Development of Revised Token Test in Oriya

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Abstract

The present study is aimed at adapting the Revised Token Test into Oriya (RTT-O) language based on the principles of the original English version (Mc Neil & Prescott, 1978) and Kannada version (Veena, 1982). The adaptation of the test was done in three phases- listing of the test stimuli, development of test material and the administration of the test. The scores obtained on the test were subjected to appropriate statistical analysis. The level of performances in terms of comprehension ability on the RTT-O in normal population across age group 20-60 years was documented and then compared with the performance of the aphasic group. The findings of the present study revealed that the performances of males and females across subtests in different age groups did not differ significantly. The younger age groups (20-30 years) were better in their performance in comparison to the older age groups (30-40, 40-50 and 50-60 years). Obvious differences were observed among the persons with respect to the response patterns such as promptness, responsiveness, self-correction and sub-vocal rehearsals. Aging, memory span, attention are described in context to this. Hence, a reorganization of the test is recommended thereof. A hierarchy in the magnitude of comprehension deficits was exhibited by the normal participants on the various subtests. The aphasic participants performed relatively poorer than the normal participants. Cognitive and/or auditory processing deficits have been implicated from the responses of most of the aphasics. This study underscores the importance of a thorough assessment of auditory comprehension and its implication in drawing a profile of a person with aphasia and documenting even the subtle deficits in auditory comprehension among the different aphasic types and that research should be orientated at ameliorating the language specific test development in a multilingual country as India.

Key words: Revised Token Test, aphasia, auditory comprehension

Aphasia has been described as a multi faceted problem involving deficits in the communicative modalities of speaking, reading, writing and listening; and manifesting greater impairment in language areas than other intellective or mental functions. Due to the complexity of the problem, diversity in the approaches and opinion can be seen at the level of definition. Hence, it is necessary that it has to be studied from different dimensions. Of the various views on aphasia, it has also been described as a 'disorder of comprehension' with an inability to understand linguistic utterances that cannot be attributed to deficient sensory input or generalized cognitive deficits (Rosenbek, La Pointe & Wertz, 1989). Schuell and Jenkins (1961) and Smith (1971) even reported of auditory comprehension deficits that exist in all the cases of aphasia.

There are many factors which contribute to this comprehension difficulty and these factors are interacting. Some of these factors (speech sound and word meaning recognition) may be selectively impaired as a result of focal lesions, and may contribute to clearly defined aphasic syndromes. Other factors such as attention and short term auditory memory problems are more difficult to isolate and also they interact with the other two factors mentioned.

Aphasia research has shown that majority of the expressive problems are often associated with impairments of comprehension. However, the comprehension deficits in aphasia have been studied lesser than the expressive deficits. It can be possibly due to the fact that the analysis of comprehension needs to be based on observations of overt responses, which is usually confounded by the observed output deficits. A set of tests in common currency facilitates communication among clinicians and researchers, enabling them to compare and contrast persons under investigation from a known baseline. Kertesz (1988) has suggested that standardized assessments are necessary to diagnose the type of aphasia, allow a prognosis, and help in planning therapy. Thus, it should be taken care to devise a crisp and adequate test tool which would avoid the non-essential or frankly dubious aspects, and follow the essential components in the test structure. In the assessment of comprehension ability, the stimulus material will be presented to the subject, and his ability to comprehend will be inferred based on the response. A test of comprehension, thus, consists of carefully worked out administrative procedures, and stimulus materials that are designed to elicit relatively simple responses. The individuals with severe expressive deficits can also express their degree of comprehension using simple responses. The complexity of stimulus materials presented can also

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be systematically varied across test batteries, and the stimulus material can be increased by increasing the number of items to be presented (such as phonemes, morphemes, phrases and sentences) in a test. The level at which the performance is disrupted due to information overload can be determined by systematically increasing the number of items to be processed both in terms of semantic content as well as syntactic complexity.

Keeping the above attributes in mind, it was decided upon to construct a test that would prove effective at assessing the comprehension ability of a person with aphasia.

Despite India having vast ethno-cultural variations, still there have been very few attempts at studying and developing language test tools to assess brain damaged individuals in the Indian context. As far as concerned, the aphasia tests developed in Indian languages are intended mostly at testing the expressive ability of a person with aphasia in comparison to his comprehension ability. Of these various assessment tools developed in the Indian languages, Revised Token Test-Kannada (Veena, 1982) is the only test that has been developed to assess Kannada speaking persons with aphasia on their receptive abilities. With these aspects in mind, there developed a need to study and effectively assess the comprehension deficits in Oriya speaking persons with aphasia, Oriya being another Indian language. This led to the development of the test tool, Revised Token Test in Oriya.

The present study aimed at adapting the Revised Token Test into Oriya language based on the principles of the original English version (Mc Neil & Prescott, 1978) and Kannada version (Veena, 1982) into Oriya language. The objectives of the study were to (1) determine the performances of normal participants on the Revised Token Test-Oriya (RTT-O), (2) to identify the level of performances in terms of comprehension ability in different age groups across the test (RTT-O), (3) to assess the variability in performance of participants across the complexity of the test (on various subtests) and (4) to compare the normal and the persons with aphasia on their comprehension abilities.

Method

Procedure: The 'adaptation' of test was done in three phases. First phase included listing of the test stimuli, second phase included development of test material in Oriya and in the third phase, the test battery was administered on normals and four persons with aphasia.

Phase-I: Listing of the test stimulus: The first phase involved the development of the test stimuli in Oriya. Basically this test is a modified version of the already existing Revised Token Test in Kannada (Veena, 1982). For the present study, 5 objects, 2 colours, and 2 sizes were incorporated. The list of objects included were flower, comb, tumbler, pencil, and bangle. Each of the object was in either of the colour- red or yellow and of varying sizes as big and small. A total of twenty objects were considered as the test material.

Phase-II: Development of test material: The Revised Token Test- Oriya (RTT-O) was developed after taking input from the Revised Token Test-English and Kannada. The RTT was translated into Oriya language by experienced Speech–Language Pathologists (SLPs) and linguists while considering the information from various sources like the RTT-English and RTT- Kannada. Syntactic and semantic aspects of the Oriya language was kept in mind while preparing the test material. The developed test was given to five SLPs who were proficient in reading and writing Oriya and have been exposed and trained on the language as a subject during the primary study career. The SLPs were asked to rate the test on various parameters on a scale, "Feedback Questionnaire for Aphasia Treatment Manuals" (Field Testing of Manual for Adult Non-fluent Aphasia Therapy in Kannada, MANAT-K; Goswami, Shanbal, Samasthitha & Navitha, 2010).

Description of the test: The RTT-Oriya consisted of ten subtests which comprehensively assessed different command lengths and different sentence types involving the twenty test stimuli. Each subtest further included ten homogeneous items ranging in difficulty and linguistic construction. A total of twenty objects (tokens) were considered for the test, RTT-Oriya involving five objects of two colours and two sizes each.

Distribution of subtest difficulty: The test consisted of ten subtests with increasing order of difficulty with each subtest. The test contained four different sentence types. The four sentence lengths in the Revised Token Test varied between 3, 4, 6 and 8 critical stimulus units in the commands (Park, McNeil & Tompkins, 2000). The sentence types included imperative prepositional phrases, adverbial clauses, simple imperatives and compound imperatives. The conjunction used in the RTT-O was and. The spatial pospositions used were on/above, below/under, by the side of, behind and in front of. The two left/right directional postpositions in Oriya were- left and right. The subordinate clauses used were- unless, either-or, instead of, if-then, if you have not-then.

Phase-III: Administration of the test: The normal participants were tested to form a baseline which was considered as normative for this test. The participants were seated comfortably; the objects were arranged according to the demands of the task of each subset and the instructions were given verbally. The test was conducted in a quiet environment.

Participants: The test was administered on all the group of participants whosoever were available in colleges, clinics, work stations, and/ or houses. The details of the participants are provided in Table 1 and 2.

Table1. *Details of the participants of the study*

Type of Population	Age Range (in yrs)	Males	Females
Normal participants	20-30	5	5
	30-40	5	5
	40-50	5	5
	50-60	5	5
Persons with Aphasia	20-60	3	1

Table 2. *Details of persons with aphasia*

Participant No.	Age/Sex	Cause and Aphasia type
1	35 yrs/M	Cause-Thalamic hemorrhage Diagnosis- Global Aphasia
2	46 yrs/ M	Cause-Cerebro-vascular accident Diagnosis-Wernicke's Aphasia
3	57 yrs/M	Cause- Ischaemic infarcts of the thalamus Diagnosis-Transcortical aphasia
4	52yrs/ F	Cause-Brain tumor Diagnosis- Sensory Aphasia

Procedure followed in test administration arrangement and placement: The tokens were arranged on a standard table in front of the participant, and the order of arrangement was kept the same always, for all groups of participants and all subtests. For all the odd-numbered subtests only big tokens (objects) were arranged and for the even numbered subtests both the small and the big tokens (objects) were arranged as per the subtest commands. Appropriate distance was maintained between the objects and rows. Each participant was seated in front of the table at a comfortable distance from where it was easy for him/her to reach and pick up the test material. The examiner sat to the left of the participant and slightly behind clearly out of his/her

working area and field of vision to avoid distractions that he/she might receive.

Ethical considerations were maintained and adhered to while selecting the participants (or family members/ care takers in case of persons with aphasia) were explained the procedure and the purpose of the study and an informal verbal/written consent was taken. They were randomly selected based on the following inclusionary criteria/s. (1) All the participants selected in the study were native speakers of Oriya. (2) The participants in the normal group had no past/present history of any neurological, psychological problems and sensory deficits and of any history of alcoholism or drug/abuse. (3) The persons with aphasia were identified through local hospitals, neurological clinics and/or speech and hearing centers. All of them had adequate sensory abilities (hearing and vision) and reported to be having no history of gradual deterioration in cognitive abilities.

Test instructions and parameters: The participants were instructed to point out to the appropriate items, when named by the examiners. Prior to the actual test the participants were given pre-test instructions. If any part of the test trial was not performed correctly, the instructions were repeated.

Introduction of subtest: The examiner administered the subtests while giving the commands. The behavior of the participant was observed during the command following which the participant's behavior and response was rated.

Scoring pattern: A 15-point multidimensional scoring system was used to describe performance, and quantify deficits and differences among normal and pathological groups. McNeil and Prescott (1978) used the five dimensions of the PICA to construct a 15-point multidimensional scale in the Revised Token Test (RTT), in which each of the 15 scores represents a different combination of response adequacy on all five dimensions. This 15-point scale allowed for quantification of each response on the following dimensions: (a) Accuracy, (b) Responsiveness, (c) Completeness, (d) Promptness, and (e) Efficiency.

While administering the test, provision for repeat cue was provided and while scoring this was taken into consideration. Repeats and cues were judged to be appropriate only by the verbs. The command was repeated when the participant did the wrong task (judged by verb only), or did nothing for 30 seconds, indicated that he/she has not understood the command, or requested for repetition of the command.

Table 3. *RTT scale score category descriptions*

Score	Description of Response
15	Complete
14	Vocal-Subvocal Rehearsal
13	Delay
12	Immediacy
11	Self-correction
10	Reversal
9	Repeat
8	Cue
7	Error
6	Perseveration
5	Intelligible/Rejection
4	Unintelligible (Differentiated)
3	Unintelligible (Perseveration)
2	Omission
1	No Response

The score sheet included a place to accommodate the participant's demographic data (name, age, sex), handedness, diagnosis, age of onset etc. A place for the summarization and accessibility of the overall test time, mean overall score for all subtests, and the mean for each individual subtest is provided.

The time taken to complete the test was approximately 20 minutes for normal participants and approximately one and a half hours for the persons with aphasia.

Statistical analysis: The normative values for each group were calculated separately and the mean scores were compared in all the age groups and between normal adults and the aphasic groups across all subtests. Statistical analysis for the above was done using SPSS software (Statistical Package for the Social Sciences package, version 16.0).

Results and Discussion

An 'item analysis' for the test was conducted from the ratings of the five SLPs on the 'Feedback Questionnaire for Aphasia Treatment Manuals'. The SLPs rated the test to be 'good' to 'excellent' on various parameters as Simplicity, Proverbiality, Size of the picture, Colour and Appearance, Arrangement etc. indicating that the test has enough implications in its scope of practice and generalization of the test commands for intervention purposes in persons with aphasia. The findings of the present study have been broadly presented and discussed under different headings.

I. Performances of males and females across subtests in different age groups: Mean and standard deviation (SD) were calculated for all the dependant variables i.e. subtests of RTT-O. Table 4 illustrates these scores for all the participants. From the mean values it can be inferred that, on an average

most of the participants obtained either a mean of 15.00 or 14.00, indicating that the responses were either complete or in the form of sub-vocal rehearsals. Based on the quantitative data, , a Mann-Whitney U-test was conducted within each age group for all the subtests and the overall mean to detect the differences between them, if any. The results revealed that, there was no significant difference between the males and females on any of the subtest or on groups at $p<.05$ (i.e. the males and females performed equally well on all subtests). Owing to this very reason, males and females were combined and considered as one single group, for further analyses i.e. consideration of ten participants instead of five males and five females in each age group. Moreover, there were only five participants of each gender in each age group (which is not a large sample to be considered). Hence, gender was not regarded as an independent variable on all advanced analyses.

Table 4 summarizes the qualitative responses in male and female participants across ages. It is evident that the younger age groups 20- 30 and 30-40 years responded mostly in a normal manner without needing any extra information to perform the task. The responses of these participants were mostly complete type and few of them on rare occasions showed sub-vocal rehearsals, whereas in the older age groups (40- 50 and 50- 60 years), few of the participants even scored as poorer as delayed, immediate and self correction type of responses. To generalize, it can be put down that the normal responses across the test varied between complete and subvocal rehearsal, thereby paving the idea that the Revised Token Test involves tasks that are well suited to identify an individuals' auditory comprehension levels.

Table 5. *Types of responses of participants across gender in various age groups*

Age Group	Gender	Type of responses in various age groups				
		C	SVR	D	I	SC
20-30	M	✓	✓			
	F	✓	✓			
30-40	M	✓	✓	✓		
	F	✓	✓			✓
40-50	M	✓	✓			
	F	✓	✓	✓	✓	
50-60	M	✓	✓			
	F	✓	✓	✓	✓	✓

Note. C=complete, SVR=Sub-vocal rehearsals, D=Delayed, I=Immediate, SC= Self Correction

Many authors have reported that there is a difference in the performance between the two tasks in comprehension and reception tasks i.e females are considered to perform better on comprehension task

better than males (Ramer, 1976). Moreover, the test encapsulates a series of cognitive processes in addition to auditory comprehension, including working memory (Kitson, 1985; Emery, 1986), analysis of the whole into a series of items, or the ability to adequately ignore automatically evoked, distracting stimuli. Such factors are evidently distinct in both the gender. The present study, thus, provides corroborative evidences to the existing research that gender variation in normal persons may not be a major variable in comprehension task in auditory mode only. Either there are no differences in the performances of the two groups, or if present, may be subtle in nature.

II. Overall performance of the participants in the various subtests: A mixed ANOVA was administered to find out the differences in subtests (where age served as the independent factor) and across age groups (where subtests was considered as the independent factor).

a. Comparison of the performance on subtests: Table 5 and Figure 1 give the mean scores of age groups across each subtest. It is evident that 20- 30 years age group scored the highest and the 50-60 years age group scored comparatively the lowest, with 30-40 years and 40-50 years preceding it. However, the meager mean differences were evident in the performances of the participants.
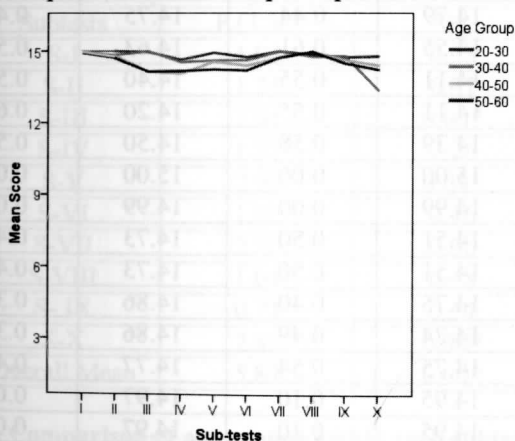

Figure 1. *Mean scores of the different age groups on various subtests.*

The results of the present study are in accordance to the results of various studies on Token Tests where researchers have confirmed that age-related effects in normal population although not very distinct, were still observed with elderly participants scoring comparatively low than the others (De Renzi & Faglioni, 1978; Emery, 1986; Pena-Casanova, Quinones-Ubeda, Gramunt-Fombuena, Aguilar, Casas, Molinuelo & Blesa,

2009). Researchers have also reported that the differences in scores could be that older individuals face difficulty in retaining the auditory stimuli for a longer duration in comparison to the younger individuals. They even face problems in retaining verbal memory span (Albert & Bear, 1974). It is also evident that the scores of subtests in each age group indicate that there is deterioration in comprehension from the S-I to S-X subsections in a gradual fashion. This is because of its minimal redundancy, where the participants are required to understand the significance of each word in a series of increasingly complex commands (Goswami, 2004). Moreover, on RTT the linguistic stimuli are presented only in the verbal mode, hence the participants do not get any additional cues, graphic or visual to aid in comprehension. Next to complete responses, sub-vocal rehearsals were noticed in few normal participants, which is an indication that they rely on their auditory feedback for comprehension.

On mixed ANOVA (repeated measures ANOVA with age as independent factor), a significant difference was observed between the subtests [F (9,234) =10.937, p<0.001]. Therefore, subsequently, a post- hoc Bonferroni test for pairwise comparison was done to find out the subtests which differed significantly.

The results obtained are attributed to various reasons, first of all, subtest I involves easiest of the commands hence, it differs from subtest S-III, S-IV, S-V, S-VI and S-X. The increasing complexity of the tasks in terms of grammaticality brings about a difference in the overall scores. Similarly, the significant difference of other subtests from the rest is because of the increase in sentence length and linguistic complexity. The second fact evident is that the even numbered subtests are only an increase in the linguistic level of the immediately preceding odd subtests and is hence, predictable by the participant after performing on the odd ones. Moreover subtests (except I and II) integrate two step tasks which demands an extra cognitive load on the participant and demands on the performance thereby are expected to increase (Goswami, 2004).

b. Comparison of the performance on age groups: A significant difference on Mixed ANOVA was observed between the performances of various age groups for F(3, 36)=5.895, p<0.001 as the participants of the various age groups exhibited comprehension deficits to varying degrees of severity. Post-hoc Duncan's mean range test (5% level of significance) (DMRT) elaborated on the differences between the various age groups.

Table 5. *Mean and SD values for male and female participants (normals) across subtests*

SUBTESTS	GROUPS	MALES		FEMALES		TOTAL	
		Mean	SD	Mean	SD	Mean	SD
S I	20-30	15.00	0.00	15.00	0.00	15.00	0.00
	30-40	15.00	0.00	15.00	0.00	15.00	0.00
	40-50	15.00	0.00	15.00	0.00	15.00	0.00
	50-60	14.99	0.00	14.80	0.44	14.89	0.31
	TOTAL	14.99	0.00	14.95	0.22	14.97	0.15
S II	20-30	15.00	0.00	15.00	0.00	15.00	0.00
	30-40	14.80	0.44	14.88	0.15	14.84	0.31
	40-50	15.00	0.00	14.60	0.54	14.80	0.42
	50-60	15.00	0.00	14.40	0.54	14.70	0.48
	TOTAL	14.95	0.22	14.72	0.43	14.83	0.36
S III	20-30	14.99	0.00	14.94	0.10	14.97	0.07
	30-40	14.99	0.00	14.99	0.00	14.99	0.00
	40-50	14.45	0.79	13.85	0.78	14.15	0.80
	50-60	14.25	0.75	14.05	0.94	14.15	0.80
	TOTAL	14.67	0.60	14.46	0.77	14.56	0.69
S IV	20-30	14.62	0.60	14.66	0.52	14.64	0.53
	30-40	14.97	0.05	14.13	0.90	14.55	0.74
	40-50	14.24	0.75	13.91	0.90	14.07	0.80
	50-60	14.24	0.75	14.10	1.02	14.17	0.85
	TOTAL	14.52	0.64	14.20	0.84	14.36	0.75
S V	20-30	14.91	0.19	14.97	0.05	14.94	0.14
	30-40	14.44	0.56	14.79	0.45	14.61	0.51
	40-50	14.75	0.43	14.36	0.63	14.55	0.55
	50-60	14.12	0.83	14.36	0.63	14.24	0.71
	TOTAL	14.56	0.59	14.62	0.53	14.59	0.56
S VI	20-30	14.72	0.42	14.79	0.44	14.75	0.41
	30-40	14.70	0.64	14.55	0.61	14.63	0.59
	40-50	14.70	0.44	14.11	0.55	14.40	0.56
	50-60	14.29	0.84	14.11	0.55	14.20	0.68
	TOTAL	14.60	0.59	14.39	0.58	14.50	0.59
S VII	20-30	15.00	0.00	15.00	0.00	15.00	0.00
	30-40	15.00	0.00	14.99	0.00	14.99	0.00
	40-50	14.96	0.08	14.51	0.50	14.73	0.41
	50-60	14.96	0.08	14.51	0.50	14.73	0.41
	TOTAL	14.98	0.06	14.75	0.40	14.86	0.31
S VIII	20-30	14.97	0.15	14.74	0.49	14.86	0.35
	30-40	14.80	0.44	14.75	0.54	14.77	0.47
	40-50	15.00	0.00	14.95	0.10	14.97	0.07
	50-60	15.00	0.00	14.95	0.10	14.97	0.07
	TOTAL	14.94	0.22	14.85	0.35	14.89	0.29
S IX	20-30	14.78	0.45	14.72	0.44	14.75	0.42
	30-40	14.68	0.68	14.92	0.15	14.80	0.48
	40-50	14.70	0.53	14.57	0.58	14.63	0.53
	50-60	14.50	0.58	14.49	0.62	14.49	0.56
	TOTAL	14.66	0.53	14.67	0.47	14.67	0.50
S X	20-30	14.79	0.45	14.79	0.45	14.79	0.42
	30-40	13.41	0.56	13.36	0.45	13.38	0.48
	40-50	14.94	0.10	13.88	0.78	14.41	0.77
	50-60	14.59	0.90	13.88	0.78	14.23	0.88
	TOTAL	14.43	0.81	13.97	0.79	14.23	0.82
OVERALL	20-30	14.88	0.12	14.86	0.09	14.87	0.10
	30-40	14.68	0.13	14.63	0.20	14.66	0.16
	40-50	14.77	0.15	14.37	0.27	14.57	0.29
	50-60	14.59	0.15	14.36	0.28	14.18	0.24
	TOTAL	14.73	0.16	14.56	0.29	14.64	0.25

on the post hoc test reveals that the age groups 30-40, 40-50 and 50-60 years perform similarly on the test (without any significant differences) whereas they differ significantly from the age group of 20-30 years. A study by Blumenfeld, Schroeder, Ali and Marian (2009) on inhibition and facilitation in auditory comprehension across the lifespan shows that both accuracy rates and response latencies in word comprehension decline with age. Age-related effects were reported as few in a series of papers on Token Test and its versions (De Renzi & Faglioni, 1978; Ivnik, Malec, Smith, Tanglos & Peterson, 1996).

c. Interaction of the subtests and groups: On repeated measures ANOVA, interaction effect between the subtests and groups was evident {4 (Group) x 10 (Subtests)}. Results revealed that a significant interaction was present between them at F (27,324) =2.89 for p<0.001.

III. Comparison of normals in various subtests of RTT in the different age groups: Since repeated measures ANOVA revealed a significant interaction effect between age groups and subtests; hence comparisons were made to determine the age group differences varying in magnitude within each subtest and comparison of subtests within each age group.

Table 6. *Comparison of overall mean of the part*

Subtests	F (3,36)	Sig.
S-I	1.04	0.38
S-II	1.21	0.31
S-III	7.04	0.00*
S-IV	1.37	0.26
S-V	2.99	0.04*
S-VI	1.82	0.16
S-VII	2.70	0.06
S-VIII	1.04	0.38
S- IX	0.72	0.54
S-X	7.85	0.00*
Overall Mean	5.89	0.00*

a. Comparison of age groups within each subtest: Collapsing results across all subtests, a Multivariate Analysis of Variance (MANOVA) was performed. The MANOVA revealed statistically significant differences on subtests. Table 6 lists the ten subtests for which a significant difference was found for the total scores.

With age as independent variable and dependent variables as subtests S-I to S-X and overall mean, a MANOVA depicts that subtests S-III, S-V, S-X and overall mean present with a statistically significant difference at p<0.05 for F(3, 36) equaling to 7.04, 2.99, 7.85 and 5.89 respectively. Various inferences are attributable to the above results. From the RTT-O it is seen that every subtest is a transition to the preceding pair of

even and odd subtests, such as, subtests III (and IV), V (and VI), and IX (and X) have a slightly different complexity in their grammatical structure than the rest (I and II, VII and VIII). Unlikely the subtest VII (and VIII) did not show any evident difference in scores from the simple imperative sentences as in subtest I (and II), which could be likely that the left-right postpositional scores have not been encountered by the participants to be as tough as the III, V, X subtests and thus has elicited scores following that of subtests I and II. This trend in scores is likely to suggest that a reorganization of the subtests could be effective, i.e. the subtests VII and VIII dealing with left-right postpositional commands could succeed immediately after the subtests I and II and take over places of III and IV in terms of complexity. Thus, it is suggested that the sequence of subtests in the RTT-O can be reorganized as– I, II, VII, VIII, followed by III, IV, V, VI, IX and X.
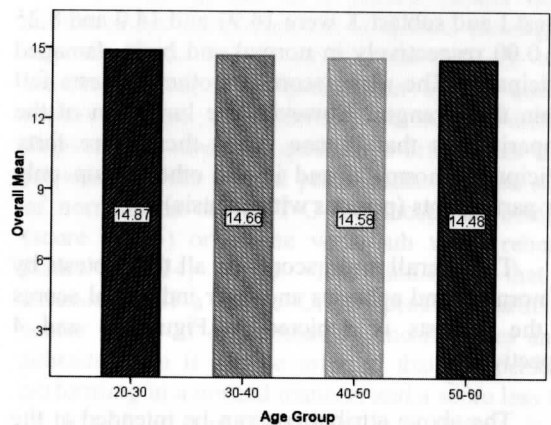

Figure 2. *Overall mean scores on all the subtests produced by the different age groups.*

Further post- hoc Duncan Mean Range test elaborated on the differences between the age groups on each of the significant difference of the RTT-O. The Duncan's mean range test at 5% level of significance was conducted for S-III, S-IV, and S-V subtests and overall mean scores of the RTT-O. On different subtests adjacent groups were similar in their performance while in others younger age groups were significantly different from the older ones.

b. Comparison of subtests within each age group: Repeated measure of ANOVA was conducted for each of the age groups to determine the difference in subtest scores, if any. Appropriate statistical tests like tests of within-participants, post-hoc pairwise comparison on Bonferroni test and paired t- test was conducted.

On a careful observation of the findings revealed from the tests, it can be summarized that, in the older age groups (40-50 years and 50-60 years),

the scores on the various subtests follow a similar pattern of differences. The fact that the higher age groups perform similarly and that the complexity of the task encountered by them is the same can be explained by the fact that language comprehension and production plays a major role in aging (Gutbrod, Meger, Meter & Cohen, 1985).

IV. Comparison of normal population and the brain damaged individuals (persons with aphasia) on comprehension abilities:

From the Table 7 it is viewed that, the normal participants exhibited significantly better comprehension as compared to the aphasics (persons with aphasia) on all the linguistic levels (subtests I to X) at which comprehension was assessed. It is evident from the Table 7 that the mean scores in each subtest in the normal participants' decreased with complexity of tasks. From the scores of both the groups of participants (the normals and brain damaged), it is observed that highest mean scores were observed in subtest I and lowest in subtest X. The mean scores in subtest I and subtest X were 14.97 and 14.0 and 8.25 and 0.00 respectively in normal and brain damaged participants. The mean scores of other subtests fell within these ranges. However, the limitation of the comparison is that in one group there were forty participants (normals) and in the other group only four participants (persons with aphasia).

The overall mean scores on all the subtests by the normals and aphasics and their individual scores on the subtests is depicted in Figures 3 and 4 respectively.

The above attributions can be intended at the brain damage in aphasics, which causes a deficit in individual's ability to comprehend linguistic stimuli (Caramazza & Zurif, 1976; Peach, Canter & Gallaher, 1988).

A further comparison on Mann– Whitney U-test (Table 8) showed that RTT scores for the persons with aphasia were significantly poorer than those of the normal participants at 0.05 levels. Thus, the persons with aphasia performed significantly less in auditory comprehension capabilities than normal population of the same age range.

The influence of stimulus length on comprehension has also been reported by Shewan and Canter (1971) and Curtis, Jackson, Kempler, Hanson & Metter, 1986. These authors reported that other factors held constant, the sentence comprehension tends to decrease as length increases. The deterioration of comprehension with increase in sentence length is indicative of retention deficits in persons with aphasia. Comprehension of grammatical elements requires intact reasoning skills and good attention and memory span (as the length

and complexity of the stimuli increases), and deficits in all of these cognitive processes are implicated in persons with aphasia (Wright & Newhoff, 2004). Aphasic individuals do better on single word comprehension tasks when written and auditory stimuli are used instead of auditory stimuli alone (Schuell & Jenkins, 1961). Goswami (2004) reported that the repetition of linguistic command also improved the performances of these persons in the form of sub-vocal rehearsals.

Table 7. *Summaries of mean and standard deviation (SD) scores on subtests in normal and aphasic groups*

Subtests	Normals (N=40)		Aphasics (N=4)	
	Mean	S.D	Mean	S.D
S-I	14.97	0.15	8.25	3.30
S-II	14.83	0.36	7.75	3.30
S-III	14.56	0.69	6.07	3.17
S-IV	14.36	0.75	2.24	1.25
S-V	14.59	0.56	2.55	1.44
S-VI	14.50	0.59	1.58	1.33
S-VII	14.86	0.31	2.82	1.90
SVIII	14.89	0.29	1.88	1.45
S-IX	14.67	0.50	1.50	1.00
S-X	14.20	0.82	1.00	1.00
Overall Mean	14.64	0.25	3.36	1.16

Table 8. *Results of Mann- Whitney U-test (comparison of normals and aphasics)*

Subtests	|Z|	Sig.
S-I	5.47	0.00*
S-II	4.17	0.00*
S-III	3.53	0.00*
S-IV	3.35	0.00*
S-V	3.46	0.00*
S-VI	3.38	0.00*
S-VII	4.05	0.00*
S-VIII	4.29	0.00*
S- IX	3.34	0.00*
S-X	3.30	0.00*
Overall Mean	3.26	0.00*

The results of the following study can be summarized as follows (1) The performances of males and females across subtests in different age groups did not differ significantly. (2) On a comparison of the performances on the various subtests, it was evident that subtests III, IV, V, VI and X differed significantly from Subtest I. (3) Critical analysis of the age groups reveal that 30-40, 40-50 and 50-60 years performed similarly and were different in their scores from the 20-30 years. (4) An interaction effect was observed between the subtests and groups which was present at 0.05 level. (5) In a
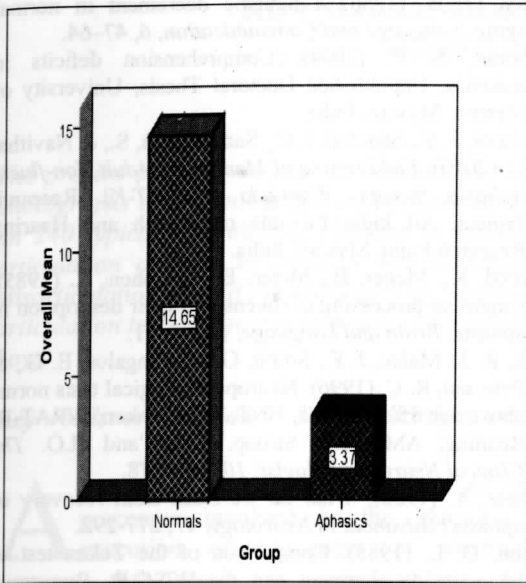
Figure 3. *Overall mean scores on all the subtests as produced by the two groups (normals and aphasics).*
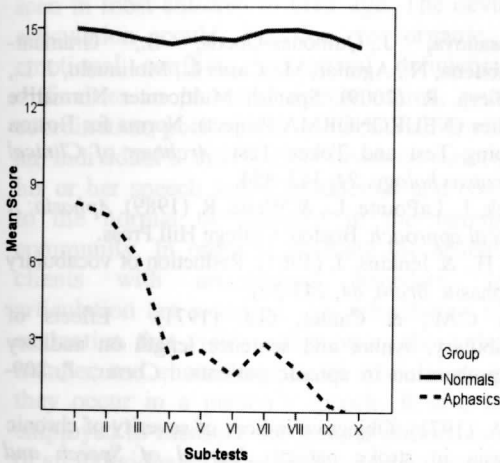

Figure 4. *Mean scores of normals and persons with aphasia on various subtests.*

comparison of subtests across age groups, S-III, S-V, S-X and overall mean present with a statistically significant difference where adjacent groups performed comparably than the non adjacent ones (except on S-X). (6) The older age groups (40-50 years and 50-60 years presented a similar pattern of differences, that is, in both the age groups the following pairs showed significant differences: S-I from S-III and S-V, S-II from S-VI, SIII from S-VII and SVIII from S-III, S-IV, S-V, S-VI, S-X. (7) The normal participants exhibited significantly better comprehension as compared to the aphasics (persons with aphasia) on all the linguistic levels (subtests I to X).

Therefore the present test satisfies the criteria of a good and useful test for aphasia. These facts indicate RTT to be one of the most elaborate clinical tools that help in terms of assessing an individual's auditory comprehension with stimuli of gradual complexity, and thereby identifying the auditory deficits in a person with aphasia. This study (adapting RTT in Oriya), thus, underscores the importance of a thorough assessment of comprehension and its implication in drawing a profile of a person with aphasia and documenting even the subtle deficits in auditory comprehension among the different aphasic types.

Conclusions

The present study was aimed at drawing some theoretical conclusions as obtained on the RTT-O which is listed below: (1) On the auditory comprehension test, the performance of the males and females was similar across all the subtests of RTT-O. The gender of a person seems not to influence his comprehension of spoken messages to any significant extent. (2) On the RTT-O, which assesses syntactic comprehension in the auditory modality alone, the deficits varied to different degrees, and also had qualitative differences in the responses of the normal participants. (3) The scores of normals on the RTT-O fell mostly in complete (score of 15) or in the vocal-sub vocal rehearsal (score of 14) range. This indicates that on assessment, if a native Oriya speaking participant scores 14 or 15 on commands, mean values and/or subtests, then it can be inferred that the person is performing in a normal manner; and a score less than 14 would account that there is a deficit in the auditory comprehension skills of the person and a treatment in that area is intended thereof. (4) The sentence length, linguistic complexity, grammatical usage and number of critical stimulus in the commands were factors that contributed to the test results. The scores on the third, fourth, fifth, sixth and tenth subtests were evidenced to differ from that of subtest one. (5) The younger age groups (20-30 years) were better in their performances in comparison to the older age groups (30-40, 40-50 and 50-60 years). Obvious differences were observed among the persons with respect to the response patterns such as promptness, responsiveness, self-correction and sub-vocal rehearsals. Aging, memory span, attention are described in context to this. Hence, a reorganization of the test is recommended thereof. (6) There was a hierarchy in the magnitude of comprehension deficits exhibited by the normal participants on the subtests. The trend of scores was highest for subtest I followed by II, VII, VIII, III, IV, V, VI, IX and X. (7) The aphasic participants performed relatively poorer than the normal participants. Cognitive and/or auditory processing

deficits have been implicated from the responses of most of the aphasics.

The RTT-O results are conclusive of the fact that the difference in performances within normals and in persons with aphasia intend towards the effectiveness of the test in fulfilling its purpose of assessing auditory comprehension; and the variation in each category of stimuli can be considered indirectly to be measuring the linguistic competence of normals as well as the persons with aphasia.

Results of this study present the importance of having testing tools that assess a person's skills in one of the modalities (or dimensions), like, RTT-O is projected at assessing the comprehension in terms of auditory modality only, and moreover out of all linguistic levels it is focused at measuring solely the syntactic level. Results even underscore the fact that research should be orientated at ameliorating the language specific test development in a multilingual country as India, and that it caters to the needs of all the assessors within a broad work culture. The normatives obtained on the RTT-O, as put forth, have been collected from a group of persons who belong to a part of eastern India, and thus acknowledge the fact that these performances (scores) can be accepted and generalized to the wider dimension of inhabitants residing in this region of the country.

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