

Word class deficits in individuals with aphasia: A syntactic analysis at discourse and single word production in the Kannada language

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Abstract: Aphasia commonly leads to word retrieval issues, particularly with nouns and verbs. Traditional assessments often focus on single-word. This study uses qualitative and quantitative methods to assess word class deficits in Kannada-speaking Individuals with Aphasia (IWA) compared to Neurotypical Individuals (NTI) in single-word production and discourse production. Twenty IWAs (aged 20-50) and twenty age/gender-matched NTIs were recruited. Confrontation naming evaluated single-word production, while structured picture description (picnic scene) assessed discourse. Both tasks included a fixed set of nouns and verbs for comparison. The results were that IWAs performed poorer than NTIs in both tasks. Statistically significant noun and verb usage differences were observed between IWAs and NTIs in the picture description task ($p < 0.05$). However, word class differences in the IWA group were insignificant across tasks. NTIs showed significant differences only in the picture description task. This study underscores word class deficits in aphasia, particularly at the discourse level. Discourse analysis is crucial for understanding language characteristics in aphasia and should be integrated into routine assessments.

Keywords: Aphasia; Lexical retrieval; Word class; Discourse; Picture naming.

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1.0 INTRODUCTION

Aphasia is a common and debilitating impairment that impairs language comprehension and production. The ability to retrieve words in individuals with aphasia shows impairments in lexico-semantic and phonological representations (Semenza, 2020). Specifically, people with aphasia struggle to name objects (nouns) and actions (verbs) (anomia), respectively (Li & Kiran, 2024). Most studies investigating the neurological basis of noun and verb recognition use single-word tasks (naming or lexical creation). Feng et al. (2020) studied

network lesion-symptom mapping to examine the neural correlates of nouns and verbs during image description in post-stroke aphasia. According to this study, action word production was supported by frontal networks, while object word production was supported by posterior networks spanning the occipital, parietal, and posterior inferior temporal areas.

Some studies have shown more significant verb deficits than nouns in Individuals with Aphasia (IWA) (Li et al., 2019). A possible reason discussed by de Aguiar and

Rofes (2022) to account for significant noun-verb dissociations is that of 'semantic distinctions' between nouns and verbs. There are strong indications that noun-verb differences at the single-word level may be due to semantic and psycholinguistic differences. In confrontation naming tasks involving verbs, their semantic distinction tends to be lower in imageability (the degree to which a word can generate a mental image and sensory experience) than nouns. It has fewer perceptual features (Heikkola et al., 2022). Verbs are typically semantically more complex and abstract than nouns (Li & Kiran, 2024; de Aguiar & Rofes, 2022). Another factor is 'cross-linguistic differences' between nouns and verbs in sentences in terms of morphological markers and syntactic complexity. Lastly, a third factor is 'task,' whether it tackles lexical retrieval or sentence processing and phrasal construction. The present study is interested in the third variable, task; the study addressed noun and verb naming in single-word production and discourse tasks in Individuals with Aphasia.

Spoken naming ability is often assessed in the clinical setting through confrontational naming tests. These tasks are simple to administer, assess specific words, provide information on the severity of the naming deficit through scoring and error analysis, and in some instances can identify the psycholinguistic variables that affect naming performance (Heikkola et al., 2022; Bemani et al., 2022). Thus, confrontation naming tasks offer a valid means of assessing single-word lexical retrieval. For example, current aphasia tests, such as the Western Aphasia Battery-Revised (WAB-R) (Kertesz, 2007), the Boston Diagnostic Aphasia Examination (Goodglass et al., 2001), and the Standard Language Test of Aphasia (Tamura et al., 1996), are mainly limited to the single-sentence level or the single-picture description using expository narrative (Stark, 2019; Westerveld & Claessen, 2014).

The picture-naming task primarily focuses on producing nouns, which might facilitate better sentence production for individuals with aphasia than picture-naming tasks (Malyutina & Zelenkova, 2020). Significant verb deficits in aphasia may arise at the connected speech level due to the complex syntactic roles required

by verbs in sentences (Malyutina & Zelenkova, 2020). Studies on comprehension and production in non-fluent aphasia types show more significant difficulties with verbs than nouns (Feng et al., 2020). These verb deficits may underlie challenges in lexical retrieval, sentence comprehension, or production, impacting overall

discourse (Alyahya et al., 2018). Discourse is defined as "any natural form of language comprising utterances or phrases," according to Wright and Capilouto (personal communication). Discourse comprises multiple linguistic levels: a level of macrostructural organisation, a level of utterance or sentence structure, and a lexical level (Amstrong, 2000; Halliday & Matthiessen, 2014). The present study focuses on the syntactic analysis of connected sentences and single-word production of individuals with aphasia (IWA) compared to neurotypical individuals (NTI).

Clinically, various methods may be employed to elicit and analyse discourse for the convenience of saving time and maintaining the consistency of verbal performance. Composite picture descriptions are frequently employed in clinical practice and research (Stark et al., 2019), creating useful linguistic profiles. However, picture descriptions may yield more specific words than connected speech forms, such as expository narratives (Bird et al., 2000).

For IWA, discourse generation tasks' word retrieval problems are more dynamic since contextual factors may impact retrieval processes (Wilshire & McCarthy, 2002), mainly for content word classes such as nouns and verbs. However, the evaluation of spoken discourse provides an ecologically valid method to assess day-to-day social participation and activity challenges faced by individuals with aphasia in social settings due to their communication difficulties (World Health Organization, 2018).

A discrepancy between scores from confrontation picture naming and lexical retrieval in a connected speech context has been reported in the aphasia literature (Mason & Nickels, 2022). We are analysing spoken discourse gleaned microstructural (e.g., syntax, lexical-semantic structure) and macrostructural (e.g., cohesion and coherence) information in a comparative naturalist manner in contrast to other spoken language tasks such as confrontation naming or repetition (Stark et al., 2021).

As a structured task, picture description may yield more specific words than narration and conversation discourse genres (Bird et al., 2000).

Fergadiotis and Wright (2016) studied picture-naming abilities and connected discourse in 98 individuals with aphasia (IWA) from Aphasia Bank, finding that picture-naming tasks were not strong predictors of paraphasia in connected speech but were highly correlated with

information content. A later study by Fergadiotis et al. (2019) using data from three connected speech tasks (picture description, story retelling, and prompted conversation) showed that picture naming scores correlated with %CIUs across these tasks, with prompted conversation being less strongly associated than picture description and story retelling. Fergadiotis recommended using picture naming alongside picture description to study lexical retrieval in aphasia.

Lavoie et al. (2021) compared connected speech features in individuals with logopedic variant Primary Progressive Aphasia (lvPPA) to healthy controls across three tasks using Quantitative Production Analysis (QPA). lvPPA participants showed reduced open-class word proportion, higher verb proportion, increased pronoun usage, and fewer well-formed sentences. These consistent deficits across tasks highlight the relevance of connected speech analysis in diagnosing lvPPA and recognising syntactic deficits.

Fromm et al. (2022) used unsupervised statistical algorithms to categorise 168 individuals with aphasia based on language output from various discourse tasks. They found that total words in free speech tasks and total closed-class words in Cinderella storytelling were key for grouping. This demonstrates the potential of connected speech analysis in classifying aphasia and guiding research and clinical practice.

Mason and Nickels (2022) reviewed studies on the correlation between picture naming and word retrieval in connected speech among individuals with aphasia. The review, hindered by methodological inconsistencies, showed mixed findings. They recommend supplementing picture naming tests with connected speech analysis in clinical settings and call for standardised testing procedures and more research focusing on natural conversation.

Boucher et al. (2022) examined the relationship between connected speech production and confrontation naming in early post-stroke aphasia. Speech samples from a picture description task and a confrontation naming task revealed impairments in both micro- and macrolinguistic aspects among patients. Confrontation naming abilities were strongly associated with the informativeness of picture descriptions, suggesting discourse analysis offers nuanced insights into language abilities shortly after the stroke.

Li and Kiran (2024) studied verb and noun impairments in single-word naming and discourse production among Mandarin-English bilingual adults with aphasia (BWA). Twelve participants completed assessments for object and action naming and three discourse tasks in Mandarin (L1) and English (L2). Results showed lower naming accuracy for verbs than nouns in both languages, with fewer verb productions in discourse. The relationship between naming and lexical retrieval in discourse was direct, regardless of language. These findings provide insights into BWA's verb and noun retrieval patterns across linguistic contexts and aphasia severity levels.

Fromm et al. (2017) highlighted that people with aphasia scoring above the WAB-R Aphasia Quotient threshold still have discourse difficulties, which require further research. The current study includes a participant with high WAB AQ scores but discourse impairments, as also investigated by Salis and DeDe (2022).

Inconsistent results in the literature suggest difficulties in isolating and quantifying word retrieval in connected speech due to undefined target words and challenges in identifying precise verbs. Semi-structured tasks like narration and conversation do not elicit exact verbs. Issues include counting verbs relative to total words, content words, or within specific samples. IWA often uses light verbs to compensate for word retrieval deficits, affecting verb counts. This study employs counting appropriate nouns and verbs for given tasks, as suggested by Mason and Nickels (2022) and Kambanaros (2010).

The present study addresses word retrieval deficits in confrontation naming and discourse contexts in IWA, where people who speak the Kannada language, an under-reported language in aphasia research, are present. Kannada is a Dravidian language spoken predominantly in Karnataka and by linguistic minorities in the neighbouring states of Andhra Pradesh, Telangana, Tamil Nadu, Maharashtra, and Goa. It is one of the 22 scheduled languages of India and the official language of the state of Karnataka. Kannada's script is an alphasyllabary, meaning each character represents a consonant followed by a vowel sound. The script has 49 characters. Besides being the official language of Karnataka, Kannada holds the status of a classical language in India (Narasimhachar, 1988). The Kannada language is morphologically more complex than English. Kannada, being an inflectional language, has a complex morphological appearance, with each word consisting

of a root and a set of suffixes that can be combined. These suffixes carry additional meanings besides the core semantic meaning and influence nouns and verbs in a context ([Angle et al., 2018](#)). Hence, we hypothesised that a task difference, i.e., picture naming and connected speech task performance, will affect performance. The proposed study focuses on individuals with aphasia who speak Kannada, expanding the scope of aphasia research to an underrepresented language group. Kannada's morphological complexity adds a layer of intricacy to analysing word retrieval deficits in aphasia, offering valuable insights into language processing mechanisms across different linguistic systems.

2.0 MATERIALS AND METHODS

2.1 Materials

The stimuli materials were of two types. A single word (noun, verb) production task and naming at discourse task (via picture description). The single-word task was created using 114 target words (each word class consisted of 57 words). Items were selected from the Boston Naming Test (S. Chengappa, personal communication) and the Action Naming Test adapted to the Kannada version ([Girish, 2015](#)). The second task was the 'Picnic Spot Picture' from Western Aphasia Battery-Kannada ([Chengappa & Kumar, 2008](#)). Characteristics such as word imageability, frequency, familiarity, age of acquisition, length, and visual complexity of the images were appraised by three speech-language pathologists ([Goswami et al., 2012](#)).

The study was conducted in the (native) Kannada language across all participants. Participants were assessed in a quiet room (for example, a home, hospital, etc.). Line drawings (on A4 picture cards) of the noun and verb task were presented to the participants, and participants were instructed to name each picture using a single word per item. They were asked either to name the object, if it was an object picture, or to say what was happening in it or what the person was doing if it was an action picture. Phonemic and semantic cues were provided if required. For the picture description task, participants had an average of 2 minutes to look at the picture. Then, they were instructed to describe it for 3-5 minutes. The assessment took 40-50 minutes and was completed in one sitting. For a few participants (individuals with aphasia), the activities were completed in two sittings due to fatigue and low attention abilities. The reaction time to name the nouns and verbs for confrontation naming and naming on picture description was not considered for the present study.

Responses were recorded continuously with audio-video recording using Sony Digital Camera and Praat software. Verbatim transcription was made to check for accuracy and naming errors. The first response was considered for further analysis. Time measurements were not considered for analysis.

2.2 Scoring

Confrontation naming

The original report indicated that BNT and ANT scoring exhibited dissimilar patterns. Based on a study, modifications were made to align the scoring for nouns and verbs, which equalised the scores. Consequently, scoring for the confrontation naming task involved assigning three points for the word class 'verb and noun.' A Score of 2 was given for a correct response without any cue, a Score of 1 for a proper response with a phonemic or semantic cue, and a Score of 0 for an incorrect or no response.

Picture Description

The target stimuli for the picture description task followed a standard way to list the nouns and verbs used in accurately describing the picture as per the validation of three Speech-Language Pathologists. The scoring method involved two-point rating scales developed by the investigator. Each accurate noun or verb naming corresponded to a Score-1 without any cue, and a Score-0 for the incorrect or no response and use of parenthetical remarks was not considered for scoring. Inflectional variations of target verbs were also considered for correct scoring. This scoring was considered after the verbatim transcription of the connected speech sample. If responses were recognisable verbal productions of the target objects, they were rated as correct. Self-corrections made within 10 seconds were also acknowledged, and phonological paraphasia—but not semantic paraphasia—was also considered acceptable because the present study is more interested in lexical knowledge than naming errors due to phonological processes. For verb naming, all forms were deemed acceptable and equivalent for a score of 1 concerning the root word only; [for the verb /thinnu/ (eat), /thinda/ (ate), /thinnuthidane/ (eating), and /thinnavanu/ (will eat)] were all accepted. For noun naming, scoring the scoring did not consider using parenthetical remarks like 'this,' 'that,' and 'it.' scoring the scoring did not consider using parenthetical remarks like, " 'that,' and 'it.' scoring the scoring did not consider using parenthetical comments like 'this,' 'that,' and 'it.' Accurate noun naming was considered in the scoring.

2.3 Participants

Forty individuals formed two separate groups, with twenty participants in each group included in the present study. Group I constituted the clinical group (three females and seventeen males; age range 20 – 71 years) (mean age = 42.45 years) consisting of IWA, and Group II comprised age-matched neurotypical individuals (NTI) as the control group (seven females and thirteen males; age range 20 – 71 years) (mean age = 42.45 years). The present study had specific inclusionary and exclusionary criteria for the participants. The IWA group included participants who sustained a Cerebrovascular Accident (CVA) with more than six months post-stroke onset duration in the Middle Cerebral Artery (MCA) territory confirmed by a neurologist and were at least six months since the onset of aphasia when recruited in the study. Participants of the IWA group were diagnosed with aphasia by administering Western Aphasia Battery in Kannada (Chengappa & Kumar, 2008). The types of aphasia were anomia and Broca's aphasia, with varied aphasia quotients. IWA was recruited from the Department of Clinical Services at the All-India Institute of Speech and Hearing (AIISH), Mysuru district, Karnataka. IWA had regular to mild cognitive impairment, and Participants of the neurotypical group scored >26, according to the Montreal Cognitive Assessment in Kannada (MoCA) (Kaul et al., 2022), which was administered by a Speech-Language Pathologist (Table 1). Participants both groups were native Kannada and Kannada-English bilingual speakers with a minimum of 10 years of formal education. Participants in both groups did not report any history of neuropsychiatric disorders (and this also applied to the IWA before the onset of aphasia). Sensory issues (hearing, vision) were self-reported using a questionnaire composed by the investigator.

The neurotypical individuals were residents of Mysuru district, Karnataka, who volunteered to participate in the present study. Data was collected for IWA and NTI group participants at the Department of Clinical Services at the All-India Institute of Speech and Hearing (AIISH), Mysuru district, Karnataka. The study followed the 'Ethical guidelines of Bio-Behavioral Research Involving Human Subjects' (Basavaraj & Venkatesan., 2009) and was approved by the AIISH ethical committee (No.DOR.9.1/Ph.D./YBC/929/2021-2022 DT 10.02.2023.). Written informed consent was obtained from the participants and caregivers.

2.4 Data Analysis

Ten percent of the data was subjected to interrater reliability using Cronbach's alpha coefficient, and a significant p-value of > 0.80 was obtained. A p-value >0.80 was obtained, showing good inter-rater reliability for both IWA and NTI groups. The total number of nouns and verbs was noted in the two tasks and was subjected to statistical analysis. Descriptive statistics were computed for each word class in the two tasks. Within and between group comparisons were made for performance of two tasks, using word class levels. The Friedman test compares performances within IWA and the neurotypical group. The Mann-Whitney U test was used for between-group comparisons for total nouns, total verbs, and overall total accurate words in the two tasks. The Wilcoxon Signed rank test was also used to compare within-group performance in the two tasks. Also, comparisons between the total numbers of nouns, verbs, and overall words produced by IWA and neurotypical groups were studied, which was also conducted in the two tasks.

3.0 RESULTS

3.1 Comparison Between Confrontation Naming and Picture Description tasks in IWA and NTI (Between-group comparisons)

The total raw mean accuracy score obtained by both groups in confrontation naming and picture description tasks, irrespective of word class, was computed and subjected to statistical analysis. The percentage of raw scores in the IWA group varied highly between confrontation naming and picture description tasks. In contrast, NTI showed a minimal difference between tasks concerning the percentage of raw scores. Table 2 compares mean scores obtained between groups across tasks and word classes.

Friedman's analysis of variance was applied to see the effect between two tasks, Task I- confrontation naming, and Task II- picture description for both groups as the first instance. Results indicate a significant impact of picture description and confrontation naming task in IWA with a score of $\chi^2(3)=52.60$, p -value < 0.05, and NTI with a score of $\chi^2(3)=57.54$, p -value < 0.05. Thus, task difference is seen in both the IWA and NTI groups.

For the second instance, Friedman's analysis of variance was applied to see the effect between two-word classes, the noun and the verb. The results indicated there was a statistically significant difference between the word class with a score of $\chi^2(1)=20$; p -value < 0.05 for verb and $\chi^2(1)=24$; p -value < 0.05 for noun.

Table 1. Demographic details of participants of the study.

Individuals with Aphasia (Group I)									Neuro-typical Individuals (Group II)			
SI No	Age/ Gender	Years of Formal Education	Handedness	Neuroimaging finding	WAB-AQ	WAB Naming score	MoCA scores	Diagnosis	Age/ Gender	Years of Formal Education	MoCA Scores	Handedness
P1	20 yrs/ F	14 yrs	Right handedness	Infarct in left temporo parietal lobe.	32.2	1.5	21	Broca's Aphasia	20 yrs/ F	15 yrs	26	Right handedness
P2	38 yrs/ M	15 yrs	Left handedness	Infarct in left fronto-temporo-parietal, occipital lobe.	67.7	6.8	23	Broca's Aphasia	35 yrs/ M	16 yrs	28	Right handedness
P3	34.4 yrs/ M	16 yrs	Right handedness	Hemorrhagic stroke in left putamen region	70.6	9.3	28	Anomic Aphasia	38 yrs/ M	16 yrs	27	Right handedness
P4	35 yrs/ M	16 yrs	Right handedness	Infarct in left temporo parietal lobe.	89.6	7.8	28	Anomic Aphasia	35 yrs/ M	16 yrs	26	Right handedness
P5	47 yrs/ M	14 yrs	Right handedness	Acute hemorrhage involving left basal ganglia.	89.8	8.6	19	Anomic Aphasia	34 yrs/ F	14 yrs	27	Right handedness
P6	50 yrs/ F	16 yrs	Right handedness	Infarct in left temporo parietal lobe.	83.6	6.8	19	Anomic Aphasia	50 yrs/ M	16 yrs	30	Right handedness
P7	35 yrs/ F	15 yrs	Right handedness	Infarct in left frontal operculum and adjacent white matter.	97	9.7	29	Anomic Aphasia/ Latent Aphasia	47 yrs / F	14 yrs	29	Right handedness
P8	32 yrs/ M	15 yrs	Right handedness	Acute recurrent CVA	75.8	6.8	20	Conduction Aphasia	45 yrs/ M	15 yrs	27	Right handedness
P9	31 yrs/ M	12 yrs	Left handedness	Acute non-hemorrhagic infarct in left cerebral hemisphere	80.5	8.3	21	Broca's Aphasia	32 yrs / M	12 yrs	26	Right handedness
P10	69 yrs/ M	10 yrs	Right handedness	Chronic infarct in right PCA	72.6	7.3	21	Broca's Aphasia	39 yrs/ F	10 yrs	27	Right handedness
P11	71.1 yrs/ M	15 yrs	Right handedness	Acute ischemic stroke- left frontal cortical infarct	78.4	10	24	Anomic Aphasia	61 yrs / M	15 yrs	28	Right handedness
P12	36.8 yrs/ M	15 yrs	Right handedness	Complete thrombosis of left internal carotid artery	86.2	8.8	24	Anomic Aphasia	71 yrs / F	15 yrs	29	Right handedness
P13	39.2 yrs/ M	15 yrs	Right handedness	Acute infarct in left fronto-parieto-occipital lobe	97.2	9.5	26	Anomic Aphasia	39 yrs / M	15 yrs	25	Right handedness
P14	43 yrs/ M	12 yrs	Right handedness	Acute infarct in left basal ganglia; occlusion in left MCA	87.4	9.1	25	Anomic Aphasia	39 yrs / M	12 yrs	26	Right handedness
P15	45 yrs/ M	12 yrs	Left handedness	Ischemic CVA- Left MCA territory	66	7	21	Broca's Aphasia	43 yrs / F	12 yrs	27	Right handedness
P16	23 yrs/ M	14 yrs	Right handedness	Temporo-parietal hemorrhagic infarct	66.3	6.1	24	Conduction Aphasia	45 yrs/ M	14 yrs	24	Right handedness
P17	35 yrs/ M	12 yrs	Right handedness	Subacute infarct in left fronto parietal lobe- subcortical structures	70	8	24	Broca's Aphasia	23 yrs / M	12 yrs	25	Right handedness
P18	60 yrs/ M	12 yrs	Right handedness	Acute infarct to left MCA territory	75.3	8.3	22	Broca's Aphasia	35 yrs / F	12 yrs	27	Right handedness
P19	58 yrs/ M	12 yrs	Left handedness	Acute infarct in Left MCA territory, chronic lacunar infarct in left putamen	67.4	7.7	20	Broca's Aphasia	60 yrs / M	12 yrs	28	Right handedness
P20	32 yrs/ M	15 yrs	Right handedness	Acute recurrent CVA	75.8	6.8	23	Conduction Aphasia	58 yrs / M	15 yrs	27	Right handedness

3.2 The performance of the IWA and NTI group on confrontation naming and naming on picture description (Between-group comparisons)

The performance of IWA and NTI groups in the confrontation naming and picture description task was addressed statistically using descriptive and

nonparametric methods. The results are discussed below and are specific to the task.

Confrontation naming

The main objective of the present study was to compare the performance of the IWA and NTI groups concerning

word class deficits across both tasks. The overall raw mean score of total words for the confrontation naming task was 192.40 ($SD=41.88$) for the IWA group and a score of 226.20 ($SD=2.11$) for the NTI group.

Regarding word class (noun and verb) for both

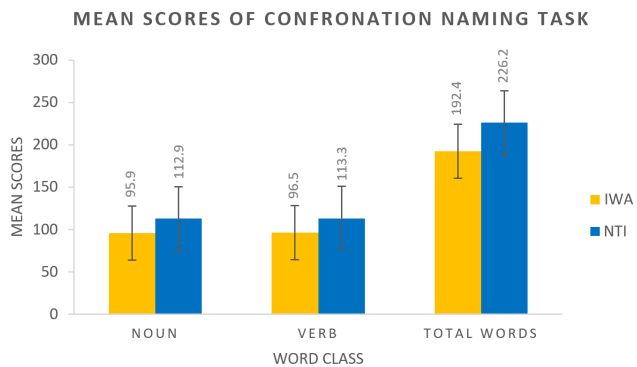


Figure 1. Mean raw noun and verb scores in confrontation naming task by IWA and NTI.

confrontation naming and picture description tasks, the raw mean scores were computed, and there was a relative difference in word classes between the groups. **Figure 1** represents the word class mean scores for IWA and NTI groups in confrontation naming. The mean accuracy score on two-word classes in the confrontation naming task for the IWA group was poor compared to the NTI group, as shown in **Table 2**.

The data were subjected to extended analysis for the confrontation naming task, where the cues were provided for target response in case the participant could not name at first instances. The analysis was the 'percentages of correct naming with a phonemic cue, percentages of correct naming with a semantic cue,' and the 'percentages of incorrect responses.' The investigator provided two cues: semantic and phonemic. The cueing percentage was higher in the IWA group with both cues (semantic and phonemic cues) than in the NTI group. Cueing was required for the NTI group for the confrontation naming task, which could be

Table 2. Mean scores of nouns, verbs and total words on confrontation naming and picture description tasks obtained by IWA and NTI.

Groups	Confrontation Naming			Naming on picture description			Total Noun Mean (SD)	Total Verb Mean (SD)
	Noun Mean (SD)	Verb Mean (SD)	Total Mean words (SD)	Noun Mean (SD)	Verb Mean (SD)	Total Mean Words (SD)		
Individuals with Aphasia	95.90 (24.67)	96.50 (20.69)	192.40 (41.88)	6.20 (1.47)	4.20 (1.50)	10.40 (2.58)	102.10 (25.23)	100.70 (21.57)
Neurotypical Individuals	112.90 (1.33)	113.30 (1.45)	226.20 (2.11)	9.65 (0.74)	5.85 (0.36)	15.50 (1.05)	122.55 (1.31)	119.15 (1.66)

due to the non-frequent noun and verb category stimuli considered for the confrontation naming task. However, the NTI participants had a good and excellent semantic expansion of the target stimuli considered for confrontation naming. Participants from both groups responded more to phonemic cues than semantic cues when nouns were the target word class. Like verb naming, phonemic cues had an advantage over semantic cues for IWA, whereas both cues were equivalent for NTI. The observation is that both groups preferred phonemic cueing strategy in both word classes. In IWA and NTI, phonemic cueing was higher for nouns than verbs. The percentage of cues obtained for confrontation naming by both groups is given in **Table 3**.

Mann Whitney U, a non-parametric test, was performed to compare the mean accuracy scores of nouns and verbs as word class in the confrontation naming task

between IWA and NTI. There were statistically significant differences between IWA and NTI for the word class under the confrontation naming task; the same is summarised in **Table 4**.

Table 3. Cue received by IWA and NTI in confrontation naming task.

Word Class	Individuals with Aphasia		Neurotypical Individual	
	Semantic cue (%)	Phonemic cue (%)	Semantic cue (%)	Phonemic cue (%)
Nouns	3.55	2.58	2.54	2.23
Verbs	2.85	3.64	1.78	2.67

Naming through picture description

Individuals with aphasia and neurotypical individuals performed poorer in picture description tasks than confrontation naming tasks due to various contributing factors of language processing. The overall mean score of total word usage in the picture description task was

Table 4. Results of Mann Whitney for word class comparison of confrontation naming task between IWA and NTI

Task with word class	/Z/	p-value
Confrontation naming - Noun	4.619	0*
Confrontation naming - Verb	4.258	0*

Note: * $p < 0.05$, indicates significant difference

10.40 ($SD=2.58$) and 15.50 ($SD=1.05$) in the IWA and NTI groups, respectively.

Specifically, for nouns and verbs as word class in the picture description task, the raw mean score of verb was lesser than noun for both IWA group and NTI group. **Figure 2** represents the mean raw score obtained for noun and verb classes on both groups' picture description tasks.

On the Mann-Whitney U test, statistically significant differences were seen for the class of nouns and verbs for picture description, summarised in **Table 5**.

On qualitative analysis, the observable differences in the sentence structure of the picture description were seen in both groups. IWA used more straightforward sentences with poor Subject-Object-Verb agreement and more active sentences with poor Subject-Object-

Verb agreement. **Table 6** illustrates the sentences in the discourse sample of IWA group participants. Meanwhile, NTI used better sentence structures, with increased morphological inflexions, passive sentences, and mean length of utterances.

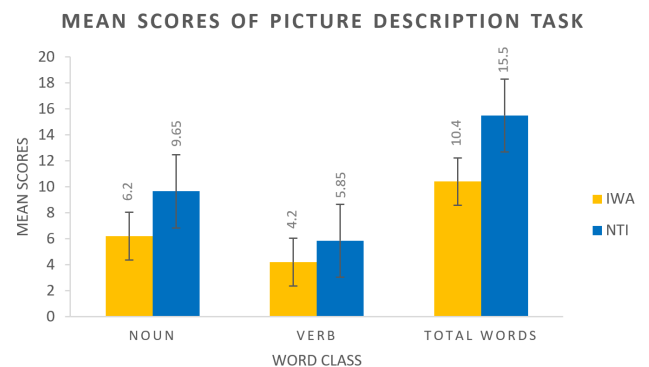


Figure 2. Mean raw scores of nouns and verbs in picture description task by IWA and NTI.

Table 5. Results of Mann Whitney for word class comparison of picture description between IWA and NTI.

Task with word class	/Z/	p-value
Picture description - Noun	5.374	0*
Picture description - Verb	3.802	0*

Note: * $p < 0.05$, indicates significant difference

Table 6. Errors analysis of sentences used by IWA in discourse sample.

Illustration of participants	Sentence type	Participant's response (in Kannada & translation in English)	No. of nouns and Verb
Illustration from P 2 (Broca's Aphasia)	Word order	/ <i>appa odu</i> / Father read	Noun - 1 Verb - 1
Illustration from P 5 (Anomic Aphasia)	Verb inflexions	/ata/- /aduthidane/ Play-playing	Verb - 1
Illustration from P 2 (Broca's Aphasia)	Simpler sentences and verb inflexions	/huduga idane/, /pata adthidane/ Boy is there. Flying kite	Noun - 2 Verb - 1
Illustration from P 3 (Anomic Aphasia)	Active sentences	/amma coffe madtale/ Mother made coffee	Noun - 2 Verb - 1
Illustration from P5 (Anomic Aphasia)	Plausible and implausible sentences	/amma, appa mathe magu mane inda horage bandidare/ Mother, Father and Kid have come out of house .	Noun - 5 Verb - 1
Illustration from P 5 (Anomic Aphasia)	Verb inflexions	/ata/- /aduthidane/ Play-playing	Verb - 1

Remark: Accurate score (1) for noun and verb naming for the sentences produced with poor morphosyntactic rules by the participant with aphasia.

3.3 Within-group comparison of noun and verb naming in IWA and NTI on confrontation naming and naming on picture description

Neurotypical Individuals

Neurotypical Individuals' accuracy scores of nouns and verbs in confrontation naming and naming on picture description tasks were addressed using the raw data of the individual participants. Most participants scored a hundred per cent accuracy on both tasks. In the

confrontation naming task, the accuracy scores of nouns and verbs were near the total score of 114, while in picture descriptions, noun scores were better than verbs. Both groups displayed a similar performance pattern in which nouns were used more frequently than verbs in picture descriptions.

Wilcoxon Signed rank test was administered to compare the difference between nouns and verbs as word class

for both the tasks in IWA. Considering significance level < 0.05 as a p -value, the NTI group showed no significant difference in the confrontation naming task, and there was a substantial difference for the picture description task in the production of nouns and verbs, as shown in **Table 7**.

Table 7. Results of Wilcoxon’s Signed Rank test for noun and verb word class in NTI.

Groups	Parameters	Tasks	/z/	p-value
NTI	Noun word class versus	Confrontation naming task	1.101	0.271
	Verb word class	Naming on picture description task	4.233	0*

Note: * $p < 0.05$, indicates significant difference.

Individuals with aphasia

IWA performed poorer in both tasks on mean accuracy scores compared to neurotypical individuals, while a statistically significant difference was seen only in the picture description task. Further analysis concerning individualistic performance on confrontation naming and picture description for both groups was attempted. Accuracy scores of nouns and verbs in confrontation naming and naming on picture description tasks for IWA were addressed using the raw data of the individual participant. The majority of the participants had more than fifty per cent accuracy scores in both tasks, revealing that Anomic Aphasics have a higher score in accuracy than Broca’s Aphasia. Wilcoxon Signed Rank test was administered, and IWA showed no significant difference in noun and verb production for confrontation naming. However, an important difference was seen in the picture description, as shown in **Table 8**.

Table 8. Results of Wilcoxon’s Signed Rank test for noun and verb word class in IWA.

Groups	Parameters	Tasks	/z/	p-value
IWA	Noun word class versus	Confrontation naming task	0.95	0.338
	Verb word class	Naming on picture description task	3.65	0*

Note: * $p < 0.05$, indicates significant difference.

To summarise the results of the present study, the performance of IWA was poorer than NTI on confrontation naming and picture description tasks. The difference in the use of word class (number of nouns and verbs) between the IWA and NTI was statistically seen for picture description. Also, there was a statistically significant difference in word class use in IWA and NTI for picture descriptions only. Irrespective

of the IWA and NTI groups, there was a statistically significant difference between the tasks (confrontation naming versus picture description) and the word classes (nouns versus verbs). In the further sections, the present study discusses the importance of tasks used to assess naming different word classes in NTI and IWA about the general naming process, lexical access specific to nouns-verb category, lexical-semantic access, non-lexical semantic access, linguistic processes, and aphasia symptoms, etc.

4.0 DISCUSSION

Picture naming is widely used to assess lexical access. It involves several stages: visual recognition of the image, matching it to the stored image in memory, selecting the lexical referent, selecting the phonological code linked to the referent, and verbalising the word. Thus, picture naming engages all stages of lexical access: encoding, search, and retrieval. The study suggests that aphasia participants likely had impairments at the encoding and retrieval levels ([Goodglass, 1998](#)).

The present study aimed to assess word class deficits at the single-word production and discourse levels in individuals with aphasia. The results found that IWA had better noun-verb retrieval at the picture naming task than at the picture description task.

However, picture naming tasks provide a comprehensive assessment of lexical access, engaging multiple cognitive stages. Picture naming tasks are straightforward and easily standardised, making them suitable for clinical and research settings. The task directly activates lexical-semantic representations, clearly measuring an individual’s ability to retrieve words. The literature supports the use of picture naming in studying lexical-semantic processing ([Goodglass, 1998](#)).

In contrast, picture naming tasks might not reflect real-life language use, where contextual and discourse-level factors play significant roles. The task lacks ecological validity compared to connected speech tasks like picture description. The better performance in picture naming tasks compared to picture description tasks may result from the task’s more straightforward and more constrained nature, which does not capture the full complexity of lexical retrieval in naturalistic settings. While the study suggests impairments at the encoding and retrieval levels, it is challenging to isolate these stages precisely. Other factors, such as working memory and attention, influence performance and are not controlled for simple picture-naming tasks. The absence

of semantic context in picture naming might not accurately reflect the participants' abilities in more dynamic and semantically rich environments. Results from picture naming tasks may not generalise well to other types of lexical retrieval tasks, such as those involving spontaneous speech or narrative discourse. While picture-naming tasks are valuable for assessing specific aspects of lexical access in aphasia, relying solely on this method may overlook critical nuances of word retrieval in more complex and naturalistic contexts. Integrating picture naming with tasks that assess connected speech, such as picture description and narrative tasks, can provide a more holistic understanding of lexical retrieval deficits in aphasia. This combined approach can better inform both clinical assessment and intervention strategies.

This research explores how individuals with aphasia (IWA) retrieve words categorised by word class during discourse ([Kambanaros, 2010](#); [Mayer & Murray, 2003](#)). Word retrieval difficulties in IWA are particularly pronounced during discourse formation, as contextual factors can influence and alter retrieval processes ([Wilshire & McCarthy, 2002](#)). The study suggests that verbs are less frequently used than nouns in discourse production tasks ([Boucher et al., 2022](#); [Brusini et al., 2021](#); [Lavoie et al., 2021](#)).

Various linguistic factors, including word frequency, imageability, and the abstract and semantic representation of the target stimulus in confrontation naming tasks, influence individuals with aphasia's ability to name objects. These factors collectively facilitate naming responses. However, in tasks such as picture description, these factors interact at a higher level, potentially causing distraction and interference, leading to poorer naming responses.

In the present study, difficulties in naming nouns may be attributed to linguistic factors such as frequency of occurrence and imageability. Verb naming difficulties could be due to linguistic and non-linguistic factors, including mental schema and ambiguity in picture interpretation ([Williams, 1983](#)). Some participants misinterpreted the target picture (picnic spot) as a village scene, affecting both noun and verb naming accuracy. This misinterpretation likely stems from syntactic and lexical deficits in discourse, leading to paragrammatical structures and impairments in micro-linguistic elements. While participants could access lexical-semantic and syntactic information, they often produced semantic paraphasias and neologistic

utterances, resulting in incoherent descriptions of the target picture ([Pallickal & Hema, 2020](#)).

Utilising the Dual Route Model provides a strong theoretical framework to interpret the differences observed in noun and verb retrieval. This model helps to understand semantic versus lexical processing routes. The study's findings are consistent with previous research ([Kim et al., 2019](#)) highlighting better noun retrieval in anomic aphasia, supporting the lexical account of noun-verb dissociation. The study offers insight into the mechanisms underlying word retrieval deficits in aphasia by acknowledging the separate storage of nouns and verbs in the mental lexicon. While the study supports one side of the debate (better noun retrieval), it does not fully address the mixed evidence in the literature. Berndt and Haendiges ([2000](#)) found the opposite pattern, suggesting that noun-verb retrieval differences may be more complex than the Dual Route Model or lexical account alone can explain.

The Dual Route Model focuses on word-level semantic processing but may not account for all cognitive and contextual factors influencing word retrieval in connected speech. Real-life language use involves more than isolated word retrieval, such as sentence-level and discourse-level processes. Picture description tasks involve more contextual and syntactic processing than simple picture naming, potentially influencing word retrieval differently. The study's reliance on picture description may not isolate lexical retrieval as cleanly as intended.

The study does not address individual differences in the severity and type of aphasia, which can significantly impact lexical retrieval patterns. These variations might explain the discrepancies in findings across different studies. The comparison between picture naming and picture description tasks reveals discrepancies but does not control for the increased cognitive load and context integration required in the picture description. This difference could affect the validity of attributing findings solely to lexical access differences. The study's findings contribute valuable insights into the ongoing debate about noun and verb retrieval in aphasia, aligning with the Dual Route Model and supporting the lexical account of word retrieval. However, the study also highlights the complexity of lexical access in aphasia, showing that different tasks and individual differences can produce varying results. Future research should incorporate a broader range of tasks and control for contextual and cognitive load factors to better understand the nuanced mechanisms of word retrieval

deficits in aphasia. Integrating findings from both consistent and contradictory studies can lead to a more comprehensive and nuanced understanding of aphasia-related lexical retrieval.

The semantic account posits that verbs pose more incredible difficulty due to their semantic complexity, lower imageability, and fewer perceptual features than nouns ([Kueser & Borovsky, 2023](#)). In the present study, naming performance at the discourse level, particularly in the picture description task, was examined considering different types of aphasia, including Anomic and Broca's Aphasia. Individuals with aphasia exhibited poorer naming performance, primarily using more nouns than verbs in their discourse, often constructing simple active sentences (e.g., Illustration P3 in **Table 6**), employing verb inflexions (e.g., Illustration P5 in **Table 6**), and forming plausible but syntactically flawed sentences (e.g., Illustration P5 in **Table 6**). This observation confirms that non-fluent aphasia types, such as Broca's Aphasia, affect grammatical systems and syntactic processing ([Fedorenko et al., 2022](#)).

Regarding syntactic processing, which involves the rules governing word order and sentence structure, the study noted discrepancies in sentence formation in Kannada, where the Subject-Object-Verb (SOV) order is typical but not always followed correctly, particularly by individuals diagnosed with Broca's Aphasia (e.g., Illustration P2 in **Table 6**). These participants often produced sentences that did not adhere to syntactic rules but were considered correct in the context of their aphasia diagnosis. In contrast, neurotypical individuals (NTI) and those diagnosed with Anomic Aphasia (e.g., Illustration P5 in **Table 6**) showed greater use of verb inflexions in picture description and confrontation naming tasks.

The study effectively highlights how semantic complexity and lower imageability of verbs contribute to naming difficulties in individuals with aphasia, supporting the semantic account. The study's exploration of syntactic processing in aphasia provides valuable insights into how grammatical deficits manifest differently across aphasia types, such as the challenges observed in producing verbs and adhering to morphosyntactic rules. Recognising the flexibility needed in linguistic analysis for individuals with minimal speech output, the study suggests that non-standard sentence structures may still convey meaning effectively in aphasia discourse. While the study acknowledges the morphosyntactic challenges in aphasia, the criteria for defining correct responses need

careful consideration to avoid over-generalisation or underestimation of participants' linguistic abilities. Future research could further investigate how varying degrees of syntactic impairment impact overall discourse coherence and communicative effectiveness in individuals with different types and severities of aphasia.

In conclusion, the study explores word retrieval and syntactic processing deficits in aphasia, emphasising the complex interplay of semantic and syntactic factors in language production tasks. These findings underscore the importance of tailored linguistic assessments and interventions to improve communication outcomes for individuals living with aphasia.

In this study, both groups showed similar deficits in the lexical-semantic processing of verbs and nouns during the picture naming task. The observed dissociation between nouns and verbs in single-word production remains challenging despite their storage in potentially different mental lexicons with partially overlapping neural foundations ([Feng et al., 2020](#)). Therefore, the study underscores the importance of assessing single-word production and discourse levels to fully capture word class deficits in individuals with aphasia. Relying on a single task alone would provide limited insights into these deficits.

Overall, the study's findings support the combined use of single-word production and discourse analysis to comprehensively evaluate word class deficits in aphasia ([Li & Kiran, 2023](#)).

5.0 CONCLUSIONS

Noun-verb disassociation has recently received attention in the study of aphasia. IWA produces fewer errors in the production of nouns than verbs. Using descriptive tasks to measure word class impairments provides more profound knowledge. This research reflects the need to include a discourse task in measuring word class impairments in IWA and planning rehabilitation about the task. The study results support the rationale of including discourse to assess word class defects through supporting statistical outcomes. Significant differences were seen in the discourse task irrespective of the group of participants and the class of words compared to the picture naming task, adding to the strength of the discourse analysis. Deficits in verb as word class were noticed more in the picture description task than in the picture naming task. Word class deficits can be noticed in single-word production well. However, discourse production tasks facilitate analysis

concerning lexical access, syntactic processing, morphological processing, and other linguistic and non-linguistic processing levels, as the literature supports.

5.1 Clinical Implications

Word class deficits are more commonly studied in single-word production. At the same time, they are ignored at the discourse level, as they are not included in most traditional language assessments. With statistical support data, the present implies adding discourse tasks to measure word class deficits in routine diagnostic language assessment for a better understanding of language characteristics of IWA at the syntactic level.

5.2 Limitations and Future Directions

Generalisation of word retrieval abilities at single word production and discourse level of this present study with different types of aphasia is ineffective. However, considering a single homogenous aphasia group can provide a better understanding of word retrieval abilities in the aphasia type and generalise the same findings. Also, discourse analysis based on core lexicons with other discourse genres provides information on lexical processing in IWA and NTI and integrates discourse analysis with standardised language assessment batteries. These considerations are

recommended for further studies on developing norms for naming assessment at the discourse level.

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Statement of Ethics: Participants/ Caregivers had given their written informed consent. According to the Declaration of Helsinki, the ethical clearance was obtained from the institutional review board, AIISH Ethics Committee (AEC), and Approval Number. No.DOR.9.1/Ph.D./YBC/929/2021-2022 DT 10.02.2023.

Supplementary Materials: The following are available online at <https://neuroscirn.org/ojs/index.php/nrnotes/article/view/339>: **Appendix A** – Stimulus for single word production (noun); **Appendix B** – Stimulus for single word production (verb); **Appendix C** – Stimulus for picture description.

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