

# A NEW SPEECH DISCRIMINATION TEST IN TAMIL\*

JESUDAS DAYALAN SAMUEL

*Speech audiometry is an indispensable clinical tool of audiological evaluation. Its assistance in measuring hearing acuity, determining the anatomical location of the hearing disorder and in evaluation of ability to communicate is well known. Non-availability of properly prepared speech materials in particular Indian languages is a well known fact. Tamil language is not on exception to it. An attempt is made to alleviate this problem by constructing phonetically balanced word lists in Tamil. A new speech discrimination test is developed in Tamil paying proper attention to meaningfulness, phonetic balance, familiarity and distinctive features. Rajaram's 'Recall vocabulary' served as the source to collection of CNC type monosyllables. They were subjected to familiarity test. Four phonetically balanced word lists were constructed. List equivalency, articulation gain function, reliability and validity of the lists were evaluated. Results suggest that it is a better tool for testing discrimination.*

## INTRODUCTION

The science of hearing is greatly indebted to speech audiometry for its assistance in identification, diagnosis and specification of site of lesion in hearing impairments. Development of such an useful tool in a particular language is one of the basic and important needs of speech and hearing centres and otolaryngological units in this country.

### The inadequacies of available tests

Though Swarnalatha (1972) had developed and attempted to use available familiar English materials on Indians it can hardly evaluate all Indians as only a small portion (nearly 4%) use English in day to day life. Studies (Sapon and Carroll, 1957; Singh, 1966; Miyawaki et al, 1975) have clearly shown that the language spoken by the listener would definitely affect the perception of the listener. So testing Indian subjects in English would not be appropriate.

Mayadevi (1974) made a greater attempt to solve the problem of this multilingual country by preparing a 'Common Speech Discrimination Test' with twenty common monosyllables of CN type. This investigator is of the opinion that those sounds do not provide all

\*Abstract by the author.

Guide : Mr. S.P.C. Pandaley M.Sc., Speech & Hearing Clinic, Cannanore-4.

NOTE : This was read as a paper at the IX Indian Speech and Hearing Association (ISHA) Conference, Bangalore, January 1977-published as an article in 'Journal of Rehabilitation in Asia', April 1978. permission to reprint has been obtained. Editor.

the necessary temporal parameters necessary for perception. As Zakrewski et al. (1975) point out they tend to test recognizability a (sub-cortical phenomenon) and not 'discriminative' (cortical phenomenon) as most of those sounds carry no meaning in any Indian Language. Also such a test possibly cannot have a phonetic balance. Kapur's (1971) material lack proper phonetic balancing, also it does not include all distinctive features of Tamil (which are considered to be the basis for discrimination) and were standardized only on three normal hearing subjects. Also the subjects reached their maximum score at about 45 dB HL re-audiometric zero which is nearly 65 dB SPL suggesting that the material is difficult to discriminate.

The present study was therefore an attempt to overcome the drawbacks and failures encountered by the previous studies. A new speech discrimination test was developed in Tamil incorporating all possible standard methods of developing and standardizing speech tests.

### Development of material

The 'Recall Vocabulary' of Rajaram (1971) served as the source for collection of familiar words. All the CNC type of monosyllables from that source were collected and were sentenced to a familiarity test. The obtained familiar, meaningful monosyllables were used to construct four equivalent word lists using the functional load advocated by Meenakshi Sundaram (Kapur, 1971). Care was taken to include all distinctive features of spoken Tamil. Word lists were recorded on a magnetic tape KBR 71. The procedure used in recording speech was similar to the one used by Rintelmann et al, (1973) All the four word lists appear on last page of the article. All words were preceded by the carrier phrase 'Solloungo' meaning 'say' in Tamil language.

Swarnalatha's (1971) English material was also recorded on a magnetic tape. The same speaker who spoke Tamil words was used in recording English material.

### Apparatus and test environment

For both preliminary screening and for speech testing a speech audiometer, Madsen OB 70 was used. The acoustic transducers (GDH 39) of the instrument were housed in cushions (MX 41 AR) and were enclosed by cup enclosure devices. The deck type tape recorder KBR 71 was used for playing the magnetic tapes.

Testing was performed in the custom made sound treated rooms of the All India Institute of Speech and Hearing, Mysore. The noise levels in the test room were far below the interference level as measured by a sound level meter (Bruel and Kjaer 2203) and its associated band pass filter (Bruel and Kjaer 1613).

The speech audiometer used in this research was calibrated to standards of ANSI (1969) and the detailed procedure is available elsewhere (Samuel, 1976).

## Subjects

The student population of the University of Mysore was the source to select the subjects. Thirty of subjects, whose mother tongue was Tamil and who were fluent in Tamil, were chosen for this study. All of them had healthy ears otologically and normal hearing audiologically in both ears as determined by a pure tone audiometric evaluation (Hearing levels within 20 dB for the frequencies 250, 500, 1k, 2k, 4k, 6k, 8kHz re. ANSI 1969).

## Test Procedure

Initially pure-tone audiometric evaluation was performed. Spondee thresholds were established using Tamil Spondee material (Kapur, 1971) which were also recorded on a magnetic tape by the same speaker. Ascending procedure (Chaiklin et al, 1967) was used in determining SRT. Subjects were familiarized with the material before the testing was performed. The newly developed Tamil PB material was used to explore the discriminative ability of the subject. Three experiment sessions were arranged to establish:

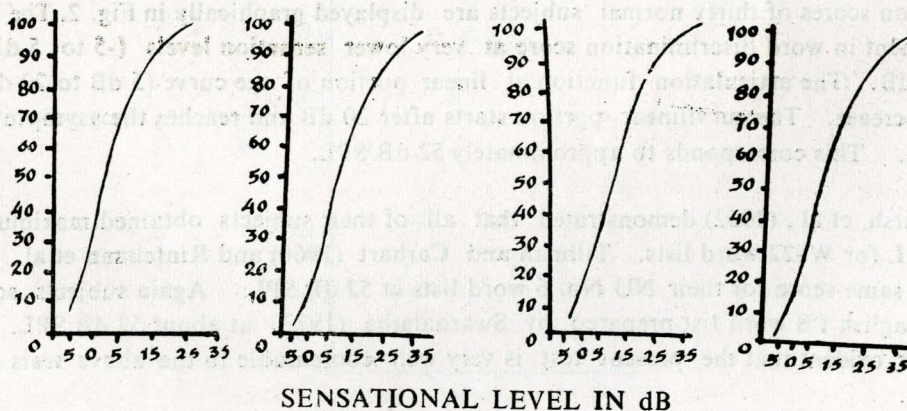
- i) List equivalency,
- ii) Articulation-gain-function and reliability, and
- iii) Validity of the present lists.

## Results and Discussion

### List Equivalency of Four Tamil PB Word Lists

The results obtained on ten normal hearing subjects in this experiment were subjected to statistical analysis. The mean scores and standard deviation of the word discrimination scores for each of the four lists as a function of sensation level are given in Table 1. The mean word discrimination value for all the four lists are graphically displayed in Fig. 1.

Fig 1. Graphs showing comparison of articulation gains of Four Lists.



**Table 1 : Means (M) and Standard Deviations (SD) of Word Discrimination Scores in percent Correct Obtained with Four Tamil PB Words Lists for Normal Listeners (N=10)**

Sensation Level	List I		List II		List III		List IV	
	M	SD	M	SD	M	SD	M	SD
-5	2.0	2.1	1.5	2.4	1.3	2.3	1.3	2.1
0	10.8	5.4	15.2	6.5	16.0	7.3	13.6	5.6
5	34.0	7.4	33.2	9.5	35.2	7.4	32.0	8.1
15	70.0	8.5	74.4	9.1	75.2	8.6	71.0	0.2
25	93.4	2.8	92.0	3.2	94.0	3.0	92.6	3.3
35	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0

Inspection of mean word discrimination scores in Table 1 convinces that all the four lists are essentially equivalent, i.e., they yield essentially, similar scores at all sensation levels. The greater standard deviations at the linear part of the curve (5 to 15 dB) reveal a larger inter-subject variability. The standard deviations for scores at very low and very high sensation levels are very small, demonstrating lesser inter-subject variability. All the lists reach asymptote at about 35 dB SL. It is also clear that all lists have an increment of 2.7% per dB.

The results are therefore agreeable to the suggestions of Tillman and Carhart (1966) that inter-subject variability is expected to be greater on the linear portion of the articulation function than on the curvilinear segment when saturation is being reached.

#### Articulation-gain-function and Test Retest Reliability of Tamil PB Word Lists

The data obtained after statistical analysis is given in Table 2. The mean word discrimination scores of thirty normal subjects are displayed graphically in Fig. 2. The percentage of increment in word discrimination score at very lower sensation levels (-5 to 5 dB) is about 3% per dB. The articulation function at linear portion of the curve (5 dB to 20 dB) is 3.3% per dB increase. The curvilinear portion starts after 20 dB and reaches the asymptote at about 32 dB SL. This corresponds to approximately 52 dB SPL.

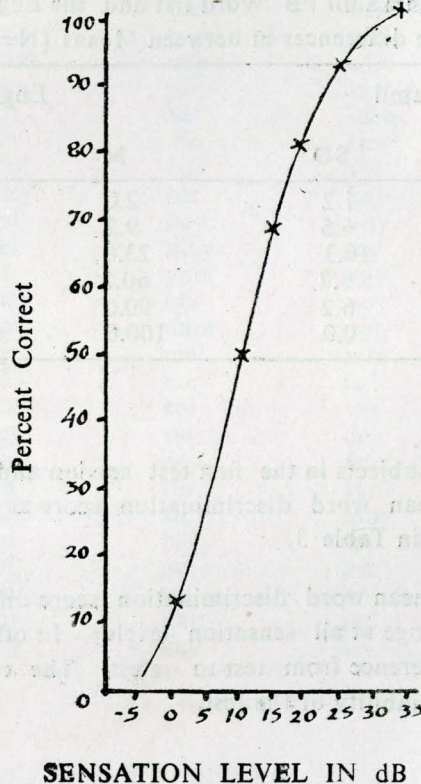
Hirsh, et al, (1952) demonstrated that all of their subjects obtained maximum score at 67 dB SPL for W-22 word lists. Tillman and Carhart (1966) and Rintelman et al., (1973) also obtained same score for their NU No. 6 word lists at 52 dB SPL. Again subjects scored 100% for the English PB word list prepared by Swarnalatha (1972) at about 52 dB SPL. Therefore it is quite evident that the present test is very well comparable to the above tests in terms of efficiency.

**Table 2, Mean (M) and Standard Deviations (SD) of Word Discrimination Scores in percent correct obtained with Tamil PB Word Lists for normal listeners (N=30)**

Sensation Level	Mean	SD
-5	2.5	2.1
0	13.5	2.6
5	30.8	7.3
10	49.2	5.6
15	68.4	4.4
20	80.0	4.3
25	92.0	4.3
30	97.2	2.8
35	100.0	0.0

For the Tamil PB list prepared by Kapur (1971) the asymptote was obtained at about 45 DB HL re-audiometric zero, which would be approximately 65 dB SPL for speech. The higher level obtained by the investigator may be because of the differences in the word lists, types of equipment used and possibly due to the difficulty of the subjects to follow the talker.

**Fig. 2 Articulation curves for Tamil PB lists N = 30**



The higher sensation level (45 dB SL) reported by Maya Devi (1974) for the monosyllable sounds is obviously because of the reasons already discussed elsewhere.

**Table 3 Means (M) and Standard Deviations (SD) of Word Discrimination scores in percent correct obtained with Tamil PB Word Lists for Test Session. Retest Session and the differences in between Means (N=10)**

Sensation Level	Test Session		Retest Session		Difference in Means
	M	SD	M	SD	
-5	2.0	3.8	1.6	2.7	0.4
0	17.8	7.8	14.9	6.2	2.9
5	30.6	9.3	33.6	8.9	3.0
10	52.0	10.5	54.5	9.7	2.5
15	68.2	8.6	70.0	8.1	1.8
20	84.4	5.5	85.2	6.9	0.8
25	92.6	6.2	96.2	4.8	3.8
30	97.2	4.5	99.2	3.2	2.0
35	100.0	0.0	100.0	0.0	0.0

Correlation = 0.9

**Table 4 Means (M) and Standard Deviations (SD) of Word Discrimination scores in percent correct obtained with Tamil PB Word list and the English PB Word lists for normal hearers and the differences in between Means (N=10)**

Sensation Level	Tamil		English		Difference in Means
	M	SD	M	SD	
-5	2.5	1.2	2.0	2.8	0.5
0	15.0	6.5	9.2	6.2	5.8
5	31.5	10.3	23.0	9.2	8.5
15	72.0	9.7	60.2	9.2	12.2
25	92.2	6.2	90.0	5.5	5.2
35	100.0	0.0	100.0	0.0	0.0

Correlation = 0.98

#### Test-Retest Reliability :

The mean scores of ten subjects in the first test session and in the retest sessions along with the difference in the mean word discrimination score at various sensation levels with reference to SRT are exhibited in Table 3.

Table 3 shows that the mean word discrimination score difference between the two test sessions were within a 36% range at all sensation levels. In other words, in most cases there was only one or two word difference from test to retest. The correlation coefficient value of 0.9 obtained indicate higher reliability of the test.

### Validity of Tamil PB Word List as a Measure of Discrimination :

Table I exhibits the mean word discrimination scores of ten subjects on English monosyllabic word test of Swarnalatha (1972) and the scores of the same subjects for the preword lists. It demonstrates that both the tests yield almost similar results ensuring external validity of the present list. Correlation value of 0.98 obtained clearly substantiates the validity of the present word list as a measure of speech discrimination values for the English word lists and the Tamil PB word lists.

### Conclusions

1. Normals obtain maximum scores at 35 dB SL with reference to their SRT.
2. All the four lists were found to be essentially equivalent and can be used interchangeably.
3. The present lists yield results similar to any other valid test of discrimination.

### Phonetically Balanced Monosyllabic Word Lists in Tamil.

	List I	List II	List III	List IV
1	nal	kar	bar	kal
2	yan	pen	jan	por
3	dam	nay	sar	vay
4	min	jor	koy	pal
5	sur	vel	men	vil
6	sir	vin	tin	bas
7	mul	bas	yal	say
8	mey	bir	kol	ser
9	val	pey	noy	car
10	vel	may	tay	hal
11	jil	yam	pay	ban
12	nan	nar	noy	ner
13	nar	dam	pon	tey
14	bir	mel	min	gol
15	bas	mey	hal	yar
16	poy	sol	var	kol
17	dey	sel	dey	nil
18	tin	dey	dam	mor
19	ten	tin	ver	man
20	sul	sil	moy	dey
21	hal	hal	sey	jey
22	gol	gol	bas	man
23	kul	ten	gol	dam
24	kur	kan	nul	ney
25	poy	kay	sey	tin

## Bibliography

- Chaiklin, J.P. J Font, R.E. Dixon, (1961) 'Spondee Thresholds Measured in Ascending 5-dB Steps,' *Journal of Speech and Hearing Research*, 10 (1967), 141-45.
- Hirsh I.J. and others 'Development of Material for Speech Audiometry' *Journal of Speech and Hearing Disorders*, 17, (1962) 321-37.
- Kapur, Y.P. 'Needs of the Speech and Hearing Handicapped in India'. A Study: Vellore, Tamil Nadu, Christian Medical College, 1971.
- Maya Devi, M 'The Development and Standardization of a Common Speech Discrimination Test for Indians'. Unpublished Master's Dissertation. University of Mysore, 1974.
- Miyawaki, K and others 'Cross-Language Study of the Perception of F3 Cue for (r) versus (l) in Speech and Non Speech like Patterns'. Status Report on Speech Research, SR 33 Haskins Laboratories (1973), p 67-75.
- Rajaram, S. 'Recall Vocabulary in Tamil'. Central Institute of Indian Languages, Mysore India, 1972.
- Rintelmann, S. W.F. and others, 'Five Experiments on Speech Discriminations Utilizing CNC Monosyllabic Words', SHSLR 1-73. East Lansing. Michigan; Department of Audiology and Speech Sciences, Michigan State University, June 15, 1973.
- Samuel, J.D. 'The Development and Standardization of PB Materials on Tamil Language' unpublished Master's dissertation, University of Mysore, 1976.
- Sapon, S.M. and J B. Carroll, Discriminative perception of Speech Sounds as a Function of Native Language. *Gen. Linguistics*, 3 (1957), 52-72.
- Singh, S. 'Cross-Language Study of Perceptual Confusion of Plosive Phonemes in Two Conditions', *Journal of the Acoustical Society of America*, 36 (1966) 635
- Swarnalatha, K C. 'The Development and Standardization of Speech Test Material in English for Indians'. Unpublished Master's Dissertation, University of Mysore, 1972.
- Tillman, T. and R. Carhart, 'An expanded Test for Speech Discrimination Utilizing CNC Monosyllabic Words', North Western University Test No. 6 Technical Report, SAM-TR 66-55 Brooks Air Force Base, Texas, USAF School of Aerospace Medicine, Aerospace Medical Division (AFSC) 1966.
- Zakrweski, A, and others 'Identification and Discrimination of Speech Sounds in Monosyllabic Words and Nonsense Words by Children, *Audiology, Journal of Auditory Communication*, 11 (1975), 21-27.