

## **Chapter 5**

### **Linguistic Analysis**

#### **5. Introduction**

In this chapter we thoroughly examine the linguistic aspects of stammering in the context of the Hindi language. Language processing and expression are intricately impacted by this complex phenomenon, and linguistic analysis of stammering entails a careful examination of the communication disorder from various linguistic perspectives. Researchers and linguists from all over the world have been fascinated by stammering, a communication disorder marked by sporadic disruptions in speech fluency, leading to a relentless pursuit of understanding its profound linguistic aspects.

The study of linguistic aspects of stammering is crucial because it sheds light on the underlying mechanisms and difficulties that people who stammer encounter when expressing their ideas. We investigate the acoustic characteristics of stammering in Hindi through linguistic analysis, identifying the distinctive speech patterns and variations that occur during disruptions, and laying the groundwork for developing targeted interventions to increase fluency and speech intelligibility.

We examine the syntactic complexities that underlie stammering in addition to phonemic analysis with the goal of illuminating how the disorder affects sentence structures, grammar, and word order. To develop strategies to improve language production and communication in people who stammer, it is essential to comprehend these syntactic difficulties.

The investigation of semantic implications also reveals the influence of stammering on the choice of words, vocabulary, and the expression of meaning. We learn more about the cognitive aspects of stammering and can create strategies to promote effective language processing and communication by examining the challenges with word retrieval and lexical access.

The social and pragmatic effects of stammering are equally important because they touch on how the disorder affects confidence in communication, social interactions, and self-worth. Understanding how stammering affects conversation repair techniques, listener reactions, and communication dynamics through linguistic analysis enables us to develop inclusive and supportive environments for people who stammer.

We contribute to the expanding body of knowledge that promotes empathy, awareness, and fact-based support for those affected by this complex communication disorder by conducting this extensive investigation of the linguistic aspects of stammering. The results of this study will offer insightful information that can guide the creation of targeted interventions, support systems, and language therapy programs catered to the specific linguistic difficulties faced by Hindi-speaking people who stammer. Our quest for linguistic understandings of stammering ultimately aims to empower people to communicate more fluently, confidently, and socially, fostering a more accepting and understanding society.

### **5.1 Linguistic analysis of stammering**

Researchers examined the language and speech patterns of PWS to find out linguistic features of stammering. Research has shown that stammering is characterized by disruptions in the normal flow of speech, such as repetitions, prolongations, and blocks. These disruptions can occur at various levels of language structure. We did phonological (the sound patterns of a language),

morphological (word formation), syntactic (sentence structure), semantic (meaning), and pragmatic (Meaning in context) analysis of the data. For linguistic analysis, we recorded, transcribed, and partially annotated spoken language data to study the stammering trends. Diary study data and 1:1 interview with participants helped us get semantic and pragmatic insights significantly.

### **5.1.1 Phonological analysis**

Phonological analysis of stammering involves the examination of the sound patterns of speech in individuals who stammer. This can include looking at issues such as difficulty producing certain speech sounds, difficulty coordinating the movements of speech muscles, and difficulty with the timing and rhythm of speech. Research has shown that individuals who stammer often have difficulty with the production of certain speech sounds, particularly those that are not common in their native language. They also tend to have difficulty coordinating the movements of their speech muscles, which can result in repetitions, prolongations, and blocks in speech. Additionally, individuals who stammer may also have difficulty with the timing and rhythm of speech, which can result in disruptions in the normal flow of speech. Research has shown that individuals who stammer tend to have difficulty coordinating the movements of their speech muscles, which can result in repetitions, prolongations, and blocks in speech. They may also have difficulty with the timing and rhythm of speech, which can result in disruptions in the normal flow of speech.

- **Effect of sound prolongation on meaning in Hindi**

PWS use prolongation technique as a part of their therapy to avoid stammering and to increase fluency. Vowel length is a phonemic feature in Hindi, it is perceived as duration of sound. Studies have shown that increase in vowel length may sound unusual to a listener, but it does

not always change the meaning in English (Martin et al., 1984). In Hindi altering vowel length leads to meaning changes (Kachru, 2006). To some extent these meaning changes can be discerned based on the context, semantic and pragmatic properties of preceding words, but it leads to increased ambiguity and defeats the purpose of successful communication.

<b>Intended word</b>	<b>Pronounced word</b>
kəm (Less)	kɑ:m (Work)
ʃɪkənɑ: (To stay)	ʃɪkɑ:nɑ:(To host someone)
ʃɛgənɑ:(wake up)	ʃɛgɑ:nɑ:(To wake someone up)
kər (Do)	kɑ:r (Car)
ləʃ (Addiction)	lə:ʃ (Leg)

**Table 2: Difference in Intended and perceived words**

- **Syllable structure of words**

Monosyllabic and disyllabic words together contributed 51%, while Trisyllabic words had over 37% stammering instances alone.

<b>Syllable length</b>	<b>Stammering contribution</b>
Monosyllabic	20%
Disyllabic	31%
Trisyllabic	37%
Tetrasyllabic and above	12%

**Table 3: Syllable classes basis their structure and class contribution in stammering**

- **Most frequent consonant sounds for stammering in Hindi**

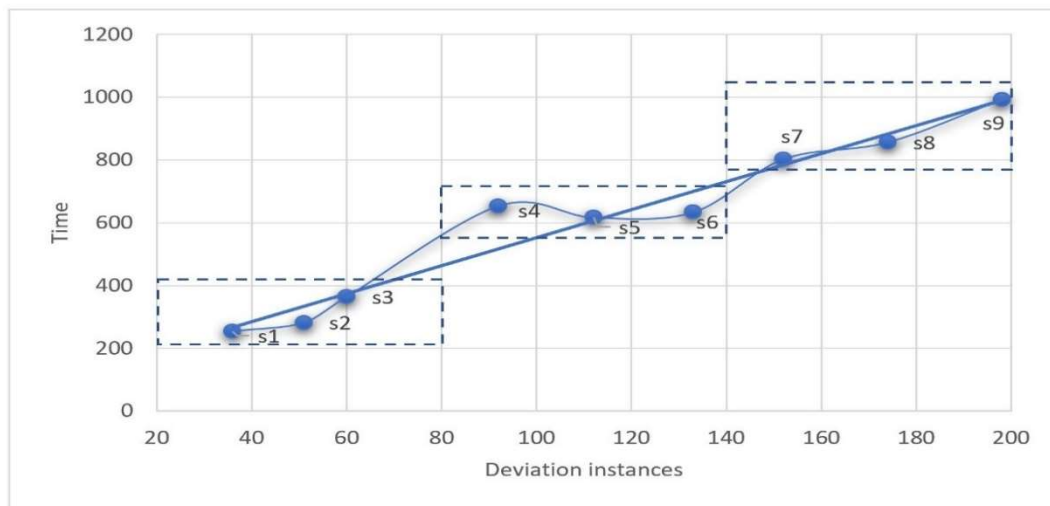
We found stammering instances on voiceless, voiced, aspirated, unaspirated and various other classes. Table 3 lists sounds with their properties. Participants faced problems in retroflex sounds often.

<b>Sound</b>	<b>Properties</b>
/k/	(voiceless, un-aspirated, velar, plosives)
/t/	(voiceless, un-aspirated, dental, plosives)
/s/	(voiceless, dental, sibilant)

/p/	(voiceless,un-aspirated, bilabial,plosive)
/j/	(voiced,un-aspirated,palatal,affricate)
/b/	(voiced, un-aspirated, bilabial,plosive)
/n/	(voiced, dental, nasal)
/r/	(voiced, un-aspirated, apico-alveolar, trill)
/v/	(voiced, un-aspirated, labio-dental, continuant)
/t/	(voiceless unaspirated retroflex postalveolar plosive)
/t <sup>h</sup> /	(voiceless aspirated retroflex postalveolar plosive)
/d, d̪/	(voiced unaspirated retroflex postalveolar plosive)
/d <sup>h</sup> /	(voiced aspirated retroflex postalveolar plosive)

**Table 4: Sounds and their phonetic properties**

Following analysis and findings are based on the linguistic and non-linguistic features from the annotated corpus.

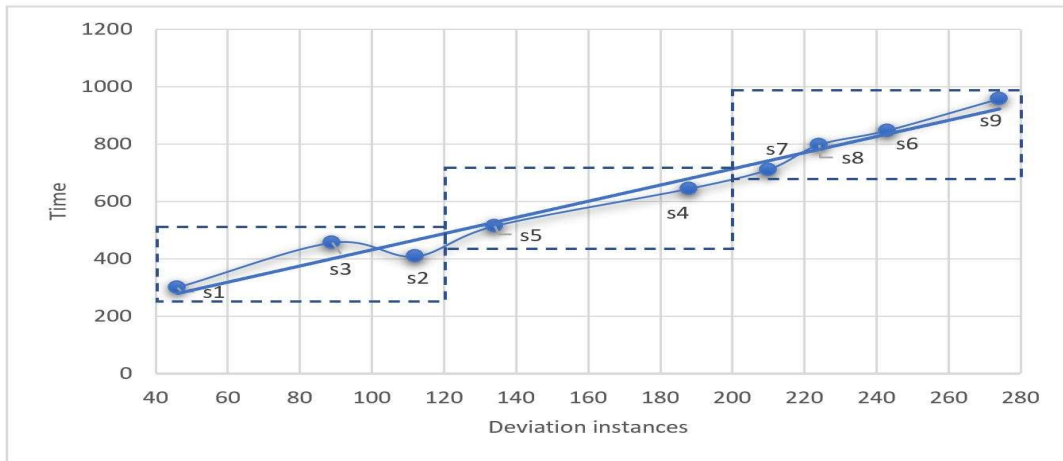


**Figure 2: Deviation instances in the non-random corpus**

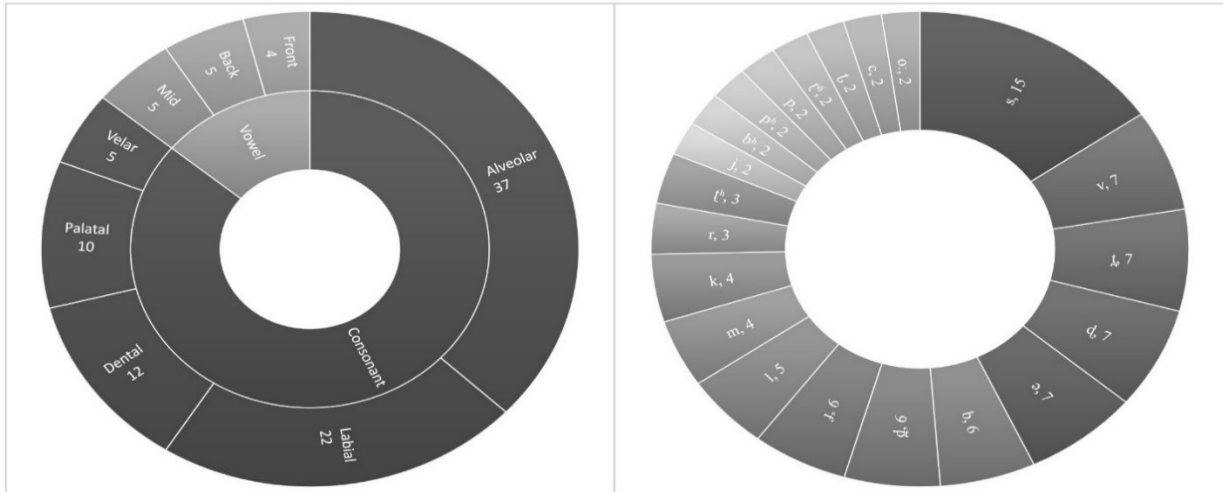
In Figure 2, we present insights derived from a non-random corpus. Speaker classification in this corpus is based on two parameters: one. Deviation instances, and two. The time taken to read non-random data comprising a total of 612 words. For clarity and comparison, we randomly selected three speakers from each category. The categorization is determined by deviation instances, with categories representing 20-80, 81-140, and 141-200 deviations, corresponding to mild, moderate,

and severe stammering traits. On average, speakers in these categories experience 5, 11, and 15 instances of stammering per minute, respectively.

In the case of the random corpus, we evaluated speech data encompassing a thousand words. Based on observed trends, speakers are classified into categories covering 40-120, 121-200, and 201-280 deviation instances in one thousand words. On average, speakers in these categories stammer 13, 17, and 20 times per minute, respectively. Notably, compared to deviation instances in the non-random corpus, there is an observed increase in the number of deviation instances for the same set of speakers, as we illustrate the same in Figure 3.



**Figure 3: Deviation instances in the random corpus**



**Figure 4: Deviation trends based on the phonetic analysis**

In Figure 4, we depict the trends in deviations at the phonetic level, focusing on the phonetic properties of word-initial sounds, which play a crucial role in stammering. The analysis reveals that 14% of stammering instances involve words starting with a vowel, while the remaining 86% have a consonant as the word-initial sound. Back, mid, and front vowels exhibit a similar distribution. Among consonants, significant contributors are alveolar and labial sounds, constituting 37% and 33% shares, respectively, whereas velar sounds have the lowest contribution at 5%.

Noteworthy contributors include /s/, /ə/, /d/, /t/, and /v/, collectively accounting for 42%. On the other hand, /o:/, /c/, /t/, /tʰ/, /p/, /pʰ/, /bʰ/, /j/, and /l/ have the lowest contributions, combining for 20%, with each individual sound contributing 2%.

Table 5 presents quantitative metrics derived from the syllabic analysis of speech data. Stammering instances involve words ranging from one to four syllables, with tri-syllabic words being the most prevalent contributors and tetra-syllabic words representing the smallest contribution in stammering instances.

S.N.	Syllabic structure	Syllable count	Consonant cluster count	Word length	Frequency	Example
1	CVCVCV	3	0	6	20	ʔəʔe:re:
2	CVCV	2	0	4	13	ka:ise:
3	CVC	1	0	3	9	ʒəg
4	CVCVCVC	3	0	7	8	ʔəma:ʔər
5	CVCVCVCV	4	0	8	9	ʔəɾəva:ʒa:
6	CVCVV	3	0	5	5	sunɑ:o:
7	VCVC	2	0	4	4	əʒi:ʔ
8	CVCVC	2	0	5	6	bʰəʒən
9	CVCC	1	1	4	4	səʔʒ
10	VC	1	0	2	2	ɑ:ʒ
11	VCVCV	3	0	5	2	ɑ:pəse:
12	CCV	1	1	3	2	kʒɑ:
13	CVCCVC	2	1	6	2	ʔʰəkkən
14	CVCCV	2	1	5	2	ʔumʒe:
15	CCVCVC	2	1	6	2	prənɑ:m
16	CVCVCVCVC	4	0	9	2	m <sup>n</sup> gələva:r
17	CCVCVCC	2	2	8	2	svəʔənʔr
18	CCVCVCC	2	2	7	2	svɑ:ʔiʔ
19	CCVV	1	1	4	2	kʒo: <sup>n</sup>
20	CV	1	0	2	2	ʒɑ:

Table 5: Syllabic Analysis

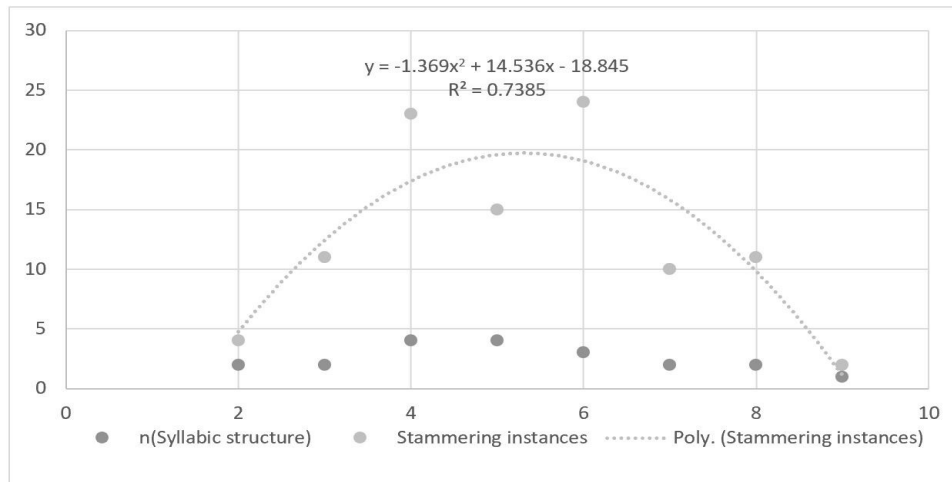


Figure 5: Deviation trends based on the word length

Tri-syllabic words with four different syllabic structures contribute to 35% of stammering instances. Di-syllabic words, with eight different syllabic structures, account for 33% of stammering instances. Mono and tetra-syllabic words, with six and two different syllabic structures account for 21% and 11% of stammering instances, respectively.

Consonant clusters have a small proportion in stammering instances as we see that just 18% of stammering instances have words with consonant clusters. In stammering instances, we found words with up to two consonant clusters appearing frequently. Words with single and double consonant clusters have a ratio of 77:23 in stammering instances due to consonant clusters.

Based on the syllabic analysis data in Table 5, we have plotted stammering trends based on the length of words and the syllabic structure distribution for the same in Figure 5. Grey dots show the frequency of stammering instances based on the length of words, and black dots show the number of sound sequence types based on the syllabic structure for a given sound sequence. We can see that the words with four to six sounds are the most significant contributors, with 62% share in stammering instances. This word group is the most diverse in terms of syllabic structure, as it consists of words with eleven types of syllabic structures, which is 55% of all syllabic structures found across speech corpus. Words with the length of two or nine sounds, which are also the lower and upper bounds in our data, are the lowest contributors with a combined share of 6% stammering instances. These have words with three types of syllabic structures which is 15% of all syllabic structures.

### **5.1.2 Morphological analysis**

We examined the way PWS form their words and use. We also took consideration of suffixes and prefixes. Research has shown that PWS often have difficulty with morphological processes such as inflection, derivation, and compounding. They may have difficulty with inflecting verbs for tense. They may also have difficulty with derivational processes, such as forming unfamiliar words by adding prefixes or suffixes. They may also have trouble with function words, such as prepositions, conjunctions, and articles, which are important for grammatical and syntactical correctness of a sentence.

- **Function words and content words**

Stammering can also affect the use of function words, such as pronouns, postpositions, and conjunctions which are important for grammatical and syntactic correctness of a sentence.

For preliminary study we broadly divided words into two categories: Content words and functional words. Content words are the open class words where words are increasing every day at a rapid rate. Functional words are closed class words where word counts are limited, and unfamiliar words do not appear often.

Our findings are in line with other research studies (Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981; Wingate, 1979), stammering instances were seen on content words more often in comparison to the function words. These content words were mostly nouns and verbs. With the age stammering instances start appearing more on content words rather than functional words (Brown, 1945)

- **Reduplication**

Hindi utilizes a process of reduplication for onomatopoeic word formations. There are three types of reduplication: Full reduplication, partial reduplication, and echo compounding. In full reduplication, the whole syllable is used twice to make a meaningful word. In partial

reduplication, either the first or second part of the resulting compound is semantically empty and cannot occur in isolation. In case of echo compounding, resulting compound copies the first part of the compound but initial consonant of the second part of the compound is always /v/ (Kachru, 2006). In our findings all research participants had stammering instances while pronouncing various types of reduplication words. Partial reduplication had the greatest number of stammering followed by echo compounding and full reduplication.

### **5.1.3 Syntactic analysis**

We examined the sentence structure and grammatical patterns of speech Hindi speaking PWS. This included looking at issues such as difficulty forming grammatically correct sentences, and difficulty with word order. Research has shown that individuals who stammer may have difficulty with syntactic processes, such as word order, phrase, and clause structure.

- **Word order observations**

Hindi has a somewhat free phrase order language, where change of phrase positions does not alter the meaning. Postpositions clearly mark the relation between different constituents that helps Hindi speakers to change constituents order as a linguistic device for focus and thematization. Although typically Hindi follows SOV (Subject, Object, Verb) order in regular conversations. In the text reading task, we did not observe any word order deviation as participants were guided by the text. But we observed word order deviations in natural conversation while talking to our research subjects. Participants interchanged verb and object positions making their conversation more like SVO (Subject, Verb, Object).

- **Phrase repetition**

Repetition is a typical characteristic that PWS use during the conversation to get some extra time to process the next phrases, it is an unintentional behavior. Generally, repetition happens at word and sound level, but we observed phrase level repetitions as well. All fifteen research participants repeated phrases and paused for longer duration at least three times during the 15 minutes conversation. Five participants repeated their sentence constituents 3-5 times, six participants repeated 10-15 times, three participants repeated their phrases 20-25 times while one participant repeated phrases over twenty-five times.

<b>Number of participants</b>	<b>Number of repetitions</b>
Five participants	3-5
Six participants	10-15
Three participants	20-25
One participant	Above 25

**Table 6: Number of participants and count of phrase repetitions**

#### **5.1.4 Semantic and Pragmatic analysis**

We examined the meaning of words and phrases used by Hindi PWS. We looked at issues such as difficulty with word choice. Research has shown that PWS may have difficulty with semantics. They may have difficulty generating words and phrases that are semantically appropriate.

We also examined Pragmatic aspects of language, such as initiating or maintaining conversations, understanding, or interpreting social cues, and using nonverbal communication appropriately. Stammering can also affect an individual's ability to communicate effectively in different social and cultural contexts, which can lead to social isolation and difficulties in work, school, and other areas of life. We got specific social and communicative contexts that are affected by stammering and revealed patterns in certain types of interactions or difficulty in certain social situations.

The Demands and Capacities Model (Adams, 1990) later renamed as The Demands and Performance model (Curlee, 2000) proposes that increased demand for one variable may affect performance of another variable. Clues for expressive as well as receptive language disorders were found in diary data provided by our research participants. Research participants reported that they often forget interpreting or expressing ‘negation’ while communicating especially over written mediums. Prima facie reports suggest that cognitively PWS may process negation markers differently and needs an independent study to verify the same.

SCD (Social communication disorder) (Topal et al., 2018) is characterized by issues in use of linguistic, paralinguistic, and non-verbal communication in a social setting. Out of fifteen participants, fourteen concurred that, if possible, they try to answer questions only using one worded reply, as they face difficulty in holding onto a conversation, especially in a social setting.

### **5.1.5 Socio-Linguistic Analysis**

The examination of speech data from individuals who stammer reveals a range of prominent sociolinguistic issues that intricately shape their communicative experiences. Central among these challenges is the existence of societal stigma and stereotyping, where prevailing norms regarding fluent speech contribute to misconceptions about the communication abilities of individuals with stammering. Consequently, these societal perceptions can impact self-esteem and self-perception. A noteworthy sociolinguistic hurdle is the potential for communication barriers and breakdowns, where disruptions in speech fluency create obstacles to effective interaction, leading to misunderstandings and heightened social discomfort. The societal emphasis on articulate communication further extends to perceptions of competence in

professional and academic realms, potentially hindering career, and educational advancements for individuals with stammering.

Moreover, the sociolinguistic impact of stammering is evident in the social anxiety and avoidance behaviors, as individuals may navigate heightened apprehension in social contexts where fluent communication is emphasized. This anxiety may manifest in the avoidance of certain social situations, limiting opportunities for personal and professional development. Stammering also exerts influence on interpersonal relationships, introducing potential challenges in communication dynamics among friends, family, and peers. In professional environments, individuals with stammering may encounter workplace discrimination or a lack of understanding, especially in the absence of inclusive policies. This can restrict opportunities for career growth and advancement. Cultural attitudes towards speech and communication further contribute to the sociolinguistic experience, with varying degrees of acceptance impacting social integration. Additionally, the portrayal of stammering in the media plays a crucial role in shaping public perceptions and awareness. Positive and accurate representations can contribute to destigmatizing stammering and fostering a more supportive societal environment.

The availability and effectiveness of support systems, including family, friends, and advocacy groups, significantly influence the sociolinguistic experiences of individuals with stammering. Advocacy efforts are instrumental in raising awareness and promoting societal understanding. In educational settings, individuals who stammer may encounter challenges related to participation and assessment. The implementation of accommodations and the awareness of

educators regarding the sociolinguistic implications of stammering are pivotal in fostering an inclusive learning environment.

## 5.2 Conclusion

In this chapter, we delved into the layers of linguistic analysis, exploring phonological nuances, morphological structures, syntactic arrangements, semantic connotations, as well as pragmatic and socio-linguistic dimensions. Our examination has unveiled linguistic patterns in the research domain. As we pivot towards the next chapter, we now transition from the theoretical framework to practical implementation. The chapter undertakes a paradigm shift, steering the discourse towards the dynamic landscape of computational experiments. Building upon the foundational linguistic insights gained, our exploration now extends into the digital domain, where algorithms and computational models come to life, offering a unique perspective that bridges theory and application.

