

THE DEVELOPMENT AND STANDARDIZATION OF A PICTURE SRT TEST FOR ADULTS AND CHILDREN IN KANNADA

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Speech audiometry embraces the clinical procedures used in measuring auditory response to speech stimuli. Speech Reception Threshold (or threshold of intelligibility) and speech sound discrimination are the stimulus dimensions assessed most frequently in clinical practice. Speech reception threshold is usually defined as the "lowest hearing level at which a person repeats correctly 50 per cent of the spondaic words heard by him".

It becomes relatively more difficult to administer speech audiometry to children and speech impaired adults. In such instances it is not always easy to determine whether the lack of response is related to the linguistic handicap or loss of hearing or to other factors. Then, it becomes a necessity to determine whether the incorrect response is secondary to the inability to correctly reproduce what he heard or to an impairment in auditory perception. Then emerged the attempts to develop tests using the "non-verbal" responses (pointing to the corresponding picture or object). Though tests on these lines have been developed, only limited research data are available.

Speech tests need to be standardized on the population to be tested. Obtaining norm is one aspect of standardization. Standardization of speech material for obtaining speech reception threshold and discrimination scores will provide norms to which comparison can be made to assess the amount of deviation.

Speech tests in Indian languages are already available (Hindi, Tamil, Telugu and Malayalam). Development of spondee and phonetically balanced word lists in Hindi was done by Abrol, B. M. (1971). Test materials in Tamil, Telugu and Malayalam (Kapur, Y. P. 1971) have been standardized utilising disyllabic words, as very few meaningful monosyllabic words were available. Apart from these, research has been done on. "The Development and Standardization of speech test material in English for Indians" (Swarnalatha, 1972); "The synthetic Speech Identification Test for determining the discriminative ability" in Kannada was developed by Nagaraja (1973) and "A common Speech Discrimination Test for Indians" by Mayadevi (1974).

Need for the Study :-

The C.I.D. W-22 lists, and the speech reception material standardized on English population (Swarnalatha, 1972) are limited to the English speaking population. There have

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been no tests developed for the determination of speech reception threshold in Kannada.

The individuals, who have speech impediments like **stuttering, aphasia, misarticulation** and **aphonia** are unable to take an active part in the conventional speech audiometric "say the word" tests. Most of the children, do not find conventional repeating of the spondaic words interesting, and meaningful and hence refuse to co-operate with the tester. Moreover, the conventional verbal tests have been condemned by many audiologists as not being very objective. Hence, an attempt is made to develop a test requiring non-verbal responses and which thus overcomes the above mentioned problems. The same test can be used as a verbal response test also.

Brief Plan of the Study :-

The most frequently occurring words in Kannada that could be easily and clearly picturized were collected. They were subjected to familiarity tests on Kannada speaking population. Pictures were drawn for the selected words. Those pictures that were ambiguous were discarded. The test materials were presented at different intensity levels. Articulation curves were drawn and speech reception threshold was determined. Reliability was established by retesting a few of the subjects after a lapse of time.

METHODOLOGY

The two aspects of this study were :

- 1) Procedure for obtaining the test materials.
- 2) Procedure for obtaining Speech Reception Thresholds.

1) Procedure for obtaining the test materials :

A set of words that were most frequently occurring in Kannada were collected from the Central Institute of Indian Languages. From these, 104 words for which pictures could be drawn were chosen. They were tested for familiarity. As spondee words are not easily available in Kannada language, 2-3 syllable words were used.

Subjects :- One hundred (graduate and post-graduate) students were selected for the familiarity test. Their ages ranged from 17 to 5 years with a mean age of 20 years. Twenty five children between the ages of 3—5 were selected with the assumption that the words rated as being familiar by this age group shall be familiar to the upper age groups as well. All the subjects had no observable physical and mental handicaps. It was ensured that Kannada was the mother tongue for all of them.

Procedure :- The word lists for adults were cyclostyled. The purpose of the test was explained to the subjects. The subjects were asked to rate the words as "Most Familiar" (ತುಂಬಾ ಗೊತ್ತು).

“Familiar” (ಸೊತ್ತು) and “Not Familiar” (ಸೊತ್ತಿಲ್ಲ). Examples for each category were given and it was made clear to them that this had nothing to do with testing their language or intellectual abilities. As majority of the words were rated as being most familiar, and no word was rated as not being familiar, the words rated as being “Most Familiar” were chosen for the study. Sixty four words, thus selected were made into four lists, each comprising of sixteen words, making use of the random numbers. These four lists were then subjected to “intelligibility” tests to determine whether they were equally intelligible or not. This was made feasible by obtaining the responses of six normal adults at -6, -4, -2, 0, +2, +4 and +6 dB with respect to their pure tone average. The words that were intelligible at lower levels and those that were difficult at higher levels were discarded and the equally intelligible words (at -2 to +2 dB HL ref : zero SRT) were selected for the formation of the final test materials. Forty “equally intelligible” words were randomly sorted into two equal lists.

Pictures for the words were used to test their familiarity with children. The pictures were shown to the children and they named them. In cases, where the children did not name the pictures for some reason or the other, the children were asked to point to the pictures randomly named by the experimenter. The words that were not familiar to any of the children were discarded and only those words that were familiar to all the children were selected.

Recording Procedure :- A dynamic microphone (Sennheiser Type MDT 22 LM) was used within an acoustically sound treated booth at the All India Institute of Speech and Hearing. The microphone was connected to a Madsen Tape Recorder KBR 71, using magnetic tape. The tape recorder gain was adjusted so that the recordings were made at ‘O’ VU meter deflection for the last word of the standard carrier phrase. The test items were said naturally without attempting to monitor the test words to a specific level on the VU meter.

The recording was made by a 19 year old male, whose mother tongue was Kannada and whose habitual frequency was measured to be 110 Hz. He was experienced in the technique of monitored live-voice speech audiometry and had adequate practice with the test materials, prior to the recording session. The items were spoken with a 5 second interval. At the beginning of the tape, 1000 Hz calibration tone was recorded. The level of the tone was adjusted so as to produce a ‘O’ VU deflection on the meter.

Equipment and Acoustic Environment : A Madsen Model OB 70 audiometer and madsen KBR 71 tape recorder were used for the study. The audiometer was calibrated to ISO (1964) specifications, using Bruel and Kjaer equipment (artificial ear - B & K type 4152 with condenser mic 4132, SPL Meter - B & K type 2203, Octave Filter - B & K type 1613 and Preamplifier), in a sound treated room. The calibration tone (1000 Hz) which was recorded on the tape was fed to the audiometer. The V. U meter was adjusted to ‘O’. The output was measured at 60 dB HL (Hearing Level) using the above mentioned calibration equipment. The output was found to be 72

dB SPL. Thus, the present audiometer's zero S.R.T. was 12 dB SPL instead of 20 dB SPL. Linearity of the dial was checked and found to be correct. A talk-back system was used for the subject's verbal responses. The scale of hearing level attenuator of the audiometer extended from -10 to +100 db in steps of 5 dB. By pushing a special button, the range could be increased by +10dB. There was provision for 1 dB vernier.

The study was conducted in a sound treated environment, a two room arrangement, of which one served as a control room and the other as a test room. The noise levels in the test room were measured by B & K SPL meter type 2203 with Condenser Mic. 4145, B & K Octave Filter Set - 1613.

Test Procedure : For standardization of speech tests with adults, 55 subjects whose ages ranged from 16 to 25 years with a mean age of 20 years were selected. Their education ranged from pre-university course and above. Thirty school going children, whose ages ranged from 5 to 10 years with a mean age of 7 years were selected for standardization of speech tests with children. All subjects knew Kannada. The ratio of male to female subjects was maintained at 1:1 in both the experiments.

Before proceeding with the actual test, all the subjects were given an otological examination and air-conduction pure tone audiometric test for both the ears. Only such of those persons who had no observable abnormalities were selected as subjects for the study.

2) Procedure for obtaining Speech Reception Thresholds

The acoustic conditions were the same as for pure tone audiometry. The subjects were given the following instructions :

“ You will hear a list of words through your ear-phones. These will be preceded by the carrier phrase ; ‘idannu heli’ (adults) / ‘idannu Torisu’ (children). You will have to repeat the words / pick up the appropriate picture. If you are not sure, guess. Do you have any questions ?”

There were two lists of twenty words each for adults and one list of fifteen words for children. Each subject was tested at only one intensity, all in the left ear, for both the lists I & II. The intensities at which the lists were presented to different adults varied from 0 to 25 dB HL (ref : zero SRT) at intervals of 2 dB.

Instructions were given to each subject and then the test items were fed from the ear-phones of the audiometer at a predetermined intensity level. A time gap of 5 seconds was given for the subject to respond. For adults, the responses were verbal. Here, the assumption was that the subjects being normal in their expression, could repeat the words heard.

In the case of children, the 15 pictures corresponding to the stimulus words were randomly divided into groups of three and were pasted on individual sheets along with two more pictures that were not included in the test. This was done in order to control the selection of pictures on the basis of elimination. Thus, each page consisted of 5 pictures (3 corresponding to the stimulus words and 2 others), the order of which was determined using the random numbers. The 5 sheets, containing 25 pictures (15 stimulus words and 10 others) were bound in the form of a booklet, the pages of which could be turned easily. An assistant turned the pages as the child came out with the responses and noted them. The assistant was aware of the order of presentation. Apart from these changes in the test procedure mentioned, the remaining procedure was same as used for adults.

Recording of responses : The number of correct responses given by each subject, for each list was noted down. These were then converted into percentage of correct responses at each intensity level for further analysis.

Plan of Analysis : The mean and the S. D. values of the percentage of correct responses were calculated for each list. Articulation curves were drawn and from the graphs, the mean SRT was determined. A few subjects, adults and children, from the original sample were randomly selected and retested to determine the test-retest reliability.

RESULTS AND DISCUSSION

Analysis

The data obtained on normal adults and children for the purpose of standardization were subjected to statistical analysis.

The percentage of correct responses, their means and standard deviations at various intensity levels were obtained both in the case of adults and children. The Table I and II show the percentage of articulation obtained using the adult lists I and II. The articulation scores obtained using the children word list at various intensity levels are shown in Table III.

Test Retest reliability of the lists was verified in the following way - the lists were administered to a few randomly selected subjects from the original sample (both adults and children) for a second time after a week, with the same lists and at the same intensity levels. The results were compared with the results obtained during the first test.

Results:—

The speech reception threshold obtained using adult subjects was 19 dB SPL for List I and 19.5 dB SPL for list II. In the case of children, the SRT was obtained at 21 dB SPL. Thus, the results of the present study show that zero SRT for the lists of the developed agrees with the zero SRT for English spondee words (zero SRT = 19 dB SPL). Speech audiometers calibrated to ANSI specifications can be used for administering SRT test in Kannada language using these standardized lists without any corrections.

TABLE I

Percentage of correct responses, their Means and S.D'S obtained using adult's Picture
SRT List I at Various Intensity Levels.

Sl. No.	Intensity in dB SPL re: 0.0002 dyne/cm ²	Percentage of correct responses					Mean	S.D.
		A	B	C	D	E		
1	12	0	0	5	0	0	1	2.24
2	14	0	15	5	15	10	9	6.52
3	16	15	35	20	30	65	33	19.56
4	18	35	45	30	55	55	44	11.40
5	20	60	55	45	40	55	51	8.22
6	22	65	60	65	55	70	63	5.70
7	24	60	75	80	65	55	67	10.37
8	26	85	80	80	80	80	81	2.24
9	28	90	90	95	90	90	91	2.24
10	30	95	100	95	95	95	96	2.24
11	32	95	100	100	95	95	97	2.74
12	34	100	100	100	100	95	99	2.24

TABLE II

Percentage of correct responses, their Means and S.D'S obtained using adult's Picture
SRT List II at Various Intensity Levels.

Sl. No.	Intensity in dB SPL re: 0.0002 dyne/cm ²	Percentage of correct responses					Mean	S.D.
		A	B	C	D	E		
1	12	0	0	0	0	0	0	0
2	14	0	40	5	25	30	20	16.96
3	16	25	40	30	45	55	39	11.94
4	18	50	40	30	55	35	42	10.37
5	20	60	50	60	45	50	53	6.71
6	22	75	55	60	50	80	64	2.94
7	24	75	80	80	75	55	73	10.37
8	26	95	90	85	80	75	85	7.91
9	28	95	90	95	90	90	92	2.74
10	30	95	100	95	100	95	97	2.74
11	32	100	100	100	100	100	100	0

TABLE III

Percentages of correct responses, their Means and S.D'S obtained using children Picture
SRT List at Various Intensity Levels

Sl. No.	Intensity in dB SPL re: 0.0002 dyne/cm ²	Percentage of correct responses					Mean	S.D.
		A	B	C	D	E		
1	12	0	0	20.00	6.67	0.00	5.33	8.69
2	17	40.00	33.33	33.33	33.33	33.33	34.66	2.98
3	22	46.67	53.33	53.33	66.67	46.67	53.33	8.16
4	27	66.67	86.67	80.00	66.67	73.33	74.67	8.69
5	32	80.00	93.33	100.00	93.33	86.67	90.67	7.60
6	37	100.00	100.00	93.33	100.00	100.00	98.67	2.98

SUMMARY AND CONCLUSIONS

There have been no tests developed for the determination of speech reception thresholds in Kannada. The conventional speech reception thresholds requiring verbal responses were found to be not suitable for the speech impaired and children. The aim of this study was to develop and standardize a Picture SRT Test for adults and children in Kannada. Most frequently occurring words in Kannada which could be picturized (unpublished words, Dr. Ranganath) were administered to one hundred adults and twenty five children for familiarity testing. The most familiar words were selected to form two lists of twenty words each for adults and one list of fifteen words for children. Corresponding pictures were drawn and the ambiguous ones were redrawn. All the test materials were tape-recorded and fed through the speech channel of the audiometer. Fifty five adults and thirty children comprised the subjects used in the standardization of the speech lists. These lists were presented to the subjects at various intensities and articulation curves were drawn. The mean SRT was determined from the articulation curves. Mean SRT's of 19 dB SPL and 19.5 SPL were obtained for adult's List I and List II respectively. A mean SRT of 21dB SPL was obtained with the children's list.

The present study resulted in standardized picture SRT lists which can be used with any speech audiometer, calibrated to ANSI (1969) specifications, without any further corrections.

Recommendations for further research:—

- 1) Validity of this may be established by administering the present lists and English spondee words to subjects knowing both English and Kannada.
- 2) Studies may be undertaken to establish the relationship between SRT and PTA, using the present lists with normal subjects.
- 3) Relation between SRT and PTA in simulated hearing loss subjects may be established.
- 4) Reliability of SRT for Kannada language in cases of simulated hearing loss maybe verified.
- 5) The test may be administered on a larger number of children in the age range of 3-5 years.

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APPENDIX

Word List II (Adults)

- | | |
|----------------------|------------------------|
| 1. a : ne (elephant) | 11. maṛa (tree) |
| 2. ili (rat) | 12. ha : vu (snake) |
| 3. Koli (cock) | 13. ta : vare (lotus) |
| 4. bi : ga (lock) | 14. maṅga (mokey) |
| 5. kaṇnu (eye) | 15. či : la (bag) |
| 6. ba : na (arrow) | 16. saikala (cycle) |
| 7. ha : ra (garland) | 17. že : lu (scorpion) |
| 8. kivi (ear) | 18. pennu (pen) |
| 9. re : dio (radio) | 19. ba : tu (duck) |
| 10. haḡga (rope) | 20. Kurči (chair) |

Word List I (Adults)

- | | |
|----------------------|------------------------|
| 1.. gula : bi (rose) | 11. hallu (teeth) |
| 2. maḍake (pot) | 12. simha (lion) |
| 3. Ka : ru (car) | 13. kuri (sheep) |
| 4. e : ni (ladder) | 14. mosale (crocodile) |
| 5. mane (house) | 15. bekku (cat) |
| 6. čandu (ball) | 16. buguri (top) |
| 7. čakra | 17. kode (umbrella) |
| 8. jinke (deer) | 18. uyya : le (swing) |
| 9. maṇča (cot) | 19. gu : be (owl) |
| 10. kitaki (window) | 20. gante (bell) |

Word List (Children)

- | | |
|---------------------|-----------------------|
| 1. Kudure (horse) | 9. a : ne (elephant) |
| 2. na : yi (dog) | 10. Ko : li (cock) |
| 3. hu : vu (flower) | 11. kaṇnu (eye) |
| 4. ka : ru (car) | 12. kivi (ear) |
| 5. mane (house) | 13. maṛa (tree) |
| 6. huli (tiger) | 14. s : ikala (cycle) |
| 7. Bekku (cat) | 15. ba : tu (duck) |
| 8. buguri (top) | |