from speaking to the media, even as a private person, by using the media review regulations.

Pressure from the administration on agency personnel to limit the speech of government scientists has led to abuses like these. It may be required for an organization that is independent of the government to oversee and examine the actions linked to the regulation of speech by government personnel in order to guarantee that rules that restrict speech are applied equitably. Internal review and media relations rules should be carefully examined by the organization to ensure that they are not too burdensome or restricted. The group should also respond to concerns from government scientists about speech freedom and stand up for staff members who experience censorship, intimidation, or retaliation because of their public remarks. The group would take on a similar function to the AAUP in terms of academic institutions' freedom of speech. What kind of entity may serve as this watchdog? Congress may enact legislation to establish an agency to oversee limitations on government free speech, but interest groups that like the status quo would be politically opposed to this legislation. Additionally, a government office could not have enough autonomy from the executive branch, particularly if it is based there. The American Association for the Advancement of Science is one scientific organization that has established a committee or group to address these concerns. This is probably the greatest strategy to protect free expression in government science. The Committee on Scientific Freedom and Responsibility a standing committee of the AAAS, would be an ideal choice for this position. The CSFR is tasked with keeping an eye on government and commercial organization acts and policies that limit scientific freedom, gathering data on such limitations, and creating laws to defend scientists' rights to freedom [7], [8].

Hate speech aimed against certain minorities is not covered by Article 10. In the case of Videoland and Others v. Sweden, 60 of the petitioners were found guilty of disseminating 100 flyers in an upper secondary school that the judges deemed insulting to homosexuals. By placing flyers from a group named National Youth in or on the lockers of the students, the applicants communicated information about the organization. Particular claims made in the pamphlets included those that homosexuality was a deviant sexual proclivity had a morally destructive effect on the substance of society, and was to blame for the spread of HIV and Aids. The applicants said that their conduct was meant to spark a discussion about the lack of impartiality in the instruction provided in Swedish schools and that they had not intended to show disdain towards gays as a group.

Even while these words did not specifically call for acts of hatred, the court determined that they nevertheless constituted substantial and unfavorable charges. The Court emphasized that sexual orientation-based discrimination was just as problematic as discrimination based on race, origin, or color. It came to the conclusion that there had been no violation of Article 10 of the Convention because the Swedish authorities had legitimately believed that interfering with the applicants' exercise of their right to freedom of expression was necessary in a democratic society to protect others' reputations and rights. member who embodies the burning Twin Towers. The phrase "Islam out of Britain - Protect the British People" was written alongside the image. He was found guilty of aggravating animosity towards a religious community as a result. According to Article 17 of the Convention, which forbids any action "aimed at the destruction of any of the rights and freedoms set forth herein," the Court ruled the complaint to be inadmissible. The Court stated that the right to free speech cannot be used to undermine the rights and liberties guaranteed by the Convention. It was determined that such a broad, impassioned assault on a religious community, which associated the community as a whole with a serious act of terrorism, was inconsistent with the principles upheld and secured by the Convention, including tolerance, social harmony, and non-discrimination. Therefore, any speech that includes components of racial and religious prejudice shall be excluded from the purview of Article 10.62. The Court has also had the chance to look at racist utterances made on television and shown as part of a public service announcement regarding a group of young people exhibiting racist beliefs. In Jersild

v. Denmark, 63 the petitioner was a television journalist who had been found guilty by the national courts of encouraging the spread of discriminatory remarks. He had taken the effort to put together a show in which three young people who held racist ideas were questioned.

The journalist had actively promoted racial remarks since she was aware that they would probably be said during the interviews. When editing the interviews, he added the offending statements. The interviews were then included on a sober television series that covered a wide variety of social and political problems, including xenophobia and immigration, and was designed for informed viewers. It was possible for the crowd to hear remarks like It's wonderful being a racist. We believe that Denmark belongs to the Danes People should be permitted to keep slaves; Just look at a picture of a gorilla... and then look at a nigger, it's the same body structure and everything... flat forehead A nigger is not a human being, it's an animal, that goes for all the other foreign workers, Turks, Yugoslavs, and whatever they are called," etc. The young males were also questioned on their residences, places of employment, and criminal histories. The lack of a concluding comment, by which, in the opinion of the judges, he should have strongly rebuked the racist beliefs voiced during the interviews, was the key factor that led the national courts to find the journalist guilty of aiding and abetting racist utterances. The necessity to defend the rights of people who were offended by the racist words was the government's justification for the conviction before the Strasbourg Court. The court stressed the critical need to combat racial discrimination and emphasized how deeply concerning the applicant's broadcast was to the general public.

In a similar vein, the Court denied Dieu Donne M'Bala protection for public insults directed at an individual or group of individuals due to their origin or membership in a particular ethnic community, nation, race, or religion, specifically in this case individuals of Jewish origin or faith. M'Bala was a comedian who participated in political activities.71 The applicant invited Robert Faison to join him on stage to accept a prize for unfrequentability and insolence at the conclusion of a performance at the Zenith in Paris in December 2008. Faison was an academic who had been convicted on several occasions in France for his negationist and revisionist views, particularly his denial of the existence of gas chambers in concentration camps. The award, which was presented to him by an actor dressed in what was called a garment of light a pair of striped pajamas with a stitched-on yellow star bearing the word Jew and who thus played the part of a Jewish deportee in a concentration camp took the shape of a three-branched candlestick with an apple on each branch. According to Article 35 admissibility criteria of the Convention, the Court declared the application inadmissible incompatible rationed material concluding that the applicant did not have the right to the protection of Article 10 freedom of expression under Article 17 prohibition of abuse of rights. The Court specifically thought that the performance during the offensive scene could no longer be considered as entertainment but rather resembled a political gathering that, under the guise of comedy, promoted negationist through the central role given to Robert Faison’s appearance and the demeaning portrayal of Jewish deportation victims confronted with a man who had denied their extermination. The Court held that this performance did not, although being ironic or provocative, fall inside the ambit of Article 10's protections; rather, it was, given the facts of the case, an expression of anti-Semitism, hate, and sympathy for Holocaust denial. In reality, it was a head-on, abrupt attack disguised as an artistic performance that offered a platform for an ideology that violated the Convention's core principles.

The Court came to the conclusion that by using his right to free speech for purposes that were inconsistent with the letter and spirit of the Convention and that, if accepted, would contribute to the destruction of Convention rights and freedoms, the applicant had attempted to divert Article 10 from its true purpose. Contrary to Holocaust denial, Article 10 protection was given to the denial of the Armenian genocide as a topic of historical and public discourse. A Turkish politician named Pericak publicly said in Pericak v. Switzerland that the

mass deportations and murders of Armenians in the Ottoman Empire in 1915 and the years that followed did not constitute genocide.72 The Swiss courts specifically ruled that his views did not further the historical discussion and that his motivations seemed to be racist and patriotic. The petitioner claimed that his right to freedom of speech had been violated by his criminal conviction and sentence. The Court determined that Article 10 of the Convention had been broken [9], [10].

## CONCLUSION

Academic and governmental science both depend on freedom of expression. Government-employed scientists need the right to free expression in order to carry out their research, offer knowledgeable commentary, and inform the public. Government scientists are still permitted to have a few minimal restrictions on their right to free speech in order to protect sensitive government research, ensure the integrity of employee-conducted scientific research, and support consistent policy positions. To prevent damaging government science, these speech restrictions must be used wisely and discreetly. Opinions that conflict with those of the government shouldn't be censored or suppressed via internal peer review or media review. Government science free speech should be monitored and protected by independent scientific organizations like the AAAS.

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# CHAPTER 5

# AN ANALYSIS OF SOCIAL MEDIA AND FREEDOM OF SPEECH AND EXPRESSION

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**ABSTRACT:**

India is one of those places on earth where, at least up until now, you may speak your mind without worrying about being shot dead for it. Even while Indians' lives are significantly better than those of their counterparts in other countries, this reality is no longer particularly calming or captivating for Indians. This observation is being made in reference to the arbitrary application of the country's so-called cyber laws, particularly Section 66A of the Information Technology Act, 2000, and the barriers put in the way of exercising the right to freedom of speech and expression in the context of social media. It is advisable to first comprehend the ideas of social media and freedom of speech and expression before digging into the topic in more detail.

**KEYWORDS:**

Captivating, Censorship, Interactive Discourse, Social Media.

## INTRODUCTION

Social media largely consists of tools for sharing and debating information that are based on the internet and mobile devices. It combines technology, communications, and social interaction and offers a platform for exchanging ideas through written words, images, moving pictures, and music. Interactive discourse is made possible by social media, which uses mobile and web-based technology. Social media are any web-based or mobile-based platforms that allow for interactive communication between individuals or groups of people as well as the sharing of user-generated content. Social media are a group of internet-based applications that build on the theoretical and technological foundations of Web 2.0, and that allow the creation and exchange of user-generated content, according to Andreas Kaplan and Michael Haenlein. Internet platforms that enable interactive user engagement are referred to as Web 2.0.The term user generated content refers to all of the methods that users might use social media [1], [2]. Three requirements are set forth by the Organization for Economic Cooperation and Development for content to be categorized as user generated It should meet the following criteria:

1. It should be accessible to the general public on the internet
2. It should require a little amount of creative effort, and
3. It should be created outside of professional routines and practices.

Another type of social media is mobile social media, which refers to the usage of social media in conjunction with mobile devices. Mobile social media, which operates on mobile devices, differs from traditional social media in that it takes into account fresh elements such the user's present position location sensitivity or the time elapsed between sending and receiving messages time sensitivity.

**Social Media Platforms:**

**Social media can be categorized roughly into the following nine types:**

Social networking, first Online social networking services let users build virtual networks of people who share their interests. It provides tools including chat, instant messaging, photo sharing, and video. updates, sharing, etc. Facebook and LinkedIn are the most widely used Blogs are descriptive online publications that are run and updated by lone users. Text, pictures, and internet links. The capability of blogs to be interactive is comments from readers are welcome, and the comment thread can be followed. Micro blogs are similar to blogs that often have a character limit of 140 or less, which enables people to publish and distribute information. Twitter is a microblogging platform that gives users the ability to Blogs called video blogs Vlogs primarily employ video as their primary content format. Backed up by text. The biggest video-sharing website in the world is called You Tube [3], [4].

A video is on You. users can watch, upload, share, and even comment on videos on a live casting and video sharing website. A collaborative website called Wiki enables numerous users to add and change pages. Specific or connected topics. Wiki pages pertain to individual pages, but the full 'Wiki' is a collection of relevant information on that subject. These numerous pages are connected by Users can interact in a complicated, non-linear way thanks to hyperlinks. One can use these services to manage, organize, and preserve links to numerous websites. Resources available online. Searching through and tagging websites is how people interact. Websites that other people have bookmarked. Stumble Upon and Delicious are the most well-liked. One can upload a variety of news items or links to external articles using these services. Interaction by voting on the products and leaving comments about them. The fundamental component as the items with the most votes are highlighted. The most well-known are Digg and Reddit. One can upload and share photographs or movies using these services. When people interact, they share and remarking on user-submitted content. YouTube and Flickr are the most well-liked. The aforementioned social media platforms might overlap. For example, Facebook status update' function includes microblogging capabilities. furthermore, YouTube and Flickr possess commenting mechanisms like to those found on blogs.

**Speech & Expression Freedom:**

The idea that everyone has the natural right to freely express oneself through any media and medium without outside intervention, such as censorship, and without fear of retaliation, such as threats and persecutions, is known as freedom of speech and expression. The right to freedom of expression is complicated. This is due to the fact that the right to free speech is not unqualified and comes with particular obligations and responsibilities, hence it could be subject to specific legal limitations. The phrase "freedom of expression" has been used for a very long time at least from the Greek Athenian period, more than 2400 years ago.10 Some of the most widely accepted definitions of freedom of expression that are accepted as legitimate international norms are as follows: Everyone has the right to freedom of opinion and expression, which includes the freedom to do so without hindrance and the freedom to use any media or method, regardless of boundaries, to gather, process, and disseminate information and ideas.

Everyone shall have the unhindered right to have beliefs. Everyone has the right to express themselves freely, which includes the freedom to look for, receive, and share information and ideas of all types without regard to boundaries, whether verbally, in writing or print, via art, or through any other medium of his choosing. International Covenant on Civil and Political. The right "to freedom of speech and expression" is also granted to Indian citizens under of the Indian Constitution. The freedom of speech and expression refers to the ability to freely

express one's beliefs and thoughts through voice, writing, printing, images, and other media [5]. It also involves the freedom to spread or make public the opinions of others. No matter what media is employed, "freedom of speech and expression" refers to any act of obtaining, receiving, or disseminating knowledge or ideas. According to John Milton's reasoning, freedom of speech is seen as a complex right that encompasses not only the right to express or distribute information and ideas but also the right to look for, receive, and share knowledge and ideas. The idea of democracy and freedom of speech and expression are closely related.

One of the links' proponents, Alexander Meiklejohn,12 says that democracy is self-government by the people, and that in order for it to work well, an informed voter is essential. This, in turn, necessitates that there be no restrictions on the free exchange of ideas and information. If those in power have the ability to mislead the electorate by withholding information and limiting criticism, democracy will not be loyal to its fundamental purpose. Richard Moon asserts once more that social interactions are where the value of freedom of speech and expression is found. According to him, y communicating, an individual develops relationships and affiliations with others, including family, friends, coworkers, the church community, and fellow citizens. Additionally, by engaging in discourse with others, an individual contributes to the growth of knowledge and the direction of the community.

## DISCUSSION

The significance of freedom of speech and expression on social media can be better appreciated in the context of Moon's argument. Free speech, expression, and use of social media on the internet Through the use of the Internet and social media, people may now exercise their right to freedom of speech and engage in information and idea exchange. Around the world, there has been a growing movement of individuals in recent years calling for justice, equality, transformation, the accountability of the powerful, and respect for human rights. The Internet and social media have frequently played a crucial part in such movements by allowing individuals to rapidly connect, exchange information, and foster a sense of solidarity. The UN Special Rapporteur on the promotion and protection of the right to freedom of opinion and expression stressed the significance of the internet in his Report, which was submitted to the Human Rights Council.

He stated that because the internet has become a crucial medium for people to exercise their right to freedom and expression, internet access is a human right.15 The report also emphasized the need for States to make sure that internet connectivity is always available, especially in times of political instability. The States were also reminded of their responsibility to actively encourage or assist the exercise of the right to freedom of expression and the tools required to do so, such as the Internet. Additionally, the States were urged to implement measures to ensure that everyone has access to the Internet and can use it affordably.

The UN Human Rights Committee has also attempted to put freedom of speech into practice in the drastically changing media landscape, where the internet and mobile communication take central stage. The Committee emphasized that the States should take all necessary measures to encourage the independence of these new media and also enable access to them, describing new media as a worldwide network to exchange ideas and opinions that does not necessarily rely on the conventional mass media. Additionally, freedom of speech and expression is guaranteed under, including in the situation of the internet and social media. Thus, it can be shown that the Indian Constitution and other international documents recognize freedom of speech and expression as a basic right, regardless of the media through which it is expressed. Access to this medium has also been acknowledged as a fundamental

human right in view of the expanding usage of the internet and social media as a means of exercising this right.

**Limitations on the Right to Free Expression and Speech:**

The right to free speech and expression does not provide citizens the freedom to talk or write without restraint. It does not serve as an unrestricted license that shields users from penalty for abusing their freedom of speech in any way. The following justifications are included in Article 19 of the ICCPR as reasons for restrictions.

1. Respect for others' reputational rights;
2. Protection of national security,
3. public order, public health, or morality.
4. Social Media Censorship

Information is a trendy word right now. In the modern world, it is imperative to follow the advancing trends. The ability to communicate, organize, and store information more quickly and more simply thanks to technology has made information the foundation of progress. Without openness and information exchange, democratic decision-making is impossible. Social media's ability to reach a large audience and disseminate information has led to everyone acting as a watchdog, investigating the powerful, and exposing waste and wrongdoing. Governments all across the world attempted to suppress information from the general public up until recently under a variety of justifications. And now that social media has emerged, governments are cautiously attempting to control it because of its enormous capacity to spread information to the public. Internet's boundless potential and extensive reach have made it the cornerstone of modern society [6], [7]. Due to its significant contribution to the collection and diffusion of knowledge, it now plays a special role in the operation of democracies throughout the globe. The public may get together online and through social media despite geographical restrictions. Even when everyone is not physically there, the protest's impact remains unaffected. It is therefore clear why governments all around the globe want to restrict the internet. Again, in addition to its useful functions, the Internet is also susceptible to abuse, which provides the State with a case for regulating online material in the interests of the general public. Social media makes it simple to commit a number of cybercrimes, including defamation, invasion of privacy, incitement of crime, racist remarks, stalking, abuse, hacking, harassment, and many more. Once such objectionable content is uploaded, it goes viral and is therefore very difficult to control. Therefore, it is equally important for the government to control social media.

There can be no problem with government regulation as long as the interests of the people, both individually and collectively, are protected. The issue arises when, in the name of regulation, it begins censoring, infringing upon the civil rights of the people, such as freedom of speech and expression, etc. Despite the fact that there are protections in this area, every State tends to go beyond them in some fashion, albeit to varying degrees. In terms of Internet censorship, China is at the top. It has a complex system in place to impose censorship colloquially as the "Great Firewall of China" and formally as the Golden Shield Project. The typical method of internet censorship is blocking websites with problematic material. Specifically speaking, India's overall Internet Freedom Status is "Partly Free" according to the most recent Freedom House report, "Freedom on the Net, 2012". India ranks 20th out of the 47 nations that were considered for the study with a score of 39 on a scale from 0 to 100 .20 On the basis of the government's expanding control over the internet, Reporters Without Borders produced a study titled "Internet Enemies Report, 2012" on March 12, 2012.

The report included a list of "Enemies of the Internet" that censor online content and harass their internet users, as well as a second list of "Countries under Surveillance" for their troubling online behaviour. India was included as one of the "Countries Under Surveillance"

in a report. The Internet giant Google reported in its seventh transparency report, released on April 27, 2013, that the Indian government had nearly quadrupled its demands for Google to remove information in the second half of 2012 compared to the first half. According to the study, Google received over requests from governments to erase pieces of information between July and December. Google received requests to delete 18,070 items of information in the first half. In the same six-month period, the Indian government asked Google to hand up user information 2,319 times for a total of 3,467 users/accounts, both through court orders and police demands. Even though the Information Technology Act was passed in 2000, India did not actively control the internet until the Mumbai terrorist assault in 2008.

The Information Technology Act of 2000 was revised in the wake of the assaults to increase and improve the government's capabilities for monitoring and censorship. The Indian cyber law now includes provisions for blocking websites, tracking and gathering data on internet traffic, intercepting or decrypting that data, granting unrestricted access to sensitive personal data, holding intermediaries, such as social media websites, accountable for hosting objectionable user-generated content, etc. In this context, India has been referred to as a nation that uses "selective" Internet blocking [8], [9].

**Pre-screening Social Media Content:**

The Indian government urged internet service providers including Google, Facebook, Microsoft, and others to develop a framework to pre-screen data before it is posted online in December 2011. A social networking site had some defamatory material on it; therefore, the government urged the corporations to come up with a plan to make sure that such material is vetted before it is posted online. Kapil Sibal informed the media that the Government was not attempting to suppress the freedom of speech and expression online; rather, it only intended to prevent objectionable information from being shared on social networking sites as a significant discussion on the subject erupted and it was painted in a negative light. The corporations further stated that they were unable to satisfy demand owing to the abundance of user-generated content in India and that they were unable to decide what was or was not libelous. Cricket Association of Bengal and others. Secretary, Ministry of Information and Broadcasting, Government of India and others the Supreme Court ruled that it is vital for the people to enjoy the advantage of plurality of ideas and a variety of viewpoints on all public matters in order to ensure the citizens' right to free expression. An educated populace is necessary for a thriving democracy.

To allow the population to reach educated judgement on all matters affecting them, a diversity of viewpoints, views, ideas, and ideologies is necessary. This cannot be done through a medium that is under the control of a monopoly, whether that monopoly belongs to the State or any other person, group, or organization. In light of the aforementioned, it might be suggested that regulation of social media, as opposed to censorship, is preferable in a way that simultaneously upholds user rights and safeguards those of the victims. This takes us to the topic of the cyber laws of India, which, however subtly, aim to control social media.

**Social media and Indian Cyber Laws:**

Despite the fact that social media are not specifically covered by Indian law, there are a number of provisions under the so-called cyber laws that can be utilized to seek remedy when any rights in cyberspace, the internet, or social media are violated. The following laws and regulations are particularly listed as being pertinent. Sections 65, 66, 66A, 6C, 66D, 66E, 66F, 67, 67A, and 67B of Chapter XI of the Act contain penalties for computer-related offences that can also be committed through social media, such as tampering with computer source code, committing computer-related offences listed in Section 43, sending offensive messages through communication services, identity theft, cheating by personation using computer resources, violation of privacy, cyber.

Section 69 of the Act gives the Central or a State Government the authority to issue directives for the interception, monitoring, or decryption of any information through any computer resource in the interest of India's sovereignty or integrity, of its defense, of its security, of its friendly relations with other States, of its public order, of preventing incitement to commit any cognizable offence, or of investigating any offence.

1. Section 69A gives the Central Government the authority to authorize the blocking of public access to any material via any computer resource on like grounds.
2. The Central Government is given authority under Section 69B to issue directives allowing any agency to monitor and gather traffic data or information through any computer resource for cyber security.
3. Section 79 addresses intermediary responsibility. In the following scenarios, an intermediary is not responsible for any information, data, or communication connection provided by or hosted by a third party.

The Rules for Sensitive Personal Data or Information and Reasonable Security Practices and Procedures in Information Technology, 2011With respect to the appropriate security practices and procedures and sensitive personal data or information under Section 43A, the Central Government has the authority to make these regulations in accordance with Section read with Section 43A. According to Rule 6, the owner of the sensitive personal data or information must give their prior consent before a body corporate can disclose it to any third party. However, without getting prior approval, the information may be disclosed to government organizations for the purposes of confirming identification or for the prevention, detection, and investigation of crimes, including cybercrimes, as well as for the prosecution and punishment of offenders.

**The Information Technology Act of 2000's Section 66A:**

Of all of these clauses, Section 66A has recently made headlines, but for the wrong reasons. It is preferable to first have a look at Section 66A, the provision, before delving deeper into the problem. Sending offensive messages via communication services, etc. is punishable under Section 66A of the Information Technology Act of 2000, which was added by the Information Technology Amendment Act of 2008, which reads as follows: Any person who sends, by means of a computer resource or a communication device any information that is grossly offensive or has menacing character any information which he knows to be false, but for the purpose of causing annoyance, inconvenience, Explanation: For the purposes of this section, "electronic mail" and "electronic mail message" refer to any message or information that is created, transmitted, or received using a computer, computer system, computer resource, or communication device, including any attachments that may be sent along with the message in the form of text, images, audio files, video files, or other types of electronic records. Through an amendment to the Act in 2008, Section 66A was added. Only the first two subclauses of Section 66A were included in the Amendment Bill when it was initially submitted in Parliament in 2006. The initial purpose of Section 66A was to combat spam, which is defined as unsolicited and unjustified email [10], [11].

## CONCLUSION

It is undeniably true that using social media to express one's freedom of speech and expression is a very effective strategy. However, it is also being used more often for unlawful activities, which has made the government's efforts to restrict social media more effective. While social media abuse necessitates the necessity for legal censorship, there are real concerns that filtering would inevitably lead to the infringement of people's civil rights. So, rather than censoring social media, regulating of it is preferred. However, India's current cyber regulations are not fit nor sufficient in this regard. When it comes to dealing with cyberspace security, a study of the existing IT legislation reveals that the government has

unchecked and enormous power. Even then, it is insufficient to stop social media abuse. Therefore, it would be good to have particular regulations to control social media. However, doing so may provide a number of practical challenges. There is a very fine line that separates exercising one's rights and impairing someone else's rights in the process. In social media, exercising one's right to free speech and expression can lead to privacy invasion and defamation. Again, different people have different ideas of what is undesirable stuff. A cartoon is a pleasant, innocuous way to pass the time, yet the target audience may find it offensive. Similar to this, various people have varied interpretations of hate speech, racial insults, and religious beliefs.

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# CHAPTER 6

# THE TREATMENT OF SPEECH APRAXIA: AN OVERVIEW

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**ABSTRACT:**

With apraxia of speech, the brain's signals to the mouth are messed up, making it difficult for the person to move their lips or tongue to the proper location to pronounce sounds properly. The exercises are now done in one-on-one sessions with a therapist as part of the treatments for this illness. Our goal is to advance the field of robotic treatments by giving a social robot the capacity to help therapists with exercises for rehabilitating apraxia of speech, either partly or entirely autonomously. As a result, we use computer vision and machine learning algorithms to identify the user's mouth position, and our social robot also carries out the various therapeutic procedures on its own utilizing multimodal interaction.

**KEYWORDS:**

Apraxia, Pronounce Sounds, Rehabilitating, Social Robot.

## INTRODUCTION

Due to a neurological condition known as apraxia of speech, a person with this condition has trouble moving their lips or tongue to produce the desired sounds. This disorder is brought on by damage to the left hemisphere of the brain brought on by, among other things, strokes, Alzheimer's, or brain injuries. The kind of the brain injury determines how severe the apraxia is. Acquired apraxia of speech, verbal apraxia, and dyspraxia are other names for AOS. Enhancing the planning, sequencing, and synchronization of muscular actions for speech production is the main goal of the intervention. The speech muscles often need to be "retrained" in order to make sounds appropriately and arrange sounds into words. Exercises are made to enable repetition of sounds and practice of appropriate mouth motions for sounds. There are now three distinct AOS rehabilitation interventions: The goal of this exercise is to produce phonemes and sequences of phonemes using precise, controlled, and deliberate movement. These treatments are designed to automate these actions so that they are afterwards carried out unintentionally; intervention based on enhanced systems: these techniques use several input channels to enhance the effectiveness of the therapy. To assist patients, recall how to pronounce difficult and lengthy words, audio and visual cues are usually used; melodic treatments are used with patients who still have auditory understanding of the language. In these situations, the patient must replicate several melodies that have been suggested and indicate the wards' emphasized syllables in order to determine the rhythm of the melodies. For both children and adults, these treatments are usually designed as intense, one-on-one speech-language therapy sessions. Therefore, it is challenging to provide the repeated exercises and individualized attention required to enhance AOS in group treatment .Robots are becoming more and more common in rehabilitation therapy, particularly in traumatology, where they support the user's weight or assist in moving a specific limb [1], [2]. It has been shown that robots can help the therapist provide stroke patients safe and rigorous rehabilitation instruction. While the robot performs the real physical engagement with the patient, in the typical context of these systems, a therapist is still in charge of the nonphysical interaction and observation of the patient while keeping a supervisory role of the training. Rehabilitation robots have often been used for lower- and upper-limb treatment. Robotic rehabilitation is often well tolerated by patients and has been shown to be a

successful addition to treatment in people with motor deficits, particularly those caused by stroke. As a result, we think robots may be used to other rehabilitation fields, including AOS. As far as we are aware, this suggestion is novel since robotic technology have not yet been used in this sector. In our situation, we are inspired by mouth poses related to the five vowels in the Spanish language. We suggest adopting the first kind of intervention described in this part, in which the user repeats exercise to practice mouth motions. As a result, we suggest adopting some of these sounds as their pronunciation suggests various mouth stances and a variety of muscle actions. We think a social robot might be useful in AOS treatment by providing a fresh and eye-catching manner to support the activities. The robot brings additional tools to the treatment including a screen to engage the patient and reinforce the activities visually. Additionally, the HRI skills of a social robot might improve conventional therapy, optimizing human resources while maintaining a customized approach. In other words, by having robots create some of the therapies, a therapist could care for more patients [3], [4].

For the detection and identification of vowel poses, we suggest employing machine learning approaches. A Microsoft Kinect RGB-D device collects the input data, and using this data, the system generates mouth gestures that are used to direct users through workouts. A multimodal system is used for interaction that combines body language, voice interaction, and a graphical user interface, and all of these modalities are designed to teach and motivate the patient while they are exercising. The remainder of this document is organized as follows: Insights into existing AOS treatments are provided along with recent robotic breakthroughs for physical therapy and cognitive rehabilitation, as well as an analysis of various face detection and classification methods that are relevant to our strategy. The specifics of our plan are then presented, which highlights its essential components. The tests performed to verify our findings are presented, together with the robotic platform, the social robot Mini, and the metrics used to assess the strategy. The early findings from incorporating and testing the AOS exercises in the social robot are also presented in this part. The key findings are then drawn which also assesses the main contributions of our study. Speech capacity is often impacted by dementia, Alzheimer's disease, or a stroke. Traditional speech treatments concentrate on rehabilitating patients after cerebrovascular accidents or reducing this issue in cases of cognitive impairment. These patients typically recover in three years, during which speech treatment often produces fruitful outcomes. In addition to this kind of treatment, there are others, like music therapy, that are often used with patients who have neurological issues, who are typically older people. In the instance of music therapy, patients sing and make sounds from prescribed melodies in order to enhance speech intelligibility and pitch variability. According to Tomaino and Sacks, music therapy aids individuals with brain abnormalities in reorganizing their brain function.

Technology is being introduced into healthcare settings in addition to conventional treatments. More specifically, the domains of physical therapy and cognitive rehabilitation are where robotics is becoming more important. In these situations, therapists are in charge of choosing the exercises to execute and supervising the process. A notable illustration of how robots are used in cognitive therapy is the robot Paro. It mimics a newborn harp seal and has been employed in treatment with elderly dementia patients, boosting the desire of patients to converse and a steady rise in physical engagement between patients and the robot as well as among patients. The Babylonic robot, which resembles a baby and is made to be cared for, is another robotic platform used in cognitive therapy. This robot is meant to be used in recreational therapy, where it takes the place of an animal and is treated as a pet. These ideas are primarily designed for interacting with senior citizens who have mild cognitive limitations. Other robotic systems provide more engagement during therapy sessions with patients who have modest cognitive issues. This is the case with Elderton, a robot designed to have amusing and geriatric functions. Gestures, speech, touch-screen, and external actuators

are just a few of the ways this robot may interact with people. This robot's concept for therapy involves manipulating and displaying multimedia information. As a result, treatment professionals are given a tool that can conduct games utilizing the platform's inbuilt sensors. Another suggestion for treatment with seniors who are in the early stages of Alzheimer's or dementia is the robot Mini. Mini is a desktop robot that resembles a soft toy and provides features for personal help, stimulation, entertainment, and safety. With this effort, we want to expand Mini's skills to provide speech therapy. It contains further information on the characteristics and design of the robot. Computer vision is another field of study that is included in our work. Numerous methods for face detection and identification are provided in the literature. Applications include recognizing persons, monitoring, and regulating emotions. Although there are many methods for retrieving facial characteristics, the issue is still difficult since the majority of solutions rely heavily on the orientation of the face. In this study, Stash, an active shape model-based method linked with an SVM classifier that extracts face characteristics, has been implemented. The mouth of the user is represented by 18 3D points from these attributes, which will be the input for the machine learning method [5], [6]. In addition to identifying the mouth, it is essential to have an algorithm that can be included into a speech therapy programmed that can recognize the mouth stance. Machine learning has been used extensively in the identification of facial expressions and faces. SVM, Ad boost, linear discriminant analysis, and deep learning, among other approaches, attempt to address well-known issues including various positions, lighting, ages, and occlusions that are still problematic in modern times. In this research, we evaluate a number of classifiers included into Sci-Kit Learn, an open-source, Python-based machine learning toolkit. It offers techniques for feature categorization, regression, and grouping.

## DISCUSSION

This section outlines the suggested method for enabling a social robot with a 3D camera to carry out an AOS exercise on its own. The key phases of our approach, which are generally separated into two operating modes. We must first evaluate the classifier that works the best with the data we have. In this procedure, we collect user-provided data, preprocess it, train a number of classifiers, and then choose the one that performs the best. The speech treatment application employs the mouth position that is recognized to carry out the workouts when this classifier is employed next online and therefore included in the robotic platform. Keep in mind that both techniques start with the same four stages. This system makes use of a Microsoft Kinect, which offers synchronized RGB pictures and depth data in terms of both time and field of view. The system extracts facial features in 2D using the open-source package Stash after performing information gathering. The mouth posture is then recognized once those traits are converted into 3D points. There are two primary phases in the mouth detection procedure. Data collection is carried out using Opening, a middleware created especially for RGB-D devices. The Kinect gadget produces two information flows: an RGB picture stream and a point cloud with depth data. The algorithm then uses Stash to analyze the RGB data to locate the mouth inside an identified face. This collection attributes 77 points to a face, 18 of which are assigned to the mouth. These points are then prepared for use in the mouth position classification phase after being matched to the depth data from the camera. In a recent study, the mouth detection system was described in further depth. Our method for recognizing mouth poses aims to evaluate a number of classification methods included within Scikit-Learn. We use a prior study as a starting point for the classifier selection since it examined mouth detection using WEKA, a well-known data mining programmed that enables preprocessing, classification, regression, clustering, association rules, and data visualization. Since WEKA was not directly incorporated into the ROS framework, we wanted to take the research a step further and include the top-performing classifier into our robotic platform. As a result, we evaluated the effectiveness of the following classifiers The k-Nearest Neighbors approach, a nonparametric technique for classification and regression, takes as its input the k

training instances in a feature space that are nearest to it. In our example, a sample is categorized by a majority vote of its neighbors, with the item being allocated to the class that has the most members among its k-nearest neighbors. The outcome is a mouth posture Support vector machines construct a hyperplane or collection of hyperplanes in a high- or infinite-dimensional space as a supervised learning approach for classification and regression. An SVM may map the inputs into high-dimensional feature spaces and conduct linear and nonlinear classification [7], [8].

C4.5 is an algorithm that creates a decision tree utilizing information entropy from a collection of training data. The method selects the property of the data from each node of the tree that best divides the collection of samples into subsets enriched in one of the classes. The normalized information gain serves as the splitting criteria class that corresponds to the mode of the potential classes is produced using the random forest ensemble learning approach for classification and regression, which builds numerous decision trees during the training phase. Random forest has the benefit of reducing the overfitting issue brought on by conventional decision trees. Establishing which classifier performed better with our input data was required before discussing the rationale of the speech treatment exercise. The data collection phase of this operating mode, which is shown in the top route begins with the RGB-D device providing color pictures and point clouds together with the 3D representation of the scene. The following phase, mouth detection, uses Stash to create a 3D array of 18 points that match to the mouth that was found in the input data. As the user moves, the head position in the picture changes, thus it's crucial to normalize the data to provide a uniform frame of reference. In order to calculate the centroid of the mouth, which serves as the origin of coordinates for the 18 points, one must first do the normalization step. Since the x, y, and z components of each of these points define them, as shown by and, the normalization for each of them is determined with regard to the centroid. The online execution mode of our system, shown in the bottom path incorporates the best-performing classifier found in the preceding section. The first four phases, which are used for data gathering, locating the points that belong to the mouth and normalizing them, as well as preparing the data for classification, are the same for offline and online executions. The prepared data is then analyzed in a classifier in the online mode, and the result is utilized in the AOS exercise to evaluate the user's performance and direct him or her throughout the session. When one of the three positions receives a certain number of detections, the system chooses that stance as the current one and engages in conversation with the user, expressing satisfaction if the pose detected matches what was anticipated or correcting the user if a different pose is found. on addition to the visuals shown on the tablet, a repertory or corpus of utterances has been developed to congratulate and correct the user. In order to engage the user in the activity, the robot also makes body motions. Instead of explaining what they are about here, a demo film has been created in which those movements are plainly exhibited. When the user fails to make the posture, a sad expression is performed whereas otherwise the robot displays a joyful emotion.

**Compatibility with the Social Robot:**

This section evaluates how well the speech therapy application's detection and categorization work. In this instance, users trained the system online for the combined three positions at intervals of between 5 and 10 minutes. We can see how the system's performance might decline to the point that it is unusable in specific situations, such as the mouth-closed position. At this point, we discovered that we needed to train the system using the data from the new users, but that the training should not be as rigorous as it had been in earlier tests. We cannot anticipate that people will be eager to train the robot for a lengthy amount of time given that the eventual use is speech therapy. In this instance, the system trains the users with online detections for the three positions in combination over durations of 5 to 10 minutes. Given that it only has to be done once for each new user, we think this won't make the users

bored or worn out. With the addition of this additional data, the system's performance increases to levels equivalent to experiment although these levels fall short of the results obtained in experiment with cross-validation, they are still high enough to guarantee a high detection rate. At this point, we discovered that we needed to train the system using the data from the new users, but that the training should not be as rigorous as it had been in earlier tests. We cannot anticipate that people will be eager to train the robot for a lengthy amount of time given that the eventual use is speech therapy. In this instance, the system trains the users with online detections for the three positions in combination over durations of 5 to 10 minutes. Given that it only has to be done once for each new user, we think this won't make the users bored or worn out. With the addition of this additional data, the system's performance increases to levels equivalent to experiment; although these levels fall short of the results obtained in experiment 2 with cross-validation, they are still high enough to guarantee a high detection rate.

We experimentally adjusted the score threshold for valid detection in the online execution to 0.35, and after six successful recognitions, a posture was generated. The detection score was often very near to one, falling to low levels for misdetections. The number of valid poses that must be successfully recognized before a posture is considered to be genuine directly affects how quickly our system responds since both a low number and a high number might result in incorrect detections. Six valid detections were thus thought to be a fair compromise between reaction time and accuracy.  provides a summary of the speech therapy plan, illustrating the several stages in which the robot directs the user through the exercise. The robot starts out by giving a brief description of the practice utilizing motions, speech, and the tablet. As the system detects and categorizes the mouth stance, the exercise then begins, and the user should continue striking the appropriate pose. The robot finally congratulates the user after three successful detections. Another issue is that the system fails to recognize the intended stance. In this instance, the robot instructs the user on how to adopt the proper attitude in order to rectify them. Along this activity, the robot instructs the user and provides feedback via speech, gestures, and the tablet. More information regarding the system's operation may be obtained in a movie that has been released at provides an overview of the outcomes and experimental circumstances of the suggested methodology. These findings demonstrate how our approach offers good classification accuracy for mouth posture, up to 0.95 in the cross-validation test. Noting that we are now working on testing it with actual users, the experimental phase in this article is meant to serve as a proof of concept. Additionally, we are aware that when dealing with individuals who have motor mouth issues, mouth positions may alter, which may have an impact on the performance of the classifiers. When implementing the system in actual circumstances, our strategy in this respect is to integrate real user data and retrain the system.  provides an overview of the outcomes and experimental circumstances of the suggested methodology. These findings demonstrate how our approach offers good classification accuracy for mouth posture, up to 0.95 in the cross-validation test. Noting that we are now working on testing it with actual users, the experimental phase in this article is meant to serve as a proof of concept. Additionally, we are aware that when dealing with individuals who have motor mouth issues, mouth positions may alter, which may have an impact on the performance of the classifiers. When implementing the system in actual circumstances, our strategy in this respect is to integrate real user data and retrain the system [9], [10].

## CONCLUSION

This article described a method of speech treatment for apraxia that makes use of social robots. The system has two key phases: an offline phase where we train a collection of classifiers after identifying and normalizing mouth data from users, and an online phase that runs on our social robot Mini. The best-performing classifier is integrated into this real-time

procedure, which also directs the user through an AOS exercise. Up to three mouth positions were used in the studies, which we believe to be sufficient for a first round of mouth position-specific treatment. In order to determine which classifier is the best, we used data from 14 users during offline tests to train classifiers on our dataset. C4.5 was the most accurate classifier in these offline testing, hence it was included in the final strategy. We ran further trials with 7 new users in the online testing with the whole system incorporated in the social robot, with the first user operating the system with untrained data, which revealed a decline in performance in the categorization of mouth postures. This served as the inspiration for the second experiment, in which the classifier was retrained using a tiny sample set from the new users. In this instance, the performance once again reached competitive levels.

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# CHAPTER 7

# THE EXCEEDING OF FREEDOM WITH HIERARCHICAL PRECODING

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**ABSTRACT:**

A common strategy for raising the spectral efficiency per area of cellular networks is cell densification. Macro base stations often manage these small-cell-based ultra dense networks. The system's spectrum efficiency is constrained by macro-BS interference with global frequency reuse. In this study, interference coordination is used by using the degrees of freedom at the macro BS. In order to project interference from the macro-BS into the subspace of small cell users, permitting linear cancellation, we suggest a hierarchical precoding technique in the spatial domain. The interference from the macro-BS directed at small cell users is aligned inside the shared null space of users that the macro-BS serves. Our method does not need coordination between microcells and tiny cells, unlike standard interference alignment. We provide three algorithms: the first uses iterative alignment to minimize interference; the second takes into account the uncoordinated interference from tiny cells; and the third use the iterative Minimum Mean Square Error approach. Based on a realistic channel model, we give numerical assessment, complexity analysis, and robustness analysis of various algorithms to demonstrate the advantages of hierarchical precoding over the uncoordinated situation.

**KEYWORDS:**

Common Strategy, Exceeding of Freedom, Hierarchical Precoding, Uncoordinated Situation.

## INTRODUCTION

Wireless communication systems have faced a variety of difficulties over the last several decades, including the rapid growth of data traffic and the vast expansion of mobile User Equipment. Thus, providing the UEs with fast data rates in order to enable real-time applications is one of the key goals for future wireless technologies. Another goal is to increase coverage and UE support while taking into consideration the limited availability of the licensed spectrum resources already in use. A combination of increased spectrum resources, improved spectrum efficiency and cell densification may be used to address this ongoing rise in data traffic and the number of UEs. Ultra dense Network deployment is one method for achieving this combination. These kinds of dense deployments often take the shape of a heterogeneous network , in which several tiny cells are set up with less capabilities, i.e., less transmit power than the macro base stations [1], [2].

This power imbalance limits interference at customers serviced by these tiny cells in a universal frequency reuse. The macro-BS broadcasting to users who are not covered by a small cell is the reason of this interference restriction. As a result, the emphasis of this research is on improving the system's spectrum efficiency by coordinating spatial interference among users of small cells and macro-BS in a HetNet. The goal is to make use of the "large" number of antennas' degrees of freedom at the macro-BSs. We concentrate on the 4 and 8 antennas that are already included in the standard as opposed to enormous Multiple-Input Multiple-Output that was derived from where the number of antennas is supposed to be infinite. To project interference from the macro-BS towards small cell linked UEs such that it may be cancelled with linear receivers, degrees of freedom are employed. Meanwhile, the

macro-BS continues to provide service to UEs beyond of a small cell's coverage area. Therefore, we suggest a two-stage hierarchical precoding/beamforming strategy to concurrently serve macro UEs and shield the small cell linked UEs from the macro interference. This is accomplished via a two-stage, or hierarchical, precoding technique that combines the concepts of interference alignment, iterative reduction, and working in the null space of macro UEs supported by Block Diagonalization. To do this, an iterative IA approach that was first described in is modified so that it may work in the joint null space of the macro UEs that were created via BD. Thus, we guarantee that linked UEs to macro and small cells are decoupled from interference. We introduced two updates to the algorithm in and.

The first technique, dubbed "Block Diagonalization-Interference Alignment uncoordinated takes into account random interference from nearby macro-BSs or small cells. The iterative IA aim is modified to Minimum Mean Square Error in the second method, which is referred to as the Joint Transmit and Receive structure. These algorithms need access to Channel State Information at the transmitter from linked UEs in macro and small cells. We begin by assuming that you have complete knowledge of the CSI, and then we expand on your work to take into account the circumstance when you don't. By analyzing the spatial hierarchical precoding methods in a more realistic ultra dense HetNet, we additionally expand on our work from. As a result, we have up to 10 tiny cells inside a macro-BS's coverage region, exceeding the macro-BS's degrees of freedom. Additionally, we take into account the out-of-cell interference from different macro-BSs layers in the architecture for hierarchical precoding. This may be done by taking use of the suggested hierarchical framework's ability to include the MMSE pre- and postcode. Finally, we provide a thorough analysis of the conflicting impacts of the suggested hierarchical algorithms on the received power of the signal and interference as well as the spectral efficiency separately for attached UEs to macro and small cells [3], [4].

**Following is a summary of this work's novel contributions:**

The algorithms are compared and the complexity analysis is given. In this study, we break down the necessary stages of the algorithms and detail the level of complexity needed at each step. In addition, we looked at the trade-off when the degrees of freedom at the macro-BS surpass the system's spectral efficiency. The number of tiny cells in a UDN may easily surpass the number of macro-BS antennas. Lastly, we examine the robustness of the algorithms we've suggested. Because perfect channel information is taken into account in, we add a channel uncertainty and examine in this study how it affects the spectral efficiency of the system. We also consider the effects of having numerous macro-BSs and demonstrate the benefit of our suggested algorithms by expanding the number of antennas and therefore the degrees of freedom at the macro-Seamark. In our work, the macro-BS handles all of the processing for the hierarchical precoding scheme, allowing autonomous transmission at the small cells. This indicates that there is no need for transmit nodes to communicate user information or feedback. Scalar, vector, and matrix are used throughout the whole work for the sake of ease in notation. It is written as matrix conjugate transpose. The greatest eigenvector, or most dominant eigenvector, of a matrix is stated as, while the smallest eigenvector, or least dominant eigenvector, is expressed as. As shown, the Frobenius norm is. Identity matrix is shown by the matrix. The expectation operator is abbreviated as [5], [6].on this study, we examine the downlink scenario within coherent channel bandwidth while taking into account the HetNet deployment. Multiuser MIMO Orthogonal Frequency Division Multiplexing system with constant CSI per Resource Block is the system under consideration. The deployment consists of a central macro-BS that is encircled by numerous layers of microsites and serves a specific group of UEs that are located within its transmission range. Small cells are placed within each of the three sectors that make up each microsite. The fundamental idea of this study is to serve more UEs concurrently inside the

cluster than there are transmit antennas at the macro-BS, hence surpassing the macro degrees of freedom. Then, we examine the impact of this on the hierarchical precoding schemes shown in and determine whether or not we can still outperform the uncoordinated situation. When there is no coordination, the macro-BS merely applies BD and ignores interference with the underlying small cells. However, by using the free spatial dimensions present and applying the hierarchical precoding techniques at the macro-BS, it may direct its interference in the direction of the underlying small cells. With additional explanation of the coordination mechanism between the macro-BS, small cells, and the UEs inside the cluster, we will provide an introduction to the schemes in this part. Two layers of hierarchical precoding are required for this BDIA technique. In order to reduce the interstream interference between the spatially multiplexed macro UEs, BD is used in the first precoding step. The orthogonal streams are maintained for the serviced macro UEs while iterative IA precoding is used in the second stage to lower the rank of the macro interference subspace towards the small cell connected UEs.

## DISCUSSION

Similar to method the BDIA uncord method is more complex since it considers the uncoordinated interference indicated in. When just one cooperation area is operational, we classify the unwanted signal coming from small cells towards macro UEs and other small cells UEs as uncoordinated interference. All of the interference from BSs outside the cluster is added to the uncoordinated interference when numerous surrounding tiers are active as well. The hierarchical precoding framework simply takes into account this uncoordinated interference by changing by in step of Algorithm. The highest eigenvector of the uncoordinated interference contributed to the interference subspace from the macro-BS towards the small cell linked UEs is now used to compute the orthonormal basis for the received interference subspace. Due to the addition of the uncoordinated interference to the macro interference leakage in this addition, the macro-BS transmission power cannot be immediately normalized as in. Both microcells and small cells, each of which has a varied transmission power, are contributing to this disorganized interference. This section examines the computational complexity of the three IA-based algorithms that have been presented: uncord., and Jurists, we provide the justifications that demonstrate the significance of the computational complexity analysis of the suggested methods. IA-based algorithms may use the reciprocity of the channel to spread the computation of the transmit precoders and receiver beamformers. The Time Division Duplex operating mode with synchronized time-slot is the foundation of reciprocity. Time-varying wireless channels are often used. Therefore, techniques with low computational complexity are needed to prevent performance loss resulting from imperfect reciprocity in actual systems. This is because assuming perfect reciprocity is not always correct and might cause residual interference at the receiver side. In our example we offer the algorithms in a general framework to function in Frequency Division Duplexing or TDD modes. In real-world systems, receivers also have little processing capabilities. They can no longer handle algorithms that need a lot of computing complexity [7], [8].

This could put restrictions on how complicated the algorithms can become. As a result, we must create algorithms with minimal complexity and straightforward processing. As illustrated in our scenario, we assume that all calculations are performed inside the macro-BS, which is endowed with significant processing capabilities, alleviating the complexity limits. In addition, methods with lesser complexity are always preferred for scalability challenges so that they may be applied to large-scale concerns. We simulated a realistic ultra dense HetNet scenario, where the network is overloaded with many UEs that must be supplied concurrently in the same time-frequency resource with high data rates, in order to assess the suggested methods. 500 runs of Monte-Carlo simulations were performed. Every

run is a distinct channel realization. Here, we assume that a coordinated cluster consists of a single macro sector and the underlying tiny cells, which are dispersed at random over the macro sector's coverage region. The macro sector serves as the cluster's primary component, while tiny cells are only deployed as needed when the number of clustered UEs rises. The macro-BS is outfitted with 8 transmit antennas, compared to 2 transmit antennas for the small cell BS. In each of our simulated scenarios, a small cell can only support one user entity per resource block, but a macro-BS can support up to the same number of UEs as it transmits antennas. The homogeneous environment, where only macro UEs are supplied and no small cells are installed, and the ultra-dense heterogeneous environment, where the macro sector is overloaded with small cells. We contrast the cluster sum spectral efficiency for three distinct circumstances. The first scenario is homogeneous; the second is ultra dense heterogeneous, in which the cluster UEs use the MMSE linear equalizer and the macro-BS only uses the BD algorithm. Since there is no coordination between the macro and small cell BSs, this situation is known as an ultra-dense uncoordinated scenario. The third example is the coordinated ultra dense one, in which the macro-BS uses the algorithm. In this instance, coordination takes place between the macro and small cell BSs within the same cluster. even when there is no coordination between the macro and small cell BSs, the HetNet deployment always achieves a greater total spectral efficiency than the homogeneous one.

Additionally, we can see that a coordinated ultra-dense scenario outperforms an uncoordinated ultra-dense scenario in terms of spectral efficiency only in cases when the macro-BS has enough open spatial dimensions to align the macro interference with the small cells. Here, we can see that coordinated beamforming, up to the scenario when 6 UEs are supplied per macro-BS and two spatial dimensions are available at the macro-BS for aligning the interference, achieves greater spectral efficiency than the uncoordinated one in ultra-dense deployment. The aggregate spectral efficiency, however, falls below the uncoordinated scenario when 7 UEs are fed per macro-BS and only 1 spatial dimension is open for interference alignment.

the scenario in which there are sufficient free spatial dimensions in the macro-BS for aligning the interference. The macro-BS is only serving 2 UEs in this instance, leaving 6 open spatial dimensions, while tiny cells are deployed in groups of 1–10, each serving 1 UE. We note that the BDIA achieves greater spectral efficiency than using solely BD algorithm at the macro-BS, even when the macro-BS Doff are exceeded. Additionally, the also known as the coordinated beamforming case, achieves the highest spectral efficiency with a gain of 20 bits/s/Hz over the uncoordinated beamforming case, which is when the macro-BS only applies BD while each UE within the cluster applies MMSE equalizer provide the coordinated and uncoordinated interference power received by the small cell linked UEs in and 8, respectively, to allow for a more thorough examination of the findings in. According to the BDIA algorithm can precisely align the macro interference towards the small cell-connected UEs as long as the cluster's UE count is less than or equal to the doff available at the macro BS. The BDIA is no longer able to orient the macro interference precisely towards the small cell linked UEs when the number of clusters UEs exceeds the macro doff. Even when the number of UEs within the cluster exceeds the macro doff, applying at the macro-BS achieves the lowest received interference power at the small cell connected UEs side compared to all the other introduced algorithms. It can still partially align the macro interference.

As we go to, we can see that, when compared to all the other mentioned algorithms, the method delivers the lowest received uncoordinated interference power at the small cell linked UEs side at the macro BS. We provide the findings for having faulty CSI and assess the sensitivity of the proposed algorithms to the channel error in order to evaluate our framework in a more realistic context. shows that when the algorithm is used, raising the channel error

variance from to dB results in a decrease in the sum spectral efficiency of bits/s/Hz. However, it results in a loss of bits/s/Hz when the MMSE linear equalizer is used on the receiver side and the BD algorithm is applied on the macro-BS side. While a loss of 12 bits/s/Hz happens when the macro-BS side uses simply the BD algorithm. The MC scenario, shown in is the last stage in making the simulation environment more realistic. In this scenario, the coordinated cluster is now deployed between two layers of active macro-BSs that are severely interfering with it. We contrast the cluster sum spectral efficiency between the Single Cluster and the Multi Cluster scenarios in. Within the coverage of the macro sector, small cells are installed, each with 2 transmit antennas and serving UE. In this deployment, the macro-BS is deployed with 4 transmit antennas and servicing. demonstrates that switching from the SC scenario to the MC one results in a significant reduction in the cluster sum spectral efficiency for all of the algorithms given, particularly for the algorithm, which experiences a reduction of 35 bits/s/Hz. Due to this deterioration, the also known as coordinated beamforming, outperforms the BD with equalizer, also known as uncoordinated beamforming, in the MC situation by just 0.5 bits/s/Hz. We raise the number of macros transmit antennas to 8 in order to fully use the benefit from employing coordinated beamforming. shows the benefit of expanding the microspatial dimensions. We can see that increasing the number of macros transmit antennas produces gains for all of the introduced algorithms, but especially for the coordinated beamforming scheme. In fact, the gain of the coordinated beamforming scheme over the uncoordinated one increased to 2.5 bits/s/Hz instead of just 0.5 bits/s/Hz in the case where the macro-BS was only outfitted with 4 transmit antennas. As a consequence, while using the coordinated beamforming technique, we may achieve greater increases in the cluster sum spectral efficiency by increasing the microspatial dimensions. Going to a large MIMO regime is thus anticipated to result in significant benefits for the newly presented hierarchically coordinated beamforming techniques [9], [10].

## CONCLUSION

We may infer from the findings presented that, when a SC scenario is present and there are sufficient free spatial dimensions at the macro-BS for aligning the interference, the hierarchical precoding framework outperforms the uncoordinated beamforming in terms of spectral efficiency. This is true even if the cluster's total number of UEs exceeds the doff capacity of the macro BS. We may also draw the conclusion that even if a SC scenario is provided with adequate free spatial dimensions at the macro-BS, robust coordinated beamforming cannot be fully assured using the presented hierarchical precoding architecture in the ultra-dense HetNet scenario owing to the significant susceptibility to poor CSI. Furthermore, we can see that in the MC situation, the total spectral efficiency for the hierarchical structure suffers significantly. Therefore, increasing the number of spatial dimensions accessible at the macro-BS provides a solution to this issue. This was shown where a high gain for the coordinated beamforming method was obtained by increasing the number of macros transmit antennas from 4 to 8.

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# CHAPTER 8

# A COMPREHENSIVE REVIEW OF FREEDOM SYSTEMS AND ITS APPLICATION

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**ABSTRACT:**

In a weakly damped millidegree of freedom system, a technique is described for estimating the linear and nonlinear damping parameters, allowing the system to be divided into a number of single degrees of freedom nonlinear systems. In order to prevent phase distortion between data from affecting the amplitude of the damping parameters, just one response measurement from a free decay test is needed as input. Each of the natural frequencies in the response is band-pass filtered in the time domain. The natural frequencies must be different and separated, which imposes a limitation even though it allows for a free response measurement for each mode. The long-term development of the mode is described by the instantaneous energy of each trace. The stiffness and inertial forces are effectively neglected in favor of simply taking into account the damping forces since this is accomplished by considering only the peak amplitudes in each phase. As a result, the technique is similar to the well-known decrement approach, which may be used to calculate the viscous damping in linear systems. The technique is created for a two-degree-of-freedom weakly nonlinear system with linear and Coulomb damping. The technique's accuracy is shown using simulated response data.

**KEYWORDS:**

Decrement Approach, Freedom Systems, Long-Term Behavior, Natural Frequencies.

## INTRODUCTION

The long-term behavior of weakly nonlinear systems may be significantly influenced by weak nonlinear damping. For instance, the onset of instability in self-excited systems, such as fluid elastic systems with strongly coupled structural and fluid mechanics, is largely controlled by the total linear damping in the system, whereas the amplitude of the resulting self-excited limit cycle oscillations is controlled by the nonlinear damping in the system. Meskell and Fitzpatrick used experiments to demonstrate this for tube arrays, where it was discovered that the nonlinear damping is cubic in nature. The most probable kind of nonlinear damping in structural systems is Coulomb damping, which may be challenging to measure because of the unpredictability of the supports. Since the relative impact of the Coulomb damping would diminish as response amplitude grows, utilizing an effective linearized damping alone in this situation is unlikely to provide accurate predictions of vibration amplitude under varying excitation. Therefore, a better prediction of the vibration response amplitude, which is problematic for precise long-term fatigue estimations, would be possible with a quantified nonlinear system model. However, the overall structural damping is quite low for many structural and fluid-coupled systems [1], [2].

Because the terms of interest contribute so little to the total force acting on the structure, determining the functional form of nonlinear damping and calculating the pertinent coefficient in weakly damped systems, as those covered above, may be challenging. There are sophisticated methods for identifying nonlinear systems. For instance, Rice and Fitzpatrick have presented nonlinear spectral estimation in the frequency domain and extensively used it to numerous nonlinear systems. With a focus on fluid elastic systems,

Granger created an estimating methodology that was mainly based on a nonlinear optimization of a data model made up of damped sinusoidal basis functions. Lightly damped fluid elastic systems have been successfully used the force surface mapping approach in the time domain. The majority of the systems included in a recent assessment of identification techniques display quite high nonlinearities. These strategies, as well as many others not mentioned, are weak when the term of interest has a little contribution, however.

Additionally, the value of the damping coefficients acquired is particularly sensitive to even a slight relative phase distortion between the signals if more than one measuring equipment is necessary. A novel method for weak nonlinear systems with a single degree of freedom was put out by Meskell. This approach just needs one input signal and is comparable to the decrement approach used to calculate the logarithmic decrement. As this signal represents a predictable response, noise and unneeded excitation may be minimized via ensemble averaging in the temporal domain. While it is true that Feeny and Liang devised a decrement approach for systems with viscous and Coulomb damping, this method is only applicable to Coulomb damping. Mottershead and Stanway created a generic identification approach for n the power damping, however since the stiffness is determined as part of the process, weak nonlinear damping terms cannot be produced consistently.

The benefit of the Meskell technique is that it may be used with any functionally-formed system with low damping. Furthermore, Eret and Meskell have shown that it can be effectively used to a fluid elastic system, and by first using Feldman's approach, the condition to know the functional form a priori may be satisfied. One drawback of the approach is that it can only be used for systems with a single degree of freedom. In this essay, the method is extended to systems with several degrees of freedom. A multi-degree-of-freedom system with mild linear and nonlinear damping may be broken down into a number of uncoupled single-degree-of-freedom systems with both linear and nonlinear damping using band-pass filters applied to a single response measurement. A numerical simulation of a discrete two-degree-of-freedom system with Coulomb damping as well as linear damping is used to illustrate the improved technique [3], [4].

**Adding an additional degree of freedom:**

It should be emphasized right away that the sort of system of interest is only weakly damped and nonlinear. Only the reaction at the natural frequencies will be important since the systems are only mildly damped. Therefore, the goal is to account for the nonlinear damping's impact on the system response at each natural frequency rather than to isolate the nonlinearity. Consider the two-degree-of-freedom system shown in to study the applicability of the nonlinear decrement approach to a system with more than one degree of freedom. Except for a slight nonlinear damping that directly couples the two masses, the system is linear. This nonlinearity serves as a Coulomb damper for the analysis's needs. the system might be precisely divided into two uncoupled single-degree-of-freedom systems if the viscous damping is proportionate. The modal decomposition of the undamped system, however, provides a decent approximation of both the natural frequencies and the apparent mode shapes of the damped system if the damping is non-proportional but the system is weakly damped. It is considered that this engineering technique may be used with the nonlinear system since the overall damping is minimal and the nonlinearities are modest.

To put it another way, it is presumable that the system shown may be substituted by two mass-normalized single-degree-of-freedom systems, each of which has a weak nonlinearity. For this, it will be necessary to know the modal matrix for the undamped system rather than simply the mode ratios. This is not an easy condition to meet since it requires some understanding of how mass and stiffness are distributed throughout the system, but it is not impracticable either. The other modal parameters are more challenging to determine directly

from the system response. The free response will display both natural frequencies and therefore both modes if the system is disrupted from equilibrium such that the initial displacements are not in the ratio of only one mode. In all likelihood, if both system answers are captured, the normal coordinates may be created using the modal matrix, resulting in the modal decoupling. Then, utilizing parameter identification strategies created for SDOF systems, the system parameters may be discovered. If the system contains more than two degrees of freedom, it may not be feasible to measure all the responses directly. Even if it were, magnitude and phase distortion in the instruments would probably cause significant inaccuracies in calculating the damping parameters. As a result, it would be ideal to derive the damping parameters for each system mode from only a single response measurement. Given one observed free system reaction to a disturbance, let's assume decomposing the answer into the uncoupled modal replies is the current challenge [5], [6].

## DISCUSSION

The system's free response in the frequency domain will be limited to small bands at the natural frequencies because of the system's light damping. If the natural frequencies are distinct, a sequence of band-pass filters may be used to readily isolate the response at each natural frequency, and consequently at each mode. This filtering works best in the time domain since the signal is inherently transitory and the relatively long-term development of the response is what matters most. The free answer x 1. It is clear that both of the inherent frequencies are vibrated by the reaction. The filters employed are two third-order elliptic filters with narrow pass bands 4 Hz wide and centered on each natural frequency, each having a pass band ripple of 1 dB and a stop band attenuation of 50 db. The fact that the filter will create transients due to the nonzero starting circumstances is a practical problem. This is seen. Naturally, estimating the damping from such a signal would be difficult. Since the filtering is done off-line and the whole-time record is accessible, it is possible to eliminate this filter transient using a straightforward technique.

Simply reversing the order of the time record before filtering and reversing again after filtering eliminates any filter features from the region of interest, where the time record of the free response automatically decays to zero. displays the split modes that were produced by this technique. The system response has been divided into two single-degree-of-freedom systems after the normal coordinates have been recovered. As a result, the approach suggested by Meskell for a system with a single degree of freedom may be used right away. To be thorough, the approach is succinctly described below, along with the formulation for a system with Coulomb damping. Consider a system with one degree of freedom that consists of a generic nonlinear element and a linear spring. Since the system is responding freely, no outside force is influencing it. In order to determine the rate of energy dissipation and, therefore, the relative strength of the different damping components, the approach shown here uses repeated peaks in the system's free response. A common component of audiological examinations is the measurement of sensitivity to pure tones, the results of which are summarized on an audiogram or audiological record. A normal audiogram is typically taken as indicative of normal auditory function for educational and communicative purposes. For the majority of patients, the demonstration of normal peripheral auditory sensitivity suggests that auditory function is most likely adequate for speech and language development and communication.

A normal audiogram does not, however, accurately anticipate how the patient would behave under typical listening settings for many patients with neurological illness or malfunction. In the current research, situations will be discussed where the audiogram did not foresee the patients' severe speech processing abnormalities. The detailed analysis of the brain processes causing the patient's hearing and speech processing abnormalities. Case 1: Patient CF, a young boy of 7 years old, was first believed to have normal hearing until he failed both a

school hearing test and a follow-up hearing test at his pediatrician's office for his left ear. Academically, he was doing above grade level. There were no behavioral issues, and speech articulation was excellent. He was born after a 31-week gestation and weighed 3.5 pounds. Preeclampsia and the use of blood pressure medication hampered the pregnancy. He spent six weeks in the NICU. Acid reflux and bradycardia were also present. He had previously passed neonatal hearing tests that included measurements of both ears' otoacoustic emissions. An audiogram was done, and it revealed a unilateral, profound hearing loss with sensorineural origin in the left ear. Even at dramatically higher intensity levels, CF was unable to repeat any phrases that were said to his left ear. Tympanometry for both ears was within acceptable ranges. Acoustic responses for pure tone stimuli were found for ipsilateral stimulation of the right ear but lacking at equipment limitations for the left ear. For stimulation of both ears, transient-evoked otoacoustic emissions were observed. Measurements of the auditory brainstem response were carried out due to the mismatch between pure tone sensitivity results showing the existence of a severe hearing loss, worse speech processing than would be predicted, and the presence of otoacoustic emissions. illustrates the ABR's clearly aberrant waveform shape for stimulation of the left ear.

At the limitations of the technology, neural components could not be detected. But by delivering rarefaction and condensation clicks and analyzing a shift in the phase of the early activity in the first 1-4 msec after the stimulus presentation, a cochlear microphonic was discovered. Unilateral auditory neuropathy/desynchrony syndrome was identified in CF. In the educational context, preferential seating to the front left and the usage of an FM system were disease at the age of 23, GW was a restrained driver who was involved in a car accident and had a closed head injury. He had a Glasgow Coma Scale of 3 and was intubated when he arrived at the emergency department. A first brain scan showed bilateral inferior colliculi injury and severe subarachnoid hemorrhage affecting the frontal lobes as well as further hemorrhage into the quadrigeminal plate cistern. The hemorrhage has also entered a little portion of the left lateral ventricle. GW also had an orbital fracture. A swallow study showed aspiration of both thick puree and thin liquids throughout the oral and pharyngeal stages of swallowing. Due to his inability to walk, GW's speech was profoundly dysarthric, and he is now confined to a wheelchair. illustrates the results of an audiological examination that showed both ears to have a substantial hearing loss for pure tones.

The patient was unable to repeat spondaic phrases or point to images of spondaic words for stimulation of either ear, therefore speech audiometry could not be performed. He said that although he could hear the words, he was unable to interpret any of them. The results of the ABR testing showed that the stimulation of both ears had aberrant waveform shape. displays ABR data for the left ear. Wave V wasn't present under any circumstances. The ABR interpeak latency intervals, denoted by letters I through III, were within acceptable bounds for stimulation of both ears. Tympanometry results for both ears were normal, suggesting that the middle ear is functioning normally bilaterally. For both ipsilateral and contralateral stimulation of both ears, acoustic responses were visible at normal intensity levels for all stimulus situations [7], [8]. The afferent and efferent neural components regulating the auditory reflex arc at brainstem levels were found to have intact structure and/or function. For the purpose of stimulating both ears, measurements of transient-evoked and distortion product otoacoustic emissions were made. Both ears were stimulated with robust TEOAEs and DPOAEs, and GW's DPOAEs are shown in.GW was determined to have bilateral inferior colliculi injury, which resulted in a neurological hearing loss. Hearing aids were used for amplification, but GW did not benefit from them. A service for assistive technology was recommended to GW in order to help him set up a communication system. Case 3. Patient CF was a middle school-aged youngster who was functioning normally until he was hit by a car while bicycling. At the site of the collision, he was unconscious and scored a 3 on the Glasgow Coma Scale. Ten days after the injury, CF underwent magnetic resonance imaging,

which revealed extensive damage to subcortical and cortical structures. These included white matter edema of the subcortical medial bifrontal regions, cortical injury to the anterior temporal poles, edema to the left splenium of the corpus callosum, edema of the bilateral caudate nucleus, edema of the right thalamus, edema of CF was discovered to have normal peripheral auditory sensitivity, in contrast to the cases covered above. Additionally, it was discovered that he had normal auditory brainstem response and appropriate acoustic reflexes for both ipsilateral and contralateral stimulation of both ears. However, when both ears were stimulated, there was no intermediate latency response. Speech processing was quite challenging for CF. He was evaluated using many standardized and non-standardized tests of central auditory function in addition to electrophysiological tests that have already been covered in more depth. For stimulation of both ears, the middle latency response was not present.

Auditory agnosia was identified in Felsite having normal otoacoustic emissions, a sign of typically operating outer hair cells, all of the individuals mentioned above exhibited noticeably reduced speech perception. OAEs have made it possible to distinguish between solely sensory and neural forms of hearing loss for individuals with sensorineural and other types of nonconductive hearing loss. When the ABR is abnormal in children with neurological disorders, the presence of OAEs has also given researchers a way to confirm retro cochlear pathology even though using traditional audiometric techniques is still a crucial adjunct to figuring out the patients' functional hearing capacities. The presence of TEOAEs in conjunction with an abnormal audiogram was crucial in indicating the need for additional electrophysiologic measures to better define the auditory pathology manifested by the patients, even though measures of otoacoustic emissions did not accurately predict the extent of the communication difficulties of any of the patients. The audiogram could never have predicted the severity of the speech processing problem. The audiogram for Case 3 showed that the patient had normal peripheral hearing sensitivity for pure tones, which makes this the most obvious case. Although Cases and 2 did exhibit considerable peripheral hearing loss, the speech processing impairment was more severe than anticipated in light of the results regarding pure tone.

ABR measures indicated indicate ANDS in Case 1 and were in line with inferior colliculi lesions in Case 2, but they were insensitive to the subcortical and cortical level deficiencies shown in Case 3. The processes underlying the hearing and speech processing deficiencies in Cases 1 and 2 were correctly diagnosed thanks in large part to the auditory brainstem response. The ABR depends on the synchronized firing of neuronal cells in the auditory pathways, which run from the 8th nerve down the brainstem's auditory circuit. The auditory nerve is the neurological generator for waves I and II in humans, according to measurements taken after surgeries for cranial nerve abnormalities in people. The breadth of parallel processing in the auditory pathway at brainstem levels makes it more difficult to identify particular generators of the later peaks of the ABR; the peaks of waves following wave II have several origins underpinning their creation. The cochlear nucleus is the neuronal generator for wave III of the human ABR, according to data based on intraoperative recordings, and wave III's creation may be more complicated than first thought. The most distal part of the auditory nerve and the contralateral cochlear nucleus may both contribute to the development of wave III. The wave V generators come from a variety of brain sources. While the subsequent negative dip in traditionally recorded ABRs is produced by slow dendritic potentials in the inferior colliculus, the highest positive peak of wave V is likely created near the conclusion of the fiber tract of the lateral lemniscus.

Based on brain recordings made in human participants, it seems that contralateral rather than ipsilateral structures are what contribute the most to the peak of wave V. For Case 1, there were no neural components in the ABR, either as a result of the cochlea's inability to

appropriately activate the auditory nerve or as a result of the auditory nerve's own deficiencies. In Case 2, the lack of wave V upon stimulation of the inferior colliculi in both ears was consistent with the existence of bilateral lesions. The fact that Case 3's ABR was normally indicated that the auditory circuits via the brainstem levels were in good condition. Insensitive to the auditory disease shown in Cases 2 and 3, measurements of the acoustic reflex were also found, although they were consistent with Case 1's unilateral deficiency. Humans' acoustic reflex includes the stapedius muscle contracting in response to moderate to loud noises. The reflex arc includes the neural connections between the stapedius muscle on both sides and the motor nuclei of cranial nerve VII on each side of the brainstem, as well as the cochlear nucleus on one side of the brainstem. The cochlear branch of the eighth nerve, which supplies input to the ventral cochlear nucleus, is the starting point of the afferent component. From the VCN, neuronal connections lead to each superior olivary complex. The motor nuclei of the 7th nerve, which innervate the stapedius muscle on both sides, receive neurological input from the ipsilateral and contralateral SOC. The stapedius muscle and the Vith cranial nerves are involved in the efferent component of the auditory reflex. Acoustic reflex arc lesions in either the afferent or efferent directions may produce aberrant thresholds. Given that ANSD is linked to the cochlea's inability to stimulate the 8th nerve to react or to the 8th nerve's own malfunction, there were no acoustic responses in the afflicted ear in Case 1.

The existence of hearing loss, disproportionate loss of speech discriminating abilities, and lack of acoustic reflexes with existing in Case 1 lead to the diagnosis of ANSD for the left ear. Prematurity, hyperbilirubinemia, and a history of using ototoxic drugs are risk factors for while 38.5% of patients report a normal birth and neonatal history. The capacity to understand speech in is often subpar. For pure tones, the audiogram might show anything from normal hearing to severe hearing loss. Up to 40% of graduates with hearing loss have. The existence of unilateral has already been mentioned in many investigations. According to study the left ear has been implicated in the majority of unilateral patients, which is likewise the situation in situation 1. Because the cochlea and auditory nerve cannot be examined histologically, the causes behind in a living patient cannot be confirmed with precision. The malfunction may be caused by issues with the cochlea's inner hair cells, issues with the synapse between those cells and the auditory nerve, issues with the ganglion neurons, or issues with the auditory nerve itself. solely serve as a sign that the cochlea's outer hair cells are healthy. With angled sagittal of the internal canal in unilateral cochlear nerve insufficiency may be shown when the auditory nerve itself is the location of the impairment. It has been shown that head trauma-related injuries to the inferior colliculi may cause hearing loss. Although there have been reports of unilateral involvement as well, bilateral involvement has been seen in the majority of cases with hearing loss and injury to the inferior colliculi. Since the majority of the auditory fibers from the lateral lemniscus and lower nuclei synapse either directly or indirectly with the inferior colliculus, as highlighted by Musiek and Baran, lesions to the inferior colliculi would be predicted to have a devastating effect on auditory functionary components I and III and the midbrain level of the pathology are both compatible with the existence of acoustic reflexes in Case 2.

The presence of intact contralateral acoustic reflexes indicates that the auditory pathway, which includes the trapezoid body, runs through the level of the pons. Although an exception to this tendency has been recorded, intact acoustic reflexes have been seen in individuals with lesions to the inferior colliculi in the past. There has been evidence of retained ipsilateral acoustic reflexes but missing reactions to contralateral stimulation in a patient with bilateral midbrain trauma. According to A. Moller's remarks, this was caused by damage to the trapezoid body while preserving the superior olivary complex. While some studies have revealed bilateral absence or considerable decrease in wave V amplitude in individuals with midbrain injury to both inferior colliculi, other investigations have documented the existence

of normal ABRs in patients with lesions to the inferior colliculi. Several patients with inferior follicular lesions have reported normal sensitivity for pure tones or only a mild-moderate hearing loss. In contrast, Case 2 and other patients' pure tone audiograms have revealed severe hearing loss or were not possible due to the patients' inconsistent response to stimuli. Although some patients' problems have been transient and have resolved after 3 or 18 months for certain individuals, all studies concur that patients with injuries to the inferior colliculi exhibit substantial speech processing difficulties. Over the course of the 8 years after Case 2's accident, his speech processing has not gotten any better.

The existence of subcortical and cortical level disruption to the auditory structure and function after a traumatic brain injury was the mechanism behind the speech processing difficulties in Case 3. Speech processing was severely compromised, yet peripheral auditory functions including TEOAEs, the ABR, and peripheral auditory sensitivity were completely unaffected. Severe speech processing abnormalities affected all of the patients discussed in this research, which were bilateral for Cases 2 and 3 and unilateral for Case 1. Measurements of the MLR were crucial in identifying the cause of the deficiencies that Case 3 who was identified as having auditory agnosia experienced. Normal peripheral auditory sensitivity and the absence of MLRs are consistent with bilateral lesions of the auditory radiations and/or the auditory cortex. The neuronal generators of the also comprise parts of later-developing mesencephalic reticular formation units, in addition to thalamocortical pathway units. Higher cortical dysfunction has an effect on the. Because the MLR is sensitive to interaural level and timing discrepancies, it is possible that the brain mechanisms governing processes of sound localization are linked to the.

Numerous implications for audiological practice may be drawn from the situations examined in this research. Otoacoustic emissions will not detect in neonates when used for newborn screening. The adoption of ABR screening techniques in the is advised given the rising frequency of among graduates. Despite the fact that a child has passed a newborn hearing test, a comprehensive audiological examination is advised in cases of delays in the development of speech and language abilities or failed screenings. It is not appropriate to provide hearing aids to people who have auditory abnormalities like the one shown in Case 2. Furthermore, the patient had problems processing loudness for amplified speech, therefore there was no further advantage for Case 2 beyond the absence of assisted benefit. Moreover, amplified speech was not any clearer for the patient. The results of an amplification experiment were predicted given the poor processing for speech 20–30 dB HL over Case 2's speech threshold. Administration of a technique that accurately detected the existence of normal peripheral auditory sensitivity for pure tones, normal acoustic reflexes, and normal OAEs originally failed to detect the auditory abnormalities in Case 3. Only when the patient's hearing was questioned by multiple medical specialties , was a more thorough battery of tests conducted, and his auditory agnosia was discovered [9], [10].

## CONCLUSION

In the framework of a discrete 2-DOF system, it has been examined if it is feasible to split up a weakly damped multi-degree of freedom system with mild nonlinearity into a number of single-DOF systems. It has been shown that band-pass filtering at each natural frequency enables the free response at each mode to be determined from a single free response measurement. It has also been shown that the resultant free decay traces display nonlinear damping and that quantifiable damping values may be extracted for each mode. Importantly, the damping parameters produced are independent of response amplitude since the nonlinear behavior is properly accounted for. If a straightforward seeming linear damping was computed, this would not be the case. Such a method is likely to result in an overestimation of the operational damping ratio and, thus, an underestimation of vibration amplitudes in the case of Coulomb damping. Additional research is needed to evaluate the range of parameter

values for which the limiting assumptions are acceptable and to show the method's applicability on experimental data. However, the approach described here is a promising strategy for fluid-coupled system identification.

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# CHAPTER 9

# ANALYZING THE IMPORTANCE OF RELIGIOUS FREEDOM AND FREE EXPRESSION

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**ABSTRACT:**

In India, where the State targets authors, film directors, and academics by censoring books, films, and other forms of critical expression in order to appease nationalist and fundamentalist groups, the conflict between freedom of expression and religious intolerance is particularly pronounced. In light of this, this study investigates some of the viewpoints held by graduate students regarding the tension in India between freedom of expression and religious intolerance. Conceptually, the author handles the conflict between freedom of expression and religion by using a secular-multiculturalist contextual perspective. This study uses in-depth interviews, desk research, and narrative analysis as its primary qualitative research techniques. The results of this study explore Western secularism principles and the necessity of contextualizing the right to free expression while demonstrating how to manage conflicts between freedom of expression and religion in Indian society.

**KEYWORDS:**

Appease Nationalist, Indian Society, Intolerance, Skepticism.

## INTRODUCTION

According to Sen 2005 and Upadhyaya 2009, ancient India was recognized for its skepticism towards religion and tolerance of different viewpoints. However, both academics and public intellectuals have well observed the frightening increase of Hindu religious nationalism and Islamic fundamentalism, and consequently, the developing tension between freedom of expression and religion. In India, there is a well-known conflict between freedom of expression and religion. It is commonly known that the State censor's literature and films, and that Hindu and Muslim religious-nationalist groups target writers, filmmakers, and academics. In this regard, the Indian Constitution empowers those who are offended by religion as well as the media and free thinkers. The main area of contention between religious-fundamentalist groups and free thinkers is the desire of many people to outlaw religiously offensive speech. Many authors, journalists, and academics have been harassed as a result of Indian Penal Code. Fundamentalist Muslim and Hindu organizations also repress freedom of expression through the use of violence and fatwas. Hindu religious nationalists' primary goal is to impose Hindu authority throughout India, as well as to defend Hindu society from other religions, cultures, and philosophies. and Shiv Sena are three well-known fundamentalist Hindu organizations. These teams have been somewhat accountable since the early 1980s for These Hindu fundamentalist organizations are adamantly opposed to the notion that people of other ethnic or religious minorities should enjoy the same rights as Hindus [1], [2].

R.S.S. is one of these organizations that ultimately wants to convert India into a Hindu nation and believes that Western political ideologies like secularism and democracy are inappropriate for Indian culture. Since the Bhartiya Janta Party, a Hindu nationalist party, took office in 2014 and chose Narendra Modi, Hindu fundamentalist groups have grown more assertive. Hindu fundamentalism has been successful in silencing dissenting voices that challenged Hindu religious myths and legends by putting pressure on movie studios to censor

films that they felt offensive to their political agenda. The murder of journalist Gauri Lankash1 in 2017, who criticized Hindu nationalism, the right-wing, and violence in the wake of the divisive film Padmavati demonstrates how fundamentalist forces are stifling free speech by fostering an atmosphere of fear. Even after a court judgement lifted limitations on James W. Laine's book about Shivaji, retailers are still reluctant to stock it. This is because there is such a palpable fear of the mob. Consequently, extreme Hindutva groups are posing significant threats to the Mughal empire suffered under British occupation, which resulted in the loss of elite power. Muslim nationalism was consequently caused by Muslim backwardness and, to some extent, by Hindus' political reassertion in India. Later, Islamic nationalism and the reinforcement of Islamic religious principles were significantly influenced by the emergence of Deoband and the Aligarh school.

Men like Shafiullah and Syed Ahmad developed the notion of 'purifying' Islam and Muslims in India, which represented some of the anxieties plaguing the local Muslims. This led to an obsession with the "revival of Islam's lost glory" among India's Muslim elites. The Muslim League, which called for the creation of a separate state for Muslim-Pakistan, was founded in 1885 in response to the establishment of the Indian National Congress and fears of Hindu dominance. Arya Samaj and Braham Samaj, two Hindu revivalist groups, helped to formalize Hindu nationalism and Muslim fanaticism. Muslims in India have not advanced economically or politically since 1947. However, an Islamic state and a global Islamic revolution continue to be ideals for hardline Muslims. The Babri mosque demolition and the insurgency in Kashmir further alienated Muslims in India. According to Varshney, the polarization of the Hindu-Muslim populace was influenced by Pakistan, the Indian state, Hindu nationalism, and Kashmiri Muslim ethno-religious nationalism. Mutual distrust as a result aided in the strengthening of hardline forces in Muslim society. When they find something that offends their religion, fundamentalist Islamic organization’s like Deoband and the All India Muslim Personal Board4 frequently turn to mob violence, public and religious denunciation, or legal action. In 1988, India outlawed the book Satanic Verse after pressure from Muslim political organizations. 'Dikania', a book by Bangladeshi author Taslima Nasrin5, was similarly outlawed in India for hurting Muslims' religious sensibilities. Nasrin was not even given citizenship by the Indian government due to pressure from Islamic fundamentalists [3], [4].

## DISCUSSION

Indian Penal Codes 298, 295A, and 153A have been used in court to prosecute free thinkers.9Islamic radicals have used threats, physical violence, and fatwas in more covert methods. Free thinkers typically encounter difficulties on two fronts: either the aggressor drags them into court or coerces them through intimidation, bodily harm, and social pressure. However, the Indian government employs a special kind of secularism where conflict always exists between liberals and conservatives, the modern and the traditional, and religion and rights in order to address the complex and multireligious makeup of Indian society. The Indian Constitution's Article 19 declares freedom of speech and expression to be a basic right. However, as stated in Article 19, the right to free expression is constrained by the state has vast authority to defend restrictions and unreasonably impose restrictions on freedom of expression due to the vague wording of these restrictions. It’s interesting to note that both extremist Muslims and Hindu nationalists opposed Indian secularism. The general critique of modernity includes anti-secularist arguments that link secularism to the mission of modernity, science, and logic while making fun of the believer's morals and religion. The theories used in this investigation are briefly covered in this section.

### The Secular and Multicultural Movement:

Hindu cultural revivalists dominated the anticolonial political sphere in India throughout the first ten years of the twentieth century. According to the growing discourse of "Indian

secularism," Congress leader Mahatma Gandhi openly subordinated individual freedoms to greater cultural and spiritual concerns with the resurrection of Indian culture as well as the "sentiments" of religious groupings. 'Political neutrality' has become the guiding principle, which to some extent has led to Indian secularism, in order to manage the enormous multicultural Indian society and to prevent potential sectarian violence. Secularism is described by the Supreme Court of India as "more than Some academics have stated that secularism is deeply insensitive to religious people in the Indian context since it has a Western character and is incompatible with local worldviews. However, Taylor believes that secularism is the democratic state's solution to managing diversity since secular reason is a language that everyone can understand and use to argue and persuade others. India adheres to a modified kind of secularism, which broadens the area for religious matters inside the secular political system in order to accommodate its cultural political space. According to Parekh, no one model is appropriate for all countries. Every multiracial community should design its own suitable political framework to fit its history, cultural traditions, and scope and depth of diversity, he advised. In this regard, the development of Indian Contextual Secularism—conceptually distinct from its Western counterpart and appropriate for India's multicultural needs—can be attributed, in part, to the Indian manner of handling religious pluralism.

**Contextual Secular-Multiculturalism in India:**

India strives to manage religious disputes amicably and adheres to contextual diversity while at the same time maintaining a principled distance in state-religious issues. According to earlier debate, a theoretical framework is forming that can be used to approach the complicated relationship between the state, human rights, and the management of religious plurality and conflict. This is the idea behind contextual secular multiculturalism in India. However, practically speaking, contextualizing the idea of secular-multiculturalism in an Indian setting could move the country closer to a theocratic state, limiting the role of secular-minded people in public life and possibly limiting freedom of expression. The ambiguous or blurred boundaries between State and religion can invite excessive State interference in the communities' private religious concerns. Particularly by the main religious-nationalist organizations, as is shown in the Triple Talaq controversy, where Prime Minister Narendra Modi urged the Muslim community to abolish the practice. The contextual secular-multiculturalism theoretical framework has been used by the author throughout this study. This conceptual framework is used to clarify how and why the Indian State reacts to disputes over religious freedom. The case study that follows and the analysis that results are carried out using this conceptual framework. In-depth interviews and semi-structured interviews, two qualitative research technique tools, have been used in this study to better understand and analyses students' worldviews, behaviors, and thoughts.

The respondent's impression of the tension between religious intolerance and freedom of expression in India's fundamentalist Muslim and nationalist Hindu communities served as the basis for the empirical data. Two major questions served as the focal points of the interviews: Is religious intolerance from extremist sections of Hinduism and Islam putting freedom of expression in danger? and how do students see the tension between free speech and religious intolerance? The theoretical underpinnings of this research were discussed in interview questions in an implicit manner. Students' stories about the importance of religion and freedom of speech in their lives, as well as their own definitions of terms like fundamentalism, freedom of speech, intolerance, and secularism, were collected through interviews used as research too [3], [4]. The guiding strategy was utilized to make sure that each respondent's information was captured in the same general area. Thirteen respondents in total were spoken with. Nine graduate Hindu students and four Muslim graduate students made up the two groups of respondents. In relation to this research, numerous themes were

used to categories narrative contents. According to Bryman on page 584, the purpose of the narrative interviews was to extract respondents' rebuilt versions of links between events and between events and environments. An approach to the examination of qualitative data is narrative analysis. Different levels of coding are acknowledged in grounded theory. Categories are created through a continuous comparison of indicators and conceptualization, as well as between examination and the organization of the respondents' interviews, to ensure that concepts match indicators well. This approach was carried out until theoretical saturation was reached. With the hypotheses under investigation in mind, a theme analysis is done. A category discovered through analysis is known as a theme.

It has a connection to a study subject and gives the researcher a theoretical knowledge foundation. Repetition, metaphors and parallels, similarities and differences, and linguistic links are some factors that might be considered while looking for themes. The relationship between new data and the hypothesis is then examined, which could serve as a foundation for theoretical understanding and to close knowledge gaps. I have categorized the parallels, differences, and newly apparent recurrent patterns among the responder interviews in order to put them into practice. This procedure is based on the understanding received from books. Examines topics like secularism, multicultural idea of cultural acceptance, and free speech principles. I synchronized my analysis with existing theory during the theme classification process using the data and information provided by respondents, as well as information learned from reading the literature. The results of this study are contextual because of the tiny sample size of data. The theoretical inference that arose, nonetheless, would be essential for more extensive generalization. Being a Hindu, the researcher might have certain prejudices against Muslim respondents. An analysis of the narratives underlying religious and political processes is the goal of this work. Although the author is unable to draw broad generalizations, I provide a model to help comprehend the contentious relationship between human rights and religion in the case of India [5], [6].

**Thematic Grouping and Analysis of Hindu Student Narratives:**

**There are constraints on freedom of expression:**

The majority of the students who were interviewed thought that the right to free expression could not be absolute. Some students claimed that restrictions on free speech may be necessary to preserve social cohesion. Few pupils held the opinion that religion cannot be mocked. Hindu religious icons like the cow and the Ganga River cannot be insulted in the name of free speech. Most of them held the opinion that religion can only be criticized so much. However, responses implicitly imply that a religious believer could punish individuals who support secularism and human rights of free expression if their religious sensibilities are offended, which is problematic because it goes beyond the subject storyline. most fascinating

**Defended censorship of free speech by the government:**

The majority of the students cited India's multi-religious, multi-ethnic, and multicultural nature as evidence for why the government should control speech to preserve religious harmony and maintain the peace. Some students held the opinion that government censorship was required to stop troublemakers from all religions and to stop violence. Few students, nevertheless, questioned the political motivations behind official censorship. Only in extremely delicate situations, according to a few pupils, can objectionable items be blocked. Many students argued that censorship was necessary to suppress troublemakers, stop violence, or preserve interreligious harmony. There is some support that extends beyond this thematic storyline for the government to suppress objectionable religious information. This matter can be troubling for a democratic secular nation, which embraces secular principles and declares in its constitution that it would preserve fundamental freedoms of expression. Even among academics, it is challenging to critique religion in public discourse in this type of

circumstance due to worries about political correctness and potential legal ramifications. This can tend to suppress and discourage open communication in a liberal democratic society. In addition to encouraging armed underground radicalism, free speech restrictions can do so as well.

**Violence, religious hostility, and breaches of human rights:**

Nearly all Hindu students concurred that when free speech and religion clash, violence and religious hostility grow. The students also identified public riots, curfews, violent protests, and the implementation of religious dogma by extremist members of religious nationalist groups as other key effects of this war. The majority of students said that liberal portions of society are terrified by fundamentalist extremists. Some students expressed concern that writers and filmmakers could be reluctant to address religiously sensitive topics and that religious nationalists and the mainstream media might push people who disagree with the dominant perspective out of the public eye [7], [8].

**Conflict is caused by local politics:**

The majority of students accused politicians, both Hindu and Muslim, of creating racial and religious tensions. One student claimed that since the general public might not be aware of a divisive book or movie and that such issue is exaggerated by politicians for political purposes, motivating people to incite communal violence, the general public has nothing to do with such conflicts. Few students, however, held politicians accountable for their support of Islamic political organizations in order to pacify minorities, fanning racial tensions, and limiting free speech to those who criticize Islamic principles [9], [10].

## CONCLUSION

This study has shown that, especially in an Indian context, concessions between secular and non-secular persons are necessary for a harmonious multicultural society. Contextual secular-multiculturalism may be a solution in the mitigation of multicultural conflict, notably between free speech and religion, as society and the state both need to be tolerant in order to accommodate differences and radical point of views. This idea, however, has certain drawbacks because it still allows for religious polarization, racial violence, and the stifling of secular thinkers. The multicultural nature of society necessitates, on the one hand, the formulation of policies based on respecting the fundamental beliefs of various religions; however, on the other hand, the state must ensure the fundamental rights to freedom of expression and human rights as well as a safe public space that is unhindered and unrestricted by religious fanatics. It's important for academics and artists to have unrestricted expression. They ought to be allowed to "offend, shock, or disturb" if it is ethically acceptable. However, the opposite is true now in India, where pressure from Hindu religious nationalist parties puts the right to free speech in danger.

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# CHAPTER 10

# INTRODUCTION TO STUTTERING SPEECH PROVOKED AUDITORY BRAINSTEM RESPONSE

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**ABSTRACT:**

Deficits in auditory processing have been proposed as the main cause of stuttering. Prior research has shown aberrant responses to speech cues at the higher level of the central auditory system in people with persistent developmental stuttering. The potential value of speech-evoked auditory brainstem responses in diseases of central auditory processing has recently received attention. The present investigation tested the theory that PDS patients have a particular auditory perception impairment using speech-evoked ABR. Objectives. to see whether PDS sufferers and regular fluent speakers have different brainstem reactions to speech inputs. Methods. In this investigation, 25 PDS patients took part. The 40 ms long, five-formant synthesized syllable "da" was used to elicit speech-ABRs. Results. The offset and onset transient peaks showed substantial group differences. In comparison to the control group, PDS patients reported longer latencies for the onset and offset peaks. Conclusions. In the early stages of the auditory pathway, PDS subjects had a poor neuronal timing consistent with temporal processing abnormalities, and their incorrect timing may be the cause of their disfluency.

**KEYWORDS:**

Auditory, Aberrant Responses, Disfluency, Persistent Developmental.

## INTRODUCTION

A clinical feature of developmental stuttering, a subset of speech fluency disorders, is a disturbance in verbal fluency. The basic causes of stuttering remain poorly understood despite a substantial body of research and several ideas. There is a minority of stuttering children that do not recover, and their stuttering habits continue into adulthood, even though the disease generally improves with age and prior to puberty. The incidence of chronic stuttering in adulthood has been calculated to be about 1%, regardless of gender or handedness. Developmental stuttering is associated with aberrant brain activity in the auditory and motor domains as well as subcortical regions such the basal ganglia, according to recent advancements in neurological investigations. Subjects with persistent developmental stuttering exhibit structural and functional anomalies in the central nervous system, including unusual activation patterns in the auditory and motor areas as well as girl and planum temporal anomalies, according to neuroimaging and magnetoencephalography studies .Several later investigations largely confirmed these results [1], [2]. Two imaging investigations, at the very least, indicate structural brain abnormalities in PDS patients. According to the findings of the initial investigation PDS is linked to abnormal planum temporal asymmetries. The PT is believed to be crucial in synchronizing incoming auditory input with speech production as well as in the representation of speech information at the higher levels of auditory processing. Diffusion tensor imaging, a cutting-edge imaging technique, was used in another research by researcher to determine that stutterers' left operculum's white matter tracts were less dense than controls. Cortical dysfunctions in stuttering have been shown in a number of electrophysiological investigations.

Mismatch negativity abnormalities, which are more pronounced in the left hemisphere in PDS individuals, have been found in recent investigations. Another unfavorable element of ERPs called MMN is thought to indicate the automatic processes involved in word sensory memory. Researcher investigated the MMN response between participants with PDS and fluent speakers using simple pure tone stimuli and speech stimuli. Both groups' MMN responses to tone stimuli were found to be normal, whereas PDS individuals had aberrant left mastoid MMN amplitudes in response to speech stimuli. This conclusion is in line with anomalies in the left temporal-parietal region's primary auditory cortex, a part of the brain involved in verbal sensory memory. In patients who stutter, Cuadrado and Weber-Fox looked at the p600 late language related wave. Stutterers had lower p600 amplitudes, which might indicate abnormal syntactic processing. In order to compare the findings with 8 matched controls, researcher collected P300 potentials from the left and right hemispheres in 8 stutters. And 60% of stutters in the left hemisphere had greater p300 amplitudes, the researchers discovered. Compared to stutterers, the amplitude of P300 was higher in the right hemisphere in all normally fluent speakers. Timing deficits have also been used to describe stuttering. Stuttering mistiming is not only confined to the speech motor regions. In a MEG investigation, researcher showed evidence in favor of timing abnormalities in the auditory cortex. During passive listening and active speaking activities, they assessed the auditory evoked magnetic fields in PDS participants as well as fluent speakers. According to their findings, auditory M100 latencies were longer in persons with PDS compared to fluent speakers, which indicated decreased auditory motor integration. Additionally, as shown by Kent, those who stutter may have difficulties processing auditory temporal information. Stuttering adults varied from adults who did not stammer in various elements of auditory temporal information processing, according to investigations of central auditory processing in stuttering [3], [4].

A central auditory deficiency in stutterers has been linked by a number of researchers to the auditory brainstem. Defects in brainstem timing may be found using electrophysiological tests like the auditory brainstem response and frequency following response. The assessment of speech-ABR is a viable method for determining brainstem timing in clinical groups that are suspected of having auditory processing abnormalities, according to a number of articles. The speech evoked ABR measurements are probably the most accurate brainstem timing measurements at this level, providing a quantitative assessment of the auditory circuits in the rostral region of the brainstem. The speech-ABR delivers essential information regarding pitch and harmonic encoding in addition to brainstem timing measurements. Stutterers perform worse than non-stutterers, according to three investigations utilizing synthetic sentence identification-ipsilateral competing message. In different research, 10 people with developmental stuttering took the binaural masking level difference test at 500 Hz. Smaller MLDs were seen in adults who stammer compared to controls. This difference raises the possibility that PDS individuals may struggle to process binaural interactions. Under dichotic listening circumstances, the BMLD is an improvement in the signal's ability to be distinguished from noise when the noise or signal is delivered out of phase. Interaural phase difference encoding, which is represented by BMLD, relies on the health of ITD-sensitive neurons in the brainstem nuclei and needs temporal processing on the order of microseconds. Both tests require the individuals to utilize temporal information and are vulnerable to brainstem dysfunction. These results provide further evidence that the brainstem is involved in stuttering. The speech-ABR was utilized in the present investigation to investigate the idea that people with PDS exhibit unique auditory perception abnormalities at the brainstem level. Twenty-five PDS sufferers were included in this cross-sectional research from the IRAN Society of Stuttering and the Speech Therapy Department of Iran University of Medical Sciences. The control group consisted of 25 fluent participants. All of the participants spoke Persian as their first language, had normal hearing sensitivity between the octaves of 250 and 4000 Hz, and had no ontological or neurological issues. For education and sex distribution,

both groups matched. According to the Persian version of the Edinburgh handedness questionnaire, all individuals were right-handed. Speech language pathologists evaluated the clinical diagnosis of developmental stuttering and the severity of the stuttering.

No stutterer has received comprehensive therapy for at least the last year despite having the ailment for more than 10 years. The Stuttering Severity Instrument-3 was used to quantify stuttering severity and ranged from moderate to severe. All stuttering adults satisfied the clinical criteria for developmental stuttering, which were distinguished from neurogenic stuttering by word-initial stuttering, the presence of anxiety during stuttering, secondary behaviors, adaption effect, and situational changes. The research eliminated participants whose click-ABR responses were abnormal. Stutterers and control participants alike completed an informed consent form. The Medical Ethics Committee of Iran University of Medical Sciences gave its approval to the project. All data were converted to a text file using AEP to ASCII after the Biomarker answers were recorded, and they were subsequently uploaded to the Brainstem toolbox for additional analysis. A MATLAB-based toolkit for doing temporal and spectral analysis is the toolbox. We calculated temporal, composite, and spectral measurements using the brainstem toolbox. This wave was not included in the statistical analysis because the peak C's poor detectability precluded its inclusion [5], [6].

We used automated peak-picking methods from the brainstem toolkit to systematically find all peaks in order to increase the reliability of the timing measurements. Fast Fourier transform was used to measure the spectral magnitudes of the FFR over a time window of 11.4–40.6 ms in each of the three frequency ranges in order to gather more information about the frequency encoding in the sustained segment of the response. F2 and the higher formants, which have frequencies that are higher, could not be recorded because of the maximum limit of phase locking at the level of the rostral brainstem. A Kolmogorov-Smirnov test revealed that the data from the two groups were regularly distributed. Consequently, parametric tests were applied for statistical analysis. For each of the test variables, independent sample t-tests were used to assess if there were any notable changes in the timing, composite, and spectral measurements between stutterers and nonstutterers. The association between the severity of stuttering as measured by the SSI-3 scores and the brainstem timing measurements was examined using a Pearson product-moment correlation. SPSS version 17 was used to statistically analyze the data gathered for this study. The significance threshold for each statistical test was set at.

## DISCUSSION

To our knowledge, this is the first investigation of persistent developmental stuttering using speech-ABR. In this research, a group of people with chronic developmental stuttering participated, and their brainstem neuronal synchronization was examined using the speech-evoked ABR. All participants' ABR components were comparable to normative data. Our analysis of the speech-ABR revealed substantial increases in waves V, A, and O latencies as well as a steeper VA slope in the stuttering group compared to the control group. The latencies of transient measurements and the degree of stuttering were also shown to be significantly correlated. The findings of our investigation support Kent’s theory by showing that PDS participants' brainstem responses to transitory stimuli are less synchronized than controls’. Absolute latencies and interpeak latencies for all groups were within normal ranges according to normative data for the click-ABR and in accordance with normative data in our lab. Contradictory findings have been found regarding the auditory brainstem responses in stuttering. ABR components between stutterers and non-stutterers were shown to be significantly different by several investigations.

Others questioned these findings and failed to demonstrate variations in the central conduction time of ABRs between stutterers and controls, in contrast to and in agreement

with our results. Some of the inconsistent results in this area are brought on by variations in study methods and the pathological heterogeneity of stuttering. This research, however, demonstrated that changes in neural synchrony in the brainstem response to/da/stimuli may take place before any appreciable changes in the latencies of the click-ABR components, at least in a subset of stutterers. As a consequence, timing deficiencies in the midbrain are not completely ruled out by an ABR with normal latency values. Electrophysiological tests, such as the ABR, have a great sensitivity for identifying central lesions at the caudal region of the brainstem, but they may not pick up on more mild central auditory abnormalities at the higher levels. researcher reported a case in which the click-ABR was unaffected by medial geniculate body degeneration and partial inferior colliculus loss. Accordingly, it seems that the speech-ABR provides additional information regarding subcortical information processing in addition to what was discovered by the click-ABR.

**Provoked Speech ABR:**

For the aperiodic portion of the answer, timing measure analysis revealed a statistically significant difference between the two groups. The majority of the patients in the group of people who stutter had abnormally lengthy delays for the offset peak, and the onset peaks were much longer for them than for the control group. Because PDS patients have abnormal brainstem timing, it may be inferred that their neural responses to fast auditory transients are less synchronized than those of controls. Our investigation found that people with PDS had FFR interweave delay values similar to those of the control group and that there were no significant variations in F0 magnitude between stutterers and nonstutterers. Pitch and harmonic encoding are not affected by stuttering, as seen by the absence of magnitude variations in the frequency encoding components. The differences between groups in the onset and offset timing, but not in the F1 and HF magnitudes, support the findings of behavioral investigations of central auditory processing in persistent stuttering and show that the issue is with temporal processing rather than spectral encoding. The findings of the current investigation agree with those of researcher Stutterers and nonstutterers did not show any differences in group performance on the synthetic sentence identification-ipsilateral competitive message. The SSI-ICM heavily depends on spectral analysis to identify the target text. However, they found that persons with chronic developmental stuttering had considerably worse temporal processing than fluent speakers based on the binaural masking level differential. These temporal irregularities may be categorized into two possible reasons. The timing disturbance in the auditory pathways, which causes asynchronous transmission of auditory afferent information and inefficient processing of stop consonants, may be one explanation for the shallower slope and longer latencies of the fast onset components of speech-ABR in subjects with PDS. Accurate temporal information is needed for speech encoding.

Therefore, the brainstem's participation in the neuronal generators of onset and/or offset responses may be the root of stutterers' timing abnormalities [7], [8]. Influences from the top down are another reason. Top-down processes have an impact on subcortical speech encoding via the corticofugal system, and these influences may alter the response characteristics of the neurons in the brainstem structures. Studies revealing aberrant brainstem timing in people with cortical dysfunction provide more support for the hypothesis that auditory function at the brainstem and the cortex are related. It may be assumed that cortical dysfunction causes abnormal corticofugal feedback on the subcortical areas, which ultimately results in poor neuronal synchronization at the level of the brainstem since the cortex projects to both the rostral and caudal half of the brainstem. Animal experiments in which primary auditory cortex was removed altered the neuronal response characteristics in the inferior colliculus, lending more credence to this theory. It is still debatable whether asynchronous responses to fast acoustic transients are a consequence of top-down or bottom-

up processes. Although the extent of each person's participation is unclear, it seems plausible that both are involved. The fact that the stimuli employed were not similar is the most probable reason for the disparate results of the speech and click elicited responses. Different systems may be used to encode click versus voice cues, according to certain theories. The central auditory system may find it more difficult to process speech cues because of the backward masking effect. Disparity in how these stimuli were encoded suggests that the anomalous timing deficit shown by the speech-ABRs is due to variations in response generator synchronization. The results of the present study indicate that PDS patients exhibit poor neuronal timing in response to voice stimulus start and offset. There were substantial differences for several filter cues in this investigation, despite the fact that there were no group differences in the encoding of source cues. These findings suggest that speech encoding in the brainstem is subtly impaired in stutterers [9], [10].

## CONCLUSION

These results showed neuronal encoding abnormalities for timing elements in the early stages of the auditory pathway in people with chronic developmental stuttering. These findings also show a favorable link between the severity of stuttering and an auditory perceptual loss in developmental stuttering, proving the importance of speech perception networks for speech production. Both the perception and production of speech are influenced by cognitive processes, such as working memory and attention. We hypothesize that the speech-ABR may be employed as an objective method for monitoring the stuttering rehabilitation after speech fluency shaping programmed in individuals who stammer given the impact of high-level cognitive processes on the speech-ABR. To verify this premise, further research is required. We may better understand chronic developmental stuttering and its connection to auditory abnormalities using the data from this research. The brainstem reaction to synthesized speech sounds seems to have significant potential for use in clinical populations, according to recent research. However, further study is required before it may become widely accepted.

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# CHAPTER 11

# EXPERIENCES OF LIFE WITH FREEDOM AND CONFINEMENT

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**ABSTRACT:**

Dialysis is necessary for patients with chronic end-stage renal illness to live, but they also require a therapy that fits their lifestyle. It is crucial that healthcare professionals provide patients accurate, current information about the various dialysis treatment alternatives. Since home hemodialysis is a relatively new medical procedure, additional information regarding what it involves from the patient's viewpoint is required. This research set out to depict what it was like for people to get home hem dialysis. Patients were encouraged to compose narratives outlining both their positive and negative aspects of life while receiving therapy in order to obtain access to their experiences. A qualitative analysis of the tales was conducted. Five themes emerged from the study' findings, including the freedom to regulate one's own treatment at home, the sense of being burdened alone with responsibility, changes to the home environment, the need for help, and security and well-being with home hem dialysis. The conclusion is that although home hemodialysis allows for a certain amount of freedom, that freedom is constrained by how limiting the therapy is. More research based on patient experiences is required, and patients must be included in the design of the treatment in order to enhance their experiences with home hemodialysis.

**KEYWORDS:**

Chronic, Canada Exhibit, Dialysis, Hemodialysis.

## INTRODUCTION

When a person has chronic end-stage renal disease, they must be treated for the rest of their lives in order to survive. Hemodialysis, home hemodialysis, peritoneal dialysis, and kidney transplant are only a few of the various therapeutic options available today. 2,894 people underwent HD, 132 had HHD, 786 underwent PD, and 5,040 underwent kidney transplants in Sweden in 2012. It becomes obvious how the illness and its treatment restrict the patient's quality of life when they have chronic end stage renal disease. For instance, the patient's social life and food intake are adversely impacted by the dialysis treatments that he or she undergoes many times and for several hours each week. The patient's life is negatively impacted, but so are the patient's loved ones' lives as well. HD entails a patient visiting a hospital, for instance, three times per week for a total of four hours in order to have their blood cleaned by a dialysis machine. The number of dialysis treatments that may be performed each week is limited by the availability of dialysis equipment, personnel, and patient energy and time. The health of the patient is improved by receiving more dialysis. Hemodialysis at the patient's home has become more typical in recent years. It enables the patient to have dialysis every day or every night in the comfort of their own home. Utilizing their own resources, patients have control over when to get therapy. Anyone who is determined enough to learn may be taught to self-manage and do HHD. Training patients in a clinic typically takes 6 to 8 weeks.

About 25% of all dialysis patients in New Zealand have HHD [1], [2]. The percentage of HHD patients in Sweden makes up around 3% of the country's overall dialysis population. American research that focused on the consequences of HHD found that patients were more satisfied with their lives overall and had stronger relationships with their spouses than they

had before beginning HHD therapy. Frequent dialysis lowers the risk of cardiovascular disease and enhances quality of life, according to Minnesota research, although it is yet unknown if it affects the odds of survival for really sick patients. Patients with HHD in Canada exhibit physical and mental improvement because they felt more in charge of their life and had less unpleasant encounters with the condition. According to this research, the success of HHD required the assistance of the medical community. According to researcher people are more influenced by information regarding HHD they get from other patients than they are by information they receive from healthcare practitioners when selecting their preferred mode of therapy. Patients who need dialysis therapy who are chronically unwell get a lot of assistance and education from the nurses who look after them. Researcher study on nurse-led patient education discovered that patients with PD and HHD who are well-informed prefer to begin dialysis to a larger degree than patients with insufficient knowledge of their treatment choices.

The findings also showed that patients who selected HHD thought more highly of their own competence to provide care than they did before beginning HHD. Patient education and the patient's learning process have a substantial impact on the patient's ability to adapt to the condition and are crucial to the therapy. Patients should be able to participate as much as they want in their therapy, under Swedish legislation. However, there are often discrepancies between patients' and healthcare professionals' viewpoints on the best course of treatment and what the patients should know. Berglund emphasized that learning how to manage a chronic illness is a significant task. Learning is defined as a sophisticated continuing process that affects a person's whole being in both physical and mental as well as social contexts. It entails being able to identify chances to impact one's life in terms of the disease and treatment and comprehending the effects of decisions made in everyday life. Medical research demonstrates that HHD has a good impact on the patient's health. HHD is a therapeutic option that is growing in popularity. There are still few studies that thoroughly examine the benefits and drawbacks of HHD from the viewpoints of patients, despite its rising popularity. In order to close this gap, this study's goal is to [3], [4].

The study's goal was best served by a qualitative technique. Henricson and Bilbul assert that qualitative data, such interviews or written narratives, might aid in the development of new understanding about a topic. Written narratives, according to researcher concentrate on a specific instance from the informant's life that in some way illustrates the topic under study. The benefit of written narratives is that they are often topic-focused; this means that one may prevent the informant focusing on information that is unrelated to the experiences or impressions that are being discussed, which is typical in interviews. The drawback of written narratives is that, compared to interviews, there is less room for the researcher to add to the content. When the informant talks about a real-life event, the emphasis is often on a difficult circumstance. A more accurate image may be obtained by asking for both a positive and a negative story.

**Participants and Data Gathering:**

All HHD patients from a hospital in Sweden made up the sample. Before sending informational letters to the informants, permission was sought from the hospital director. Data was gathered between June 2013 and August 2013. The participants were initially written to and then spoken to. They were invited to submit accounts of both their positive and negative experiences with HHD. They were questioned about one or two instances from their day-to-day lives with HHD. They were instructed to explain the circumstances as completely and truthfully as they could, including all of their emotions and thoughts. Only two of the eleven patients choose not to participate, leaving nine of them included in the data collection. Between the ages of 30 and 70, there were five males and six women.

The social conditions of the individuals varied; some were single, others had partners, and some had children living at home. Some people's relatives were employed, while others were retired and spent more time at home. Everyone had their own home. The tales have undergone a qualitative examination. The analysis may be thought of as a process that begins with the whole, analyses its components, and then reconstructs the entire in order to comprehend the phenomena. The first entire is where the analysis begins, after which the researcher familiarizes themselves with the text. The researcher reads the content in its entirety and gains a preliminary knowledge of it during the well-known release phase. The researchers read the tales aloud repeatedly until they could quickly recognize each paragraph. According to researcher it is appropriate to continue when the researcher can simply characterize the various tales. In order to get a better knowledge, the researcher must use creative interpretation throughout the analysis step. Reading is centered on the components, which involves looking for meaning-containing units like words, sentences, or larger passages of text. Groups of meanings were created. Five themes were created as a result of this text analysis. The themes are accompanied with quotes from the stories to help the reader understand how the stories have been interpreted [5], [6].

## DISCUSSION

The ethical guidelines for this study are based on Swedish legislation and the ethical standards for research described in The Declaration of Helsinki. The conditions of information permission, secrecy, and usage have been imposed based on these ethical principles. The study's details were included in a letter that was sent to each participant. Participants were given the assurance of secrecy and were made aware that their participation was entirely optional and that they may withdraw at any moment without facing any repercussions. Two envelopes—one for the written tales and the other for the consent—were included with the letter. Additionally, they were told that none of the data from their medical journals would be utilized. The stories that were signed and delivered to us were rendered anonymous. In order to prevent the informants from being recognized, names of people, businesses, hospitals, and places were altered. The findings represent the experiences of patients with HHD. The findings are broken down into five themes: freedom to stay at home and manage one's own treatment, feeling alone and responsible, changes in the home environment, requirements for assistance and safety, and wellbeing with HHD. Each major concept is accompanied by illustrative excerpts. Both good and bad aspects of HHD are discussed, including its independence.

It is a freedom that offers the patient autonomy over their medical care. The doctor issues the patient a prescription for dialysis, which specifies how many treatment hours they should get each week. With a dialysis machine at home, the patient may do the procedure whenever it suits him or her, without having to adjust to the clinic's operating hours or schedule appointments. The patients had a good experience with this. When receiving dialysis at a hospital, one must modify their schedule to accommodate the procedure. HD at home implies having the autonomy to choose the best time and frequency of treatments, as well as the length of each. As a result, patients have greater flexibility to arrange their daily activities around what they want to accomplish and may schedule their therapy accordingly. One patient offers the following description of this freedom: You don't have to alter your schedule to fit the clinic's hours and location. Which day of the week you receive dialysis is entirely up to you. Additionally, you have the freedom to choose whether to begin your dialysis at night or during the day each day. Patients with HHD have the option to get therapy at night. Those who get their dialysis at night report being able to spend their days more freely than those who receive it during the day.

They have less fatigue after receiving dialysis at night. The flexibility also entails having the ability to modify the course of therapy in response to climatic and seasonal variations. When

the sun is shining, patients find it challenging to do dialysis inside; they would much prefer be outside. Many people decide to get their dialysis in the morning throughout the summer. They can spend more time outside by doing this. The choice in such situation is when the therapy will interfere with activities the least. One of the patients gave the following description of this sense of independence and self-control: I don't shout "HURRAY" every time I get dialysis, but I do so because I can and will do so at home. The independence is also shown by the opportunity to relax in one's own home right after a dialysis procedure. HHD indicates that patients get care without having to go to the hospital. They recall previous trips to and from the hospital as being time-consuming, tiresome, and uninteresting. Additionally, it is annoying to be compelled to continue the taxi drivers chat when one is fatigued and just wants to go home. Thus, HHD gives patients additional time flexibility and post-treatment comfort [7], [8]. HHD also reduces the danger of infection for the patients since they do not have to share a room with other patients. A patient explains why they chose HHD in the following manner.

It was the independence that made me decide to do home hem dialysis. It's not my ideal to lay down for 4-5 hours in a large space with lots of people. However, there are certain restrictions on the flexibility to handle the therapy alone when at home. Equipment for dialysis sometimes has technical issues. Patients find it difficult to go to the hospital for treatment when engineers are unable to immediately fix the equipment. When issues with the AV-fistula emerge, having to visit the hospital is seen negatively, especially if the time period lasts for too long. Patients want stronger backup services so they won't need to visit the hospital if there are technological difficulties. In light of the dialysis monitoring and doctor's appointment, some patients feel that having their dialysis performed in hospitals is unnecessary. They characterize it as a dialysis unit routine. They would like to see the doctor once, followed by a trip home. Holidays are part of life, but so is the independence to control the course of the therapy on your own. Patients find it challenging to travel since the guest clinic only provides restricted, facility-dependent dialysis hours. Some of the patients are unable to travel because of this. This emotion is described by a patient as: At times, it's difficult to understand why this sickness will specifically affect me. When friends go on vacation or engage in other enjoyable activities, I have no options to follow. I'm saddened by it, and everything seems really problematic. Patients can travel thanks to a portable hemodialysis unit. The patient has the ability to do the dialysis wherever they want to live, and knowing this equipment might increase their sense of independence. According to a sufferer, it is like this: Obviously, travelling with a dialysis machine requires extensive preparation. I can travel and still do the dialysis whenever I like, so that's good. On vacation, I don't need to get used to being in a hospital. The patients' experiences of HHD are heavily influenced by their ability to live at home and regulate their medical care. With the treatment, they may make a variety of decisions and subsequently affect their own circumstances, but the freedom is limited by the actual therapy and any underlying technical or physiological issues.

**Feeling alone with the responsibility:**

HHD experiences often include a sense of being responsible for the therapy on one's own. When receiving therapy, the patients say that they are often alone themselves at home. When the patient is receiving therapy, their companion engages in other activities. This may sometimes be seen as worse than receiving dialysis in a hospital setting where they may interact with medical personnel or other dialysis patients. In addition, patients worry about problems since they undergo therapy alone. Either the patient or a manufacturing flaw in the equipment or dialysis material might result in complications. Stressful conditions make it simpler to make mistakes or forget to do things, such as when there isn't enough time, and these mistakes might risk the patient's life. A patient gives the following example of how they

have improved at managing stress: “I discovered never to deviate from my processes. Only seconds, if even that, would have been saved by doing things differently. There is constant anxiety after this incident to repeat it. The accounts of complexities make it clear how it feels to bear the burdens alone. For instance, blood loss may happen and be unnoticed.

The sufferers explain how they must handle circumstances like these on their own. They also spoke about their anxiety of going into hypotension, losing consciousness, and being unable to contact for assistance. Because of this, the patient may experience anxiety and may need hospitalization for blood pressure or blood value checks. When the dialysis clinic is shut down, some patients experience caution and insecurity. When unable to contact the dialysis nurse or technician, a patient characterizes the loneliness they experience as follows: Where do you turn if something unexpected occurs late at night? We are not doctors or other health experts. When the nurses provide numerous instructions on hygienic needs, such as how the patient should handle their AV-fistula/CDK at the beginning and end of treatment, it makes them feel more alone and responsible. Patients start to feel alone with the duty and fear making errors. When the dialysis equipment is installed, the physical surroundings at home alter. Patients note that a lot of room is needed at home for the dialysis equipment, water cleaner, dialysis supplies, and empty wrappings. The gadget makes noise that disturbs a generally quiet household setting. Despite being aware of how the environment has changed, the majority of participants find having the equipment at home to be beneficial. One patient explains where he has his dialysis equipment set up so that it is accessible but does not take up too much room in the house: I have set up a wardrobe in the bedroom so that the machine, water cleaner, and dialysis supplies are accessible. “The family finances are only one way that the environment includes the domestic situation. Patients discuss how rising water and power costs associated with conducting the dialysis treatment had an impact on the family budget. The participants also discuss how they have more time to spend with their family and socialize as the social environment changes.

They may schedule their time and participate in family events; this is a benefit of HHD.HHD patients need safety and assistance. Above all, the patients emphasize the value of having family and medical staff in the dialysis clinic to assist them. Some patients who have a family member at home report feeling well supported: When the equipment whistles and breaks down, my relative offers me amazing help. Despite the fact that he is calmer than I am, I am able to relax. The assistance gives one a sense of security, particularly when difficulties occur when receiving home dialysis. Patients also have a sense of security when they call nurses and technicians for assistance and guidance when anything goes wrong. When patients desire to leave blood samples to the closest healthcare facility but the medical staff is unsure how to handle them, the patients encounter a lack of assistance from the primary healthcare facilities. On the other hand, they may make referrals to dialysis ward personnel who can assist the main health care medical staff. This is how a patient recounts the experience: If anything goes wrong, I may always call some medical staff from the dialysis ward for support and advice. Nothing is insurmountable. When patients enter the dialysis ward, they get assistance and a sense of security. Here, kids may learn about their blood pressure and get assistance with adjusting their medication. Several separate nurses perforate the blood access during therapy on a dialysis unit. Unfortunately, it may result in issues with the patient's life-saving blood access. Without this crucial lifeline, the patient cannot get life-saving care. Patients who undergo HHD perceive the ability to perform access perforation on their own as a definite benefit. Having control over who punctures and knowing that it is done consistently fosters a sense of safety.

**Health and Happiness through HHD:**

In comparison to when they received their therapy in a hospital, people with HHD feel better and are more robust. Through HHD, patients have the option to receive dialysis more often,

i.e., six to seven times per week for many hours, as opposed to in a hospital setting where three to four times per week is the typical treatment schedule. They think the fact that they have more frequent dialysis from HHD is the cause of their improved health. Patients might say they "have gotten their life back." They have the vigor to do tasks they have put off for a while. The association of HHD with a chronic illness has diminished. According to a sufferer, this is how it is described “The dialysis equipment is constantly there at home and serves as a reminder of the condition. I place a lot of importance on not letting the illness rule my life. Although it is a part of me, I do not connect with it, which is what I have too often seen happening to others who have a condition. The patients talk of feeling better and having fewer limitations on how much liquids and food they can consume. They are free to consume anything they want, which contributes to an overall feeling of wellbeing. Patients with nocturnal HHD feel less fatigued and their bodies aren't put under as much stress. The following is how a patient described it: I reluctantly walked over to nighttime dialysis. Because the procedure is less taxing on the body and I can spend my days more freely, this dialysis approach worked really well. I had time on my hands and wasn't exhausted. Some patients recall how good it felt to do their first dialysis treatment at home with a nurse at their side.

They also spoke about how brave they had to be to endure the therapy and how fantastic it felt. Over time, as their confidence grows, they venture to administer therapy even while they are alone themselves at home. Although the duty is heavy, they develop along with it. Even though accidents might happen during dialysis, the patient has the fortitude to handle the circumstance. According to a patient, it was like follows: You take responsibility for your own health and govern your own life. It is a substantial, weighty, and large obligation. The patients' bravery also provides them the will to persevere in the face of challenges, such as when they interact with other healthcare professionals. The patient might be proud of his or her knowledge and abilities in this scenario. They've never heard of someone being able to accomplish it this way, a patient said. The findings of this research demonstrate that patients felt a feeling of independence from being at home and in charge of their therapy, that is, from being able to decide when and how to receive it. It has been emphasized by researcher how important life-world-led care is. This gives care and practice a direction that is fundamentally and favorably health-focused, where patients are seen as full individuals with physical, psychological, and social aspects. Life-world-led cares assist the patient in striking a balance between the freedom and vulnerability that the disease and therapy provide. The outcomes highlight the value of HHD's flexibility to arrange for relaxation and medical care and establish a regular daily schedule. According to Policheck, HD in a hospital necessitates the patients' attendance in accordance with the facility's timetable.

It can take all day to get there and be treated. According to the findings of this research, HHD is advantageous since the patient may choose the time of the therapy Despite receiving HHD, some patients express feeling as if they are in captivity. The doctor recommends a specified amount of weekly dialysis hours. When the weather is pleasant or they have plans to do something enjoyable, they struggle to stay motivated. Due to their chronic illness and the need for HHD, the patients experience loneliness and isolation. Thus, the flexibility to stay at home and regulate one's own therapy may be seen as both a plus and a bad aspect. This is similar to the thesis put forward by Dahlberg and Segesta regarding enduring illness. In their theory, they discuss the will to endure a chronic or fatal illness, which severely restricts everyday life. Berglund contends that it is crucial to comprehend this, specifically what can be changed about a person's therapy or way of life and what cannot. The findings that demonstrate patients' sense of being on their own with the burden are connected to worries about serious consequences that could arise after therapy. Despite receiving therapy at home for a long period, patients still feel scared and alone. In spite of their concerns about unforeseen incidents and their duty to the medical community, patients have developed the

ability to do nocturnal HHD, according to researcher. According to the findings of our research, patients' levels of confidence rise with time, and they now feel comfortable administering medication to themselves at home. This suggests that a person might develop in a job when they feel alone with the responsibilities.

The findings indicate that the patients need stability and assistance. When they are unable to contact medical personnel via phone, people worry about serious dialysis issues. This is consistent with the findings of researcher who discovered that HHD patients value the assistance of the medical community. They stress how crucial it is to be able to phone the hospital and seek assistance if there are issues with the therapy. According to Policheck, the nurse is crucial in assisting patients in managing their chronic diseases. Living with uncertainty is essential for those with chronic conditions, say researcher and Berglund. They are compelled to live a life they did not choose, which often leaves them feeling unsure, lonely, disappointed, and afraid. Researcher claim that telemedicine/webcam may help the patients if difficulties with HHD occur. Support and instructions may be given to the patient through webcam; this might become a feature of HHD therapy. The outcome demonstrates that HHD boosted the patients' emotions of wellbeing. They can now do tasks that they haven't been able to for a while since they have more energy. The patients also talk about how they are developing more self-confidence to defend themselves when they experience failures. Additionally, they now feel more accountable and are more knowledgeable about their condition and its treatment. According to Dahlberg and Segesta, being healthy is having the capacity to make decisions and shoulder responsibilities in addition to being able to do life's essential tasks. Health is defined as having a sense of vigor and balance in life.

According to researcher HHD patients often feel better and have a greater feeling of wellbeing. Physical and mental benefits in HHD patients were noted by researcher. The patients' fatigue subsided, allowing them to resume work. Knowing how to manage HHD might be considered as learning on this level, according to Berglund, who contends that true learning on an existential level can help to promote health and well-being. HHD provides the patient the ability to take control of his or her life and make choices based on the options available to them. This is what we mean by a rise in wellbeing. Due to the study's focus on the patients' actual experiences with HHD, a qualitative analysis of the data was pertinent. Patients who have HHD authored autobiographies about the condition. Written narratives have the benefit of having the information selected for us by the informants themselves. Because the participants in this study were familiar with the researchers, selecting the data gathering technique raised ethical concerns. Researcher state that one drawback of written narratives is that the researcher may have less opportunities to supplement the data than, say, during an interview. Even though we agree with this reasoning, we came to the conclusion that the written narrative was the most appropriate given the circumstances after weighing the advantages and disadvantages of each data gathering technique. We had to choose an acceptable strategy of data collecting since the informants knew and relied on us as treating nurses and because we had a prior grasp of the circumstance. One preconceived notion that was widely held before the research began was reexamined in light of the findings, which made clear a number of previously unknown facets of the therapy. As recommended by Henricson and Bilbul , the preunderstanding has also been thought about and shared with our supervisor and clinic colleagues [9], [10].

## CONCLUSION

The findings demonstrate that patients feel not only free to live at home and decide their own treatment plans thanks to HHD, but also dependent on it. The ability to dialyze yourself more often makes the patients feel better both physically and emotionally. To overcome the fear of making errors in HHD, bravery is necessary. Patients with HDD are better able to discuss their treatment options and place demands on their care because to their knowledge and

experience, which also gives them greater confidence. The study also discovered that patients' wellbeing was improved by not having to go to a hospital for dialysis. The study did uncover several drawbacks of HHD, including the patients' occasional lack of stability and assistance from the dialysis staff.When choosing PD, HD, or HHD therapy for chronic end-stage renal disease, patients need to be educated and supported. Patients' experiences of enduring the therapy should comprise a significant portion of this material. The results of this research may help patients better grasp what HHD is and are helpful in providing information about available treatments.

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# CHAPTER 12

# TECHNOLOGY FOR SPEECH ENHANCEMENT IN MUSIC SYNTHESIZER

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**ABSTRACT:**

Creating music through sound synthesis is the most representative electronic music creation method, and electronic music is actually the result of sound synthesis technology. Today, the field of electronic music encompasses multiple areas such as recording, mixing, composing, and producing. It also has some advantages over traditional music composition. Voice is the most effective and direct way of communication between people. And with the explosive development of speech recognition technology, the recognition rate of speech recognition systems in the near field environment has been greatly improved. However, in practical applications, there is often a large amount of ambient noise. If these environmental noises are strong, it will seriously affect the quality, accuracy, and speed of music synthesis. This greatly reduces not only the sound quality and clarity of speech but also the speed of speech recognition. To solve these problems, this paper proposes a multisensory speech enhancement technique and implements a multisensory speech enhancement system. It also proposes an enhancement method based on speaker speech and microphone speech. In this paper, the low-frequency harmonic components of the bone conduction signal are employed to substitute the frequency points affected by wind noise to lessen the influence of wind noise on speech quality and intelligibility. The experimental findings demonstrate that the PESQ and MOS scores of the improved algorithm in this paper are 1.65 and 3.67, respectively. Compared with the existing methods, it has a great improvement. This can significantly increase the voice quality of the music synthesizer and eliminate background noise.

**KEYWORDS:**

Creating Music, Demonstrate, Multisensory, Synthesis Technology.

## INTRODUCTION

Different design concepts are used to create music synthesizers today. It is the result of the blending of classical music and contemporary electronic technologies. Its sound is created using the idea of sound signals generated by electronic oscillators. For the purpose of simulating the impact of sound in various propagation conditions, the original sound is processed using digital processing technologies. Both new electronic sounds and natural sounds can be created by composers. The original single music keyboard control mechanism, which later evolved into fingerboard control and wind control, is still used to operate the synthesizer. In real manufacturing, work, and life, the sound field environment is frequently complex. The main factors that lower the recognition accuracy of the speech recognition system and degrade the call quality of the speech communication system are now harsh sound field environments like mechanical noise interference, reverberation interference in conference rooms, and noisy human voice interference [1], [2]. Industry-leading speech recognition technologies do not perform reliably or robustly in such a sound field situation. It is crucial to research voice augmentation technologies for music synthesizers since this significantly reduces the application space for speech recognition systems. The following studies about music synthesizers have been conducted by experts in the field.

For the builder to hear the results right away after soldering the kit, Altman M added an amplifier chip and speakers to the board. Pulse width modulation was used to encode the stereo audio channel for output. There is a low-pass filter on each channel. It transforms the signal into audio and is made up of a resistor and a capacitor. A multichannel receiver with a method that allows all of the signals to be processed by a single piece of hardware was proposed by researcher. The findings of an experiment using an electronic drum with no connecting wires completely show that a self-powered wireless transmission system with a latency of 700 microseconds is feasible. The goal of Soni and Macharia's work was to create novel musical synthesizer designs that were very adjustable, scalable, and highly miniaturized. Through the use of sophisticated algorithmic implementation of digital logic blocks, whole octave notes are produced and evaluated. He looked at the limits of timing, power, and space for logic devices. Consumption and time limits were considered, and both manual and automatic octave creation are possible with this approach. Pinch initiated a discussion between the sound and technical academic research. He presented social construction techniques for influential technology in technology studies, highlighting the importance of keyboard standardization and the crucial role users play in the creation of this technology. The consumer can accept certain noises because they stabilize while rejecting others. A brand-new approach to sound transformation based on control parameters was proposed by researcher. These variables make sense to musicians and are pertinent to them. He made use of a different autoencoder model. On a vast database of synthesizer sounds, it is trained unsupervised. Currently, the primary issues with music synthesizers are their poor sound quality and inability to effectively remove noise. This paper examines the issues with music synthesizers and introduces multisensory and voice augmentation techniques to address them [3], [4].

Relevant scientists have conducted the following studies in relation to voice enhancement technology and multisensory. Li and You suggested a speech-based reinforcement strategy to increase the strength of speech activity detection even further. Since the residual noise in the augmented speech satisfies the Laplacian distribution, the residual noise is modelled using this distribution. His suggested method outperforms baseline methods, notably in low SNR and nonstationary noise circumstances, according to experimental results. A vision-centric multisensory fusion framework for traffic environment perception techniques for autonomous driving was proposed by researcher. For effective self-localization and obstacle perception, the framework systematically combines camera, lidar, and GIS data through geometric and semantic restrictions. His empirical findings supported its effectiveness and robustness. In order to identify the three primary classical sub technologies diagonal, kicked sculls, and double sculls—Seeberg et al. devised a multisensory technology. Miscellaneous sub technologies are categorized differently. The device performs well on outside snow in a variety of circumstances. Video analysis was used to verify the algorithm he had constructed. Liu et al. suggested a new technique of multisensory information fusion fault diagnosis based on BP neural network and evidence theory in order to address the incompleteness and uncertainty of information in single-parameter diagnosis of complex systems.

It effectively increases the system's reliability by realizing fault location and diagnosis of the key hydraulic drive servo system components. He compared tracking performance to the top multisensory solutions both with and without missing samples, which is insightful. The performance bounds of the two approaches for sparse-aware multisensory multitarget tracking algorithms were assessed in the Subedi et al. investigation. Additionally, he demonstrated that when the measurement vector is tainted by missing samples and additive noise, recursive learning structures perform better than conventional techniques. The distributed joint Kalman filter fusion problem for a class of multisensory unreliable network systems with uncorrelated noise was the main focus of Xing and Xia's research. In order to demonstrate the efficacy of his suggested approach, he provided two simulation examples

and offered an ideal algorithm for unstable network systems without buffers. Gomes et al. compared the capabilities of a multisensory camera with a modified RGB camera in order to determine the normalized differential vegetation index of coffee-growing regions. He employed a camera with a single sensor and a multispectral camera with five sensors. The NDVI acquired with the multisensory camera turns out to be more comparable to the NDVI obtained with the Green Seeker NDVI sensor. The aforementioned research offers a thorough review of multisensory and music synthesizer applications as well as voice augmentation methods. There is no denying that this research has significantly aided the growth of the relevant professions. Methodology and data analysis teach us a lot. It is vital to completely incorporate voice enhancement techniques and multisensory research on music synthesizers to study in this area because they are somewhat uncommon. In this study, the SNR and the segmented SNR average are achieved by building a multisensory-based speech augmentation system. are the fused speech SNRs. Using the Deep Noise Suppression Challenge data set, it trains a more effective speech improvement algorithm. Our method's PESQ, STOI, and parameter count are 2.52, 78.1%, and 89 k, respectively. The full dual-microphone noise reduction system is created by combining the post-filtering algorithm and the front-stage array processing algorithm. The test set is divided into the four noise reduction systems, and the appropriate scores are computed. The method used in this research has higher PESQ and MOS scores than the current methods. It lessens ambient noise and enhances the voice quality of music synthesizers.

**Designing Music Synthesizers:**

Sine waves are produced, modified, and applied using music synthesizers. To create certain sounds, they input it into sound generators and speakers. The harmonic structure of a sound affects its quality. Music synthesizers included into sound cards produce sound effects that resemble a variety of musical instruments. A music synthesizer's function is to transform information into music. Electroacoustic music includes electronic music as a significant component. Electronic music was expanded by the electronic piano, but it reached a new level with the introduction of electronic music synthesizers. depicts the basic block diagram of the synthesizer [5], [6].

## DISCUSSION

A digital music instrument is a digital music synthesizer, often called a digital sound synthesizer. It produces an electrical signal, and the speaker and equipment it uses to create sound. In actuality, the idea of a digital synthesizer is more expansive. Its multi-fingered sample utilization is a contemporary synth that mimics the sounds of analogue synths and genuine instruments. Additionally, it is the most typical and frequently observed one. The ability to create new electronic sounds, also referred to as sounds by musicians in the field, is the key feature of digital music synthesizers. Musical keyboards, physically adjustable sliders, and knob buttons make up the majority of common digital music synthesizers available today. It is also known as a music control synthesizer as a result.Pianos, electronic musical instruments, and flutes are just a few examples of the sounds that music synthesizers may mimic from nature and reality. Other musical instruments, human voices, and inanimate noises like ocean waves are also present. Traditional analogue music synthesizers produce sounds made up of components with various frequencies by using the electronics of a signal generator. After that, it is up to each user to adjust the sound to match the features of time, space, and terrain. On the other hand, digital music synthesizers take a straightforward digital approach to waveform synthesis and sound data conversion. Traditional sampling techniques can be used to directly sample a digital music synthesizer's oscillating sound waveform, although these techniques must primarily be used for implementation.

Three sounding options are available on the music synthesizer, one of which is to directly alter the voltage type, like an analogue synthesizer. The second involves creating computer-based simulations of mathematical operations using tools like software synthesizers. The third synthesizer combines the first two synthesizer types, and the fourth synthesizer produces a voltage signal that causes the membrane gasket of the speaker or earphone to vibrate. The term synthesizer refers, broadly speaking, to the instrument employed in the field of sound synthesis. The singer's vocal apparatus and all the instruments are examples of this. While synthesizers are frequently viewed as "artificial," pianos, cellos, and flutes are actually all musical instruments that use synthesis to produce sound. Synthesizers are tools for creating bizarre sounds that do not occur in nature. Thus, the playback of sounds made by natural things is all that is considered to be true imitation of sounds in nature. The two fundamental components of an electronic music synthesizer are the control surface and the synthesis engine. The parameters that define and control the synthesized sound are set using the control surface. The sound synthesis parameters are transformed into audio signals by the synthesis engine.  depicts the waveform generation circuit.

The block of a synthesizer that creates the fundamental waveform audio signal is called an oscillator. Sine wave, sawtooth wave, and square wave are the three fundamental waveforms that it can typically produce. Only sine waves can be produced by some oscillators. The three fundamental waveforms can also be produced by oscillators in simple variations, such as a square wave that is a little bit rounder, a sawtooth wave that is a little bit sharper, etc. However, the waveforms are typically quite straightforward. The oscillator also has amplitude and frequency settings in addition to the fundamental waveform. Most synthesizers normally have one or two oscillator blocks at the very least. Depending on the user's requirements, they can produce one sound or several sounds at once, or they can use the signals from several oscillators as modulation signals to modulate other oscillators during frequency modulation synthesis. Some synthesizers use wavetables or audio samples in place of oscillators. In reality, we can also employ this additional sounding apparatus as an improved or alternative oscillator. The frequency modulation synthesis technology is a modulation technique that modifies the modulation signal by changing the frequency of the high-frequency oscillating wave. The modulation unit and the carrier unit are the two primary operational units required by an actual frequency modulation synthesizer.

The sine table, envelope generator, and pulse generator are the three functional components found in each device. Each unit is capable of producing a sine wave. The envelope generator determines the sine wave's amplitude, whereas the pulse generator determines its frequency. The carrier unit is modulated using the output of the modulation unit. Harmonics are present in the carrier element's output waveform as a result. The modulating waveform's amplitude determines the harmonics' amplitude. The modulation unit's frequency and amplitude controls can be used to alter the synthesizer's sound quality.

The LFO must be used if the synthesizer parameter is to be changed automatically and repeatedly. Low frequency oscillators aren't the same as what people typically refer to as oscillators. It generates a modulated signal that alternates periodically rather than an audio signal. However, the amplitude's value describes the output to the modulated object, not the volume. Therefore, the modulation source determines how this value impacts the sound. The LFO's oscillation frequency controls how quickly the value output to the modulated item changes. The LFO's primary settings include oscillation frequency and waveform selection. This modulation value is comparable to a relative amplitude since the modulation value in the modulation matrix determines the extent of effect on the modulation object. The sound created by a digital music synthesizer is fundamentally distinct from the actual sound of a recording device from a mechanical standpoint. People frequently claim that the purpose of recording is to transform the mechanical energy present in a sound wave into a sound wave

signal, and that playing a sound can transform information into mechanical energy. Since the keyboard serves as the control interface for most digital music synthesizers, they are frequently referred to as keyboard instrument devices. However, the keyboard is not always the synthesizer's control interface. For instance, fretboard controllers, guitar chord controllers, air vent controllers, and electronic drums are all included in it. A key element in enhancing musical expressiveness is loudness dynamics, which mostly applies to musical expressions in traditional instrumental music performances. The musical expression is considerably more crucial if the sound is linear, such as a string legato. Musical expressions will inevitably be included into the playing of real instruments, even if the musician doesn't intend for them to be. Consequently, this musical component frequently goes unnoticed, especially by amateurs. But when using sound synthesis to make electronic music, it is a component that requires further care. The oscillator provides a sound signal with a completely steady volume by default because the volume is not designed. Such noises are frequently prone to dullness and even aural fatigue in the absence of other design features. Additionally, it will provide more novel effects than conventional music if it is intended [7], [8]. The advancement of DSP and computers has accelerated the development of digital audio.

Electronic music synthesis technology holds a significant position among them. voice quality, background noise, and how to recover clean original voice have all become significant issues that need to be resolved since the invention of music synthesizers. In order to address these issues, this study introduces multisensory and voice augmentation technology. For speech amplification with microphone clusters, beamforming is a key idea. In cluster signal processing, it is also a key field of study. In order to efficiently accomplish the purpose of speech enhancement, beamforming technology can be utilized to amplify the speech signal in the direction of the target sound source and suppress the interference and noise in other directions. It is typically essential to execute some analysis operations on the various speech signals acquired by the microphone array, such as weighting, time division, and summation, presuming that the target signal's direction differs from the direction of the noise signal. As a result, the secondary branch of the beamforming pattern created by the microphone array is suppressed since the main branch of the beamforming pattern is aligned with the target speech signal and the null branch is aligned with the target sound source. The number of microphone arrays, the distance and spacing between the arrays, the incoming angle of the sound source, the sampling frequency, etc. all affect the direction of the beam and the width of the primary beam. The transducer's reaction depends on the frequency and direction of the target source. The method of using voice enhancement techniques to improve speech quality is depicted.

In areas with a lot of noise, different speech improvement algorithms based on air conduction speech sensors don't work very well. Because both useful information and noise are carried through the air, air-conduction-based voice sensors like microphones are sensitive to noise. If it is assumed that the noise is conveyed over the air but the relevant information is not, the performance of speech transmission can be enhanced by successfully isolating the noise. Generally speaking, voice processing or voice recognition uses the voice conveyed by the non-air-conduction sensor rather than the voice input by the non-air-conduction sensor directly. In order to combine their benefits, it typically needs to be analyzed with air-conducted voice signals. Alternatively, the voice from a non-air-conducted sensor can be processed to have better voice quality. Speech is an embodied bodily activity that has visual and aural components.

Noise pollution can be effectively managed by improving speech. Its major objective is to enhance voice quality by eliminating as much background noise as possible from the incoming speech signal. Speech enhancement is strongly tied to both the qualities of speech

and how the human ear perceives sound, in addition to typical signal processing theory. As a result, these qualities should be combined, and the best speech enhancement technique should be chosen based on the current circumstances. Homomorphic filtering is typically used to reduce or eliminate nonadditive noise. Three subsystems comprise the convolutional homomorphic system. Two feature subsystems that solely rely on the signal combination rules. Processing demands affect a linear subsystem. The operations to transform the convolutional signal into an additive signal are carried out by the first subsystem. The second subsystem, which is utilized to transform the additive signal linearly, is a regular linear system that adheres to the idea of linear superposition. The additive signal is inversely transformed into a convolutional signal by the first subsystem, which is the third subsystem.

The voiced and unvoiced segments are identified using the signal from the non-air-conduction voice sensor, and the voiced segment mark is applied to the voice from the air-conduction voice sensor to extract the voice signal. The spectrum of the voice of the air conduction voice sensor is very untidy and irregular in the case of noise, which is the difference between a standard air conduction voice sensor and a non-air-conduction voice sensor input voice. The two signals' eigenvectors are combined. It still offers a lot of advantages over the single-channel noisy air conduction sensor in environments with different signal-to-noise ratios. It creates a combined model of speech detection using both air-conducted and non-air-conducted speech sensors. In order to accurately estimate the acoustic noise model, this study uses non-air-conducted speech sensors to detect speech during augmentation. Vibrations from the throat, head, ear canal, etc. cause the sensor's reed to deform, and this vibration is then converted into an electrical signal to produce a voice signal. Reeds used in non-air-conduction sensors do not distort since they are not impacted by sound waves carried in the air. Non-air-conduction sensors are very resistant to interference because air-conducted sound is not audible. Non-air-conducted sensor speech has drawn significant interest for robust speech processing applications because it is more robust in noisy situations and has a strong correlation with air-conducted sensor speech. However, the voice quality they gather isn't very good because to the limitations of the transmission routes and equipment. Spectrum restoration, Wiener filtering, Kalman filtering, waveform modification, and other speech enhancement techniques all need a single microphone. These techniques for improving speech use network signal processing. To spatially filter incoming speech and create a directional spatial beam, they exploited spatial phase information of speech signals from numerous microphones.

In terms of the properties of speech recorded by non-air-conduction sensors, excluding the effects of sensor quality and hardware circuitry, it is most clear that the waveform amplitude of speech exhibits some attenuation in the time domain. If the sampling frequency is 8 kHz, the non-air-conduction sensor's voice exhibits a significant attenuation in the middle and high frequency. Its speech is often between 0 and 2 kHz, but microphones and other air conduction sensors operate between 0 and 4 kHz. The detail components of the sound signal are represented by the high-frequency components. Non-air-conduction sensor voice consequently lacks a lot of clarity and has a muddled pitch. Low-frequency non-air-conducted sensor speech is noisy. The other component of the signal acquisition process which is connected to external interference or power supply is tied to the properties of the sensor itself.  depicts the speech reconstruction system's block diagram. The voiced and unvoiced segments are identified based on the non-air-conduction voice sensor's signal. In order to extract the speech signal from the air conduction voice sensor, the determined voiced segment markings are used in this research. In the case of noise, there is a difference between speech recorded by an ordinary air-conducted speech sensor and speech recorded by a non-air-conducted speech sensor. In a noisy environment, the frequency spectrum of the air speech sensor's speech is not clean and irregular. On the other hand, the external voice sensor's frequency spectrum for voice is extremely clear and mostly unaffected by ambient

noise. Using the input from the airborne speech sensor, this feature can extract speech sequences from noisy surroundings and distinguish between audible and inaudible sequences. Along with using the non-air-conducted speech sensor to help the air-conducted speech sensor identify speech, the air-conducted speech sensor also uses the non-air-conducted speech sensor's signal as a feature in its speech. It then uses the improved joint model to improve the voice picked up by the input air conduction voice sensor after making the necessary adjustments to the joint model's parameters. The channel parameter joint model's parameters can be changed using the model compensation technique. The throat microphone's excellent anti-interference capabilities cause the voice it records to have strong noise in environments with loud noise. The throat microphone's simultaneously recorded voice has extremely little background noise. However, the voice's high-frequency energy is extremely low, giving the recorded voice a depressed and artificial sound. This work applies spectrum spread processing to the voice captured by the throat microphone. This fills in the high-frequency gaps so that the microphone voice can later be fused with the data. It is a multisensory-based voice augmentation system, as depicted[9], [10].

## CONCLUSION

Digital sound processing technology has gradually superseded analogue sound processing technology and is currently advancing quickly due to the rapid development of information and recording technologies. There are more and more restrictions on the capability, volume, and sound quality of human audio processors. Technology that can autonomously create electronic systems or products is known as electronic design automation technology. Applications of speech recognition technology include autonomous conversation customer service robots, industrial intelligent control terminals, voice assistants for mobile phones, and military settings. The phoneme model of the voice signal and the language model are jointly modelled by the speech recognition system to give the computer the ability to recognize speech. In this paper, a multisensory-based speech enhancement system is built to address the issues with voice quality and background noise of music synthesizers. It efficiently lowers the music synthesizer's background noise while enhancing speech clarity. This research offers and simulates a fusion method for the investigation of fusing the voice spectrum of the throat microphone and the voice spectrum of the microphone due to the temporal relationship. There are numerous additional strategies to attempt in addition to the one suggested in this paper. Additionally, more thorough research can be done on the weight function.

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