

## Development and Standardization of Spondee Words In Bangla

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**ABSTRACT:** Spondee words are important for measuring speech recognition threshold. The basic criterions for selecting spondee words is that the bisyllabic words should be equal stressed. The words should be familiar or frequently used and homogeneous in audibility. The aim of the present study was to develop and standardize Bangla spondee word list on above criterion. The method included collecting maximum numbers of unduplicated bisyllabic Bangla words which did not rhyme. These bisyllabic words were judged for equal stress and then rated for familiarity on 5 points rating scale. For each rating a particular familiarity weightage was given. The original list was formed with total familiarity weightage of each word. A list of selected 40 words was formed. From this list, two lists were prepared such that each list of 20 words had same total familiarity weightages. The words of spondee list I and spondee list II were found homogeneous in terms of audibility after testing. SRT were measured with both the spondee lists on 30 normal hearing individuals and it inferred that, obtained SRTs were within 25 dB HL and SRT-PTA agreement within +/- 6 dB. A good correlation was obtained between SRT and PTA, between SRT obtained with both the spondee lists. Hence it can be concluded that this developed and standardised Bangla spondee list can be used for the SRT measurement of adult native Bangla population to fulfil clinical purposes of speech audiometry.

**Key words:** Spondee words, bisyllabic, familiarity, standardization.

### INTRODUCTION

Hearing loss is the primary cause that creates communication problem in day to day life irrespective of type and degree of loss. An audiologist spends considerable time using speech audiometric procedure that provides unique information. Clinical speech audiometry was developed from a need to quantify this ability. The speech recognition threshold is the minimum hearing level for speech at which an individual can recognise 50% of the speech material.<sup>1</sup>Speech recognition threshold is a recognition task in which the subject selects the test item from a closed set of choice. The most commonly employed and recommended speech stimuli for speech recognition testing are spondaic words.<sup>1,2,6</sup> Spondaic words or spondee words are bisyllabic words with equal stress on both syllables.<sup>1</sup>

Perception of speech is the process whereby an utterance is decoded into a representation in its linguistic unit. For speech recognition threshold testing spondees are presented via monitored live voice (MLA). It was considered that the SRT to be in agreement with the PTA if there was less than 12 dB difference between these measures.

Most of the studies with spondee regarding its criteria were done on normal hearing population. Standardization of spondee words aimed at developing a norm on normal. There are studies that describe high percentage of recognition score of spondee words upto severe degree of hearing loss. Thus it can be predicted that spondee words are sophisticated enough to determine the speech recognition threshold of hearing impaired population also. Hence this study has been taken up for importance of language specific spondee list.

### METHOD

The aim of the present study was to develop and standardize Bangla spondee word list for speech audiometry. The study included groups of participants to perform different tasks needed for development and standardization of spondee list such as 10 audiologists and speech language pathologists for judgement of equal stress on bisyllabic words. For familiarity judgement of spondee words 150 adults (75 male and 75 female) participated in

the study. The participants were native Bangla speakers. For judgement of homogeneity in audibility of spondee words, 10 normal hearing (pure tone thresholds within 25 dB HL at octave frequencies 250 Hz to 8000 Hz) Bangla adults with no history of any ear disease (identified through interview method). It also includes 30 normal hearing (pure tone thresholds within 25 dB HL at octave frequencies 250 Hz to 8000 Hz) Bangla adults with no history of any ear disease (identified through interview method) for standardizing the developed Bangla spondee list. Otoscope was used for the examination of the ears. MAICO MA 53 dual channel diagnostic audiometer was used for pure tone audiometry and speech audiometry.

**PROCEDURE**

The entire procedure was divided into five phases. In phase 1, bisyllabic words were collected followed by phase 2 which included judgement of equal stress on bisyllabic Bangla words. In Phase 3 familiarity of equally stressed bisyllabic Bangla words was done as shown in Table 3. The Phase 4 included collection of data on homogeneity in audibility. In the final phase 5 the standardization of word list through various steps which include pure tone audiogram, measurement of speech recognition threshold was conducted.

The table shows Phase 3, i.e. Rating scale and their corresponding familiarity weightage.

Rating		Familiarity weightage
1	Most familiar	+3
2	Familiar	+2
3	Not very familiar	+1
4	Doubtful	0
5	Unfamiliar	-1

**DATA ANALYSIS**

Calculation of total familiarity weightages and median of Bangla equal stressed bisyllabic spondee words and mean of intensity levels for 0%, 50% and 100% scores for both the ears of 10 individual for homogeneity with respect to audibility was done. Mean score and standard deviation of SRT for both the lists were obtained of 30 normal hearing subjects and then the correlation coefficient of the two lists were obtained. Correlation coefficient between SRT and PTA was calculated. This was followed by the testing of significance of the correlation coefficient and testing of null hypothesis against alternative hypothesis assuming normality.

**RESULTS**

The aim of the present study was to develop and standardize spondee word list in Bangla. The words, marked as

“yes” (i.e. equal stress on both the syllable) by atleast 6 out of 10 audiologists and speech language pathologists were separated and then the list of 130 words were prepared. Familiarity of 130 Bangla spondee words was judged by 150 (75 male and 75 female) native Bangla speakers. Total familiarity weightage of each word marked by 150 participants were calculated. The most familiar Bangla spondee word was having familiarity weightage of 425 and most unfamiliar spondee word was having familiarity weightage of 25. After finding the median word, 20 words below and 20 words above the median were taken to prepare the final word list. A list of 20 words each was prepared, as final spondee word list, out of 41 words. Two lists of 21 words each were prepared in such a way that total familiarity weightage of both the list must be very close. Among those 40 words, highest familiarity weightage was 288 and lowest familiarity weightage was 202. The spondee list I has total familiarity weightage of 4972 and spondee list II had familiarity weightage of 4961. The average minimum intensity level for 50 % and 100 % score and maximum intensity level for 0% score of each 20 words in spondee list I for right ear of 10 normal hearing individuals shows that the score of all the words are very near to each other. For 0 % score the intensity levels among the words varies from 2.5dB to 8dB. Thus the range of threshold of the spondee word list I in right ear varies only 2.5dB. The average minimum intensity level for 50% and 100% score and maximum intensity level for 0% score of each 20 words in spondee list I for left ear of 10 normal hearing individuals shows that the score of all the words are very near to each other. Thus the range of threshold of the spondee word list I in left ear varies only 3dB. The mean and standard deviation of pure tone average of right ear, pure tone average of left ear, SRT of right ear obtained with spondee word list I, SRT of left ear obtained with spondee word list I, SRT of right ear obtained with spondee word list II, SRT of left ear obtained with spondee word list II in given in the following tables 1 and 2.

**Table 1:** Mean, Standard deviation, minimum and maximum of PTAs

	PTA <sub>Rt</sub>	PTA <sub>Lt</sub>
Mean	14.78	14.06
Standard deviation	3.59	3.35
Maximum	21.6	20
minimum	8.3	8.3

**Table 2:** Mean, Standard deviation, Minimum and maximum of SRTs

	SRT I <sub>Rt</sub>	SRT I <sub>Lt</sub>	SRT II <sub>Rt</sub>	SRT II <sub>Lt</sub>
Mean	15.93	15.50	15.77	15.47
Standard deviation	3.61	2.99	3.58	3.23
Maximum	24	20	23	21
minimum	10	9	10	10

To draw statistical inference about the population from the sample, null hypothesis were tested against the alternative hypothesis computing test statistic (C) at  $\alpha$  equal to 0.05 and 0.1 level of significance assuming normal population.<sup>4</sup> Both the null hypothesis were accepted. The correlation coefficient (r) was obtained between SRT and PTA of both ears and SRT I and SRT II of both ears. From the following table 3 we can see that all are highly positively correlated to each other. In order to test the significance of the correlation in population of test statistics t were computed and compared with t- distribution at (n-2) degrees of freedom at  $\alpha=$  0.05 and 0.1 level of significance.<sup>5</sup> All the correlation was found to be significant for population also.

	Correlation coefficient (r)
PTA <sub>Rt</sub> and SRT I <sub>Rt</sub>	0.72
PTA <sub>Rt</sub> and SRT II <sub>Rt</sub>	0.72
PTA <sub>It</sub> and SRT I <sub>It</sub>	0.699
PTA <sub>It</sub> and SRT II <sub>It</sub>	0.599
SRT I <sub>It</sub> and SRT II <sub>It</sub>	0.82
SRT I <sub>Rt</sub> and SRT II <sub>Rt</sub>	0.86

### DISCUSSION

Spondees are the bisyllabic equal stressed words. As Bangla language is rich in rhyming and reduplicated words so during the collection of Bangla spondee words, rhyming and reduplicated words were not included because the patient may guess the word and threshold may be over estimated. In Bangla it is difficult to find bisyllabic words that have equal stress on both the syllable. In standard Bangla, Stress is predominantly at initial syllable. The next important parameter of spondee word is familiarity. It was reported that familiarity and prior knowledge of test vocabulary decreases the speech recognition threshold.<sup>3</sup>

The words having familiarity weightage more than 288 were described as “too easy” word. On the other hand, the words having familiarity weightage less than 202 were also described as “too difficult” with the possibility of underestimating the SRT.

In present study, the development of spondee words in Bangla passes through different phases of collection of bisyllabic words, judgement of equal stress, familiarity and homogeneity with respect to audibility to fulfil the criterions of spondee words. Thus, the word list developed in present study meets the general criterions of spondee words. Pure tone audiogram and speech recognition

thresholds with Bangla Spondee word list I and Bangla Spondee word list II were obtained for both ears and used for hypothesis testing and correlation analysis. In present study, it has been found that SRT obtained with the word list will be within 25 dB HL for normal hearing population (PTA less than 25 dB HL) and SRTs obtained with the developed spondee word list will be in agreement of +/- 6 dB with PTA.

Measured SRT with developed spondee word list is within 25 dB HL for normal hearing population, and SRT-PTA correlation is +/- 6 dB. Thus the word list will help to identify functional hearing loss (pseudohypacusis cases). As 100% score is obtained at 10-15 dB SL level, the spondee word list can be used for the validation and verification of hearing aid after fitting.

### CONCLUSION

The Bangla spondee word list developed in present study can be used for speech recognition threshold measurement of adult native Bangla speakers. These word lists were developed on the basis of familiarity judgement by adult native Bangla speaker population.

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APPENDIX 1

**Spondee Word List - I**

Bengali	IPA
জাতসাপ	dʒatˌsap
মেঘনাদ	megʰnadˌ
রাজকর	radʒkɔr
শোকতাপ	ʃoktˌap
ভাবলেশ	bʰableʃ
প্রেমরস	premrɔʃ
রাজদূত	radʒdūtˌ
রাজকোষ	radʒkoʃ
ধনহীন	dʰɔnhin
ঘুরপথ	gʰurpɔtʰ
পাপভোগ	papbʰog
দেবলোক	deblok
দায়ভার	daẽbʰar
ফাঁকতাল	pʰãktal
পরচুল	pɔrtʃul
দানশীল	danʃil
তাপমান	tɔpman
গরমিল	gɔrmil
চিৎপাত	tʃitˌpatˌ
চাঁদমুখ	tʃãdˌmukʰ

## APPENDIX 1

**Spondee Word List - II**

Bengali	IPA
তাঁতশাল	tãtʃal
নীলকর	nilkɔr
দেবনাথ	ɔɐbnatʰ
প্রানপাত	pranpatʰ
দানবীর	danbir
মলমাস	mɔlmas
কামচোর	kamtʃor
প্রাননাশ	prannas
ট্যাঁকশাল	tækʃal
লোকনাথ	loknatʰ
তীরবেগ	tirbeg
দুর্গম	durgɔm
যজমান	dʒɔdʒman
কালসাপ	kalsap
মানহীন	manhin
তৎকাল	tɔtkal
পিছটান	pitʃʰtan
বাকরোধ	bakrodʰ
শেষভাগ	ʃeʃʰag
রাজপুত	radʒputʰ