PROJECT REPORT

DEVELOPMENT OF SENTENCE TEST FOR SPEECH RECOGNITION IN HINDI

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Abstract

Objective: The aim of the study was to develop a test material in Hindi for assessing sentence recognition threshold in noise. *Design:* The study was conducted in two phases. First phase involved three experiments. First experiment involved the collection and recording of sentence material. In the second experiment, sentence perception was assessed at five signal-to-noise ratios (SNRs) for equalization of sentence material. In the final experiment using numerical optimization procedure 20 different lists with 10 sentences each were formulated. The second phase of the experiment also involved three experiments. The first experiment was aimed at assessing sentence identification scores for each list at -8 dB and -2 dB SNR. In the second experiment, SNRs for 50% correct sentence score was estimated. In the third experiment developed list was administered on clinical population. *Study Sample:* Total of 130 native speakers of Hindi participated in the study. Thirty listeners with normal hearing sensitivity participated in the first phase of the experiment , 80 listeners with normal hearing sensitivity and 20 listeners with hearing loss participated in the second phase of the experiment. *Results:* Twenty optimized lists were formulated. Lists were found to be of equivalent difficulty in normal-hearing listeners. The average SNR 50 (the signal-to-noise ratio for a 50% sentence score) was -4.56 dB with a standard deviation of 0.45 dB. The clinical utility of the test was also assessed on individuals with mild and moderate degrees of hearing loss. *Conclusions:* The developed test provides a valid and reliable means of measuring sentence recognition thresholds in noise for native speakers of Hindi.

CHAPTER 1

Introduction

Hearing is the physiological process of perceiving sound. It is measured to determine the extent and type of any hearing loss. These measurements can be used to make decisions on rehabilitative and other support measures (Hersh & Johnson, 2003). Hearing assessment also contributes to the identification of medical conditions, tumors or other diseases of the auditory system (Hersh & Johnson, 2003).

A number of audiological tests have been found to be useful in the identification and diagnosis of hearing problems. These include Pure-tone audiometry, Speech Audiometry (Speech awareness threshold, Speech-recognition threshold & Speech identification score), tests to assess middle ear functions like Tympanometry and Acoustic reflex threshold, Auditory brainstem response (ABR), Otoacoustic emissions (OAEs) etc. The method used may depend on the age of the individual or other subject and environmental related factors.

The most commonly used procedure for assessment of hearing has been reported to be the determination of the threshold of audibility, more specifically pure-tone audiometry. Thresholds for pure tone has been shown to vary in an individual by up to 5 dB from day-to-day and from determination-to-determination (Water & Staecke, 2005). Despite the small variations, it has been found to be a useful tool for identification of problems related to audibility for individuals with several pathologies.

In spite of its usefulness in the assessment of hearing sensitivity, pure-tone audiometry provides only a partial picture of the patient’s auditory abilities as it does not give any information about one’s ability to understand speech. Pure-tone audiometry does not talk about the communication ability or lack of it in a person. A better idea about one's understanding of day-to-day conversation may be provided by speech audiometry. As speech is the mode of everyday communication, it is likely to provide a true index of a person's performance in his daily living.

Speech audiometry has been an essential component of the audiological test battery for ages, as it provides information concerning one's sensitivity to speech stimuli and the understanding of speech at suprathreshold levels. Speech audiometry has become a fundamental tool in audiological assessment, and it has been used diagnostically to examine speech processing abilities throughout the auditory system. In addition to the assessment of difficulties in communication, speech audiometry has also been found to be useful in finding out the type and degree of hearing loss, a hearing aid selection, identifying functional hearing loss and the site of lesion. Speech Audiometry has also been found to take less time than pure-tone audiometry (Kutz, Mullin & Campbell, 2010).

Speech audiometric tests include Speech Awareness Threshold (SAT), Speech Recognition Threshold (SRT) and Speech Identification Score (SIS). Speech-Awareness Threshold (SAT) is also known as Speech-Detection Threshold (SDT). The objective of this measurement is to obtain the lowest level at which speech can be detected at least half of the time (Hain, 2012). During the SAT, the patient's task has been suggested to be merely for an indication of hearing the sound. Speech materials usually used to determine this measurement are certain standardized words or phrases. This is merely an awareness test and therefore does not provide information regarding a person's ability to understand speech. There are other tests like SRT or SIS that have been found to give better indication about an individual's ability to perceive and understand speech.

The objective of speech-recognition threshold is to obtain the lowest level at which speech can be identified at least half of the time. SRT can be measured using speech stimuli such as nonsense syllables, monosyllables, spondees, sentences etc. Nonsense syllables have been reported to be the most difficult to recognize (McArdle & Hnath-Chisolm, 2009). They have been reported to have minimal semantic content and give very little information about the auditory disability and handicap that an individual experiences in everyday life (Gatehouse & Robinson, 1997).

Monosyllabic words have also been used for the assessment of speech recognition. However, Giolas and Epstein (1963) stated that monosyllables provide diagnostic but not prognostic values, as it does not approximate how an individual understands conversational speech. Cox, Alexander and Gilmore (1987) reported no relationship between the monosyllable recognition threshold and hearing aid benefits. They attributed it to be a lack of lexical, semantic, syntactic redundancies, and dynamic cues in monosyllables.

Spondee words have been reported to be used frequently in the clinical setting to measure SRTs because they are faster and easier to administer (Carhart, 1965) and also used to confirm the pure tone audiogram (Scourfield, 2011). But spondees are believed to be less representative of natural language communication than sentences and are spoken as isolated utterance or in carrier phrases. Hence they may not represent the normal spectral weighting, level fluctuations, intonations, pauses and other aspects associated with conversational speech (Nilsson, Soli & Sullivan, 1994). Moreover, the limited number of spondees together with the risk of familiarization and learning effect associated with randomization and reuse of the same items has been shown to prevent measurements and comparison of performance in multiple experimental or clinical conditions (Nilsson, et al, 1994). Furthermore, word tests are not suited for more advanced testing and fitting of hearing aids, since the compression and the noise reduction algorithm do not take full effect with isolated single words (Nilsson, et al, 1994). These limitations underscore the need for sentence length test materials that can be used to measure SRTs.

Thus sentences will be more advantageous than any of the other stimuli, as the day-to-day conversation majorly involves the use of full length sentences. Some of the sentence materials developed are Central Institute for the Deaf (CID) sentences in English (Silverman & Hirsh, 1955), Hearing in Noise Test (HINT) sentences in English (Nilsson et al., 1994), German (Kollmeier & Wesselkamp, 1997), Cantonese (Wong & Soli, 2005), Swedish (Hallgren et al, 2006), French (Vaillancourt et. al., 2005), Mandarin (Wong et al., 2007), Polish (Ozimek et al, 2009), Kannada (Avinash et al, 2009) and Afrikaan (Scourfield, 2011).

Need for the study

The present study was carried out in order to develop material in Hindi language for speech recognition testing. It will help to assess the identification ability of individuals using hearing aid and cochlear implant. It will be useful in assessing the efficacy of therapy, that is, by doing pre and post therapy evaluation, helps to conclude about the usefulness of the therapy.

Need to develop Sentence test.

Pure tone audiometry measures the audibility component of hearing loss (Wilson & McArdle, 2005) but cannot predict the successful use of amplification (Walden & Walden, 2004) or signal to noise ratio loss. So it is advisable to go for audiological tests which uses speech stimuli. Monosyllables and spondees gives limited information about the speech perception ability as it lacks lexical, semantic, syntactic redundancies, and dynamic cues. Sentences provide information regarding the time domain of everyday speech and can approximate contextual characteristics of conversational speech (Jerger, Speaks & Trammell, 1968). Brinkmann and Richter (1997) stated that the sentences provide additional information on the ability of participants to understand speech in daily life and have proved to be a useful tool, especially for the selection of a suitable hearing aid. It was reported that the tests using sentences as stimuli have much higher face validity than tests using single words as stimuli (Nilsson et al, 1994).

Moreover the discrimination function (often referred as performance intensity curve) has been steeper for sentence material than for shorter speech segments and thus provide a very accurate measurement of a speech recognition threshold (Bosman & Smoorenburg , 1995 ; Kollmeier & Wesselkamp , 1997). There are several limitations in using sentences over other speech stimuli. There is no possibility to test the same sentence twice with the same subject. Low frequency components are given higher weightage than high frequencies in the speech spectrum compared to monosyllables (Kollmeier & Wesselkamp, 1997). Many sources of information, such as acoustic and contextual cues, are used to understand sentences and they have many extrinsic redundancies. These characteristics make it harder to predict which specific information is being used by the listener, as so many sources of information are involved (McArdle & Hnath-Chisolm, 2009). Lyregaard (1997) found that the sentence test therefore, measures a hearing deficiency only partly at the peripheral level and thus can be considered as a measure of a combination of linguistic competence and central processes. Despite the pitfalls, the day-to-day conversation majorly involves the use of full length sentences and hence speech recognition testing should be more aptly performed using the sentence material.

Need to develop sentence material in Hindi.

Speech material for SRT tests has to be similarly intelligible across sentences, and across lists. In terms of phonetic, syntactic and semantic complexity, the different lists, and the sentences composing the lists should thus be comparable (Raake & Katz , 2006). Such sentence material has been developed in several languages as mentioned earlier and cross-language researches have indicated that some speech contrasts present greater perceptual difficulty for adult non-native listeners than do others. This perception difference is seen in both infants as well as adults (Polka, 1992; Tsao, Liu & Kuhl, 2006). However, there is an obvious dearth of sentence materials in Indian languages. In India, as there are a number of languages spoken by people all around, it is ideal to have a speech test in all languages, as the perception of speech is influenced by their first language (Singh & Black, 1966). Thus, Hindi being the most used Indian language, there is a need to develop the sentence material in this language.

Need to develop sentence test in the presence of noise.

Speech recognition in noise will provide insight into the difficulty faced by individuals in understanding speech in the presence of background noise and will also be helpful in accounting for the benefits from amplification. This information would be further helpful in counseling patients regarding their expectation about the benefits from hearing devices when listening in background noise (Wilson & McArdle, 2005). The only measure to determine the SNR loss is by speech in noise testing. Taylor (2003) stated that this measurement provides a percentage score, which is more easily understood by patients than degree of hearing loss.

Wilson and McArdle (2005) reasoned the use of speech in noise testing for three main purposes. First, it assesses the most common complaint of patients, which is, their inability to understand speech in background noise. Second, it provides insight into the most appropriate amplification strategy for the patient. Third, its result can be used while counselling patients regarding their expectation about the benefit of a hearing aid when listening in background noise.

Aim of the Study

To develop sentence test for speech recognition threshold in the presence of noise in Hindi language.

Objectives of the study

The objectives of the present study are as follows:

- To develop the sentence test in Hindi language for speech recognition testing.
- To standardize/ validate the developed sentence test in the presence of noise.
- To investigate the utility of the developed test across clinical populations, including individuals with conductive hearing loss and sensorineural hearing loss.

CHAPTER 2

Method

The study was conducted in two phases. The first phase involved the development of sentence material. In the second phase validation of this developed sentence material was done on individuals with normal hearing sensitivity and on individuals across clinical populations, including individuals with conductive hearing loss and sensorineural hearing loss. All the subjects involved in the present study were native speakers of the language.

The listeners who participated in both the phases of the study were divided into group I, II and III. The group I consisted of individuals who had normal hearing and criteria for selection of individuals in Group I was:

- No history of middle ear infection, tympanic membrane perforation, head trauma, noise exposure and ear discharge.
- Subjects with pure-tone thresholds less than 15 dB HL for octave frequencies between 250 Hz to 8000 Hz for air conduction and 250 Hz to 4000 Hz for bone conduction. The pure tone threshold was obtained by using a modified version of Hughson and Westlake procedure (Carhart & Jerger, 1959).
- Speech recognition scores ± 12 dB with reference to pure tone average (PTA).
- Speech identification scores greater than 90% in both the ears.
- Bilateral ‘A’ type tympanogram with ipsilateral and contralateral reflexes present in both the ears. During this testing subjects were made to sit comfortably and asked not to swallow. Tympanometry was carried out

with 226 Hz probe tone and ipsilateral and contralateral acoustic reflex were obtained at 500, 1000, 2000 and 4000 Hz.

- No illness present at the time of testing.

The participants who were studied in the second phase of the study had conductive and sensorineural hearing loss and were categorized as Group II and III. Group II included nine individuals with conductive hearing impairment and inclusion criteria for Group II was:

- Pure tone threshold greater than 16 dB HL and less than 60 dB HL.
- Air bone gap of more than 10 dB with bone conduction threshold within 15 dB HL from 250 Hz to 4000 Hz.
- Middle ear dysfunction as indicated by immittance evaluation.
- Speech identification scores proportionate to their pure tone average (not less than 75%).
- No history of any neurologic problems.
- No illness on the day of testing.

Group III included 10 individuals with sensorineural hearing impairment and inclusion Criteria for Group III was:

- Pure tone threshold greater than 16 dB HL and less than 60 dB HL.
- Air bone gap of less than 10 dB.
- A normal middle ear functioning as indicated by immittance evaluation.
- Speech identification scores proportionate to their pure tone average (Not less than 70%).
- No history of any otologic, neurologic problems.

- No illness on the day of testing.

Instrumentation

The instruments involved in both the phases of the study include

- A calibrated two channel audiometer with TDH 39 headphone with MX-14 ear cushion and Radio ear B-71 bone vibrator was used to estimate air and bone conduction thresholds respectively.
- A calibrated immittance meter, GSI-Tympstar to assess middle ear functioning using tympanogram and acoustic reflexes..
- A personal computer loaded with TOKEN software and a compatible headphone was used for the purpose of equalization of the stimuli. Apex software was also loaded into the PC to estimate SNR 50.
- Tucker-Davis Technology (TDT) was used for the levelling of the stimulus.

Test environment

All the audiological tests were administered in a well illuminated air conditioned sound treated room with noise levels within permissible limits as per ANSI S3.1 (1991)

Phase I

Phase I involved three experiments, first experiment comprised of collecting and recording suitable sentences in Hindi; second experiment consisted of selecting the sentences that were equally intelligible in noise, and the final experiment involved making of optimum lists with equal difficulty.

Experiment I

a. Collection of Sentence Material

The aim of Experiment-I was to collect suitable sentences in Hindi for the assessment of speech recognition in noise. The available literature shows that there are no formally standardized sentence tests or suitable sentence collections in Hindi. Therefore, 650 sentences were collected from children's textbooks, magazines and day to day conversation. The following criteria were used in the selection of the sentences (Versfeld et al, 2000): (1) The sentence chosen composed of three to seven words (2) The total number of syllables in a sentence ranged from eight to nine. (3) Any of the words in a sentence did not contain more than three syllables. (4) Sentences did not contain punctuation characters and proper names. (4) No duplicate sentences were selected and (5) The sentences were grammatically and syntactically correct and semantically neutral. The structure and the grammatical difficulty of the sentences were kept as similar as possible. Semantic neutrality was achieved by avoiding material related to politics, war, or gender topics. Questions, proverbs, proper names, and exclamations were eliminated.

The naturalness of these sentences was evaluated by administering it on ten native Hindi speakers who were asked to rate the naturalness of the sentences on a five point rating scale and the predictability on a three point rating scale (Appendix 1). Only those sentences that were rated '4' or '5' on naturalness rating scale and '2' or '3' on the predictability rating scale by $\geq$ 80 % of individuals were selected for recording. A total of 512 sentences were selected after naturalness and predictability rating.

b. *Recording and Editing of Sentences*

The selected 512 sentences were recorded digitally in a sound-proof booth, using a Computerized Speech Lab (CSL) at a sampling rate of 44.1 kHz with 24-bit resolution. A microphone was placed 20 cm from the speaker's mouth and the speaker was informed to articulate all words clearly, while still retaining a natural intonation pattern and maintaining equal vocal effort throughout each sentence. These sentences were spoken by a young adult female, who was a native speaker of Hindi, in a standard Hindi dialect among the many dialects present in Hindi (standard and non-standard). These sentences were high-pass filtered at a cutoff frequency of 50 Hz slope of the filter and split into individual waveforms, where unwanted silences preceding and following the recorded speech were eliminated. The resultant waves were saved as dot wave (. wav) file. All the individual wave files were adjusted to an average Root Mean Square (RMS) level of -20 dB (with respect to maximum digital output) with maximum peak levels of approximately -5 dB. The files were edited using Adobe Audition (Version 3.0) software.

c. Generation of Background Noise

A speech spectrum shaped background noise was generated to match the long-term average spectrum of the sentence material. In the presence of speech spectrum shaped noise, slope of the psychometric function for sentences is maximized, hence the accuracy of the Speech Recognition Threshold normative (SNR 50) determination is high (Prosser et al, 1991). Further, the average SNRs across frequencies were similar to the speech spectrum shaped noise. However, it is expected that SNR will show some variation across the frequency spectrum due to the varying duration of different speech sounds. For example, for short and intense high-frequency consonants, the mean level of these speech sounds (which is by definition is the level in the speech-shaped noise) will be relatively low due to their short duration, however when truly present in the speech signal, they will have a level well above the mean.

The noise was generated using the randomizing phase of the Fourier spectrum of concatenated sentences. The sentence sound files were concatenated in random order and Fast Fourier Transformer (FFT) was performed for these concatenated sentences. The phase of the FFT was randomized and converted back to wave file by means of inverse FFT. The noise generated had only little amplitude variation and a frequency spectrum that corresponded with the long-term average spectrum of the sentences. The RMS level of the noise was matched to the same level as the sentences. The one third octave spectra of noise and concatenated sentences are presented in figure-1.

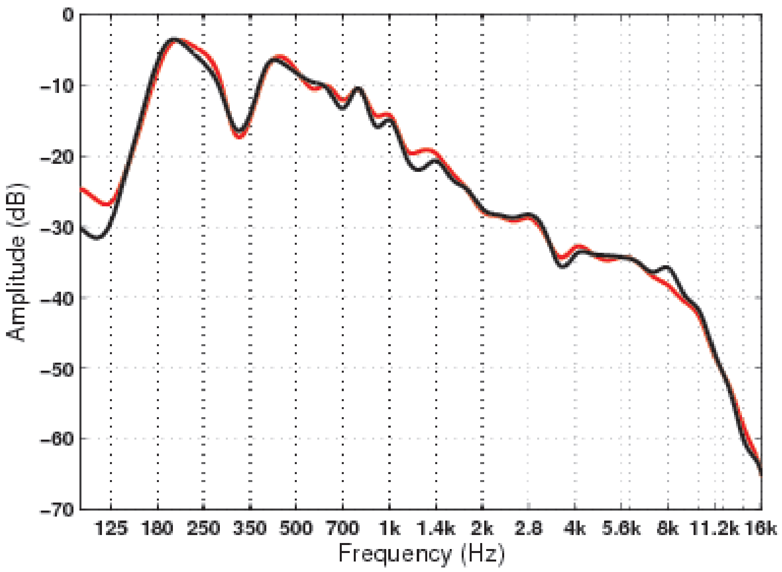

Figure 1. One third octave spectrum of noise (black) and concatenated sentences (red).

Experiment II: Equalization of intelligibility of sentences

The second experiment was aimed at selecting the sentences that were equally intelligible in the presence of noise. This was ensured through the selection of sentences that yielded similar performance and psychometric function (percentage intelligibility as a function of SNR) in the presence of noise.

a. Stimuli

The stimuli consisted of a corpus of 512 sentences and the corresponding speech-shaped noise. Each sentence was digitally mixed with speech spectrum-shaped noise at required SNR using the MATLAB code. The noise onset preceded the onset of a sentence by 600 ms and continued till 600 ms after the end of the sentence. The noise was ramped using the Cosine square function with ramp duration of 200 ms. The onset of the noise before the speech is believed to guard against unintended onset effects. A similar protocol has been used for determination of normative data for the development of sentence material in various languages (Neilson & Dau, 2009).

b. Procedure

A pilot experiment was conducted initially to decide the value of SNR at which 50% identification score was achieved. This was assessed by presenting the entire collection of 512 recorded sentences to four subjects with normal hearing sensitivity (Group I) in the presence of -6 and -4 dB SNR. The level chosen here is in accordance with the findings of previous investigators (Kollmeier &Wesselkamp, 1997; Nilsson et. al., 1994; Vaillancourt et. al., 2005). The mean percentage of intelligibility was calculated at each SNR for each sentence and an overall mean of all the sentences was calculated based on the number of correctly repeated words. It was observed that 50% score was obtained at around -4 dB SNR and thus for the equalization procedure, the SNRs selected were -8 dB, -6 dB, -4 dB, -2 dB and 0 dB.

Later equalization was done on 25 subjects with normal hearing sensitivity (Group I). Each subject was seated in a sound-proof room with the test administrator (a qualified Audiologist). One subject was tested only at one SNR using all the sentences and a total of 5 subjects were tested at each SNR. The sentences were assigned to nine different play lists and the order effect was counterbalanced by testing each subject with a different list each time. The sound files were presented using TOKEN software and routed through the Tucker Davis Technology system using auxiliary input. They were played using a sampling rate of 44.1 kHz with 24-bit resolution. The sound was presented binaurally, using standard Sennheiser-HD 200A headphones as transducers at an intensity of 70 dB SPL. Sennheiser-HD 200A headphone was used as it has a wider frequency resolution. No sentence was presented twice and presentation of playlists was controlled by the test administrator. Breaks were given at appropriate intervals to prevent the influence of fatigue on the results. The subject's task was to repeat the heard sentences or parts of sentences verbally every time. They were also encouraged to guess the content if uncertain.

Overall, five data points (percentage of words repeated correctly) were selected to give good psychometric function. The SNRs selected in the study covered the extent of the psychometric curve and were adequate to provide reliable estimates of the psychometric curve slopes. The five data points for each sentence were used to derive sentence-specific psychometric function with a logistic shape fitted to the data. The logistic function fitted to the data is as follows:

$$S(L) = \frac{100}{1 + e^{\frac{-(L-L_{50})}{s}}}$$

The parameter '*L*50' denotes the level corresponding to 50% intelligibility for each respective sentence and '*S'* denotes the spread of the psychometric function which is inversely proportional to the slope '*m' of* the psychometric function (S=*25/m*). Due to the careful selection of the 5 SNRs for testing all the sentences, a reliable fit of the psychometric function could be obtained. A subset of sentences with similar psychometric slopes and SNR 50 were then selected. Sentences with slopes and SNR 50 that fell within one standard deviation of the mean were used in subsequent phases.

The majority of previous investigators has used performance-intensity slope as a guide to adjust the RMS intensity required to equalize the difficulty of all the sentences in the collection (Soli & Wong, 2008). Whereas, in the present study, performance-intensity slopes (i.e. Similar intelligibility at other SNRs as well) and SNR 50 (similar SNR at the 50% intelligibility point) were employed to select sentences for further testing. The present test was developed to estimate the SNR required to obtain 50% intelligibility. However, the SNR at which 50% intelligibility is obtained was unknown at this stage of the test development, because the final testing was conducted using an adaptive procedure with a whole sentence scoring of 1 or 0 instead of scoring the number of words correctly identified. It was necessary to ensure the uniformity of the selection of sentences not only at the SNR 50 point, but also across the extent of the psychometric curve, so that the sentence lists could be compiled from a relatively uniform collection of sentences.

Experiment III: Composition of Optimized lists

The selected sentences in previous phase were grouped into 20 lists of equal difficulty with each list consisting of ten sentences. The procedure of equalization was similar to the procedure implemented by Kollmeier & Wesselkamp (1997). The equal difficulty lists were constructed by optimization of SNR 50 and spread '*S*' obtained from psychometric functions in addition to the number of phonemes and the frequency distribution of the 36 different phonemes within the sentence material. Thus in total, there were 39 parameters (36 phonemes + SNR 50 + spread 'S' of psychometric function) that needed to be optimized. The optimization was accomplished using a numerical optimization procedure (Otten & van Ginneken, 1989). The actual parameter values of all 200 sentences were placed into a vector P_j (j=1-200). The average values of SNR 50, *S*, the number of phonemes and frequency distribution across all 200 test sentences were placed as the ''desired'' value into the vector 'V'. In addition, a vector 'g' of weighting factors was defined which determined the priority of the parameters to be optimized by the algorithm. The algorithm tried to optimize the 'important' parameters SNR 50, S and number of phonemes with higher priority than the frequency distribution of the phonemes. The minimization algorithm, thus, had to minimize the function.

$$\mathrm{d} = \sum_{k=1}^{20} \left|\left|g \times (p_j - v)\right|\right|$$

The global minimum of 'd' was obtained by randomly selecting a set of 10 sentences from the list of 200 sentences with the optimization algorithm. These 10 sentences, which achieved a global minimum of '*d'*, were grouped as one list and were permanently deleted from the total of 200 sentences and the optimization process was repeated until 20 lists were formulated.

Phase-II: Empirical validation of the test material

In order to validate the test material optimized in Phase I of the study, three independent experiments were performed. The first experiment was aimed at assessing sentence identification scores for each list at -8 dB and -2 dB SNR. In the second experiment, signal-to-noise ratio for 50% correct sentence score was estimated using the adaptive procedure on individuals with normal hearing sensitivity. In the third experiment signal-to-noise ratio for 50% correct sentence score was estimated using the adaptive procedure for individuals with conductive and sensorineural hearing loss.

Experiment I

Method

Another set of forty subjects aged between 20 to 30 years (20 males & 20 females) with normal hearing sensitivity participated in this phase of the study (Group I). The stimuli, instrument, and general test protocol used in this phase of study were the same as those used in Phase I of this study. Each subject randomly listened to all the 20 test lists at a signal-to-noise ratio of -2 or -8 dB and thus 20 subjects were tested at each SNR. This was done in order to distribute the effect of subject and test list evenly across the two signal-to-noise ratios employed.

In all the earlier experiments, scoring was performed by counting the number of content words, which provided a percentage intelligibility score for each separate sentence. The use of the optimization procedure in the present study ensured for all sentences which allowed the use of the whole sentence scoring instead of scoring for content words alone. The test administrator assessed the correctness of the sentence by assigning numerals ‘1’ or ‘0’ for correct or incorrect repetition of the sentence respectively.

Experiment II

Method

In experiment II, all the test lists were subjected to inter-list equivalence evaluation. Listeners in this experiment were also asked to follow the same criteria stipulated for participants in Phase I of the study. Another set of 30 listeners (14 males, & 16 females) who had an average age of 24 years (ranging from 19 to 28 years) with normal hearing sensitivity participated in experiment II (Group I). Speech recognition threshold in noise (SNR 50) was measured, in an acoustically treated room. Stimulus presentation was controlled using the APEX 3.1 program and was routed through the Tucker Davis Technology (TDT) system using auxiliary input and they were played at a sampling rate of 44.1 kHz with 24-bit resolution. The sound was presented binaurally, using standard Sennheiser-HD200A headphones as transducers, at an intensity of 70 dBSPL. The APEX 3.1 is a freely available software and can be uploaded into any PC. This was used as this allows for the random presentation of the stimulus and the scoring is also done by the software which makes it very objective. TDT was used so as to maintain the output level of the sentences at one level (70dBSPL).

The adaptive up-down procedure (Plomp & Mimpen, 1979) was employed, where the first sentence in a list was presented at an SNR that would result in recognition below 50% (-8 dB in this case). The same sentence was repeatedly presented at higher SNR levels by increasing (improving) in 2 dB steps until an entire sentence repetition was achieved. The test administrator compared text version of the sentence with the listener's repetition and the sentence was rated as correct, if all the words in the sentence were repeated correctly. Once the first sentence was correctly repeated, the next sentence was presented at the same SNR. The presentation levels of subsequent sentences were determined each time by the correctness of the preceding sentence's repetition. If a sentence was repeated correctly, the following sentence was presented at a lower SNR (speech level decreased by 2 dB with noise levels kept constant). If a sentence was repeated incorrectly, the following sentence was presented at a higher SNR (speech level increased by 2 dB). After the presentation of 10 sentences, the software calculated the SNR 50 (threshold level of SNR where 50% intelligibility would be obtained) as an average of the presentation levels of the fifth to eleventh sentences (even if an eleventh sentence was never presented, its presentation level could be determined according to the correctness of the tenth sentence's repetition). Although, the SNR 50 obtained using the above procedure might differ from that obtained using the word scoring procedure, it is unlikely to affect the reliability of the test material. All the list was presented to each subject and the presentation of the test lists was randomized.

Experiment III

In experiment III clinical utility of the developed list was assessed. Listeners in this experiment were also asked to follow the same criteria stipulated for participants in Phase I of the study. Thus another set of nineteen individuals with (sensorineural and conductive) hearing loss aged between 18 to 70 years (Mean=28. 9 years) participated in the study. The degree of hearing loss consisted of mild and moderate categories (based on modified Goodman classification, 1965). Subject selection criteria are as mentioned for Group II and III. SNR 50 was estimated using the same procedure as mentioned in experiment II on individuals with hearing loss. A total of 19 individuals were tested which included four mild and five moderate conductive hearing loss and similarly five mild and five moderate for sensorineural hearing loss.

Statistical Analysis

Statistical Package for the Social Sciences (version 16) software was used to carry out the statistical analysis.

- Descriptive statistics to find out the Mean score and Standard Deviation of the developed lists.

- Repeated measure ANOVA was done to check the inter list equivalency between the lists.
- Chi square test was done to compare the phoneme distribution of the developed lists with that of the average reference phoneme distribution.
- Kruskal-Wallis statistical analysis was done to evaluate the difference in means for different types of hearing loss.
- Mann-Whitney U test was done to assess the difference between normal hearing, conductive and sensorineural hearing loss and between the degree of hearing loss.
- The Friedman test was performed to estimate the difference across lists for hearing impaired group.
- Wilcoxon Signed Ranks Test was performed to analyze the significant difference between list for the senosrineaural hearing impaired group.

CHAPTER 3

Results

The present study was aimed to develop and validate a sentence list in Hindi. To fulfil the aim of the present study data was collected on subjects with normal hearing sensitivity and subjects with conductive and sensorineural hearing loss. Data obtained from the subjects were tabulated and analysis was done using statistical package for social sciences (SPSS) software version 17. The results of the present study will be discussed under the following headings:

Phase I

Phase I involved three experiments, first experiment comprised of collecting and recording suitable sentences in Hindi; second experiment consisted of selecting the sentences that were equally intelligible in noise, and the final experiment involved making of optimum lists with equal difficulty.

Experiment 1 of the phase 1 focused on the development of the sentence material in Hindi language. This involved the collection of 650 sentences and based on naturalness and predictability of sentences, 512 sentences were shortlisted for the testing the equivalency of the sentences.

Sentence equivalency was assessed in experiment 2 at five SNRs. The mean and standard deviation of percentage words correctly identified at 0,-2, -4, -6 and -8 dB SNR are shown in Table 1. From the logistic equation, slope ‘m’ of the psychometric function was estimated. The estimated slope of these 512 sentences ranged from 3.4% per dB to 38.13% per dB, with an average of 10. 5% per dB and a standard deviation of 7.37% per dB. The SNR 50 of 512 sentences varied from -9.5 to -1.5 with a mean of -5.5 and standard deviation of 4.5. A subset of 200 sentences with slopes and scores at SNR 50 that were within one standard deviation from the mean value was selected. The selected 200 sentences had mean scores of 50.2 % (15%) and mean slope of 10. 5% per dB (2.59). Figure 2 gives the frequency distribution of the sentence-specific SNR 50 of these 200 selected sentences in comparison to the respective distribution of the 512 test sentences from the original speech material. These 200 sentences that fell within the stipulated criteria were used in subsequent phases.

Table 1

Mean and Standard Deviation of word scoring for sentence at five different SNRs

	-8dB	-6 dB	-4 dB	-2dB	0 dB
Mean	25	44	62	82	91.2
SD	29	36	36	29	19

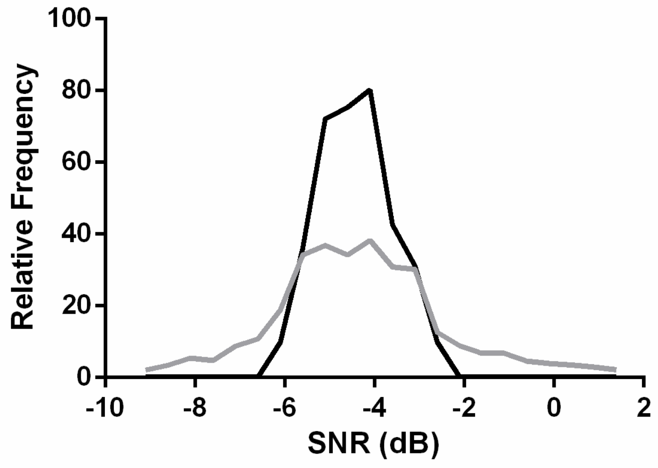

Figure 2. Frequency distribution of sentence-specific SNR 50 for all 512 test sentences (dark line) in comparison to the distribution of the 200 sentences that were selected as the final test corpus (gray line).

The selected sentences in previous phase were grouped into 20 lists of equal difficulty with each list consisting of ten sentences in third experiment. Psychometric functions calculated for each of the 20 resulting test lists are given in Figure 3. The list specific psychometric function was obtained by averaging the sentence-specific discrimination functions that had been fitted to the original data. The average SNR 50 obtained across the lists varies from -5.99 to -5.1 with a mean of -5.5 dB with a standard deviation of ±1 across the test lists. As the psychometric functions obtained across lists coincided very well, all the lists are likely to yield a similar intelligibility score over a wide range of signal-to-noise ratios.

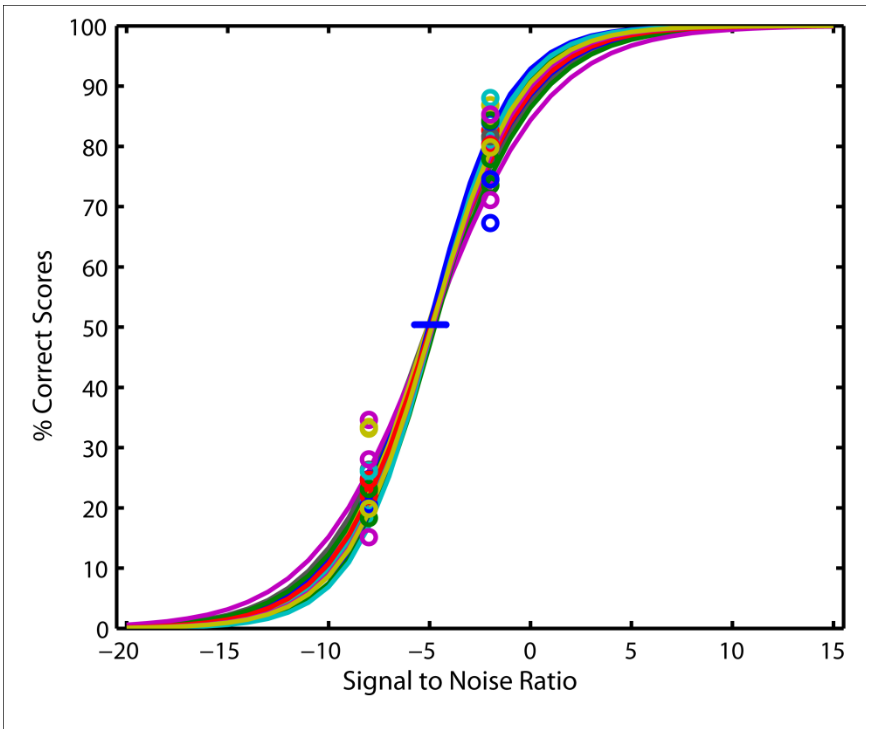

Figure 3. The calculated psychometric functions (speech intelligibility as a function of signal-to-noise ratio SNR) for all the 20 test lists resulted from the optimization procedure (phase I) (solid lines). The symbols at -2 and -8 dB SNR denote the

intelligibility scores for each of the 20 lists averaged across subjects that resulted from the independent experiment (Phase II). The error bar at -4.56 dB denote the standard deviation of the list-specific speech reception threshold SNR 50 (phase II and Table I).

The total number of phonemes in each list for 15 test lists was 201, for three test lists were 187, and 210 and 215 for one test list, respectively. Thus, the optimized test lists appeared to be fairly homogeneous with respect to the number of phonemes. The frequency distribution of the phonemes within the test list is plotted in Figure 4 as average values across test lists and minimum and maximum values of the respective phoneme frequency across all test lists. For comparison, the average phoneme frequency distribution of the Hindi language after (Ramakrishna et al., 1992) is plotted as a dashed line. The chi - square test was done to statistically compare the phoneme distribution of the test lists with that of the reference average phoneme distribution of the Hindi language. Results showed that the phoneme frequency distribution in the test lists approximates the respective frequency distribution in the Hindi language with chi-square values ranging from 370 to 470 and a p value showing no significance. This is also evident from Figure 4 where it is seen that no test list deviates substantially from this frequency distribution. One exception is the phoneme /ha/ which is over-represented in the present speech material. The reason for this could be that the sentences in the present material majorly include statements in the present tense which normally ends with /h/.

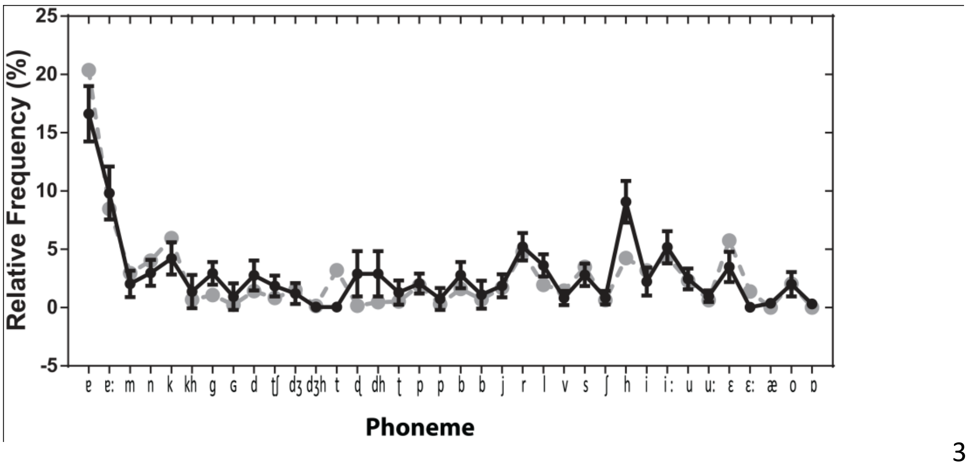

Figure 4. The frequency distribution of the phonemes within the test list as average values across test lists and minimum and maximum values of the respective phoneme frequency across all test lists (dark line) in comparison with the average phoneme frequency distribution of the Hindi language (dash line).

Phase II

In order to validate the test material optimized in Phase I of the study, three independent experiments were performed. The first experiment was aimed at assessing sentence identification scores for each list at -8 dB and -2 dB SNR.

The mean intelligibility score was assessed at -2 and -8 dB SNR across subjects for all the twenty lists separately. The mean scores obtained for 20 test lists is plotted in Figure 3 as open symbols at -2 and -8 dB SNR. The values obtained in the additional experiment in phase II of the study matched those obtained from the numerical optimization procedure. Further, sentence intelligibility scores obtained at -2, -8 dB and slope m for the fitted function are provided in the Table 2.

Table 2

Sentence intelligibility scores obtained at -2 dB, -8 dB, SNR 50 and slope m for the fitted function.

	Percent Scores (%)			
Test List No	**-8dB**	**-2dB**	**SNR 50**	**Slope (m)**
1	18.31	73.50	-4.5	11.47
2	24.60	82.68	-4.59	10.48
3	20.89	81.16	-4.62	11.18
4	15.09	71.06	-4.51	11.63
5	33.38	84.89	-4.51	10.94
6	22.79	74.46	-4.65	10.07
7	20.53	74.50	-4.62	11.26
8	26.29	77.88	-4.48	10.11
9	21.95	79.93	-4.57	9.54
10	26.03	83.92	-4.53	11.05
11	34.60	80.33	-4.54	11.24
12	33.16	86.87	-4.60	12.58
13	26.30	81.62	-4.59	10.79
14	20.03	84.13	-4.59	10.51
15	23.13	84.28	-4.64	12.72
16	24.66	80.15	-4.45	12.00
17	26.19	88.03	-4.50	10.47
18	28.03	85.33	-4.56	12.63
19	19.82	79.83	-4.64	11.27
20	24.53	80.09	-4.57	11.56
Mean	24.5	80.00	- 4.56	11.20
SD	5.07	5.45	0.43	0.90

In experiment II, all the test lists were subjected to inter-list equivalence evaluation. The average SNR 50 (sentence recognition threshold in noise) for the 20 lists measured across subjects (N=30) using the adaptive procedure and sentence scoring was -4.56 dB, with a standard deviation of 0.43 dB (Table 2). The average values across lists varies from -4.5 to -4.9 dB with standard deviations for lists ranging between 0.31 and 0.53dB. The list specific mean SNR 50, overall standard deviation is given in the last row of Table 2. The mean SNR 50 for each list relative to the overall SNR 50 is shown in Figure 5. All the SNR 50 lie within ±0. 3 dB with a standard deviation of 0.43 dB. To assess whether the mean difference across the lists reached significance, repeated measures analysis of variance (ANOVA) was performed. The analysis showed that there was no significant difference across lists at 0.05 levels [F (90,589) =1. 16, p=0. 281].

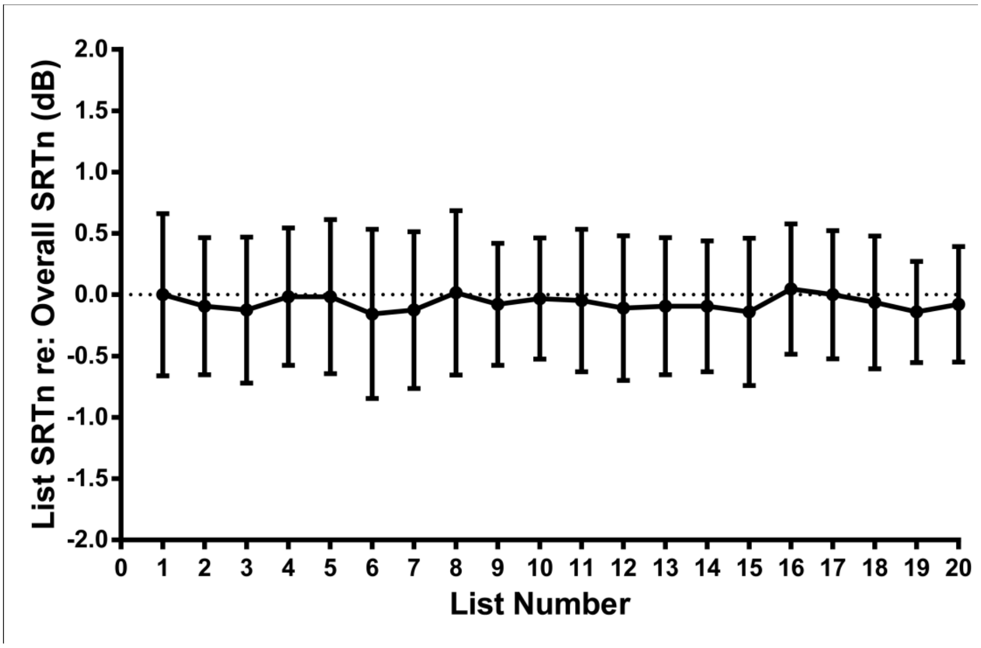

Figure 5. The mean SNR 50 for each list relative to overall SNR 50

In experiment III, SNR 50 was estimated for individuals with conductive and sensorineural hearing loss to check for the clinical utility. Table 4 shows the mean and standard deviation obtained for all the groups across lists.

Table 4

Mean SNR 50 and Standard Deviation (SD) for sentence intelligibility score across list for clinical populations (CHL-Conductive hearing loss; SNHL-Sensorineural hearing loss)

Between group comparison

List No	SNR 50 for Mild CHL	SNR 50 for Mod CHL	SNR 50 for Mild SNHL	SNR 50 for Mod SNHL
1	1.4	3.50	1.7	4.0
2	1.7	3.60	1.6	4.0
3	1.5	2.70	1.1	3.2
4	0.7	2.90	1.2	3.0
5	1.3	3.6	2.4	3.6
6	1.6	3.4	1.6	3.5
7	2.3	3.9	3.1	4.2
8	1.5	3.7	1.7	3.6
9	1.6	2.9	1.9	3.7
10	0.5	3.1	1.4	3.7
11	1.6	3.4	2.1	3.8
12	0.7	3.2	0.9	3.1
13	1.0	3.2	0.8	3.0
14	1.2	3.2	0.8	3.4
15	0.5	3.1	1.1	2.8
16	1.0	2.6	0.0	2.6
17	1.1	3.5	2.0	3.0
18	1.3	3.8	0.9	3.7
19	1.5	3.3	2.0	3.6
20	1.0	3.4	1.6	3.4
Mean	1.3	3.3	1.5	3.5
SD	1.9	1.1	1.6	1.1

The Table 4 shows the mean scores (averaged for all the lists) and the SD for clinical populations. It can be observed that the mean value decreases with increasing degree of hearing loss. It can also be noted that the mean scores are higher for sensorineural hearing loss compared to that of conductive loss.

Kruskal-Wallis statistical analysis was done to evaluate if the difference in means is statistically significant. The results revealed that a statistically significant difference between groups was present ($p<0.01$) for all the lists. Hence, Pairwise comparison was made using Mann-Whitney U test to assess the difference between normal hearing, conductive and sensorineural hearing loss and between the degree of hearing loss.

Table 5 shows that the there is a significant difference ($p<0.01$) between the scores of individuals with normal hearing sensitivity with that of conductive hearing loss and normal hearing vs sensorineural hearing loss across all lists. However there was no significant difference in the scores of sensorineural hearing loss and conductive hearing loss ($p>.05$) as evident from Table 5 (shaded areas shows no significance).

Table 5

Z values for various groups of hearing loss across lists.

Lists	Normal vs Conductive	Normal vs Sensorineural	Conductive vs Sensorineural
1	-4.48	-4.77	-0.46
2	-4.45	-4.74	-0.30
3	-4.41	-4.71	-0.19
4	-4.46	-4.76	0.00
5	-4.47	-4.76	-0.43
6	-4.39	-4.69	-0.03
7	-4.42	-4.72	-0.46
8	-4.14	-4.40	-0.07
9	-4.41	-4.72	-0.49
10	-4.60	-4.88	-0.76
11	-4.46	-4.76	-0.69
12	-4.41	-4.71	-0.11
13	-4.55	-4.83	-0.58
14	-4.49	-4.78	-0.07
15	-4.42	-4.72	0.00
16	-4.45	-4.74	-0.26
17	-4.54	-4.82	0.00
18	-4.47	-4.76	-0.07
19	-4.53	-4.82	-0.65
20	-4.53	-4.82	-0.43

- Shaded areas refers no significance

The Mann Whitney U test was also done to compare between the degree of hearing loss and it can be noted from Table 6 that there is a significant difference between mild and moderate group for almost all the lists except in the list shown in the shaded areas and the list which showed no difference between the groups can also be considered as slightly significant.

Table 6
Z values for mild v's moderate group.

	Z values	**Significance level**
List 1	-3.24	0.00
List 2	-2.26	0.02
List 3	-2.27	0.02
List 4	-2.23	0.02
List 5	-1.89	0.05
List 6	-2.79	0.00
List 7	-1.78	0.07
List 8	-2.486	0.01
List 9	-2.15	0.03
List 10	-2.50	0.01
List 11	-1.97	0.04
List 12	-2.38	0.01
List 13	-2.47	0.01
List 14	-2.53	0.01
List 15	-1.86	0.06
List 16	-2.41	0.01
List 17	-1.71	0.08
List 18	-2.13	0.03
List 19	-1.80	0.07

List 20	-1.92	0.05

- Shaded areas refers no significance

Within group comparison

In order to validate the equivalency of the lists in the hearing impaired population, within group comparison of the scores were made for the individuals with conductive and sensorineural hearing impairment. Table 7 shows the mean and standard deviation of scores for conductive and sensorineural hearing loss across all the lists.

Table 7.

Mean and SD SNR 50 for Conductive hearing loss.

List No.	**Conductive hearing loss**		**Sensorineural hearing loss**	
	Mean	**SD**	**Mean**	**SD**
List 1	2.55	1.55	2.95	1.52
List 2	2.77	1.84	2.95	1.91
List 3	2.16	1.43	2.27	1.71
List 4	1.94	1.69	2.18	1.79
List 5	2.61	1.91	3.09	1.16
List 6	2.61	1.46	2.63	1.53
List 7	3.22	1.79	3.72	1.11
List 8	2.72	1.79	2.77	1.68
List 9	2.33	1.68	2.90	1.48
List 10	1.94	1.99	2.68	2.05
List 11	2.61	1.74	3.04	1.48
List 12	2.11	2.25	2.13	1.89
List 13	2.22	2.12	2.00	1.63
List 14	2.33	1.94	2.22	1.93
List 15	1.94	2.44	2.04	1.83
List 16	1.88	1.55	1.45	2.15
List 17	2.44	2.14	2.59	1.23
List 18	2.72	2.17	2.45	2.35
List 19	2.50	1.85	2.90	1.57

List 20	2.33	2.04	2.59	1.91

The Friedman test was performed to estimate the difference across lists for both the groups. Results revealed that there was no significant difference in the Mean SNR 50 values of the conductive hearing loss group (p>. 05), however for Sensorineural hearing loss group significant difference was seen (p< .01). Later Wilcoxon Signed Ranks Test was performed to analyze the significant difference between list and it revealed all the list did not show any significant difference except that the score of list 9 differ significantly from that of list 13 (p< .01). Thus it can be noted that except these two lists in the sensorineural hearing loss group, all other lists have good inter list equivalence. However in normal hearing individuals there was no significant difference between the scores across lists. Thus it can be concluded the difference seen in the two lists could be attributed to the less number of subjects tested.

CHAPTER 4

Discussion

Phase I

The aim of the present study was to develop sentence material in Hindi for the assessment of SNR 50. The collected sentences were assessed for naturalness on five point rating scale and predictability on three point rating scale. The sentences material that never, not even after modifications, scored at least four (on a five point scale) for naturalness and 2 for predictability by 80 % of individuals were excluded from the final sentence material.

The sentence material was also equated for speech intelligibility in noise by means of deriving psychometric slope. In the present study sentences with similar performance were identified using the slopes and SNR 50 and those sentences which differed significantly from the majority were excluded. The procedure employed here was similar to the procedure employed by some of the previous investigators (Versfeld et al., 2000; Theunissen et al., 2011). The procedure of excluding sentences reduced the testing time and number of subjects tested. However, the previous studies employed the procedure of rescaling intensities for sentences to equate intelligibility and verifying the effect of the rescaling. This necessitated up to seven rounds of testing (Nilsson et al., 1994; Vaillancourt et al., 2005; Wong & Soli, 2005; Wong et al., 2008) thereby unnecessarily prolonging the procedure. The results of the present study and previous studies (Theunissen et al., 2011) have shown that, despite the use of different methods, both procedures of equating sentences resulted in similar performance as in 50% point.

In the majority of previous studies, optimized lists were created based only on phonemically balancing (Theunissen et al., 2008; Nielsen & Dau, 1997). However, Theunissen et al., (2008) lists prepared with balanced phoneme distribution did not always result in performance equivalence; rather they observed high degree of variability through the use of such a method. On the contrary, Kollmeier & Wesselkamp (1997) have demonstrated that the optimization based on SNR 50, slope and phonemic content resulted in equivalence between the lists. In the present study, lists were created by optimizing SNR 50, slope, number of phonemes and phonemic distribution. The optimization procedure employed in the present study resulted in equal SNR 50 and slope. The phoneme distribution closely approximated the respective distribution in Hindi language and no test list deviated substantially from this, except phoneme /ha/ which is over-represented in the speech material. This exception might be related to the use of present tense, which in Hindi implies towards the frequent use of this phoneme for ending a sentence.

Phase II

The second phase of the study involved validation of the developed list. The average overall SNR 50 across studies ranged from -2.7 to -7.8 with an average of -4.24. In the present study, the average SNR 50 obtained using the adaptive procedure across all lists and listeners was -4.56. This average threshold value lies well within the range observed in previous studies (Kollmeier & Wesselkamp, 1997; Versfield, 2000; Wong et al., 2007; Nielsen & Dau, 1997). The standard deviation which gives an indication of the variability within the collection of lists is a more important parameter than the absolute values of the thresholds. The standard deviations reported in the previous studies ranged from 0.27 to 1.5 dB. The present study found a standard deviation of 0.43dB, indicating a comparable degree of equivalence across lists.

For each of the lists, the SNR 50 relative to the overall mean varied within ±0. 5 dB which in agreement with some of the previous studies (Nielsen & Dau, 1997; Kollmeier et al., 1997). Some of the other studies reported the variation in SNR 50 within

±1 (Nilsson et al., 1994; Vaillancourt et al., 2005) which makes the results of the present study more stable than these studies. The standard deviation from the overall mean was also calculated for each list. In the current study, the average deviation of all the lists was found to be within ±0. 43 dB (ranging between -0. 3 & 1.17) from the overall mean. This was slightly smaller than the deviations reported in a number of other studies (Hällgren et al., 2006; Nilsson et al., 1994; Vaillancourt et al., 2005; Wong & Soli, 2005). The low variability noted in the present study implies that the optimization and equalization procedure employed has led to more homogeneous sentence intelligibilities than in the previous studies.

For estimating the clinical utility of the lists the SNR 50 was estimated on clinical population and result revealed that there was a significant difference between the scores of normal hearing and hearing loss. These results are consistent with the common fact that as the degree of hearing loss increases the amount of perceptual difficulty also increases. In the present study it was noted that although there was no significant difference in the scores of cochlear loss vs conductive loss but the mean scores for cochlear was poor compared to that of conductive hearing loss. Similar findings have been reported by Yellin, Jerger and Fifer (1989) where they found the scores of 68%, 38.5%, 24%, and 11% for Mild, Moderate, Moderately Severe and Severe cochlear pathology respectively. However these authors calculated the speech identification scores and in the present study SNR 50 was estimated and also the mentioned authors used synthetic sentences for the study which would have considerably increased the difficulty and reduced the scores.

In addition, the results reveal that the sentence material is sensitive to differences in speech identification abilities across different degrees of hearing loss except for few lists. Similar abilities have been demonstrated in well used speech tests like Hearing in

Noise Test (HINT) (Nilsson, Soli, & Sullivan, 1993) and CID Everyday sentences list (Rippy, Dancer & Pittenger, 1983). This lends support to the idea of using the developed sentence lists for routine clinical examination as well as for research studies. The probable reason as to why difference was not seen in few lists could be attributed to less number of subjects taken for the study.

CHAPTER 5

Summary and Conclusion

The aim of the project was to develop and standardize a sentence test in Hindi language. The study was conducted in two phases and first phase involved three experiments. First experiment involved the collection and recording sentence material. In the second experiment, sentence perception was assessed at five signal to noise ratios for equalization of sentence material. In the final experiment using numerical optimization procedure 20 different lists with 10 sentences each were formulated. The second phase of the experiment involved, validating and assessing test reliability of the lists and third experiment involved validating the list on clinical population.

The sentence material developed in Hindi described here contains highly homogeneous test material and 20 sentence lists which are highly equivalent with ten short sentences each. The average SNR 50 obtained using the adaptive procedure across all lists and listeners was -4.56, with a standard deviation of 0.43 dB. The test appears to be useful for clinical audiology, hearing aid fitting and assessing the communication systems.

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Appendix 1

Rating of the sentences for their naturalness was based upon five point rating scale as given below.

1. Totally unnatural, and not encountered at all.
2. Somewhat unnatural, it is unlikely that one such sentence is encountered.
3. Sentence is unusual, but you may have heard.
4. Natural but less frequently encountered in everyday conversation.
5. Natural and frequently encountered in everyday conversation.

Rating of the sentences for the predictability was based upon three point rating scale as given below:

1. Highly predictable
2. Predictable
3. Not predictable

Appendix 2

LIST 1

Sl. No.	**Sentences in Hindi**	**IPA**
1.	प्रवेश द्वार उत्तर दिशा में है।	prave:ʃ|dva:r|ut̪t̪ar|diʃa:|mẽ| hai
2	नक्शे में एक नई सड़क है।	nakʃe| mẽ| ek| nai: | saɽak| hai
3	ट्रक सड़क से लुढक गया।	ʈrak| saɽak| se| luɖak| gaja:
4	दोनो दोस्त हाथ मिला रहे हैं।	d̪o:no:|do:st̪|ha:t̪h|mila:|rahe|haĩ
5	लड़का सीढियाँ चढ गया।	laɽaka:| si:ɖhijã:| tʃaɖh| gaja:
6	भिखारी को कुत्ते ने काट लिया।	bhikha:ri:| ko|kut̪t̪e|ne|ka:ʈ| lija:
7	झिंगुर जंगल में बोल रहे हैं।	dʒhiŋgur|dʒaŋgal|mẽ|bo:l|rahe|haĩ
8	आदमी सीढियो से फिसल गया।	a:d̪ami:|si:ɖhijo:| se| phisal| gaja:
9	बच्चे की पाठशाला बहुत दूर है।	batʃtʃe|ki:|pa:ʈhʃa:la:|bahut̪|du:r|hai
10	बर्फ पर चलना अच्छा लगता है।	barph|par|tʃalna:|atʃtʃha:|lagt̪a:|hai

LIST 2

Sl. No.	Sentences in Hindi	IPA
1.	देश में निकम्मो की भरमार है।	d̪e:ʃ|mẽ|nikammo:|ki:|bharma:r|hai
2	घने जंगल में नदी है।	ghane| dʒaŋgal| mẽ|nad̪i:|hai
3	सिपाही को रास्ता मालूम है।	sipɑ:hi:|ko| rɑ:st̪ɑ:| mɑ:lu:m| hai
4	रसोइघर की खिड़की साफ है।	rasoighar| ki:| khiɽaki:| sɑ:ph| hai
5	माँ रोटी में घी लगा रही है।	mã:| ro:ʈi:|mẽ| ghi:|lagɑ:|rahi: | hai
6	रानी सहेलियों के साथ खेल रही है।	rɑ:ni:|sahelijõ:|ke|sɑ:t̪h|khel|rahi:|hai
7	घोड़ा सड़क पर दौड़ रहा है।	ghoɽa| saɽak|par| dauɽ| rahɑ:| hai
8	बाजार में फल नही मिले।	bɑ:dʒɑ:r| mẽ|phal| nahi:| mile
9	कमीज की सिलाई निकल गई।	kami:dʒ| ki:| silɑ:i:| nikal| gai:
10	हाथी पत्ते और झाड़ियाँ खाते हैं।	hɑ:t̪hi:|pat̪t̪e|ɑur|dʒhɑ:ɽijã:|khɑ:t̪e| haĩ

LIST 3

<table>
<tr><th>Sl. No.</th><th>Sentences in Hindi</th><th>IPA</th></tr>
<tr><td>1.</td><td>मेरे पास लाल कलम है।</td><td>mere| pɑ:s| lɑ:l| kɑlɑm| hɑi</td></tr>
<tr><td>2</td><td>उसने मौजा नही पहना है।</td><td>usne|mɑudʒɑ:|nɑhiː| pɑhɑnɑ:|hɑi</td></tr>
<tr><td>3</td><td>खेतों में धान सूख गए हैं।</td><td>khet̪õ|mẽ|d̪hɑ:n|su:kh| gɑẽ|hɑĩ</td></tr>
<tr><td>4</td><td>दुकानदार मक्खन बेचता है।</td><td>d̪ukɑ:n̪d̪ɑ:r|mɑkkhɑn| betʃt̪ɑ:| hɑi</td></tr>
<tr><td>5</td><td>वह बागीचे के रास्ते चला गया।</td><td>vɑh| bɑgi:tʃe| ke| rɑ:st̪e|tʃɑlɑ:| gɑjɑː</td></tr>
<tr><td>6</td><td>उसने पीट पीटकर छड़ी तोड़ दी।</td><td>usne|pi:ʈ|pi:ʈkɑr| tʃhɑɽi:| t̪oɽ| d̪i:</td></tr>
<tr><td>7</td><td>मुझे धन का लालच नही है।</td><td>mudʒhe| d̪hɑn| kɑ:| lɑ:lɑtʃ|nɑhiː|hɑi</td></tr>
<tr><td>8</td><td>छोटी कुर्सी अचानक टूट गई।</td><td>tʃhoʈi:| kursi:| ɑtʃɑ:nɑk| ʈu:ʈ| gɑi:</td></tr>
<tr><td>9</td><td>घर के भीतर कुत्ता घुस आया।</td><td>ghɑr| ke| bhi:t̪ɑr|kut̪t̪ɑ:|ghus| ɑ:jɑː</td></tr>
<tr><td>10</td><td>वह लड़का बहुत शरारत करता है।</td><td>vɑh|lɑɽaka:|bahut̪|ʃara:rat̪|kart̪a: |hai</td></tr>
</table>

LIST 4

Sl. No.	Sentences in Hindi	IPA
1.	उसकी पतलून बहुत ढीली है।	uski:| pat̪alu:n| bahut̪| ɖhi:li| hai
2	राष्ट्रपति कुर्सी पर बैठे हैं।	raʂʈrapat̪i| kursi:| par| baiʈhe| haĩ
3	लड़का हाथ के बल खड़ा है।	laɽaka:|ha:t̪h| ke|bal| khaɽa:| hai
4	बच्चे को अपनी बोतल चाहिए।	batʃtʃe| ko|apani:| bo:t̪al| tʃa:hie
5	उसने ध्यान से तस्वीर देखी।	usne| d̪hja:n| se| t̪asvi:r| d̪ekhi:
6	छोटे टमाटर हरे हैं।	tʃhoʈe:| ʈama:ʈar| hare| haĩ
7	बिल्ली ने एक छोटा चूहा पकड़ा।	billi:|ne|ek|tʃhoʈa:|tʃu:ha:|pakaɽa:
8	सब्जी में नमक ज्यादा पड़ गया।	sabdʒi:|mẽ|namak|dʒja:d̪a:|paɽ| gaja:
9	माचिस की तिल्ली टूट गई	ma:tʃis| ki:| t̪illi:| ʈu:ʈ| gai:
10	वह शहर में नौकरी करता है।	vah|ʃahar|mẽ|naukari:|kart̪a:| hai

LIST 5

Sl. No.	Sentences in Hindi	IPA
1.	बहुत तेज धूप के बाद बारिश हुई।	bahut̪| t̪edʒ| d̪hu:p| ke| bɑ:d̪| bɑ:riʃ| hui:
2	सिपाही ने चालक की मदद् की।	sipa:hi:| ne| tʃɑ:lak| ki:| mad̪ad̪| ki:
3	जमीन पर फल गिरा हुआ है।	dʒami:n|par|phal| gira:| hua:| hai
4	उसने गंदा फर्श साफ किया।	usne| gand̪a:| pharʃ| sa:ph | kija:
5	वह अपनी बहन से बहस करता है।	vah| apani:|bahan|se|bahas| kart̪a:|hai
6	दादा ने दाढी नही कटाई।	d̪a:d̪a:| ne|d̪a:ɖhi:| nahi:| kaʈa:i:
7	वह रात भर दर्द से कराहता रहा।	vah|ra:t̪|bhar|d̪ard̪|se| kara:hat̪a:| raha:
8	माँ बच्चे को दुलार रही है।	mã:|batʃtʃe| ko| d̪ula:r|rahi:|hai
9	बड़ी बहू बहुत झगड़ालु है।	baɽi:|bahu:|bahut̪| dʒhagaɽa:lu| hai
10	सूरज की गर्मी तेज हो रही है।	su:radʒ|ki:|garmi:|t̪edʒ|ho|rahi:| hai

LIST 6

Sl. No.	Sentences in Hindi	IPA
1.	उसने अपनी घड़ी खो दी।	usne| apani:|ghaɽi:| kho| d̪i:
2	उन्होने घंटे भर इन्तजार किया	unhone|ghanʈe|bhar|int̪adʒa:r| kija:
3	वो अपनी साईकल चला रहा है।	vah| apani:| sa:i:kal| tʃala:| raha:| hai
4	वह घास पर चल रहा है।	vah|gha:s| par| tʃal|raha:| hai
5	बच्चे पैदल घर जा रहे हैं।	batʃtʃe| paid̪al|ghar|dʒa:|rahe| haĩ
6	लड़की बाल धो रही है।	laɽaki:| ba:l| d̪ho| rahi:|hai
7	दादी की ऊँगली में चोट लगी है।	d̪a:d̪i:|ki:| uŋgali:|mẽ| tʃoʈ| lagi:|hai
8	घर में खाने को अन्न नही है।	ghar| mẽ|kha:ne| ko| ann| nahi: |hai
9	नाशपाती शहर में नही है।	na:ʃpa:t̪i:| ʃahar| mẽ|nahi:| hai
10	उसके हाथी को नहाना पसंद है।	uske| ha:t̪hi:|ko| naha:na:| pasaŋd̪| hai

LIST 7

Sl. No.	Sentences in Hindi	IPA
1.	बच्चे ने थैला फाड़ दिया।	batʃtʃe| ne| t̪haila| phaː ɽ | d̪ijaː
2	बच्चा सारी रात सोता रहा।	batʃtʃaː| saːriː| raːt̪| sot̪aː| rahaː
3	उसकी माँ बहुत सहनशील है।	uskiː|mãː|bahut̪| sahanʃiːl| hai
4	गाँव में भालू घुस आया।	gãːv| mẽ|bhaːluː| ghus| aːjaː
5	टोकरी में बीस सेब है।	ʈokriː| mẽ|biːs| seb| hai
6	विमान हादसा टल गया।	vimaːn| haːd̪saː| ʈal| gajaː
7	आज दीदी विदेश जाएँगी।	aːdʒ| d̪iːd̪iː| vid̪eːʃ| dʒaːẽgiː
8	माँ ने गुस्से में थप्पड़ मारा।	mãː| ne| gusse| mẽ| t̪happaɽ| maːraː
9	पुरानी पतलून ढीली हो गई।	puraːniː|pat̪aluːn|ɖiːliː|ho|gaiː
10	वह नाराज होकर चला गया।	vah|naːraːdʒ|hokar| tʃalaː| gajaː

LIST 8

Sl. No.	Sentences in Hindi	IPA
1.	नदी में घड़ियाल छुपें हैं।	nad̪i:| mẽ|ghaɽija:l|tʃhupẽ|haĩ
2	वह कॉलेज शहर के बीचों बीच है।	vah| ka꞉ledʒ| ʃahar|ke| bi:tʃõ|bi: tʃ|hai
3	दो बच्चे हँस रहे हैं।	d̪o|batʃtʃe| hãs| rahe| haĩ
4	उस परिवार ने एक घर खरीदा।	us|pariva:r|ne|ek|ghar|khari:d̪a:
5	सामने का आँगन बहुत खूबसूरत है।	sa:mne|ka:| ã:gan| bahut̪| khubsu:rat̪|hai
6	उसके घर में पोता जन्मा है।	uske|ghar| mẽ|pot̪a:|dʒanma:| hai
7	बाढ ने शहर में तबाही मचाई।	ba:ɽ|ne|ʃahar| mẽ|t̪aba:hi:| matʃa꞉i:
8	नानी रोज सैर करती है।	na:ni꞉| rodʒ |sair|kart̪i:| hai
9	पीपल का वृक्ष बहुत विशाल है।	pi:pal| ka:|vrukʂ| bahut̪|viʃa:l| hai
10	वह नदी बहुत गहरी है।	vah| nad̪i:| bahut̪| gehri:| hai

LIST 9

Sl. No.	Sentences in Hindi	IPA
1.	उसे रात में छुट्टी चाहिए।	use| rɑ:t̪| mẽ| tʃhuʈʈi:| tʃɑ:hie
2	वह कुत्तो को घुमाने ले गया।	vah| kut̪t̪o|ko|ghumɑ:ne|le| gɑja:
3	उसने काला धंधा छोड़ दिया।	usne| kɑ:lɑ:| d̪hand̪hɑ:| tʃhoɽ| d̪ija:
4	बस अचानक रुक गई।	bas| ɑtʃɑ:nɑk| ruk| gai:
5	लड़के ने जल ग्रहण किया।	laɽake| ne|dʒal|grahaɳ| kija:
6	फर्श चमकीला दिख रहा है।	pharʃ| tʃamki:lɑ:|d̪ikh|rahɑ:| hai
7	उसकी बात सत्य हुई।	uski:| bɑ:t̪| sɑt̪j| hui:
8	लड़की की इच्छा के विरुद्ध शादी हुई।	laɽaki:| ki:|itʃtʃhɑ:| ke| virud̪d̪h|ʃɑ:d̪i:|hui:
9	किसान बैलगाड़ी हाँक रहा है।	kisɑ:n| bai:l| gɑ:ɖi:| hã:k|rahɑ:| hai
10	बंदर पेड़ से नीचे उतर गया।	band̪ar|pe:ɽ|se|ni:tʃe|ut̪ar| gaja:

LIST 10

Sl. No	Sentences in Hindi	IPA
1.	एक बदमाश लड़का छुपा है	ek| bad̪maːʃ| laɽakaː| tʃhupaː|hai
2	कुत्ता पड़ोसियो पर भौंक रहा है	kut̪t̪aː|paɽ osijo|par| bhauːŋk|rahaː|hai
3	छोटी बच्ची अत्यधिक प्रसन्न है।	tʃhoːt̪iː| batʃtʃiː|at̪jad̪hik| prasann| hai
4	गाड़ी में ईंधन भर लिया है।	ghaːɽiː|mẽ|iːn̪d̪han|bhar| lijaː| hai
5	तालाब का जल दूषित है।	t̪aːlaːb| kaː| dʒal| d̪uːʂit̪| hai
6	कल रात भूकम्प आया था।	kal| raːt̪| bhuːkamp| aːjaː| t̪haː
7	शहर में मकान गिर गया।	ʃahar| mẽ|makaːn| gir| gajaː
8	अभी जाड़े का मौसम है।	abhiː| dʒaːɽe| kaː| mauːsam| hai
9	गरीब व्यक्ति काम कर रहा है।	gariːb|vjakt̪i|kaːm|kar| rahaː |hai
10	महिलाएँ कुएँ से पानी निकाल रही है।	mahilaːẽ |kuẽ|se|paːniː|nikaːl|rahiː| hai

LIST 11

Sl. No.	Sentences in Hindi	IPA
1.	बाढ़ से यातायात प्रभावित हुआ	ba:ɽh|se| ja:t̪a:ja:t̪| prabha:vit̪| hua:
2	उसने अपनी बरसाती टाँगी।	usne| apani:| barsa:t̪i:| ʈa:ŋgi:
3	यह उस लड़के की करामात है	jah| us| laɽake| ki:| kara:ma:t̪| hai
4	गली में पागल आदमी घूम रहा है।	gali:|mẽ|pa:gal|a:d̪ami:|ghu:m|raha:|hai
5	महिला की आँखो में तिनका पड़ गया।	mahila:|ki:|ã:kho:|mẽ|t̪inka:|paɽ|gaja:
6	शिष्य ने अपने गुरु से झूठ बोला।	ʃiʂj| ne|apne|guru:|se|dʒhu:ʈh|bo:la:
7	लड़की पानी पी चुकी है।	laɽaki:| pa:ni:| pi:| tʃuki:| hai
8	लड़का उम्र में लड़की से बड़ा है।	laɽaka:| umr|mẽ|laɽaki:|se|baɽa:|hai
9	आसमान काले रंग का दिख रहा है।	a:sama:n|ka:le|raŋg|ka:|d̪ikh|raha: |hai
10	हाथी का एक दाँत टूट गया।	ha:t̪hi:|ka:|ek|d̪a:n̪t̪|ʈu:ʈ|gaja:

<u>LIST 12</u>

<table>
<tr><th>Sl.
No.</th><th>Sentences in Hindi</th><th>IPA</th></tr>
<tr><td>1.</td><td>आँखो की रौशनी बढ गई है</td><td>ã:khoː|ki:| roːʃni:| baɖh|gai:| hai</td></tr>
<tr><td>2</td><td>कुत्ता गेंद से खेल रहा है</td><td>kut̪t̪ɑ:|ge:n̪d̪|se|khel| rahɑː|hai</td></tr>
<tr><td>3</td><td>हमारे दल ने अच्छा खेल दिखाया</td><td>hamɑ:re|d̪al|ne|atʃtʃhɑ:|khe:l|d̪ikhɑ:jɑ:|</td></tr>
<tr><td>4</td><td>महिला ने अपना घर साफ किया।</td><td>mahilɑ:|ne|ɑpnɑ:|ghɑr|sɑ:ph| kijɑ:</td></tr>
<tr><td>5</td><td>स्त्री ने पुरुष को धक्का दिया।</td><td>st̪ri:|ne|puruʂ|ko|d̪hakkɑ:|d̪ijɑ:</td></tr>
<tr><td>6</td><td>सेना ने डाकुओं की घेराबन्दी की।</td><td>senɑ:|ne|ɖɑ:kuõ|ki:|gherɑ:band̪i:|ki:</td></tr>
<tr><td>7</td><td>छोटा बच्चा मेले में खो गया।</td><td>tʃho:ʈɑ:|batʃtʃɑ:|mele| mẽ|kho|gajɑ:</td></tr>
<tr><td>8</td><td>थोडी देर में खाना पक जाएगा।</td><td>t̪ho ɽ i:|d̪er|mẽ|khɑ:nɑ:|pak|dʒɑ:egɑ:</td></tr>
<tr><td>9</td><td>आज जल्दी अँधेरा हो गया।</td><td>ɑ:dʒ| dʒald̪i:| and̪herɑ:| ho| gajɑ:</td></tr>
<tr><td>10</td><td>वह दाँत दर्द से परेशान है।</td><td>vah| d̪ɑ:n̪t̪| d̪ard̪| se|pare:ʃɑ:n| hai</td></tr>
</table>

LIST 13

Sl. No	Sentences in Hindi	IPA
1.	वह तैराक बनना चाहता है।	vah|t̪aira:k|banna:| tʃa:hat̪a:|hai
2	बच्चा छात्रावास छोड़कर भाग गया।	batʃtʃa:|tʃha:t̪ra:va:s|tʃhoɽkar|bha:g|gaja:
3	लड़की झूला झूल रही है।	laɽaki:| dʒhu:la:| dʒhu:l| rahi:|hai
4	भंडार में रसगुल्ले सड़ गए।	bhanɖa:r|mẽ|rasagulle| saɽ| gae
5	दाई झाड़ु लगा रही है।	d̪a:i:| dʒha:ɽu| laga:| rahi:|hai
6	दीवान पर गद्दा बिछा है।	d̪i:va:n|par| gad̪d̪a:| bitʃha:|hai
7	नदी का पानी गंदा है।	nad̪i:|ka:| pa:ni:| gan̪d̪a:| hai
8	कल रात में तूफान आया था।	kal|ra:t̪|mẽ|t̪u:pha:n| a:ja:| t̪ha:
9	रात में कुत्ता रो रहा था।	ra:t̪|mẽ|kut̪t̪a:| ro| raha:| t̪ha:
10	लड़का रोते रोते सो गया।	laɽaka:| rot̪e| rot̪e| so| gaja:

LIST 14

<table>
<tr><th>Sl. No.</th><th>Sentences in Hindi</th><th>IPA</th></tr>
<tr><td>1.</td><td>पाठशाला जल्दी बंद हो गई।</td><td>pɑ:ʈhʃɑ:lɑ:|dʒald̪i:|baŋd̪| ho| gai:</td></tr>
<tr><td>2</td><td>सब्जियों की पैदावार बढ़ गई।</td><td>sabdʒijõ|ki:| paid̪ɑ:vɑ:r| baɽh| gai:</td></tr>
<tr><td>3</td><td>आईना गिरकर टूट गया</td><td>ɑ:i:nɑ:| girkar|ʈu:ʈ| gaja:</td></tr>
<tr><td>4</td><td>इस कमरे में रोशनी कम है।</td><td>is|kamare|mẽ|roʃni:|kam|hai</td></tr>
<tr><td>5</td><td>महिला चूड़ियाँ पहन रही है।</td><td>mahilɑ:|ʈʃu:ɽijã:| pahan|rahi:| hai</td></tr>
<tr><td>6</td><td>उसकी कलाई में मोच आ गई।</td><td>uski:|kalɑ:i:| mẽ|mo:ʈʃ|ɑ:| gai</td></tr>
<tr><td>7</td><td>कुएँ में मेंढक टरटरा रहे हैं।</td><td>kuẽ|mẽ|meŋɖhak|ʈarʈarɑ:|rahe|hai</td></tr>
<tr><td>8</td><td>राजधानी में सड़कें बेहाल हैं।</td><td>rɑ:dʒd̪hɑ:ni:|mẽ|saɽakẽ|be:hɑ:l| haĩ</td></tr>
<tr><td>9</td><td>लोग जुलूस निकाल रहे हैं ।</td><td>lo:g|dʒulu:s| nikɑ:l| rahe|haĩ</td></tr>
<tr><td>10</td><td>अमीर आदमी बिस्तर पर सोया है।</td><td>ami:r|ɑ:d̪mi:|bist̪ar|par|so:jɑ:|hai</td></tr>
</table>

LIST 15

Sl. No	Sentences in Hindi	IPA
1.	ची ने आम की चटनी बनाई।	tʃɑ:tʃi:| ne| ɑ:m|ki:|tʃɑʈni:|banɑ:i:
2	वह गरीबों का भला करता है	vaha|gari:bõ|kɑ:|bhalɑ:|kart̪ɑ:| hai
3	समुद्री मछलियाँ अधिक स्वादिष्ट है।	samud̪ri:|matʃhalijɑ̃:|ad̪hik|svɑ:d̪iʂʈ| hai
4	वह रंगीन कपड़ा पहनता है।	vah|raŋgi:n|kapaɽɑ:|pahant̪ɑ:|hai
5	वह साबुन से चेहरा धो रहा है।	vah|sɑ:bun|se|tʃehrɑ:|d̪ho:|rahɑ: | hai
6	वह पुरुष अत्यंत बलशाली है	vah| puruʂ| ɑt̪jaŋt̪| balʃɑ:li:| hai
7	दादी चाय छान रही है।	d̪ɑd̪i:| tʃɑ:j|tʃhɑ:n| rahi:| hai
8	महिलाएँ कीर्तन गा रहीं हैं।	mahilɑ:ẽ| ki:rt̪an| gɑ:| rahi: | haĩ
9	हम बुजुर्गों का सम्मान करते हैं।	ham|buzurgo:|kɑ:|sammɑ:n|kart̪e| haĩ
10	लीची के फूल फरवरी में खिलते हैं।	li:tʃi:|ke:|phu:l|pharvari:| mẽ| khilt̪e| haĩ

LIST 16

<table>
<tr><th>Sl.
No.</th><th>Sentences in Hindi</th><th>IPA</th></tr>
<tr><td>1.</td><td>अतिथि को मीठा खाना पसंद   है।</td><td>ɑt̪it̪hi|ko|mi:ʈhɑ:|khɑ:nɑː|pasɑn̪d̪|
hɑi</td></tr>
<tr><td>2</td><td>खिलाड़ी के जूते खो गए।</td><td>khilɑ:ɽi:|ke|dʒu:t̪e| kho:| gɑje|</td></tr>
<tr><td>3</td><td>उसकी चार उँगलिया चोटिल है।</td><td>uski:| tʃɑ:r|uŋglijɑ: | tʃoʈil|hɑi</td></tr>
<tr><td>4</td><td>मामी ने भारी सामान उठाया</td><td>mɑ:mi:|ne|bhɑ:ri:|sɑ:mɑ:n|uʈhɑ:jɑ:</td></tr>
<tr><td>5</td><td>उसने लाल चादर ओढी।</td><td>usne:|lɑ:l| tʃɑ:d̪ɑr| o:ɖhi:|</td></tr>
<tr><td>6</td><td>माली आम गिन रहा है।</td><td>mɑ:li:| ɑ:m| gin| rɑhɑ: |hɑi</td></tr>
<tr><td>7</td><td>सेब का टुकड़ा नीचे गिर गया।</td><td>seb| kɑ:| ʈukɑɽɑ:| ni:tʃe| gir| gɑjɑ:</td></tr>
<tr><td>8</td><td>औरत मिठाई बेच रही है।</td><td>ɑurɑt̪| miʈhɑ:ji:|betʃ|rɑhi: | hɑi</td></tr>
<tr><td>9</td><td>लड़की डर कर भाग गई।</td><td>lɑɽɑki:| ɖɑr| kɑr| bhɑ:g|gɑi:</td></tr>
<tr><td>10</td><td>हम पहाड़ी इलाके में रहते हैं।</td><td>hɑm|pɑhɑ:ɽi:|ilɑ:ke|mẽ|rɑht̪e|hɑĩ</td></tr>
</table>

LIST 17

Sl. No.	Sentences in Hindi	IPA
1.	मुर्गी ने कुछ अंडे दिए	murgi:| ne| kutʃh| aɳɖe|d̪ie
2	धारदार चाकू खतरनाक होता है।	d̪ha:rd̪a:r|tʃa:ku:|khat̪arna:k|hot̪a:|hai
3	उसने समय पर भोजन किया।	usne| samaj| par| bho:dʒan| kija:
4	उनके पास दो खाली बोतले हैं।	unke| pa:s|d̪o|kha:li:| bot̪ale| haĩ
5	आज नए पड़ोसी आएँगे।	a:dʒ| nae| paɽosi:| a:ẽge
6	भैया फूल तोड़ रहे हैं।	bhaija:| phu:l| t̪o:ɽ| rahe| haĩ
7	धूप से पौधे झुलस गए हैं।	d̪hu:p|sẽ| paud̪he| dʒulas| gae| haĩ
8	दीवार घड़ी में चार बजे हैं।	d̪i:va:r|ki:|ghaɽi:|mẽ|tʃa:r|badʒe|haĩ
9	पहाड़ से पानी गिर रहा है।	paha:ɽ| se| pa:ni:| gir| raha: |hai
10	काफी समय के बाद तूफान आया।	ka:phi:|samaj|ke|ba:d̪|t̪u:pha:n| a:ja:

LIST 18

Sl. No.	Sentences in Hindi	IPA
1.	आज एक ऐतिहासिक दिन है।	ɑ:dʒ| ek|ɑit̪iha:sik|d̪in|hai
2	भिखारियो की संख्या घटी है।	bhikharijo |ki:|saŋkhjɑ:| ghaʈi:| hai
3	माँ ने जोर से गाँठ बांधी।	mɑ̃:| ne|zo:r| se|ghɑ̃:ʈh|bɑ:n̪d̪hi:
4	बाल्टी ज्ल्दी जल्दी भर रही है।	bɑ:lʈi:|dʒald̪i:|dʒald̪i:|bhar| rahi:|hai
5	दोपहर में धूलभरी आँधी आई।	d̪opahar|mẽ| d̪hu:lbhari:| ɑ̃:d̪hi:| ɑ:i:
6	बच्चा सारी रात सोता रहा है।	batʃtʃɑ:| sɑ:ri:| rɑ:t̪| sot̪ɑ: | rahɑ:| hai
7	बच्चे को घुटने में चोट लगी है।	batʃtʃe|ko|ghuʈne|mẽ |tʃo:ʈ|lɑgi:| hai
8	दोस्तों को भोजन पर बुलाया है।	d̪o:st̪o:ŋ|ko|bho:dʒan|par|bula:ja:|hai
9	मुझे दो कमरों की जरुरत है।	mudʒhe|d̪o|kamroŋ|ki:|dʒaru:rat̪|hai
10	किसान जमीन सीच रहा है।	kisɑ:n| dʒami:n| si:tʃ| raha: | hai

LIST 19

Sl. No.	Sentences in Hindi	IPA
1.	बाजार में सब्जियाँ मिल रही हैं।	bɑ:dʒɑ:r|mẽ|sɑbdʒij ɑ̃:|mil| rɑhi: |hɑĩ
2	कुत्ता कुर्सी से कूद गया।	kut̪t̪ɑ:| kursi:| se| ku:d̪| gɑjɑ:
3	उसका बंदर वापस आ गया।	uskɑ:|bɑŋd̪ɑr| vɑ:pɑs| ɑ:| gɑjɑ:
4	गर्भवती महिला अस्पताल जा रही है।	gɑrbhɑvɑt̪i:|mɑhilɑ:|ɑspɑt̪ɑ:l|dʒɑ:|rɑhi:|hɑi
5	चूल्हे में कोयला गर्म है।	tʃu:lhe| mẽ| ko:jlɑ:| gɑrm| hɑi
6	थियों ने फसल नष्ट कर दिया।	hɑ:t̪hijõ|ne|phɑsɑl| nɑʂʈ| kɑr| d̪ijɑ:
7	साईकल का पहिया टेढा हो गया।	sɑ:iːkɑl|kɑ:|pɑhijɑ:|ʈeɖhɑ:| ho| gɑjɑ:
8	बालक बिस्तर पर लेटा है।	bɑ:lɑk| bist̪ɑr| pɑr| leʈɑ:| hɑi
9	बाहर बहुत गर्मी है।	bɑ:hɑr| bɑhut̪| gɑrmi:|hɑi
10	जंगल में अंधेरा फैला है।	dʒɑŋgɑl| mẽ|ɑn̪d̪herɑ:| phɑi:lɑ:| hɑi

LIST 20

Sl. No.	Sentences in Hindi	IPA
1.	माँ ने खिड़की बंद की।	mã:| ne| khiɽaki:| ban̪d̪| ki:
2	उसकी कहानी पर हँसी आई।	uski:| kaha:ni:| par| hãsi:| a:i:
3	अंगीठी की आग बुझ गई।	aŋgi:ʈhi:| ki:| a:g| budʒh| gai:
4	चावल की खीर तैयार है।	tʃa:val| ki:| khi:r| t̪aija:r| hai
5	सड़क के निकट एक बाग है।	saɽak| ke| nikaʈ| ek| ba:g|hai
6	अंगूठी में नगीने जड़े हैं।	aŋgu:ʈhi:| mẽ| nagi:ne| dʒaɽe| haĩ
7	आलू बाजार से लुप्त हो गए।	a:lu:|ba:dʒa:r| se| lupt̪| ho| gaje
8	शिक्षक ने बच्चे पर शक किया।	ʃikʂak| ne|batʃtʃe| par| ʃak|kija:
9	आँधी में कई पेड़ उखड़ गए।	ã:d̪i:| mẽ| kai:| pe:ɽ| ukhaɽ| gae
10	घड़ी चलते चलते रूक गई।	ghaɽi:| tʃalt̪e| tʃalt̪e| ruk| gai: