DEVELOPMENT AND VALIDATION OF ACTION-VERB NAMING TEST IN HINDI (AVNT-H)

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JUNE, 2026

CERTIFICATE

This is to certify that this dissertation entitled **"Development and Validation of Action-Verb Naming Test in Hindi (AVNT-H)"** is a bonafide work submitted as part of fulfillment of the degree of Master of Science (Speech-language pathology) of the student with Registration Number P01II24S123024. This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other university for the award of any other Diploma or Degree.

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This is to certify that this dissertation entitled **" Development and Validation of Action-Verb Naming Test in Hindi (AVNT-H)"** is the result of my own study under the guidance of Dr. Abhishek BP, Assistant Professor in Language Pathology, All India Institute of Speech and Hearing, Mysuru and co-guidance of Dr. Brajesh Priyadarshi, Associate Professor in Linguistics , Department of Speech-Language Pathology, All India Institute of Speech and Hearing, Mysuru and has not been submitted earlier to any other university for the award of any other Diploma or Degree.

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List of Frequently Used Abbreviations

AVNT-H –Action-Verb Naming Test in Hindi

A1- One-argument

A2-Two- argument

A3- Three- argument

AF-Action fluency

AN-Action naming

BDAE-Boston Diagnostic Aphasia Examination

BNT-Boston Naming Test

ERP-Event Related Potential

fMRI- Functional Magnetic Resonance Imaging

IQR- Inter-Quartile Range

LEAP-Q- Language Experience and Proficiency Questionnaire

MEG- Magnetoencephalography

S-CVI- Scale- Level Content Validity Index

I-CVI- Item-Level Content Validity Index

ABSTRACT

***Background**: Confrontation naming is an important component of lexical-semantic processing for retrieval abilities, as it provides insights into lexical access, semantic memory, word retrieval abilities, visual recognition and phonological processing. Naming action verbs is considered effective in tapping lexical-semantic retrieval, syntactic processing, thematic role assignment and sentence level language production, as they closely reflect functional communication used in everyday life.*

***Aim and objectives**: The present study aimed to develop an Action Verb Naming Test in Hindi (AVNT-H) and examine age-related differences in verb retrieval patterns among healthy adults and elderly individuals. The objectives were (1)To determine the content validity of the developed tool, (2) To examine age-related differences in action verb retrieval performance across four age groups (18–30, 31–45, 46–60, and 61–70 years), (3) To examine argument structure differences in action verb retrieval performance across four age groups (18–30, 31–45, 46–60, and 61–70 years), and (4) To determine inter-rater and test–retest reliability by analyzing 10% of the collected data.*

***Method**: The study was conducted in two phases (1) to determine the content validity of the developed tool and (2) to administer the tool on neurotypical adults and elderly individuals. An Action -verb naming test using argument structure taxonomy was administered, and responses were classified as correct, partially correct, and totally correct. The verb retrieval performance across different age groups and argument complexity was determined using the appropriate statistical analysis. Inter-rater reliability and test-retest reliability was also analyzed using 10% of the collected data.*

Results*: The findings revealed predominance of total correct responses across all age groups, with a gradual increase in partially correct responses and a reduction in correct responses with advancing age and increasing argument-structure complexity. No significant differences were found across the middle and older age groups. Reliability analysis revealed good to excellent reliability across most of the responses and argument structures.*

Discussion: *Adults showed higher correct and total correct responses with greater consistency, while middle and older adults showed reduced response accuracy with increased partially correct responses and greater variability in correct responses. Argument structure complexity also revealed changes in verb retrieval performance with preserved one-argument verbs across age groups, while two and three-argument verbs demonstrated reduced accuracy and increased partially correct responses with advancing age, suggesting the responses may be compensated through semantic and context-based responses, leading to more partially correct responses in older adults. The high inter-rater reliability and test-retest reliability observed in the present study support the psychometric strength of the developed tool (AVNT-H)*

Conclusion: *The present study revealed that verb retrieval abilities decline with advancing age and increasing argument structure complexity. Younger adults showed higher retrieval accuracy, whereas older adults showed increased partially correct responses. The developed tool showed strong reliability as a reliable tool to measure verb retrieval. The findings contribute as a preliminary baseline data for retrieval performance and thus highlight the importance of assessing verb retrieval in a semantic-syntactic context rather than isolated single-word verb retrieval.*

Chapter 1

Introduction

Naming is the most important subsystem of a language module and also plays an important role in comprehending lexical-semantic processing. In order to complete the naming task, participants must retrieve semantic and phonological information arranged in memory and evaluate based on specificities of a given stimulus. Naming involves both lexical and non-lexical processing; meaning retrieval of semantic information and abstract representation connected with a particular word is related to lexical processing whereas detection and perception of visual stimuli that triggers lexical process is related to non-lexical processing.

Confrontation naming is the most commonly used task in assessment of word retrieval which requires the participant to name a representational picture or object based on visual input (pictures, line drawings, photographs or real objects) involving both frequent and infrequent stimuli in order to vary the level of complexity, comprises of three basic stages:

1. Recognizing the object being represented, this triggers mental structural representation
2. Identifying the object by accessing its semantic representation
3. Activation of phonological representation allowing the name to be spoken and the image or object to be retrieved.

Noun naming, typically involves the retrieval of object names (e.g., chair, dog, tree), is primarily associated with semantic memory and visual object recognition. Verb naming, which involves retrieving action labels (e.g., run, eat, throw), have more complex linguistic and motor-related processes. The accuracy of responses, time taken for naming, error response, response to cues and consistency of naming gives information about the lexical access.

The impact of aging on action word retrieval has been assessed by evaluating performance on the ANT in healthy population (Mackay et al., 2002). The findings from these studies demonstrated that the verb retrieval abilities decline with age while healthy participant's performance stays within the normal range. Action word retrieval is also influenced by various psycholinguistic factors such as name agreement, imageability, age of acquisition and frequency which affects both speed and accuracy of naming. The colour, complexity, clarity and overall image type also affects the naming retrieval.

While the noun naming task/test has been widely studied, there is dearth of literature pertaining to the verb naming task/test. Notably, there are clear differences between the retrieval of these two grammatical components (Morrison et al., 1992). There is no well-established standardized naming test specifically designed for verb retrieval abilities in Hindi; most available naming tests focus on nouns and are available in English and other Western languages. Despite strong linguistic, cognitive, and neuropsychological research evidence, normative data for naming actions in Hindi are lacking. The absence of culturally and linguistically valid tools for assessing verb naming in Indian languages, including Hindi, presents a significant barrier to cross-linguistic comparisons and clinical applications.

Noun production tests like confrontation naming have undergone extensive psychometric validation (Casilio et al., 2025) compared to verb production tests that remain underexplored in terms of psychometric properties because of the lack of established baseline data from the healthy population.

Verbs differ not only grammatically according to arguments (den Ouden et al., 2009) but semantically. Existing action naming research often ignores the syntactic complexity of verbs, and no studies are available in the Hindi-speaking population. In computational linguistics, the argument structures influence how verbs are used within a sentence, whether they appear with or without objects, and can vary even among verbs with similar meanings

(Beavers & Koontz-Garboden, 2012). These differences across languages point to the need for more research on how verb meaning influences its grammatical use (Papafragou et al., 2007). No data is available on how the verb retrieval abilities change with age in Hindi speakers. This factor also necessitated the current study.

Need of the study

To the best of our knowledge, there is no documented study on action verbs in Hindi. Hindi is a verb-dominant language with a rich morphology. Its complex verb conjugations and inflectional morphology makes it different from other Indian and western languages in termsof verb retrieval patterns. Although Hindi verbs are frequently assumed to be intransitive at the root level, their usage depends on syntactic and semantic context. A unique, language specific test must be developed rather than adapting an existing one because elements including verb inflection, argument structure, lexical frequency and cultural relevance greatly influence verb processing. In order to provide more valid and reliable evaluations for research and clinical applications, an action verb naming test will ensure that the stimuli appropriately reflect the language and cognitive needs of Hindi speakers. The fact that many Hindi speakers frequently mix Hindi and regional languages in everyday conversation is another important area of interest. This will provide insights into how regional exposure affects language processing in general and verb production, comprehension and retrieval in specific.

Aim

The present study aims to develop an Action-Verb Naming Test in Hindi and examine age-related differences in verb retrieval patterns among healthy adults and elderly individuals.

Objectives

1. To determine the content validity of the developed tool.

2. To examine age-related differences in action verb retrieval performance across four age groups (18–30, 31–45, 46–60, and 61–70 years).

3. To examine argument structure differences in action verb retrieval performance across four age groups (18–30, 31–45, 46–60, and 61–70 years).

4. To determine inter-rater and test–retest reliability by analyzing 10% of the collected data

Accordingly null hypothesis will be generated:

For objective 2: There is no statistically significant difference between the four age groups on the performance on the verb action naming test in Hindi

Chapter 2

Review of literature

2.1 Lexical access

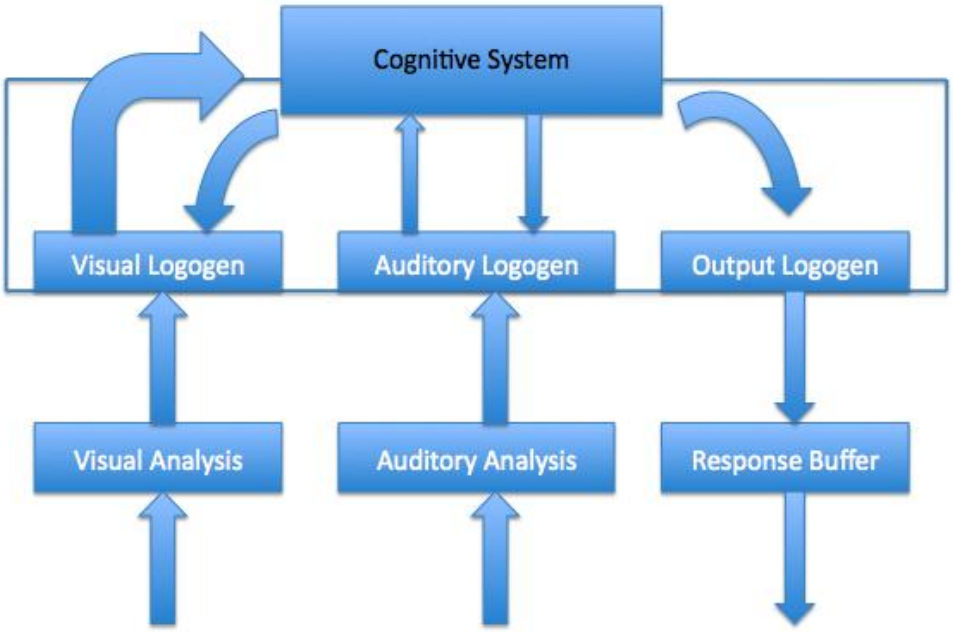
Lexical access is the retrieval of the appropriate word from the mental lexicon, applied to both recognition and production. Lexicon comprises millions of words, and the most appropriate word is retrieved based on the need and context. According to (Levelt, 2001), lexical access occurs in two distinct stages: lemma retrieval, which involves accessing the syntactic properties of a word, and lexeme retrieval, which consists of retrieving its phonological form. The process of lexical access during speech production initiates at the conceptual level, where the speaker produces a pre-verbal message that activates the associated conceptual nodes. Each node is associated with a lemma, which is an abstract grammatical representation encompassing syntactic features such as part of speech, grammatical gender, number, tense, and case. The lemma with the highest activation is then selected and passed on to the word-form (lexeme) level, where the word's phonological structure is accessed for articulation. Although activation may spread to other semantically related conceptual nodes, only the most activated lemma is selected for the next stage, which helps to explain lexical competition and some speech errors. During lexical access at the level of sentence, the grammatical details of the word, such as noun or verb, are first accessed along with the retrieval of features like gender or number. Semantic representations of verbs are thought to be different for nouns and verbs, verbs being more complex in grammar and form, as well as more abstract in comparison to nouns and not clearly categorized (Mätzig et al., 2009).

Various lexical access models have been proposed to understand how individuals retrieve words from mental lexicon which further offers a framework to explain cognitive processes involving word recognition and production. Many different models regarding lexical access have been proposed till date. Some of these models relevant to retrieval of nouns and verbs are explained in the next section.

2.2 Models of lexical access

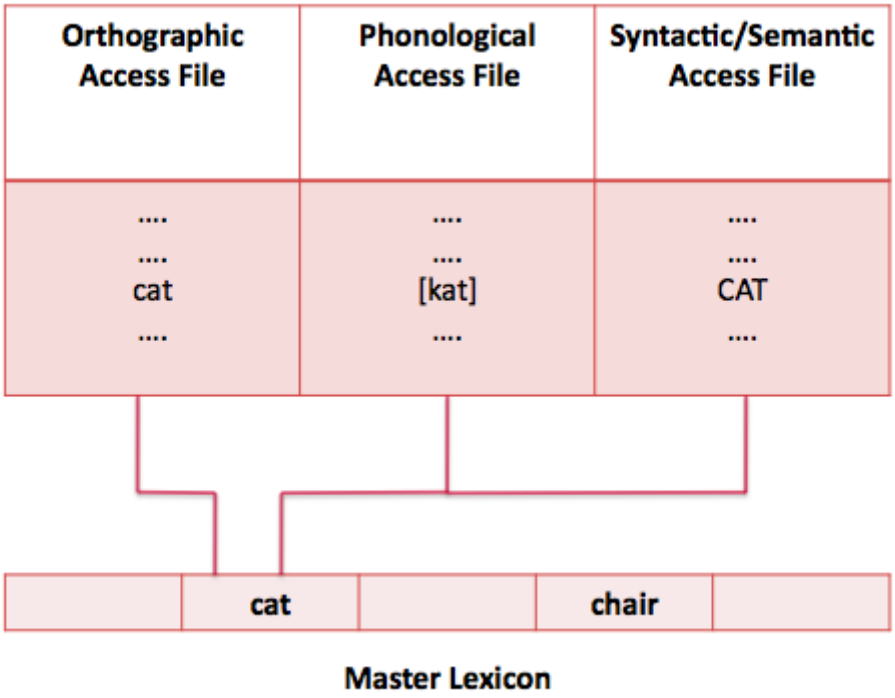
Lexical access is conceptualized as a sequence of cognitive processes that initiates with an abstract, non-linguistic idea and reaches in a phonetic sequence that an individual is capable of vocalizing, specifically a word. The process of translating thoughts into speech is associated with the connectionist model. Connectionist models have significantly advanced the understanding of language production, particularly in lexical access and grammatical encoding (Dell et al., 1999).To produce and understand language, whether it is spoken or written, an individual must have some form of cognitive representation of the words of their language.

The logogen model (Morton, 1969) proposes that each lexical entry is represented by a logogen, which accounts for activation based on how many features it shares with the input (orthographic, phonological, or semantic). When a logogen's activation surpasses its threshold, the corresponding word is recognized. This model allows parallel activation across multiple input sources, which enables faster and more interactive word recognition. High-frequency words are recognized faster because they have a lower activation threshold, requiring less input to reach recognition, facilitating quicker access. Morton's later review (1979) introduced separate visual and auditory input paths, refining the model's parallel processing framework.



Note. Adapted from "A new attempt at an interpretation or an attempt at a new interpretation", by J.Morton and K.Patterson,1980, in M. Coltheart, K. Patterson, and J. Marshall (Eds.), Deep Dyslexia(pp.91-118), Routledge.

The Autonomous search model (Forster & Chambers, 1973; Jarvis & Pavlenko, 2008) explains that lexical access occurs in a two- stage, serial search process. The model compares the lexicon to a library where access files (orthographic, phonological, and semantic/ syntactic function as catalogs that help locate words based on spelling, sound, or meaning. Using the initial part of a word, input from any modality (visual or auditory) activates one access file at a time. Once the appropriate access files have determined the correct subsets of potential word candidates, the lexicon is systematically searched in a serial manner rather than a simultaneous or parallel one. The search proceeds until the input's perceptual representation exactly matches a stored lexical entry, indicating that lexical access has been completed and the word has been successfully recognized.



Note. Adapted from Crosslinguistic Influence in Language and Cognition by Jarvis, S., & Pavlenko, A. (2008, pp.72-88), Routledge.

Spreading activation model (Roelofs, 1992) of lexical access in speech production represents some of the earliest applications of connectionist ideas to psycholinguistic data. This model explains conceptually driven lemma retrieval as the first step of lexical access in speaking, and proposes that the mental lexicon is a network of interconnected concepts, lemma, and word-form nodes, where activating a concept spreads activation to related lemmas. The most activated lemma with its meaning and syntactic properties are then selected for production. This model accounts for patterns in object naming, categorization, and semantic facilitation in language processing tasks.

The Interactive Two-Step model (Dell et al., 2000)explains picture naming as a process that maps word meaning (semantic features) to its phonological form through a hierarchical network consisting of semantic features, words, and phonemes which are linked by bi-directional excitatory connections. In the first stage, word retrieval begins with

activation of the target word's semantic features (e.g., for "CAT"). Activation then spreads bi-directionally between semantics, words and phonemes influenced by connection strength, decay rate and random noise. After a fixed period, the most activated word of the correct syntactic category (e.g., a noun for object naming) is selected, marking the completion of word retrieval stage in naming tasks. Phonological retrieval begins after word selection, with spreading upward to semantic level and downward to phoneme retrieval levels leading to selection of most active phonemes units.

Lexical memory, also known as mental lexicon, is a pool of information that is mentally stored while lexical access refers to the retrieval of such information. Lexical access is a complex cognitive process involving the retrieval of word information from memory, with its understanding developing from simple matching to intricate models that includes sub- lexical units and contexts.

According to a study by Katz & Friedmann, 2024, which examined models of lexical retrieval from neuropsychologists viewpoint (Dell & O'Seaghdha,1992;Nickels, 1995;Levelt, 2001), investigated that lexical retrieval includes the interplay among lexical retrieval, argument structure and morphology. The Study proposed a model for retrieval of alternating verbs, which in Hebrew, are morphologically marked based on argument structure, tested 23 Hebrew-speakers with aphasia, first identifying their functional locus of impairment within a lexical retrieval model for single words and then administering a test battery to assess their production of alternating verbs within sentences. The results showed that the conceptual system, semantic lexicon, syntactic lexicon, the phonological output lexicon and phonological output buffer, each plays a unique role in retrieving morphologically complex verbs , yielding a different error pattern when impaired predicted by the proposed model.

In a study by Roos et al., 2023, a sentence-constrained picture naming paradigm was used to approximate natural language production. Picture appeared as the last word of either unconstrained sentences (no predictive context) or constrained sentences (context predicts the target word). In unconstrained contexts, word retrieval occurs after the picture is seen, on the other hand where the context is constrained, the retrieval can occur in advance, based on sentence information. This experimental framework facilitates the examination of conceptually driven lexical retrieval under both visually guided and contextual information, thus providing insights into the timing and neural mechanism of naturalistic lexical production.

Another study on bilingual lexical access by Kastenbaum et al., 2019 investigated the effects of language proficiency and language combination using a category fluency task among 109 bilinguals across five language pairs revealed that language exposure strongly predicted category fluency scores. Overall the study demonstrates that language proficiency, exposure, and specific language combinations significantly influence bilingual lexical access. In addition to bilingualism, the grammatical class also influences lexical access.

These lexical access models ranging from early theoretical explanations like the logogen and autonomous search model to more dynamic connectionist framework like spreading activation and interactive two- step models shows how word retrieval consists of several interrelated processing levels, from phonological to semantic representations.

Since nouns and verbs rely on distinct semantic, syntactic and phonological pathways according to different lexical models, the next section examines how nouns and verbs differ as separate classes in cognitive and neural processing.

2.3 Noun vs verb naming

Nouns and verbs are two fundamental grammatical categories in all natural languages, and their retrieval during naming tasks relies on distinct cognitive and neural mechanisms. Noun naming, which typically involves the retrieval of object names (e.g., *chair*, *dog*, *tree*), is primarily associated with semantic memory and visual object recognition. Verb naming, which involves retrieving action labels (e.g., *run*, *eat*, *throw*), have more complex linguistic and motor-related processes, including syntactic encoding and thematic role assignment. Verbs within a sentence, especially in the form of finite verbs (e.g., "she runs"), provide a more accurate reflection of everyday language use compared to simply naming objects or producing non-finite verb forms like "running" or "to run." This is because finite verb tasks require the speaker to construct a grammatically correct sentence, including a subject and a verb that must agree in number and tense. In contrast, non-finite verb forms or object naming do not require this level of sentence structure or syntactic agreement. This highlights how verb-naming tasks, particularly sentence formation, involve more complex linguistic processes and provide insight into real-life language ability.

According to the Semantico-Syntactic Classification of Hindi verbs, based on Levin and Rappaport Hovav's (1995) paradigm, Hindi verbs can be divided into three main categories according to their lexical semantic structures and argument patterns.

1. Externally caused verbs are dyadic verbs and causative, usually change-of-state verbs involving an external cause.
2. Internally caused verbs are monadic and usually unergative, where action results from the subject itself
3. Verbs of existence and appearance which are dyadic unaccusative verbs with two internal arguments.

Hindi verbs can be broadly divided into the following ten classes: 1. Emission verbs, 2. Verbs of change of state, 3. Verbs of motion, 4. Verbs of spatial configuration, 5. Verbs of existence, appearance and disappearance, 6. Verbs of bodily process, 7. Verbs of contact/ attachment, 8. Verbs of consumption, 9. Verbs of perception , and 10. Verbs of image impression.

Argument structure refers to the number and type of participants or object phrases a verb requires and plays a vital role in lexical-semantic and morpho-syntactic processing (den Ouden et al., 2009). Research has shown that verbs and their arguments are linked through semantic networks (den Ouden et al., 2009). Despite overlapping domains, argument structure is easier to manipulate in pictures than features like inflectional morphology, making it a more practical and measurable way to study morpho-syntactic processing in verb naming.

The most consistent finding associated with concrete noun naming is with the left inferotemporal (IT) region (Cotelli et al., 2012), and the areas most consistently associated with action naming are the left frontal operculum (FO) and left posterior middle temporal region(an area related to motion processing, known as area MT). Behaviorally, a naming task would be used to test the noun and verb retrieval.

A study (Lukic et al., 2019) investigated the neurocognitive mechanism underlying the processing of category-ambiguous verbs using fMRI and a grammatical judgment task, and found that while both polysemous and homonymous verbs elicited greater left frontoparietal activation than unambiguous verbs, homonymous verbs showed higher processing costs and broader neural engagement, supporting the Single Lexical Entry Model, indicating that polysemy engages grammatical word-form processes, whereas homonymy

requires greater semantic control and selection, suggesting that ambiguous verbs are not processed uniformly

In another study by Li et al., 2019, compared mandarin-English bilinguals and English monolinguals to test the weaker links and cross-language interference accounts of bilingual lexical processing. The study examined the effect of grammatical class, word frequency and translability using a picture-naming task. Bilinguals were overall slower than monolinguals in both L1 and L2, but this difference was smaller for verbs than nouns. They showed stronger frequency effects in L2 and produced more translatable words faster, regardless of grammatical class. Lexical links appear to be less strongly reinforced due to divided language use in bilinguals. However, rather than interference, cross-language facilitation was observed, suggesting that shared representations between languages can facilitate word retrieval.

In another study by Assadollahi& Rockstroh, 2008 which involved 22 healthy right handed German speakers and used magneto encephalography (MEG) to examine how verbs with varying argument structures (one-argument, two-argument and three-argument) are processed in isolation and in minimal context. Results showed that one-argument verbs elicited stronger activation in the left middle temporal lobe around 250–300 ms, while minimal context (verb preceded by a name) also engaged the inferior frontal gyrus between 350–450 ms, and amplitude was larger and the peak latency was earlier for one-argument verbs, when verbs were presented in minimal syntactic contexts of names indicating that argument structure information is automatically retrieved and processed during verb comprehension.

In a study by Thompson et al., 2007, functional magnetic resonance imaging (fMRI) study was used to examine the brain regions involved in processing verbs with varying

argument structure complexity and to compare these patterns with noun processing. Fourteen healthy, right-handed young adults participated in a lexical decision task, where they pressed one button for real words (verbs or nouns) and another for pseudowords. The stimuli included verbs with one, two, and three arguments, along with matched nouns and pseudowords. Results showed that nouns and verbs activated overlapping brain regions; verbs additionally engaged the left inferior frontal and posterior peri-sylvian areas. As verb argument structure complexity increased, suggesting that posterior peri-sylvian regions play a key role in semantic integration and argument structure processing. The study's behavioral data indicated that verbs with fewer obligatory arguments (one- argument verbs) resulted in longer reaction times, suggesting that processing simpler argument structure might require more effort or different cognitive processes in this specific lexical decision task context. Reaction times for verbs with two and three arguments did not differ statistically. Supramarginal and angular gyri were shown to be activated in the left hemisphere for one-argument structures and bilaterally for two and three-argument structures.

According to the study by Tranel et al., 2001 which investigated the neural basis of retrieving action verbs versus concrete entity words (nouns) in 75 patients with focal brain lesions. The results using the action and object naming tasks with lesion mapping showed that impaired action naming was linked to damage in the left frontal operculum, anterior insula, and underlying white matter, with additional involvement of occipital and para-ventricular regions, suggesting a role of visual imagery.

Noun and verb naming describe what is being retrieved from the mental lexicon, relying on distinct cognitive and neural mechanisms. These retrieval abilities in clinical situations require confrontation naming tests that directly assess noun and verb retrieval

abilities under the clinically controlled settings providing a standardized method for eliciting responses.

2.4 Visual Confrontation Naming Test

2.4 a. Action naming test

The action naming test (Albert, M., 1979) is a confrontation naming test that requires the person to name an object or picture quickly and accurately. It evaluates a person's ability to recall action words or verbs. In terms of setup, administration and scoring, ANT is comparable to the Boston Naming Test (Kaplan E, Goodglass H, Weintraub S, 2001). In both tasks, people are asked to identify visually presented images that are moredifficult and rare in both tasks. The Boston Naming Test, the Peabody Picture Vocabulary Test Revised (Dunn & Dunn, 1981), and picture naming test developed by Snodgrass and Vanderwart (Snodgrass & Yuditsky, 1996). The basic difference between these tests is that ANT taps verb retrieval while BNT taps noun retrieval.

Picture naming is a psycholinguistic paradigm used to study language production from visual perception to articulation. Nishimoto et al., 2012, examined 360 Japanese pictures to understand how imagery- related variables affect naming speed and accuracy. Data was collected from 1,217 native Japanese speakers who completed timed and untimed naming tasks and rated imageability, vividness, familiarity, image agreement, and age of acquisition. The results showed that name agreement correlated strongly with vividness, familiarity, and image agreement. Imagery- related factors, particularly vividness and image agreement, significantly influenced both naming speed and accuracy.

According to the study Randolph, 1999 which examined the factors influencing the confrontation naming performance on the Boston Naming Test in 1,131 participants,

including healthy controls, Alzheimer's disease and temporal lobe epilepsy patients. Results showed that age negatively, education positively affected naming scores across all age groups and men performed better compared to females due to stimulus specific effects. High frequency words were more easily named, confirming a strong word influence. Overall performance on BNT is influenced by demographic and linguistic factors, with implications that these factors should be considered to make tests more accurate and fair.

According to the systematic review of 40 studies (1999-2013) from the PUBMED database by Beber & Chaves, 2014 on Action Fluency (AF) and Action Naming (AN) tasks to understand their mechanism and clinical use, they analyzed findings on adults and older adults. The study concluded that AF and AN are distinct but related verb generation tasks, both engaging frontal brain regions but differed in cognitive demands. AF relies on executive and retrieval processes, on the other hand AN involves visual and lexical processing

The impact of aging on action word retrieval has been assessed by evaluating performance on the ANT in healthy population (Mackay et al., 2002). The findings from these studies demonstrated that the verb retrieval abilities decline with age while healthy participant's performance stays within the normal range.

2.4b Verb naming test

Verb Naming Test, created by Cho-Reyes & Thompson, 2012 is a popular test developed as a component of Northwestern Assessment of verbs and Sentences (NAVS). It includes 22 pictures that require participants to name target verbs through confrontation naming controlling, lexical-semantic and phonological features such as word frequency and phoneme length while varying argument structure.

A more recent contribution to action verb naming in Indian languages is the development of a novel set of 269 verb pictures based on argument structure taxonomy by Ahmed et al., 2022 designed specifically for use in Kannada in children and adapted in Tamil using a similar methodology and stimulus development in adults.

Naming tests provide valuable insights into lexical retrieval abilities; however, the naming accuracy and speed is affected by various cognitive and linguistic factors explained and discussed in the next section.

2.5 Variables influencing the Action-Naming Test

Speech-language pathologists and therapists need to consider various characteristics including their type, context and whether they are concrete or abstract during selection of images as a stimulus material (Brown & Thiessen, 2018). Psycholinguistic variables may influence both the accuracy and naming speed in both neurotypicals and persons with aphasia (PWA). AI generated pictures (Pierce, 2024) help researchers and clinicians to create pictures using prompts that are culturally appropriate and free from copyright issues ; however, images may not always be generated corresponding to prompts. Thus, it is important to consider all representations for their atypicality, clarity, cultural relevance and ambiguity for using them as an assessment and therapeutic tool in clinical settings.

Picture naming is influenced by several variables or factors such as visual factors (visual complexity and image agreement), semantic factors (imageability) and lexical factors such as name agreement, word frequency and age of acquisition. Alario et al., 2004 examined nine key variables influencing picture naming speed using 388 images and 46 participants and found that name agreement, image agreement, visual complexity, imageability, age of acquisition , and word frequency significantly predicted naming speed with name agreement, image agreement, frequency and age of acquisition as the most robust and consistent

predictors. The study established the fact that naming speed is shaped by a combination of visual, semantic and lexical factors.

Picture naming test is the most common test for assessing word retrieval skills. The format of stimuli (Colored pictures as in (Zannino et al., 2010)vs black and white line drawings as in (Kaplan et al., 2016); the number of stimuli (e.g., ranging from 6 as in (Goodglass et al., 1984) and (Snodgrass & Yuditsky, 1996), the presentation time (e.g., ranging from no limits in (Goodglass et al., 1984) to 20 s as in (Kaplan et al., 2016) and the psycholinguistic properties (i.e., differences in frequency, familiarity and typicality) are some of the various factors that could affect the performance on the currently available picture naming tests (Berman et al., 1989).

Visual complexity refers to how detailed a picture is, shows minimal effects in simple drawings but slightly slowed naming in detailed and more complex pictures . The most recent view (Alario et al., 2004) supports the finding that it does not have a major impact on naming speed.

Image agreement (Bird et al., 2003) measures how closely a picture matches the mental image of a person for that particular object. It is a measure of match or mismatch between the picture and stored representation of the object. Pictures with higher name agreement are named faster due to faster recognition.

Imageability (Nishimoto et al., 2012) refers to the extent to which an object name evokes few or many different images for a particular object. Higher imageability makes it simpler to identify objects at semantic level. Imageability significantly affects naming speed as more imageable objects leads to faster naming.

Concept familiarity refers to how familiar or object is frequently encountered in daily life. More familiar concepts lead to faster naming but frequency of occurrence is not a very sensitive measure to naming tasks (Alario et al., 2004).

Name agreement (Alario et al., 2004) is the degree to which participants give the same name or agree on the name of a picture as determined by comparing many names that each participant gave the image. Pictures with the lower name agreement are the robust indicator of naming difficulty due to competition between different possible responses. Pictures with higher name agreement are faster to name as having single responses which are easier to name quickly and accurately. Word frequency refers to how frequently the stimulus (object or action) appears in a particular language. High frequency words are faster and easier to name.

Age of acquisition (Morrison et al., 1992) refers to age at which word is acquired or learned. Words learned early in life are named faster independent of frequency due to deeper phonological and lexical representations. Phonological factors like number of phonemes and syllables show no significant and inconsistent effects on naming abilities.

Colour, brightness, movement and depth are essential factors in determining the shape of visual stimulus, according to psychological models of visual processing (Viviani & Aymoz, 2001). Visual characteristics like accuracy and speed of timing are influenced by factors that typically affect how easily the external visual stimulus interacts with internal mental representation of the item (Linde-Domingo et al., 2003). Encoding speed activates the visual area (Snodgrass & McCullough, 1986).

According to a study by Uttl et al., 2006 that examined how color affects object name and identification and found that colored objects were identified quickly and more accurately than black and white line drawings. The study highlighted that color is not just an additional feature but a crucial component of visual perception, memory and naming, especially for complex objects.

Image type (Reymond et al., 2023) refers to how an image is created varying in style and detail such as a drawing, photograph or painting. Drawings include black and white or

colored line drawings, where objects are outlined with black lines and pictograms/icons representing objects in simplified black graphics Effect of image types on naming performance are mixed according to the previous findings as some studies found differences while others did not create challenges for clinicians in selecting appropriate stimuli for assessment and therapy purposes. Image features like color, texture and shading are recognized as important for object recognition and naming performance. Color of an object is important when it highlights an object's prototypicality in the sense that objects with prototypical colors are named faster and objects with low color contrast affects naming performance. No significant differences found in naming speed and accuracy for graphic and photographic stimuli.

Simple line drawings help in text comprehension in normal and impaired readers by highlighting the main features of an object and eliminating unnecessary details (Benton et al., 1972). Simple pictures are better suited to enhance comprehension and essential in evoking responses in persons with aphasia (PWA).

The visual complexity of the stimuli also influences naming speed and accuracy (Berman et al., 1989). The participant's age is also another critical factor. Investigations on lexical naming accuracy in neurotypical individuals (Gertel et al., 2020) have shown that older people have poorer naming accuracy than younger people, which could be related to decreased executive dysfunction and lexical retrieval capabilities in older people due to aging.

People with a higher educational background have a greater vocabulary than people with little or no schooling, thus highlighting the role of literacy (Rácz & Lukács, 2025). Accuracy and the response time will be impacted by educational status in at least two ways: an additional processing strain is placed on the input by lack of visual familiarity. This reduced familiarity would slow down the process, overall resulting in early delay or mistakes,

therefore the various demands that different stimuli put on initial processing might be revealed at lower educational levels. The naming ability in neurotypical participants and persons with aphasia is influenced by semantic factors such as imageability, concreteness, protypicality, semantic category, and operability (Morrison et al., 1992). Properties of the word itself, including name agreement, syllable length, and especially frequency or familiarity can also affect naming (Elizabeth Bates, 2003). While frequency has long been seen as a key factor, recent evidence suggests age of acquisition may be equally or more influential (Morrison et al., 1992).

Understanding the factors or variables that affect naming enhances the clinical usefulness of naming tests.

2.6 Utility

The ability to recall names deteriorates with age and sensitivity to various neurological disorders has made it an essential part of neuropsychological assessment to assess various linguistic and cognitive functions. The naming tests allow clinicians to compare individuals' performance across the age groups and agreement across age groups helps in establishing the sensitivity of the test to developmental and age-related linguistic changes.

The action verb naming tests allow the researchers to study language processing, including the impact of factors like age, education and cultural background on naming abilities.

According to earlier research, performance in spontaneous action naming declines with age (Cotelli et al., 2012) this suggests that age plays a significant role in action word finding abilities. This demonstrates that the naming difficulties with aging concerns difficulty in retrieval and not loss of meaning.

Naming tasks (Reymond et al., 2023) evaluates the lexical retrieval abilities across different word classes such as noun and verbs , the confrontation naming tasks allows clinicians to assess lexical breakdown and helps in differentiating between semantic, lexical, syntactic and phonological impairments and thus helpful in differential diagnosis of aphasia and related language disorders.Naming tasks measures naming accuracy and latency essential for establishing baseline performance, monitoring progress over time and for measuring treatment effectiveness.

Naming tasks facilitates investigation of factors influencing retrieval abilities such as image type, complexity, argument structure etc. and also enables comparison across different stimulus modalities such as photographs, line drawings and graphic representation to determine retrieval abilities and help clinicians to determine which type of visual input support best for retrieval in patients leads to more accurate diagnostic conclusions and effective intervention planning.

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Chapter 3

Method

The present study aimed to develop a Hindi-Specific Action-verb Naming Test, which can be used as a valuable resource to help clinicians in identifying and quantifying deficits in retrieving and producing action verbs sensitive to specific brain areas and cognitive functions.

The present study was carried out in two phases.

1. In the first phase, Action verb stimuli in Hindi were developed and were subjected to content validity (the content validity measures were adapted from the 'Manual for Adults: Non-Fluent Aphasia in Therapy' (Goswami et al., 2012).

   Examples:

   - **The boy is laughing** :लड़का हँस रहा है।

     IPA: /ləɽ.ka: ɦə̃s rə.ɦa: ɦɛ/

   - **The boy is walking** :लड़का चल रहा है।

     IPA: /ləɽ.ka: t͡ʃəl rə.ha: hɛ/

2. Field testing was conducted in the second phase.

3.1 Phase 1: Stimulus selection and content validation

3.1.1 Step 1: Initial Selection of target stimuli

The researcher (a professional SLP with native like proficiency in Hindi) shortlisted a list of action verbs using the following listed criterions to select the action verbs.

a) Frequency of use: frequently and commonly used by speakers of the Hindi language

b) Cultural relevance: appropriate and meaningful regarding Indian daily life context.

c) Real-world functionality: were easy to represent in the form of line drawings and had real-world context.

d) Argument structure variety: a total of 39 verbs were chosen, with 13 verbs in each of the three categories corresponding to actions involving one, two and three respectively, to ensure a balanced set of one, two and three argument verbs.

3.1.2 Step 2: Content-based Level 1 Expert Validation of the Shortlisted Verbs

A panel of three experts (2 SLPs and 1 Linguist), all of whom were eithernative Hindi speakers/ or native like proficiency in Hindi with at least 5 years of experience in the field of speech and language examined and validated the target verbs. Each verb was assessed for linguistic and content appropriateness based on the following parameters

- Familiarity
- Presentation
- Complexity
- Cultural and contextual relevance

Each expert independently rated the above stimulus parameters on a 3-point Likert scale as:

1- Poor

2- Fair

3- Excellent

3.1.3 Step 3: Development of picture stimuli

After the shortlisting of verbs by the researcher and content validation by experts, by using readily available tools like Copilot, line drawings were drawn to keep the images simple, straightforward and free from distractions for each of the validated target verbs for all three agreements as previously described. To ensure the consistency across the test items, all drawings were made in a standard size and resolution. Consistency in drawing style, line thickness, shading and detail level was maintained throughout the set. Every illustration included objects, settings, and clothing that were culturally known to Hindi people. Special attention was given to prevent any cultural or visual misunderstanding that might make it more difficult for participants to identify and label the action. Each illustration was designed to represent the intended argument structure of the verb accurately. One-argument verbs illustrate a single action, two-argument verbs illustrate two actions, and three-argument verbs illustrate three actions together. For Example:

1. One-argument verbs showing single action as /eːk aːd̪miː siːʈʱijãː tʃəʈʱ rəɦaː ɦɛ/

2. Two-argument verbs showing two actions as /məˈɦiːlaː seːb ʈoːʈ rəɦiː hɛː ɔːr ləʈkiː ʊnheː kəʈoːɾi meː rə kʰ rəhiː hɛː/

3. Three-argument verbs showing three actions as /ɑːd̪miː kʰɑː rəhɑː hɛ, məhilaː pəroːs rəhɪ hɛ ɔːr ləʈkaː hɑːt̪ meː kʰɑːnaː leːkər kʰəʈaː hɛ/

3.1.4 Step 4: Level 2 Expert Validation of Picture Stimuli

A second expert panel consisting of (2 SLPs and at least 1 SLP with prior experience in artwork or visual representation for clinical tools) examined the created line drawings, using a structured content validation questionnaire through a 3-point Likert scale:

Poor (1) – Requires mandatory revision

Fair (2) – May need revision based on expert consensus

Excellent (3) – Accepted as it is

The evaluation parameters were categorized as:

Picture Stimuli: Iconicity, Appearance

Structural Design: Imageability, Flexibility, Concreteness, Relevance, Stimulability

3.1.5 Step 5: Feedback integration and Finalization

All feedback was collected through a Google Form. Items rated “Poor” were mandatorily revised, Items rated “Fair” were considered for revision if concerns were

raised by multiple experts, Items rated “Excellent” were retained as they were unless improvements were recommended.

3.2 Phase 2: Field Testing

3.2.1 Participants:

The study included 80 native Hindi-speaking adults with 10 male and female participants in each age range divided into 4 groups according to age

- Group1: 18-30 years
- Group 2: 31-45 years
- Group 3: 46-60 years
- Group 4: 61-70 years

Participants were neurotypical individuals with no history of speech, language, hearing, or cognitive disorders, ensuring that the findings reflected typical cognitive-linguistic processing in the Indian context.

Table 3.1

Group1 participants demographics and Proficiency

S. No.	Age	Gender	Education	Occupation	Hindi Proficiency
1	28	Male	Graduate	Student	Native
2	22	Male	Undergraduate	Student	Native like
3	25	Male	Undergraduate	Student	Native
4	23	Male	Undergraduate	Student	Native
5	21	Male	Undergraduate	Student	Native like
6	24	Male	Graduate	Employee	Native
7	23	Male	Graduate	Student	Native
8	25	Male	Graduate	Employee	Native
9	29	Male	High school pass	Worker	Native like
10	25	Male	Undergraduate	Student	Native
11	25	Female	Graduate	Student	Native
12	24	Female	Graduate	Student	Native
13	19	Female	Undergraduate	Student	Native
14	27	Female	Graduate	Student	Native like
15	25	Female	Graduate	Student	Native
16	26	Female	Graduate	Student	Native
17	19	Female	Undergraduate	Student	Native like
18	20	Female	Undergraduate	Student	Native like
19	26	Female	Graduate	Student	Native
20	24	Female	Graduate	Student	Native

Note: a total of 20 adult participants were included in the first age group of 18-30 years with a mean age of approximately 24 years. The group included 10 male and 10 female participants. Most participants were students, and the majority had completed graduate-level education, with few being under-graduate. Nearly all participants demonstrated native or native like proficiency in Hindi.

Table 3.2

Group 2 participants demographics and Proficiency

S.No.	Age	Gender	Education	Occupation	Hindi Proficiency
1	43	Male	Bachelors in marketing	employee	Native
2	34	Male	Graduate	Male nurse	Native
3	40	Male	Graduate	Male nurse	Native
4	38	Male	Graduate	Male nurse	Native
5	42	Male	High school pass	Guard	Native
6	34	Male	postgraduate	Marketing officer	Native
7	36	Male	Postgraduate	Teacher	Native
8	31	Male	Graduate	shopkeeper	Native
9	35	Male	Post graduate	Officer	Native
10	31	Male	Graduate	Employee	Native
11	40	Female	Metric pass	Cleaning staff	Native
12	40	Female	Graduate	Nurse	Native
13	37	Female	Graduate	Nurse	Native
14	41	Female	Metric pass	worker	Native
15	34	Female	Graduate	Teacher	Native
16	31	Female	B.Ed	Teacher	Native
17	37	Female	B.Ed	Teacher	Native
18	31	Female	Postgraduate	Electrical officer	Native
19	38	Female	BA pass (GNM)	Nurse	Native
20	38	Female	Postgraduate	Nurse	Native

Note: a total of 20 adult participants were included in the second age group of 31-45 years with a mean age of approximately 36.5 years. The group included 10 male and 10 female participants. Most participants were professional nurses, few teachers and very few working staff. The majority had completed graduation and post-graduation, very few participants with metric and higher secondary qualification. All participants demonstrated native proficiency in Hindi.

Table 3.3

Group 3 participants demographics and proficiency.

S.No.	Age	Gender	Education	Occupation	Language Proficiency
1	57	Male	Metric pass	Guard	Native
2	51	Male	Graduate	Lawyer	Native
3	54	Male	Graduate	Lawyer	Native
4	47	Male	Graduate	Driver	Native
5	58	Male	Graduate	Teacher	Native
6	48	Male	Postgraduate	Teacher	Native
7	60	Male	Metric pass	Guard	Native like
8	52	Male	High school	Worker	Native like
9	48	Male	Graduate	Nursing officer	Native like
10	50	Male	Postgraduate	Psychologist	Native
11	46	Female	Graduate	Psychologist	Native
12	49	Female	Graduate	Teacher	Native like
13	54	Female	B.Com	Teacher	Native like
14	46	Female	Graduate	Teacher	Native
15	52	Female	Graduate	Teacher	Native
16	48	Female	B.Ed	Teacher	Native
17	56	Female	B.Ed	Housewife	Native like
18	55	Female	Postgraduate	Teacher	Native
19	53	Female	Graduate	Employee	Native like
20	52	Female	Metric pass	Cleaning staff	native

Note: a total of 20 older adult participants included in the third age group of 46-60 years with a mean age of approximately 51.8 years. The group included 10 male and 10 female participants. Most participants were from various professions including teacher, lawyer, nursing officer, driver etc. and the majority had completed graduation and post-graduation, very few participants with metric and higher secondary qualification. All participants demonstrated native proficiency in Hindi.

Table 3.4

Group 4 participants demographics and proficiency.

S.No.	Age	Gender	Education	Profession	Proficiency
61.	68	Male	Graduate	Businessman	Native
62.	61	Male	Metric Pass	Guard	Native
63.	65	Male	Metric Pass	Watchman	Native
64.	70	Male	Metric Pass	Employee	Native
65.	70	Male	Graduate	Retired Nursing officer	Native
66.	62	Male	Metric Pass	Factory worker	Native
67.	64	Male	Graduate	Retired Officer	Native
68.	61	Male	Graduate	Retired principle	Native
69.	65	Male	High school	Retired army officer	Native
70.	62	Male	Post-Graduate	Retired SDM	Native
71.	63	Female	Metric Pass	Housewife	Native
72.	61	Female	Graduate	Retired teacher	Native
73.	62	Female	Graduate	Retired teacher	Native
74.	63	Female	Metric Pass	Anganwadi worker	Native
75.	65	Female	Metric Pass	Housewife	Native
76.	70	Female	Metric Pass	Housewife	Native
77.	63	Female	Graduate	Retired teacher	Native
78.	65	Female	Metric pass	Retired teacher	Native
79.	62	Female	Graduate	Housewife	Native
80.	64	Female	Metric pass	Anganwadi worker	Native

Note: a total of 20 older adult participants included in the fourth age group of 61-70 years with a mean age of approximately 64.3 years. The group included 10 male and 10 female participants. Most participants were retired professionals and workers in various settings and some from professions like SDM, nursing and army officers. The majority had completed graduation, few participants with metric and higher secondary qualification. All participants demonstrated native proficiency in Hindi, ensuring adequate linguistic competence for performing action verb naming tasks.

Inclusion criterion:

1. All participants were required to have a normal or corrected-to-normal vision and report no reading or language impairments.
2. All participants were native or native-like Hindi speakers (L1) with maximal proficiency in comprehension and spoken language domains.
3. Participants were screened to ensure native-level proficiency in Hindi using LEAP Q(Kaushanskaya et al., 2020) translated and adapted for Hindi (Paurnaik et al, 2023) (only question number 2 eliciting details on the languages known to participants was used) .
4. Participants had at least 10 years of formal education in their native language, Hindi.
5. Bilingual or multilingual individuals with Hindi as their native language and the required proficiency were eligible for inclusion.
6. Older participants were screened for cognitive decline using the MOCA (Gupta et al., 2024) and were required to have intact cognitive abilities with a cut-off score of >26.

Exclusion criterion:

1. Participants with a history of neurological, psychiatric, or degenerative disorders were excluded.
2. Participants with visual field or other sensory-perceptual deficits were excluded from the study.
3. Participants with moderate to severe cognitive impairment were excluded from the study.

3.2.2 Procedure for field testing:

Participants were stratified into 4 age groups: 18-30 years, 31-45 years, 46-60 years and 61-70 years resulted in 4 age groups 20 each, a total of 80 participants after ensuring the necessary inclusion and exclusion criterion.

3.2.3 Test environment

To ensure optimal attention and performance, the administration was conducted in a quiet, well-lit room free from auditory and visual distractions. Each participant was seated comfortably at a distance of approximately 45–60 cm from the computer screen.

Using Microsoft power point slides that were shown on a 15.6 inch diagonal computer screen (picture dimensions: 8.3x5.4 inches), the stimuli were given one after the other. The test was shown on a laptop or desktop with a normal screen size (1366x768 pixels or higher) to keep things the same for everyone. One by one stimulus showed up in the centre of the screen, beginning with One-argument verbs for 2 seconds, Two-argument verbs for 4 seconds and Three-argument verbs for 6 seconds in the predetermined sequential order.\

3.2.4 Instructions

Participants were instructed as follows:

You will be shown a series of pictures showing various actions. You will be shown firstly the images having one action and later images having two and three actions. Please look at each image and actions shown in them carefully and name all the actions within a stipulated time, and find the most appropriate and common action names that come to your mind in Hindi.

आपको विभिन्न क्रियाओं को दर्शाने वाली चित्रों की एक श्रृंखला दिखाई जाएगी। पहले आपको एक क्रिया वाले चित्र दिखाए जाएंगे और बाद में दो और तीन क्रियाओं वाले चित्र दिखाए जाएंगे। कृपया प्रत्येक चित्र और उसमें दिखाई गई क्रियाओं को ध्यान से देखें और निर्धारित समय के भीतर सभी

क्रियाओं के नाम बताएं, और अपने मन में आने वाले सबसे उपयुक्त और सामान्य क्रियानाम हिंदी में खोजें।

aːpkoː ʊɪʊɪdʰn̪ kriːjaːõ koː d̪ərʃaːneː ʊaːliː t͡ʃɪt̪roː kiː ek ʃrɪŋkʰlaː d̪ɪkʰaːiː d͡ʒaːegiː pɛɦleː aːpkoː ek kriːjaː ʊaːleː t͡ʃɪt̪r d̪ɪkʰaːeː d͡ʒaːeŋgeː ɔːr baːd meː doː ɔːr t̪iːn kriːjaːõ ʊaːleː t͡ʃɪt̪r d̪ɪkʰaːeː d͡ʒaːeŋgeː. kr̥pjaː pr̥t̪iːk t͡ʃɪt̪r ɔːr ʊsmeː d̪ɪkʰaːiː gəiː kriːjaːõ koː d̪ʱjaːn seː dekʰeːŋ ɔːr nɪrɖaːrɪt̪ səməj keː bɪt̪ər səbiː kriːjaːõ keː naːm bət̪aːeːŋ, ɔːr əpneː mən meː aːneː ʊaːleː səbseː ʊpjuːkt̪ ɔːr səmənaː kriːjaː naːm hɪndiː meː kʰod͡ʒʰeːŋ.

3.3 Scoring and interpretation

The responses produced by the participants were recorded and later transcribed. The analysis was done offline. The responses were classified as correct, partially correct and totally correct. A correct response included accurate verbs without any context (Spontaneous accurate verb retrieval) and was given a score of 1. Semantic and context-based responses, commonly used synonyms, borrowed verbs (from other languages like English), and regional forms that correctly represented the action depicted in the picture, were included as partially correct scores and were given a score of 0.5. Total correct responses will include the combined score of both spontaneous accurate verbs (correct responses) as depicted in pictures and responses based on context and semantic details of depicted actions (partially correct responses).

Accurate responses were considered a clear and complete naming response before the end of 20 sec. Inaccurate responses and responses exceeding 20 seconds were given a score of 0.

Also, the responses were scored as correct if the verb was accurate and meaningful, regardless of tense variation (e.g., /kʰɑː rəɦɑː ɦɛ/; /kʰɑːt̪ɑː ɦɛ/ or plurality (e.g., /kʰaːt̪eː/). Adjectives (e.g., /t̪eːz/) were not scored unless accompanied by a clear verb.

If a participant produced an extra verb along with the target action (e.g., in a three-argument verb context), all verbs were scored separately only if the additional verb was accurate, relevant, and did not confuse or replace the target action. If the extra verb confused or changed the meaning of the main action, it got only part of the score or was marked wrong, depending on how clear the answer is. The extra verb did not carry any extra score. English verbs combined with Hindi structure (borrowed words) like “drive /kəɾ rəɦɑ: ɦɛ/”, “call /kɪjɑ:/”) was accepted if the meaning was clear and the usage was common in conversational Hindi (as judged by the investigator who has native like proficiency in Hindi). Regional verb forms were accepted if they were commonly understood and accurately represented the target action, even if they were not in standard Hindi. Responses that provided a more general or broad action instead of the specific target verb (e.g., saying "/kəɾ rəɦɑ: ɦɛ/" instead of "/pəɖʱ rəɦɑ: ɦɛ/") as superordinate errors were given a score of 0. Coordinate errors when the response gave a related but incorrect verb (e.g /d̪ɔ:ɽ rəhɑ: hɛ/ as /t͡ʃəl rəhɑ: hɛ/) were given a score of 0. Any misinterpretation of actions, where the choice of the verb did not accurately reflected or represented the action shown in the image (e.g., confusing /gɪr rəhɑ: hɛ/with /t͡ʃəɽʰ rəhɑ: hɛ/ or '/ã:kʰ mɑ:r rəhɑ: hɛ/ with /mʊskʊrɑ: rəhɑ: hɛ/ was considered a visual misinterpretation and was scored as 0.

S.No.	TARGET VERB	CORRECT/PARTIALLY CORRECT/TOTAL CORRECT	ERROR TYPE
1.*			
14**			
27***			

***** Indicates one argument structure

****** indicates a two-argument structure

******* indicates a three-argument structure

To ensure scoring consistency across raters, inter-rater reliability and test-retest reliability were established. For this purpose, 10% of the data was given to the 3 raters other than the investigator herself.

3.4 Statistical Analyses

Content validation was done using the content validity index (CVI) based on item-level content validity index (I-CVI) and the scale-level content validity index (S-CVI). S-CVI was calculated using both the average S-CVI (S-CVI/Ave) and unanimous S-CVI (S-CVI/UA). The content validity was considered good, as evidenced by the scale (Lukmanul Hakim et al., 2025), I-CVI being at least 0.78, S-CVI/UA being at least 0.8, and S-CVI/Ave being at least 0.9.

Data obtained from 80 participants were organized according to age group (18-30 years, 31-45 years, 46-60 years, and 61-70 years), gender, and the argument structure of verbs. The one- argument verbs required one response, two- argument verbs required two responses, and three-argument verbs required three responses. Initially, separate scores for two and three-argument verb types were available, and participants had more than one score for two and three-argument verb types. To make the data suitable for statistical analysis and to ensure equal comparison across argument structure, an averaging procedure was applied. For one - argument verbs, the single response score was retained; for two and three-argument verbs, the response scores were averaged to obtain one overall score. After this process, each participant had three final scores, representing responses in one, two, and three- argument verbs; this reduced the total number of response scores and ensured that each argument structure type contributed equally to the analysis. The averaged score obtained was then subjected to descriptive and inferential statistical analysis to examine the effect of age group, gender and argument structure on verb retrieval performance. Statistical analyses were

conducted separately for one-argument, two-argument, and three-argument verbs across all four age groups. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS), version 26. The data was first subjected to a test of normality using the Shapiro-Wilk test of normality, and the statistic revealed that the p values were less than 0.05 indicating that the data was non-parametric in nature. Further the median and interquartile range were computed and analyzed in accordance with the coined objectives. In adjunct the mean and standard deviation was also computed to verify if it was in the same direction as that of the median and interquartile range. To examine the first objective, the Kruskal-Wallis test was utilized. When the overall test indicated a statistically significant difference, post hoc pairwise comparisons were performed using the Mann-Whitney U test in order to verify specific differences within the groups.

Similarly, the effect of argument structure was assessed using the Kruskal-Wallis test as an alternative to one-way ANOVA for comparing more than one independent group. When the overall test indicated a statistically significant difference, post hoc comparisons were performed using the Mann-Whitney U test to determine the within-group differences.

For inter-rater reliability, the degree of agreement among the raters was determined using the intra-class correlation coefficient (ICC) and Cohen’s kappa coefficient (k).

Chapter 4

Results

The primary aim of the present study was to develop a Hindi-specific Action Verb Naming Test and examine age-related differences in verb retrieval patterns among healthy adults and elderly individuals. The study sought to analyze variations in naming responses across four age groups, two genders and verb retrieval patterns across one-argument, two-argument and three- argument structure in the visual modes of stimulus presentation. The scoring system for the test was decided to categorize responses into three parameters: correct, partially correct and total correct. This approach was considered to avoid limiting the response to binary classification and to take continuum of verb retrieval performance into consideration. The correct responses reflected accurate and complete retrieval of the target word, whereas the partially correct responses were included to account for the responses that demonstrated incomplete retrieval, such as semantic, context-based responses or responses in other languages. The total correct responses were included to show total accurately named verbs which were calculated with summing up both correct and partially correct responses. This graded scoring pattern increased the sensitivity of the assessment by allowing identification of subtle deficits in lexical access.

4.1 Phase 1- Content Validation

Content validity was established using both Item level content validity (I-CVI) and scale-level content validity (S-CVI) to establish a quantitative evaluation of the test items. The I-CVI was used to assess the relevance of each individual item based on expert ratings; this allowed identification of items that may require some modifications or deletion. On the other hand, the Scale level content validity index (S-CVI) was calculated to check universal agreement over the validity of the contents of the test, which reflects the degree to which

scale adequately represents the construct of items. The combination of these two parameters is recommended in instrument development as it ensures both item specific precision and overall scale adequacy to strengthen the validity of the tool (Polit & Beck, 2006). A structured content validation feedback questionnaire was developed with the help of Manual of Adult: Non-Fluent Aphasia Therapy in Kannada by Goswami et al. in 2012. Rating was done by a total of 5 raters across 7 domains, which were iconicity, appearance, imageability, flexibility, concreteness, relevance, and stimulability. The questionnaire was emailed to each validator individually. All raters reported having native or near-native proficiency in Hindi, which was assessed through a self-rating scale ranging from 0 to 10; ratings of 8 and above were considered highly proficient. Details of the validators are presented below.

Table 4.1

Demographic and proficiency details of raters.

Rater	Education (years of formal education)	Designation	Proficiency
1	10	Practicing SLP	High
2	10	Practicing SLP	High
3	10	Practicing SLP	High
4	10	Practicing SLP	High
5	10	Practicing SLP	High

Table 4.2
List of all the 34 stimuli used separately for one, two and three-argument structure as follows:

Table 4.2.1
List of Stimuli for One-argument Structure

S.No	Target
1.	आदमी आंख मार रहा है। /aːd̪miː aːŋkʰ maːr rəɦaː ɦɛː/
2.	शेर दहाड़ रहा है। /ʃeːr dəˈɦaːɽ rəˈɦaː hɛ/
3.	लड़का पेड़ से गिर रहा है। /ləɽkaːpeːɽ seː gɪr rəhaːhɛ/
4.	अलार्म घड़ी बज रही है। /əlɑːrm gʱəɖiː bəʄ rəhiː hɛ/
5.	लड़की स्केटिंग कर रही है। /ləɽ.kiː skeʈɪŋ kər rəhɪː hɛː/
6.	कुत्ता काट रहा है। /kʊʈ̪ːaːkaːʈ raha: he/
7.	एक लड़की घड़ी पहन रही है। /ɛk ˈləɽki ˈgʱəɽi ˈpɛhən ˈrəhiː ˈhɛ/
8.	पक्षी उड़ रहा है। /pəkʃiː ʊɽ raː hɛː/
9.	एक आदमी सीढ़ियाँ चढ़ रहा है। /eːk aːd̪miː siːɽʱijãː tʃəɽʱ rəɦaː ɦɛ/
10.	लड़की दरवाज़े की घंटी बजा रही है। /ləɽkiː d̪ərʋaːze kiː gʱəɳʈ̪iː bəʄaː ɾəhiː hɛ/
11.	महिला स्वेटर बुन रही है। /məˈɦiːlaː ˈsʊeːʈ̪ər bun rəˈɦiː ˈɦɛ/
12.	कपड़े धूप में सूख रहे हैं। /kəpɽeː d̪ʱuːp meː suːkʰrɛː hɛ̃/
13.	पक्षी पेड़ पर बैठा है। /pəkʃiː peːɽ pər beʈʰaː hɛː/

Table 4.2.2
List of Stimuli for Two-argument

S. No	Target
14.	आदमी पढ़ रहा है, उसके पास कुत्ता भौंक रहा है। /ɑːd̪mi: pəɽ ɾəɦa: hɛ ʊske: paːs kʊʈ̪ta: bʱõːk ɾəɦa: hɛː/
15.	आदमी तैर रहा है और महिला गोताखोरी कर रही है। /ɑːd̪mi: t̪ɛːr ɾəɦa: hɛː ɔːr məhila: goːt̪aːkʰoːɾi: kər ɾəɦi: hɛː/
16.	महिला लड़की के बाल संवार रही है और बेटी मोबाइल देख रही है। /məˈɦi.la ˈlɜɽ.ki keː bɑːl sənvɑːr ɾəɦi ɦɛː ɔːr beʈi moːbɑɪl d̪eːkʰ ɾəɦiːɦɛː/
17.	बिल्ली दूध पी रही है, कुत्ता हड्डी खा रहा है। /bɪl.liː duːdʰ piː ɾəhiːhɛː kʊt.tɑː ɦəd.diː kʰɑː rə.hɑːhɛː/
18.	एक आदमी फर्श पोछ रहा है और एक महिला कुर्सी पर बैठी है। /ek ɑːd̪mi: fərʃ poːtʃ rəha: hɛː ɔːr ek məhila: kursi: pər bəʈʰi: hɛː/
19.	लड़का बुलबुले बना रहा है, और लड़की उन्हें देख रही है। /ləɽkaːbʊlbʊle bə.naː rəhaːhɛːɔːr ləɽ.kiː ʊ.nẽːdekʰ rə.hiːhɛː/
20.	महिला सेब तोड़ रही है और लड़की उन्हें कटोरी में रख रही है। /məɦiːlaː seːb ʈoːɽ rəɦiː hɛː ɔːr ləɽkiː ʊnˈheː kəˈʈoːɾiː meː rəkʰrəˈhiːhɛː/
21.	महिला खाना पका रही है, और नौकरानी फर्श पर झाड़ू लगा रही है। /məɦiːlaː kʰaːnaː pəkaː rəhiː hɛːɔːr nɔːkəraːniː fərʃ pər ʈʰaːɽuː lagaː rəhiː hɛː/
22.	आदमी फोन पर बात कर रहा है, और उसके पास बैठी महिला सब्ज़ियां काट रही है। /ɑːd̪miː pʰoːn pər baːt̪ kər rəhaː hɛː, ɔːr ʊskɛː paːs bɛʈʰiː məɦiːla səbd͡ʒɪjaː̃ kaːʈ rəhɪː hɛ/
23.	दूधवाला दूध डाल रहा है और औरत पैसे निकाल रही है। /d̪uːd̪ʱʋaːlaː d̪uːd̪ʱ ɖaːl rəɦaː hɛː ɔːr ɔːrət̪ pɛːseːnɪkaː l rəɦiː hɛː/
24..	महिला बर्तन धो रही है, और गैस चूल्हे पर दूध उबल रहा है। /məˈɦiːlaː ˈbərtən d̪ʱoː rəˈɦiː hɛː, ɔːr gɛːs tʃuːlʱeː pər duːd̪ ʊbəl rəɦaː hɛː/
25.	लड़की पेड़ पर चढ़ रही है, और आदमी उसकी मदद कर रहा है। /ləɽkiː peːɽ pər ʧəɽ rəhɪ: hɛː, ɔːr ɑːdmiː uskiː mədəd kər rəhɑː hɛː/
26.	लड़का पतंग उड़ा रहा है और लड़की ताली बजा रही है। /ləɽkaː pəˌt̪əŋ ʊˌɽaː rə.haː hɛː ɔːr ləɽ.kiː t̪aː.liː bə.d͡ʒaː rə.hiː hɛː/

Table 4.2.3
List of Stimuli for Three-argument

S.No.	Target
27.	महिला चाय पी रही है और कहानी की किताब पढ़ रही है, लड़की कॉपी में लिख रही है। /məɦila: tʃa:j pi: rəɦi: ɦɛ: ɔ:r kəɦa:ni: ki: kita:b pəɽʱ rəɦi: ɦɛ: ləɽki: kɔ:pi: me: likʰ rəɦi: ɦɛ:/
28.	एक औरत नाच रही है, दूसरी औरत गा रही है और तबला बजा रही है। /ek ɔ:rət na:tʃ rəɦi: hɛ: du:sri: ɔ:rət ga: rəɦi: hɛ: ɔ:r təbla: bədʒa: rəɦi: hɛ:/
29.	एक लड़का सीढ़ी चढ़ रहा है, दूसरा दीवार रंग रहा है, और तीसरा पेंट का डिब्बा लिए खड़ा है। /ek ɭəɽka: si:ɽʱi: tʃəɽ rəha: hɛ:, d̪usra: d̪i:vəa:r rəŋg rəha: hɛ:, ɔ:r t̪i:sra: pe:nʈ ka: ɖɪb:a: li:e: kʰəɽa: hɛ:/
30.	लड़का पानी में कागज़ की नाव तैरा रहा है। लड़की छाता लेकर खड़ी है।एक बच्चा बारिश में कूद रहा है। /ləɽkɑ: pɑ:ni: me: kɑ:gədʒ ki: nɑ:ʊ tɛ:rɑ: rəhɑ: hɛ:. ləɽki: tʃʰɑ:tɑ: le:kər kʰəɽi: hɛ:. e:k bətʃ:ɑ: bɑ:riʃ me: ku:d rəhɑ: hɛ:/
31.	एक फलवाली फल काट रही है, एक ग्राहक केले पकड़ेहुए है और एक बच्चा फलों की ओर इशारा कर रहा है। /ɛk pʰəlʋa:li: pʰəl ka:ʈ rəɦi: hɛ: ɛk grɑ:ɦək ke:le: pəkɽe: hu:e: hɛ: ɔ:r ɛk bəttʃ͡a: pʰəlo: ki: o:r ɪʃa:ra: kər rəɦa: hɛ:/
32.	अध्यापिका ब्लैकबोर्ड पर लिख रही हैं, एक छात्र जमीन से किताब उठा रहा है, दूसरा छात्र हाथ उठा रहा है। /əd̪jɑ:pɪka: blɛkbo:rɖ pər lɪkʰ rəhɪ: hɛ: ək tʃʰɑ:trə zəmi:n se kɪta:b uʈʰa: rəhɑ: hɛ: d̪usrə tʃʰɑ:trə hɑ:tʰ uʈʰa: rəhɑ: hɛ:/
33.	आदमी खा रहा है, महिला परोस रही है, लड़का प्लेट पकड़े हुए है। /a:d̪mi: kʰa: rəha: hɛ: məhila: pəro:srəhi: hɛ: ləɽka: pleːʈ pəkɽe: hu:e: hɛ:/
34.	बच्चे झूला झूल रहे है, फिसलपट्टी से फिसल रहे हैं, और एक-दूसरे के पीछे भाग रहे हैं। /bət͡ʃ:e: d͡ʒʱu:la: d͡ʒʱu:l rəhe: hɛ: fɪsəlpəʈʈi: se: fɪsəl rəhe: hɛ: ɔ:r e:k d̪u:sre: ke: pi:t͡ʃʰe: bʱa:g rəhe: hɛ: /

4.1.1 Item Validation

A total of five expert raters evaluated thirty-four stimuli. The stimuli consisted of 13 one-argument verbs, 13 two-argument verbs, and 8three-argument verbs. Each item was validated across seven dimensions,whichare iconicity, appearance, imageability, flexibility, concreteness, relevance, and Stimulability.

In the one-argument verb category, items 6, 7, and 13 were removed from the stimulus set. Item 6 demonstrated an I-CVI of 0 across all parameters, indicating a lack of expert agreement and was thus removed from the stimulus set. Items 7 and 13 were excluded to maintain a balanced structure in difficulty level across the 10 items per argument structure category, as items 7 and 13 were too easy to name. In the two-argument verb category, items 19, 22, and 26 were excluded. Item 19 obtained an I-CVI/UA of 0.60, which was below the acceptable criterion for five expert raters. Items 22 and 26 were excluded due to ambiguities found in the pictorial representation of two verbs; participants can name more than two possible action verbs in the two-argument verb category, according to the feedback received from the validators. In the three- argument category, a total of 4 items with I-CVI/UA of 1.0 and items 1, 3, and 4 with I-CVI/UA of 0.8 were accepted as were above the cut-off score of 0.78 for five raters, suggesting acceptable content validity among the experts. Item 32 with I-CVI/UA of 0.6 was modified in pictorial representation and arrangement and was included in the final stimuli set. Two items (items 22 and 26) from the two-argument category represented a three-argument category more clearly according to the qualitative feedback provided by the expert validators. Therefore, the items were revised and reclassified with certain contextual modifications in the three-argument verb category to ensure accuracy and consistency of the stimulus set. The final stimulus set included 10 items in each category (one-argument, two-argument and three-argument) to ensure equal representation across argument structure. Finally, stimuli with satisfactory expert agreement and modifications according to the feedback received were included in further analysis for Item- level content validity index (I-CVI) and Scale-level content validity index (S-CVI). The complete and final list of items is listed in Table 4.2 for easy readability.

Table 4.3

Results of item validation done by nine expert raters for each item, for a total of thirty-four stimuli, as follows under three separate tables for one, two and three- argument structure

Table 4.3.1

Results of item validation done by nine expert raters for a one-argument structure

Stimulus	iconicity	appearance	imageability	flexibility	concreteness	relevance	stimulability	ICVI/UA
1.	1	1	1	0	1	1	1	0.8
2.	1	1	1	1	1	1	1	1
3.	1	1	1	1	1	1	1	0.8
4.	1	1	1	1	1	1	1	1
5.	1	1	1	1	1	1	1	0.8
6.	0	0	0	0	0	0	0	0.8
7.	1	1	1	1	1	1	1	1
8.	1	1	1	1	1	1	1	1
9.	1	1	1	1	1	1	1	1
10.	1	1	1	1	1	1	1	0.8
11.	1	1	1	1	1	1	1	0.8
12.	1	1	1	1	1	1	1	1
13.	1	1	1	1	1	1	1	0.8

Table 4.3.2

Results of item validation done by nine expert raters for two- argument structure

Stimulus	*iconicity*	*appearance*	*imageability*	*flexibility*	*concreteness*	*relevance*	*stimulability*	*ICVI/UA*
14.	1	1	1	1	1	1	1	1
15.	1	1	1	1	1	1	1	0.8
16.	1	1	1	1	1	1	1	1
17.	1	1	1	1	1	1	1	0.8
18.	1	1	1	1	1	1	1	0.8
19.	1	1	1	1	1	1	1	0.6
20.	1	1	1	1	1	1	1	0.8
21.	1	1	1	1	1	1	1	0.8
22.	1	1	1	1	1	1	1	1
23.	1	1	1	1	1	1	1	1
24.	1	1	1	1	1	1	1	0.8
25.	1	1	1	1	1	1	1	0.8
26.	1	1	1	1	1	1	1	0.8

Table 4.3.3

Results of item validation done by nine expert raters for three-argument

Stimulus	*iconicity*	*appearance*	*imageability*	*flexibility*	*concreteness*	*relevance*	*stimulability*	*ICVI/UA*
27.	1	1	1	1	1	1	1	0.8
28.	1	1	1	1	1	1	1	1
29.	1	1	1	1	1	1	1	0.8
30.	1	1	1	1	1	1	1	1
31.	1	1	1	1	1	1	1	1
32.	1	1	1	1	1	1	1	0.6
33.	1	1	1	1	1	1	1	1
34.	1	1	1	1	1	1	1	1

4.1.2 Item-level content validity index (I-CVI)

The I-CVI/UA values across the 30 items, which were included in the final stimulus set, ranged from 0.80 to 1.00 across the seven parameters. Items 6,7,13 and 19 were removed from the initial 34 stimulus set. Out of the remaining 30 final stimulus items,13 items (item 2,4,8,9,12,14,16,22,23,28,31,33,34) obtained an I-CVI/UA of 1.00 indicating complete agreement among the five validators. Sixteen items (1,3,5,10,11,15,17,18,20,21,24,25,26,27,29,30) obtained an I-CVI/UA of 0.80 and were above the cut-off score of 0.78 for five raters suggesting acceptable content validity among the experts. Item 32, with an I-CVI/UA of 0.6, required modifications according to feedback received from the validators. Among the one-argument verbs, 5 out of 10 items demonstrated I-CVI/UA of 1.00, while the remaining items showed I-CVI/UA of 0.80. In the two-argument verbs, 3 items obtained I-CVI/UA of 1.00, whereas item 19, with I-CVI/UA of 0.6, was removed from the stimulus set. For

three-argument verbs, 3 items demonstrated universal agreement, and the remaining items showed I-CVI/UA = 0.80.

4.1.3 Scale content validity index (S-CVI)

The scale level content validity for the overall 30 items was found between 0.86 and 0.9. According to argument structure analysis, S-CVI/Avg for 1 argument found to be 0.9 and 0.86 for two-argument and 0.88 for three-argument structure, indicating overall a high level of agreement among the expert validators**.**

Table 4.4

Scale content validity index (S-CVI)

Argument structure	**Items**	**S-CVI**
One-argument	10	0.9
Two- argument	10	0.86
Three-argument	10	0.88

These values suggest that the Action- Verb Naming Test (AVNT-H) demonstrates high overall relevance, representativeness and clarity.

4.2 Phase 2- Statistical Analysis

4.2.1 Objective 1

To compare the age-related differences in verb retrieval performance across the four age groups (18–30, 31–45, 46–60, and 61–70 years). The participants' responses were categorized as correct, partially correct, and totally correct.

The total number of responses varied across the participants and the stimuli according to the argument structure. The Shapiro-Wilk test indicated that the distribution of correct,

partially correct, and total correct responses significantly deviated from normality ($p < 0.05$). The responses were analyzed based on their distributional characteristics, and appropriate descriptive measures of central tendency and variability were used.

Table 4.5

Descriptive statistics of different responses across the four age groups.

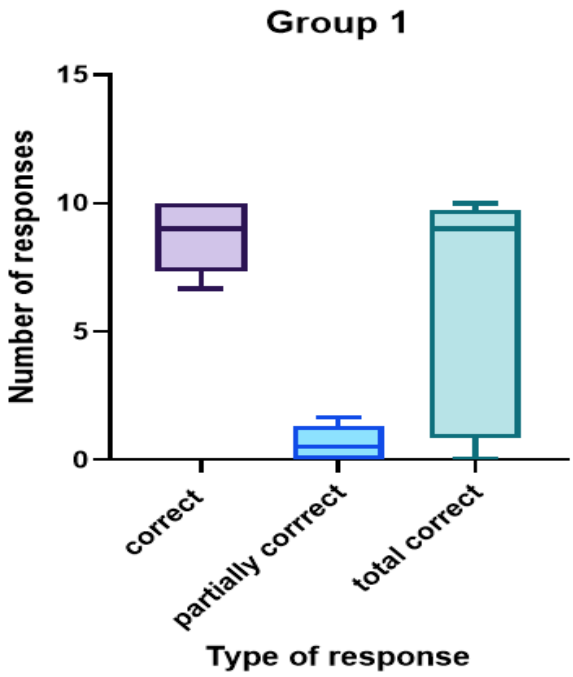
Age Group (Years)	Response Type	Mean	SD	Median	IQR
18-30	Correct	8.86	1.09	9.00	2.00
	Partially correct	0.65	0.52	0.50	0.96
	Total correct	9.38	0.60	9.50	1.00
31-45	Correct	8.10	1.51	8.50	2.00
	Partially correct	0.87	0.72	0.75	1.44
	Total correct	8.97	0.81	9.00	1.13
46–60	Correct	7.2	1.54	7.50	2.88
	Partially correct	1.04	0.79	1.00	1.31
	Total correct	8.56	0.87	8.33	1.48
61-70	Correct	7.28	1.25	7.00	1.67
	Partially correct	0.91	0.72	0.87	1.44
	Total correct	8.19	0.74	8.00	0.85

Table 4.5 presents the median and interquartile range (IQR) of correct, partially correct, and total correct responses across the age groups. As the distribution of data deviated from

normality, central tendency was interpreted primarily using the median. The interquartile range was considered to understand the dispersion of scores within each age group. In addition, the mean and standard deviation values were examined to determine the overall directional pattern of the data and to assess whether both measures of central tendency demonstrated a consistent trend across the age groups.

Figure 4.1

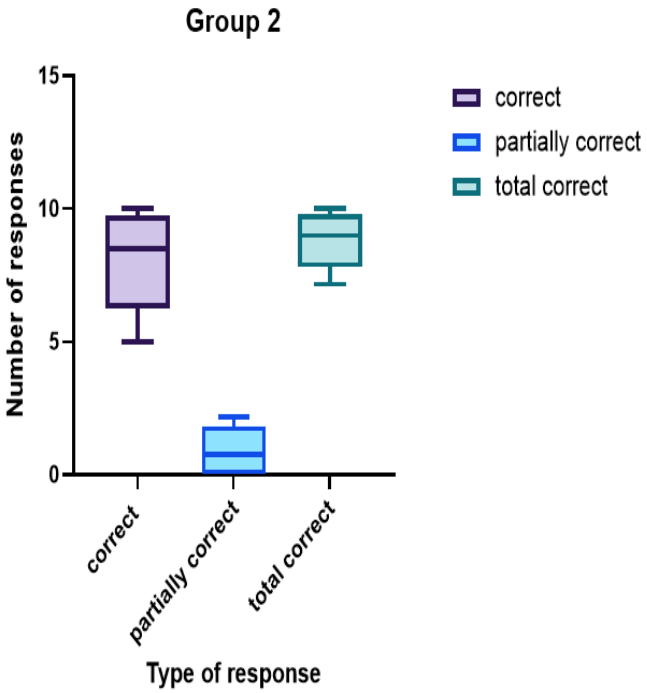
Median values of responses for the 18-30 years age group



In Figure 4.1, participants in the 18-30 years age group for total correct responses showed the highest median (9.50), followed by correct (9.00) and partially correct (0.50) responses, indicating a predominance of total correct responses. The variability was relatively low for correct responses (2.00) and total correct responses (1.00). Although the partial correct responses had a lower median, the IQR of 0.96 indicated a small but noticeable variability around the median.

Figure 4.2

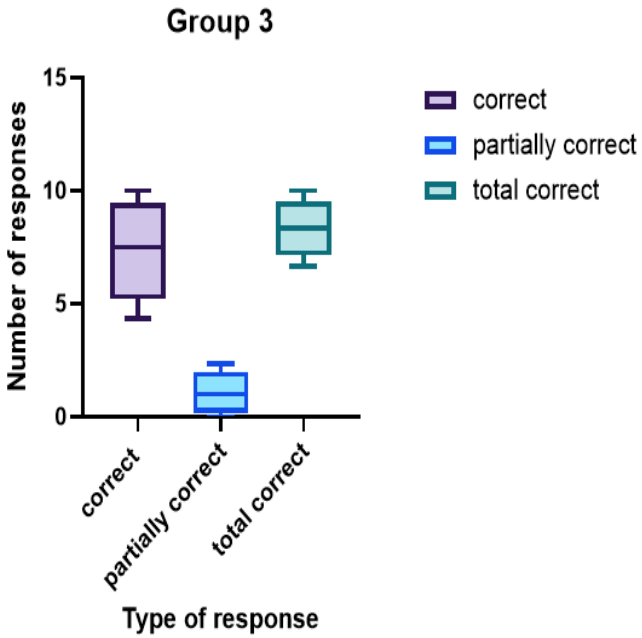
Median values of responses for the 31-45 years age group



In Figure 4.2, participants in the 31-45 years age group for the total correct responses showed the highest median (9.00) followed by correct (8.50) and partially correct responses (0.75)

Figure 4.3

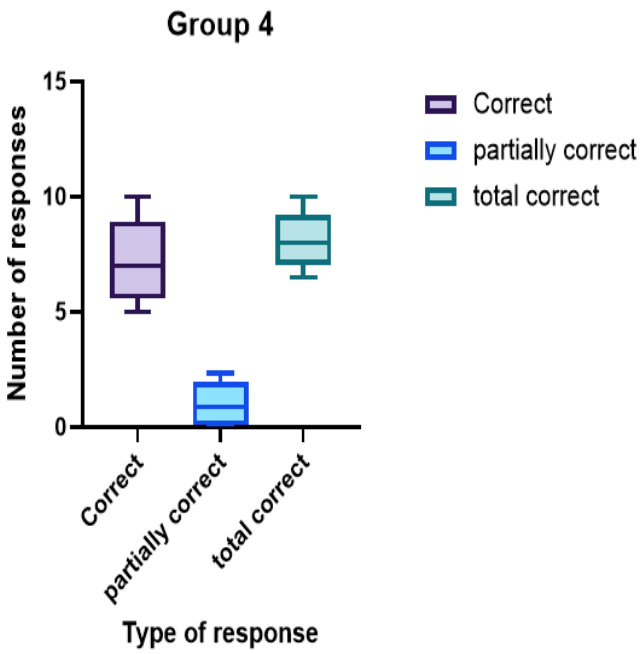
Median values of responses for the 46-60 years age group



In Figure 4.3, participants in the 46-60 years age group for total correct had the highest median (8.33) followed by correct responses (7.50) and the partially correct responses had the median value of 1.0.

Figure 4.4

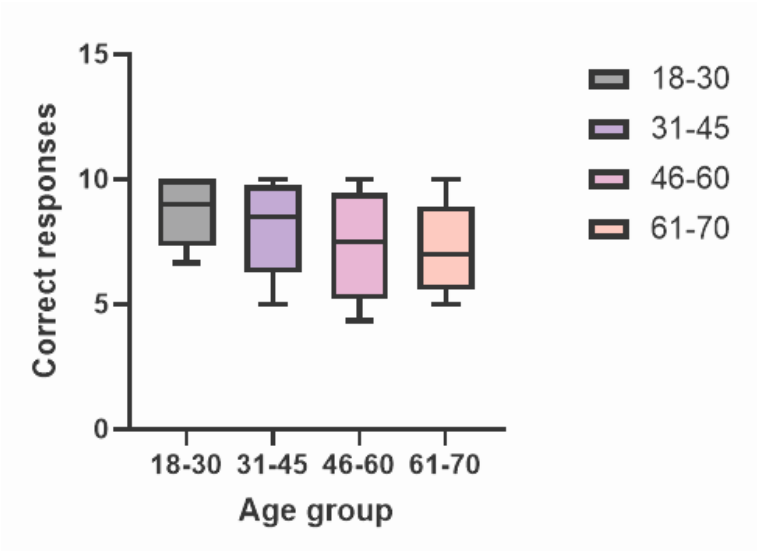
Median values of responses for the 61-70 years age group



In Figure 4.4, participants in the 61-70 years age group for total correct responses showed the median (8.00), which was highest, followed by correct responses (7.00), and the median for partially correct responses was 0.87.

Figure 4.5

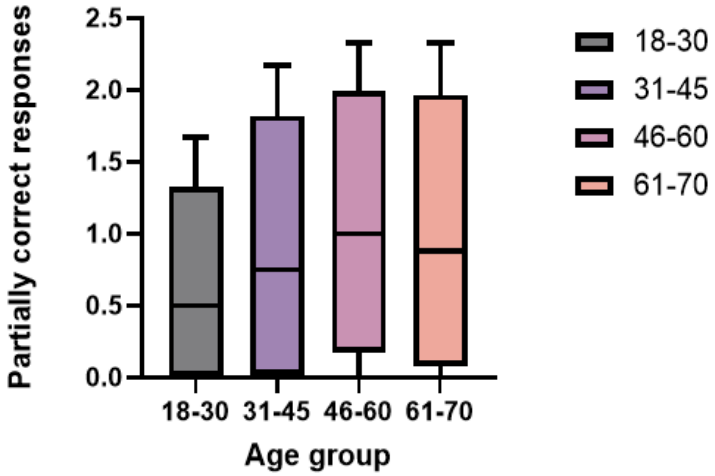
Median values for correct responses across all four age groups



In Figure 4.5, the median values for correct responses across the four age groups showed decreased values from the 18-30 years age group (9.00), followed by a decrease in the 31-45 years age group (8.50), further decreased in the 46-60 years age group (7.50) and the lowest median was observed in the 61-70 years age group. In terms of variability, the IQR showed similar values in the 18-30 years and 31-45 years age groups (IQR=2.00). However, the 46-60 years age group showed a higher (IQR=2.88), which indicated a greater variability. In contrast, the 61-70 years age group showed a lower (IQR=1.67), indicating a reduced variability. Overall, the correct responses showed a declined performance with increased age, with the highest variability in the middle age group (46-60 years) and further decreased variability in the oldest age group of 61-70 years.

Figure 4.6

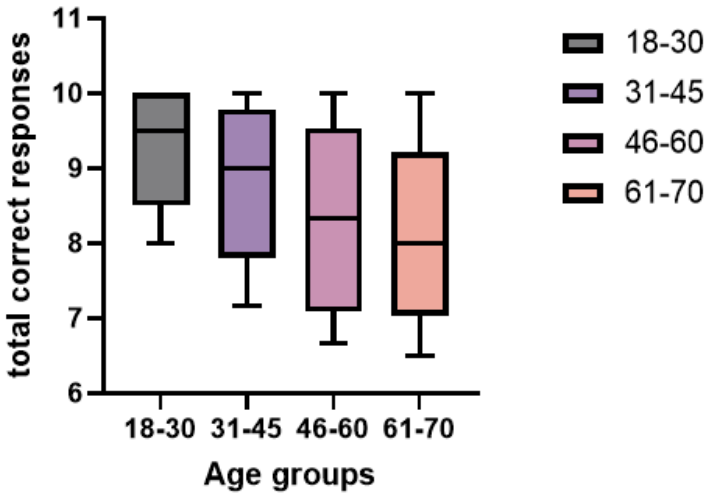
Median values for partially correct responses across all age groups



In Figure 4.6, the median values for partially correct responses showed increased values from the 18-30 years age group, with the lowest median (0.50), increased in the 31-45 years age group (0.75), and further increased (1.00) in the 46-60 years age group. The median of the 61-70 years age group was slightly lower (0.87) than the 46-60 years age group, but higher than other younger age groups. Overall, this indicated an increased tendency for partially correct responses with increased age. In terms of variability, the IQR increased from 18-30 years (IQR=0.96) to the 31-45 years age group (IQR=1.44), indicating greater variability. The 46-60 years age group (IQR=1.31) showed moderate variability, while the 61-70 years age group (IQR= 1.44) showed greater variability, similar to the 31-45 years age group.

Figure 4.7

Median values for total correct responses across all four age groups



In Figure 4.7, the median values for total correct responses across the four age groups showed a gradual decline with increased age. The highest median (9.50) was observed in the 18-30 years age group, followed by a slight reduction (9.00) in the 31-45 years age group, further decreased (8.33) in the 46-60 years age group, and the lowest median was seen in the 61-70 years age group. In terms of variability, the IQR showed a gradual increase with the 46-60 years age group (IQR=1.48) as compared to the 18-30 years age group (IQR=1.00) and 31-45 years age group (IQR=1.13). However, the 61-70 years age group (IQR=0.85) was lower value than all other groups, indicating reduced variability compared to other groups.

Overall the median values showed a decline in correct and total correct responses across the four age groups and a decline in performance across these scores as age progressed. In contrast, the median values for the partially correct responses showed a slight increase from the younger age group to the middle and older age groups, showing an increased number of partially correct responses as age increased.

The overall pattern aligned with the mean and standard deviation values obtained. The mean scores for correct and total correct responses decreased across the age groups, paralleling the upward trend observed in medians. In contrast, the mean for partially correct responses showed a slight increase in middle-aged groups, similar to that observed in median values. The direction of standard deviation broadly corresponded with the IQR pattern, with higher variability in middle age groups and lower variability in the oldest age groups.

To determine whether there was any significant difference in verb retrieval performance across four age groups, Kruskal-Wallis was performed. Statistically significant differences were observed for correct (χ^2=46.59, p<0.05), partially correct (χ^2=14.46, p=0.05), and total correct responses (χ^2=70.9, p<0.05). Since significant differences were obtained, pairwise comparisons were carried out using the Mann-Whitney U test. In comparing the 18-30 year and 31-45 year age groups, a statistically significant difference was observed for correct ($|Z|$=2.67, p<0.05), partially correct ($|Z|$=2.51, p<0.05) and total correct responses ($|Z|$=2.68, p<0.05) with the younger groups showing higher correct and total correct responses.

The comparisons involving the 18-30 year and 46-60 year also showed significant differences for correct ($|Z|$=5.51, p<0.05), partially correct ($|Z|$=3.52, p<0.05) and total correct($|Z|$=6.27, p<0.05) with younger age groups showed higher correct and totally correct responses, whereas 46-60 year age groups showed higher partially correct responses. Similarly, when the 61-70 year age group was compared, significant differences for correct ($|Z|$=6.12, p<0.05), partially correct ($|Z|$=2.80, p<0.05, and total correct responses observed ($|Z|$=7.31, p<0.05), with again the oldest age group showing higher partially correct responses.

Comparison between 31-45 year and 46-60 year age group showed significant differences for correct ($|Z|$=2.76, p<0.05), and total correct ($|Z|$=3.80, p<0.05) but did not differ statistically for partially correct responses ($|Z|$=1.18, p>0.05). Similarly for comparison between 31-45 year and 61-80 year showed a significant difference for correct ($|Z|$=3.22, p<0.05) and total correct responses ($|Z|$=5.10, p<0.05) but did not differ significantly for partially correct responses ($|Z|$=0.30, p>0.05). In contrast comparison between 46-60 year and 61-70 year showed no significant differences for correct ($|Z|$=0.21, p>0.05), partially correct ($|Z|$=0.90, p>0.05) and total correct responses ($|Z|$=1.04, p>0.05) revealed a similar response pattern between the two older groups.

Thus the Kruskal-Wallis test demonstrated marked differentiation between correct, partially correct and total correct responses. Pairwise comparisons showed higher correct and total correct responses in younger age groups whereas higher partially correct responses in older age groups. The significant differences were mainly observed for younger, middle and older age groups while the similar response pattern was observed across the two older age groups of 46-60 years and 61-70 years. These findings suggested that response accuracy decreases with age, with more noticeable changes from middle adulthood.

Objective 2: To compare the age related agreement differences across the four age groups (18-30, 31-45, 46-60 and 61-70 years). The participant responses were categorized as correct, partially correct and total correct responses.

To examine the within-group differences in verb retrieval performance across three argument structures (A1, A2 and A3), the Kruskal-Wallis was performed to determine whether any significant difference in correct, partially correct and total correct responses for each argument structure. If the analysis revealed any statistically significant

differences, pair-wise comparisons were carried out using the Mann-Whitney U test to identify the significant differences across the specific pairs.

Table 4.6

Descriptive statistics of responses for argument structure (A1, A2 and A3) across four age groups.

Table 4.6.1

Descriptive statistics of responses for argument structure (A1, A2 and A3) across 18-30 years age groups.

Age Group (Years)	Condition	Score Type	Mean	SD	Median	IQR
18-30	A1	Correct	9.80	0.69	10.0	0.00
		Partially correct	0.05	0.22	0.00	0.00
		Total correct	9.85	0.48	10.0	0.00
	A2	Correct	9.05	0.66	9.25	0.25
		Partially correct	0.45	0.29	0.37	0.25
		Total correct	9.50	0.38	9.26	0.25
	A3	Correct	7.73	0.72	8.00	1.17
		Partially correct	1.07	0.37	1.00	0.63
		Total correct	8.80	0.38	8.91	0.63

Table 4.6.1 represents the Mean, standard deviation, median and IQR of correct, partially correct and total correct across the 18-30 years age groups. As the distribution of the data approximated normality, central tendency was interpreted using both mean and median. The interquartile range was considered to understand the dispersion of scores within each age group. In addition the standard deviation was examined to determine the overall directional

pattern of the data and to assess whether measures of central tendency demonstrated a consistent pattern across age groups.

Table 4.6.2

Descriptive statistics of responses for argument structure (A1, A2 and A3) across 31-45 years age groups

Age Group (Years)	Condition	Score Type	Mean	SD	Median	IQR
31-45	A1	Correct	9.65	0.48	10.0	1.00
		Partially correct	0.12	0.22	0.00	0.38
		Total correct	9.77	0.34	10.0	0.50
	A2	Correct	8.35	0.56	8.50	0.50
		Partially correct	0.73	0.23	0.75	0.44
		Total correct	9.08	0.38	9.25	0.44
	A3	Correct	6.31	0.77	6.50	1.58
		Partially correct	1.75	0.29	1.66	0.50
		Total correct	8.06	0.48	8.16	0.96

Table 4.6.2 represents the Mean, standard deviation, median and IQR of correct, partially correct and total correct across the four age groups. As the distribution of the data approximated normality, central tendency was interpreted using both mean and median. The interquartile range was considered to understand the dispersion of scores within each age group. In addition the standard deviation was examined to determine the overall directional pattern of the data and to assess whether measures of central tendency demonstrated a consistent pattern across age groups.

Table 4.6.3

Descriptive statistics of responses for argument structure (A1, A2 and A3) across 46-60 years age groups

Age Group (Years)	Condition	Score Type	Mean	SD	Median	IQR
46-60	A1	Correct	8.80	0.76	9.00	1.00
		Partially correct	0.15	0.23	0.00	0.50
		Total correct	8.95	0.77	9.00	1.00
	A2	Correct	7.52	0.73	7.50	0.88
		Partially correct	1.06	0.35	1.00	0.50
		Total correct	8.58	0.51	8.75	0.69
	A3	Correct	5.55	0.78	5.33	1.00
		Partially correct	1.92	0.34	2.00	0.46
		Total correct	7.47	0.51	7.41	0.67

Table 4.6.3 represents the Mean, standard deviation, median and IQR of correct, partially correct and total correct across the four age groups. As the distribution of the data approximated normality, central tendency was interpreted using both mean and median. The interquartile range was considered to understand the dispersion of scores within each age group. In addition the standard deviation was examined to determine the overall directional pattern of the data and to assess whether measures of central tendency demonstrated a consistent pattern across age groups.

Table 4.6.4

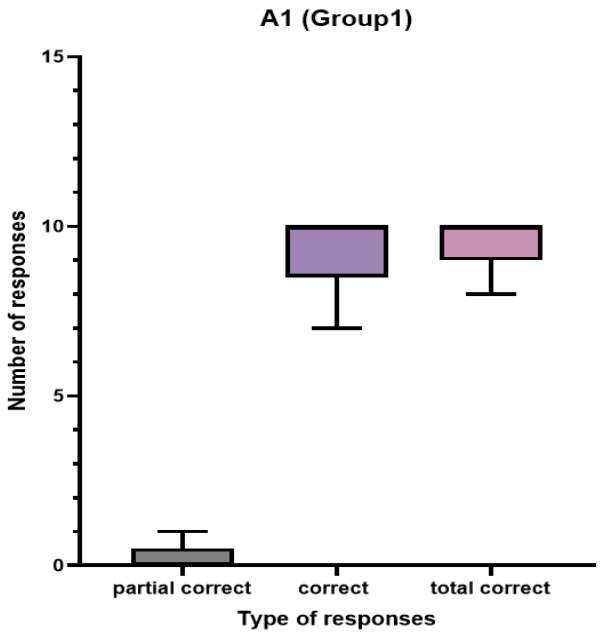
Descriptive statistics of responses for argument structure (A1, A2 and A3) across 61-70 years age groups

Age Group (Years)	Condition	Score Type	Mean	SD	Median	IQR
61-70	A1	Correct	7.95	1.05	8.00	1.75
		Partially correct	0.17	0.29	0.00	0.50
		Total correct	8.12	0.88	8.00	1.25
	A2	Correct	7.87	0.93	8.00	1.38
		Partially correct	0.81	0.43	0.75	0.50
		Total correct	8.68	0.55	8.62	0.75
	A3	Correct	6.01	0.60	6.33	1.17
		Partially correct	1.75	0.23	1.66	0.33
		Total correct	7.76	0.40	7.91	0.67

Table 4.6.4 represents the Mean, standard deviation, median and IQR of correct, partially correct and total correct across the four age groups. As the distribution of the data approximated normality, central tendency was interpreted using both mean and median. The interquartile range was considered to understand the dispersion of scores within each age group. In addition the standard deviation was examined to determine the overall directional pattern of the data and to assess whether measures of central tendency demonstrated a consistent pattern across age groups.

Figure 4.8

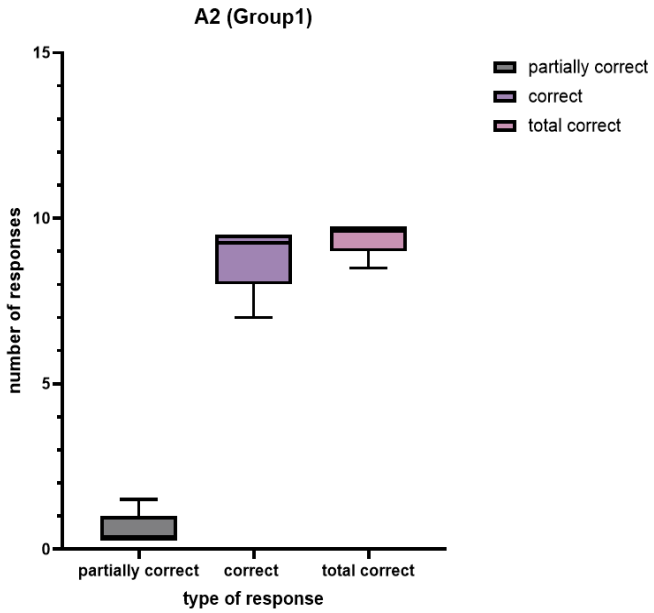
Median values for A1 across all three responses for 18-30 years age group



In Figure 4.8, the participants in the 18-30 years age group in A1 (one-argument) for both correct and total correct responses showed high median values (10.0) demonstrated predominance of these responses while the partially correct responses with median value (0.00) demonstrated minimal production of these responses. The IQR=0 across all responses showed consistent performances among participants for A1 argument structure.

Figure 4.9

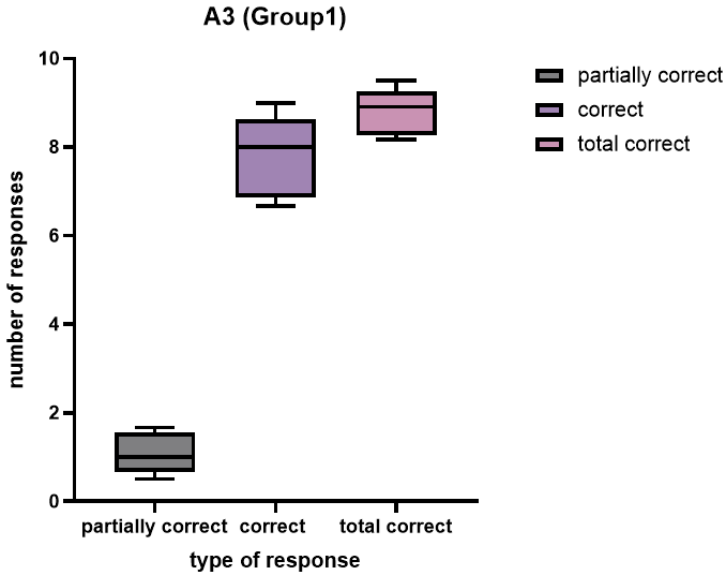
Median values for A2 across all three responses in the 18-30 years age group



In Figure 4.9, participants in the 18-30 years age group for A2 responses showed a decreased accuracy with the median values for correct (9.25) and total correct responses (9.26) as the argument structure complexity increased. The median value (0.37) for partially correct responses showed a slight increase in partially correct responses compared to A1. The IQR=0.25 across all responses showed a moderate variability compared to A1.

Figure 4.10

Median values for A2 across all three responses in the 18-30 years age group



In Figure 4.10, A3 responses in the 18-30 years age group demonstrated a lower accuracy of responses comparatively A1 and A2 with median values for correct (8.00), total correct (8.91) and partially correct responses (1.00). The interquartile range values for correct (IQR=8.00), partially correct (IQR=1.00) and total correct responses (IQR=8.91) showed a greater variability.

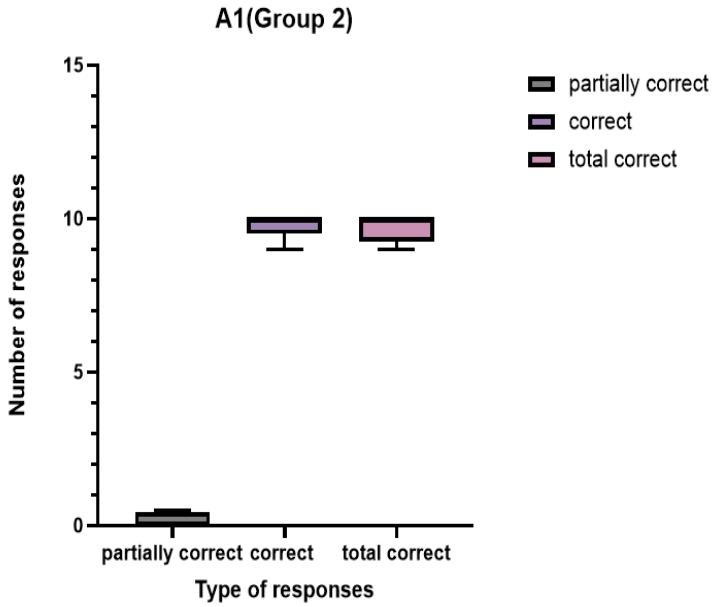
Overall, the mean and median values showed a consistent pattern across A1, A2 and A3 with decreased accuracy and increased partially correct responses as argument structure complexity increased. The standard deviation values were also consistent with IQR indicating minimal variability for A1 and comparatively greater variability for A2 and A3 responses.

To determine whether there was significant difference across the three argument structure A1, A2 and A3 within 18-30 years age group, Kruskal-Wallis test was performed and the analysis revealed a significant differences for correct (χ^2=41.73, $p<0.05$), partially correct (χ^2=45.70, $p<0.05$) and total correct responses (χ^2=37.60, $p<0.05$). Since significant

differences were obtained, pairwise comparisons were conducted using the Mann-Whitney U test. The comparison between A1 and A2 showed significant differences for correct ($|Z|$=4.80, p<0.05), partially correct ($|Z|$=5.24, p<0.05) and total correct responses ($|Z|$=4.67 p<0.05) demonstrated that A1 showed higher correct and total correct responses compared to A2. Similarly the comparison between A1 and A3 showed significant differences for correct ($|Z|$=5.23, p<0.05), partially correct ($|Z|$=5.46, p<0.05), and total correct responses ($|Z|$=4.92, p<0.05) demonstrated higher accuracy for correct responses and A3 showed higher partially correct responses. The comparisons between A2 and A3 also revealed significant differences for correct ($|Z|$=4.53, p<0.05), partially correct (Z=4.64, p<0.05 and total correct responses ($|Z|$=4.28, p<0.05) showed higher correct and total correct responses for A2 compared to A3. Overall, the results indicated that verb retrieval performance decreased as argument structure complexity increased from A1 to A3.

Figure 4.11

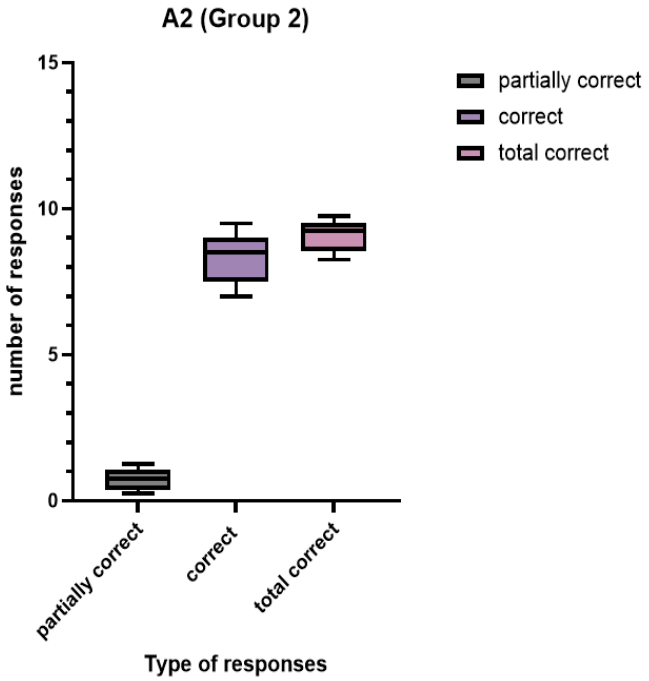
Median values for A1 across all three responses in the 31-45 years age group



In Figure 4.11, participants in the 31-45 years age group for A1 responses showed high accuracy with the median values of correct (10.0) and total correct responses (10.0) whereas the median value for partially correct responses (0.00) showed minimal production. The IQR values were examined to determine variability in responses across the three argument structures. For A1, the values for correct (IQR=0), partially correct (IQR=0.38) and total correct (IQR=0.50) indicated relatively low variability.

Figure 4.12

Median values for A2 across all three responses in the 31-45 years age group

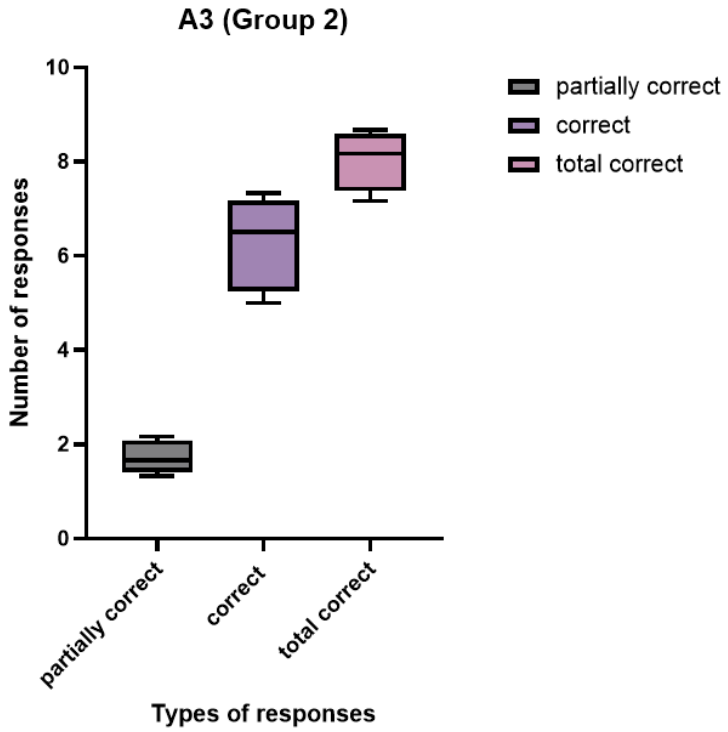


In Figure 4.12, the participants in the 31-45 years age group for A2 responses demonstrated a slight decrease in performance compared to A1 with the median values for correct (8.50) and total correct response (9.25). In contrast, the median value for partially correct responses (0.75) demonstrated a slight increase compared to A1. For A2 the values

for correct (IQR=0.50) partially correct (IQR=0.44) and total correct (IQR=0.44) showed slightly greater variability compared to A1.

Figure 4.13

Median values for A3 across all three responses in the 31-45 years age group



In Figure 4.13, the participants in the 31-45 years age group for A3 responses showed a further decline compared to A1 and A2 with the median values for correct (6.50) and total correct (8.16). Additionally the median value for partially correct responses (1.66) showed a noticeable increase with increasing argument complexity. For A3 the values for correct (IQR=1.58), partially correct (IQR=0.50) and total correct (IQR=0.96) showed comparatively greater variability particularly for correct responses.

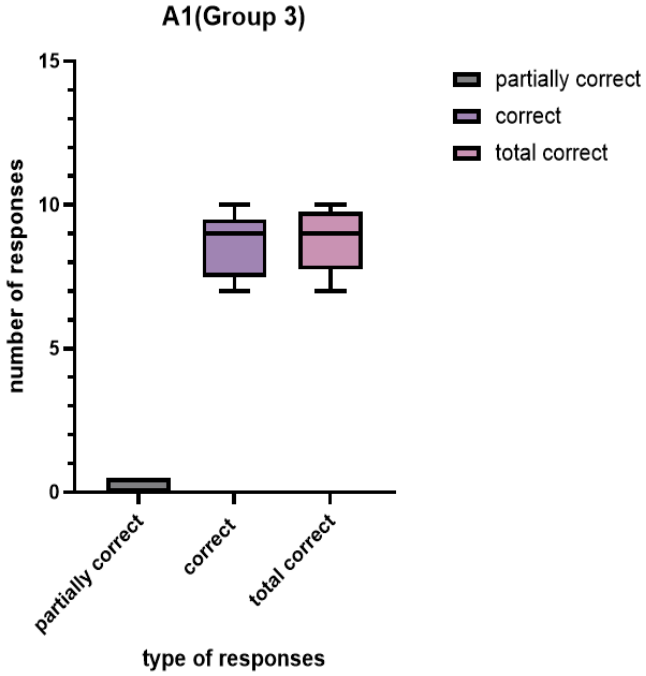
Overall, the mean and median values showed a consistent pattern across A1, A2 and A3 with decreased accuracy and increased partially correct responses as argument structure

complexity increased. The standard deviation values were also consistent with IQR indicating minimal variability for A1 and comparatively greater variability for A2 and A3 responses.

To determine whether there was significant difference across the three argument structure A1,A2 and A3 within 31-45 years age group, Kruskal-Wallis test was performed and the analysis revealed a significant differences for correct (χ^2=50.62, p<0.05), partially correct (χ^2=51.54, p<0.05) and total correct responses (χ^2=46.15, p<0.05). Since significant differences were obtained, pairwise comparisons were conducted using the Mann-Whitney U test. The comparison between A1 and A2 showed significant differences for correct ($|Z|$=5.09, p<0.05), partially correct ($|Z|$=5.14, p<0.05) and total correct responses ($|Z|$=4.48, p<0.05) demonstrated that A1 showed higher correct and total correct responses compared to A2 and A2 showed higher partially correct responses. Similarly the comparison between A1 and A3 showed significant differences for correct ($|Z|$=5.52, p<0.05), partially correct ($|Z|$=5.57, p<0.05), and total correct responses ($|Z|$=5.51, p<0.05) demonstrated higher accuracy for correct responses for A1 and A3 showed higher partially correct responses. The comparisons between A2 and A3 also revealed significant differences for correct ($|Z|$=5.32, p<0.05), partially correct ($|Z|$=5.45, p<0.05 and total correct responses ($|Z|$=4, p<0.05) showed higher correct and total correct responses for A2 compared to A3. Overall, the results indicated that verb retrieval performance decreased as argument structure complexity increased from A1 to A3.

Figure 4.14

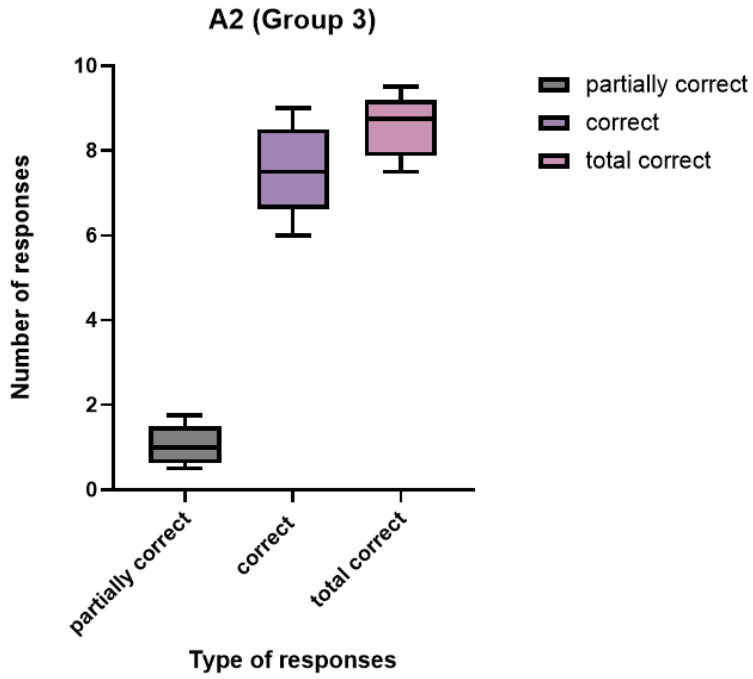
Median values for A1 across all three responses in the 46-60 years age group



In Figure 4.14, the participants in the 41-60 years age group for A1 responses, with the median value (9.00) for correct response was high indicated higher accuracy, for partially correct the median (0.00) was minimal and total correct responses showed median value similar to correct responses (9.00). The IQR for correct responses (IQR=1.00) indicated moderate variability among participants, for partially correct (IQR=0.50) indicated low variability and total correct (IQR=1.00) showed variability similar to correct responses.

Figure 4.15

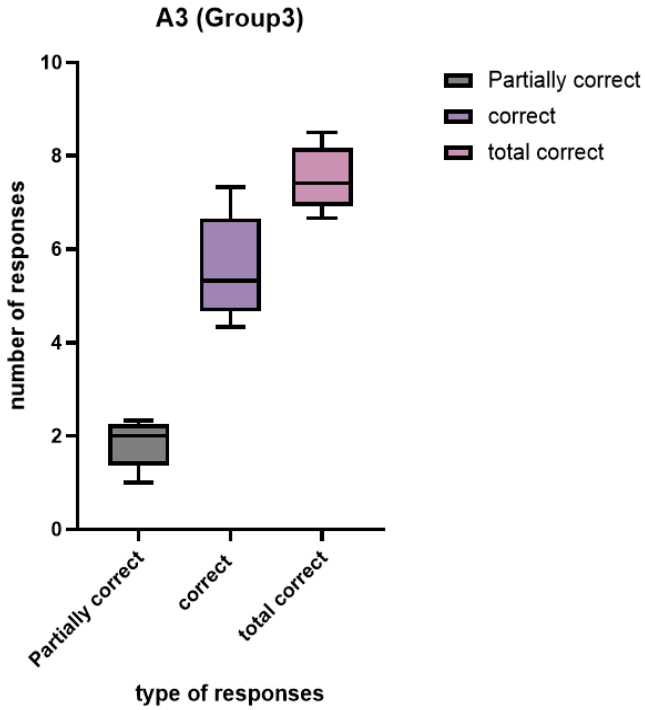
Median values for A2 across all three responses in the 46-60 years age group



In Figure 4.15, the participants in the 41-60 years age group for A2 showed reduced accuracy with the median value for correct responses (7.50) and total correct (8.75). However, for partially correct the median was (1.00) which showed increased accuracy among participants. The variability was moderate for correct (IQR=0.88) and total correct (IQR=0.69). However, the partially correct responses showed low variability (IQR=0.50) among participants.

Figure 4.16

Median values for A3 across all three responses in the 46-60 years age group



In Figure 4.16, For A3 responses in the 41-60 years age group, total correct showed the highest median (7.41), whereas correct responses with median (5.33) and median for partially correct responses was 2.00. The correct responses showed moderate variability (IQR=1.00), and total correct (IQR=0.67) reduced variability compared to correct responses. The partially correct responses showed low variability (IQR=0.46).

Overall, the median values from A1 (9.00) to A2 (1.00) and A3 (2.00) for correct responses showed decreased accuracy with increased complexity. The IQR increased from A1 (IQR=1.00) to A2 (IQR=0.88) and then showed similar variability as A1 in A3 (IQR=1.00) and thus showed comparable variability in A1 and A3 and lower variability in A2.

For partially correct responses the median values showed progressive increase from A1 (0.00) to A2 (1.00) and then A3 (2.00) demonstrated increased partially correct productions

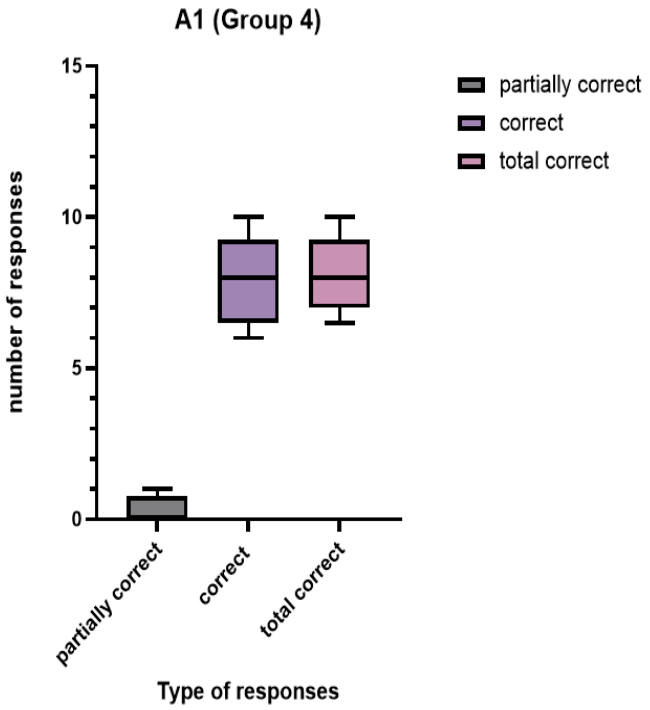
as complexity increased. The IQR for A1 (IQR=0.50) and A2 (IQR=0.50) showed similar variability and then slightly lower to A3 (IQR=0.46) and thus showed minimal variability across all levels of argument structure

For total correct responses, the median showed a declined pattern from A1 (9.00) to A2 (8.75) and then to A3 (7.41). The IQR values showed variability in A1 (IQR=1.00), moderate in A2 (IQR=0.69) and A3 (IQR=0.67) showed comparable variability to A2, thus A1 showed larger variability and similar for A2 and A3.

To determine whether there was significant difference across the three argument structure A1, A2 and A3 within 41-60 years age group, Kruskal-Wallis test was performed and the analysis revealed a significant differences for correct (χ^2=45.37, p<0.05), partially correct (χ^2=50.18, p<0.05) and total correct responses (χ^2=31.41, p<0.05). Since significant differences were obtained, pairwise comparisons were conducted using the Mann-Whitney U test. For correct responses, a significant decline from A1 to A2 ($|Z|$=4.28, p<0.05), A1 to A3 ($|Z|$=5.44, p<0.05) and A2 to A3 ($|Z|$=4.92, p<0.05). Partially correct responses showed increase from A1 to A2 ($|Z|$=5.40, p<0.05), A1 to A3 ($|Z|$=5.55, p<0.05) and A2 to A3 ($|Z|$=4.92, p<0.05). Similarly total correct responses showed progressive decline with significant differences between A1 to A2 ($|Z|$=2.05, p<0.05), A1 and A3 ($|Z|$=4.72, p<0.05) and A2 and A3 ($|Z|$=4.63, p<0.05). Overall the results indicated that accuracy of correct and total correct responses decreased and partially correct increased as argument complexity increased and significant differences were observed among the arguments on comparison revealed increased complexity affected response accuracy.

Figure 4.17

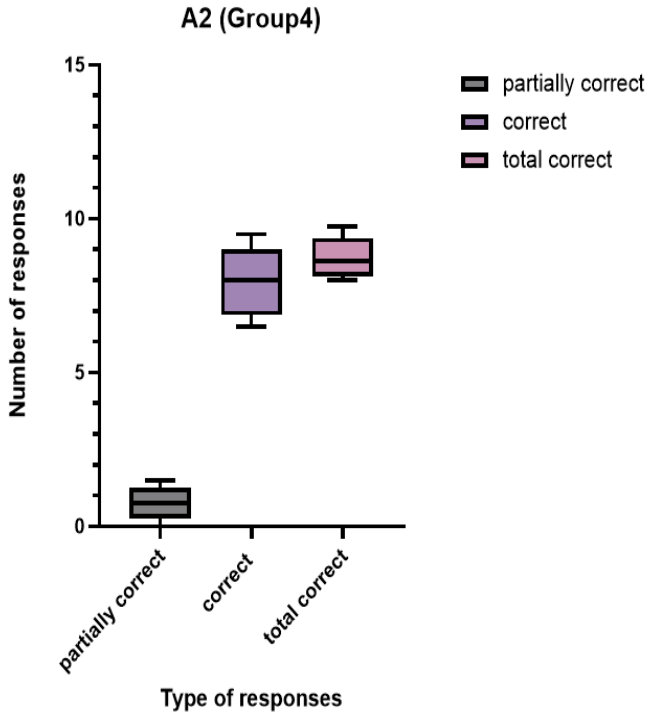
Median values for A1 across all three responses in the 61-70 years age group



In Figure 4.17, For A1 responses in the 61-70 years age group, correct and total correct responses showed the highest median (8.00) indicated higher accuracy whereas the partially correct responses with median (0.00) showed minimal accuracy. The correct responses showed the greater variability (IQR=1.75) whereas the total correct responses showed moderate variability (IQR=1.25) and the partially correct responses showed the low variability (IQR=0.50).

Figure 4.18

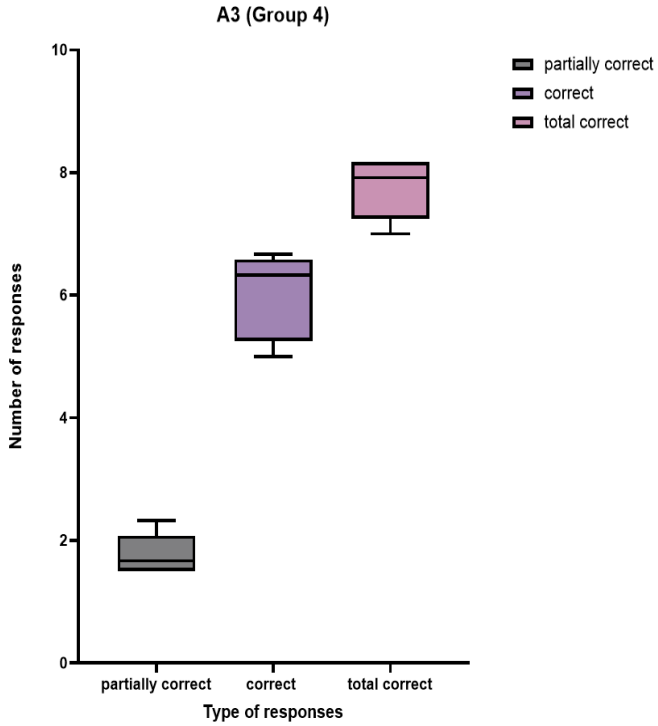
Median values for A2 across all three responses in the 61-70 years age group



In Figure 4.18, For A2 responses in the 61-70 years age group, total correct responses showed the highest median (8.63) indicated higher accuracy and correct responses with median (8.00) also indicated increased accuracy but lower compared to total correct responses. The partially correct responses showed the lowest median (0.75). The variability for correct responses was higher (IQR=1.38), while the variability for total correct (IQR=0.75) and partially correct (IQR= 0.75) was lower.

Figure 4.19

Median values for A3 across all three responses in the 61-70 years age group



In Figure 4.19, For A3 responses in 61-70 years age group, the median for total correct responses (7.93) was highest indicated higher accuracy , while the median for correct responses (6.33) indicated reduced accuracy but comparable to total correct responses and partially correct responses (1.67) showed the lowest median. The variability was higher for the correct responses (IQR= 1.17) while the lower variability for total correct (IQR=0.67) and partially correct responses (IQR=0.33).

The median values for correct responses showed decreased trend from A1 (8.00) and A2 (8.00) to A3 (6.33) demonstrated similar and comparable performance across A1 and A2 and declined in A3 with increased complexity. In A1, the IQR was (IQR=1.75) indicated greater variability across the participants of this age group. A2 (IQR=1.38) showed decreased variability compared to A1 and A3 (IQR=1.17) showed lower variability compared to both

A1 and A2. Overall, the performance of participants became more consistent as argument complexity increased.

For partially correct responses median values showed a decreased trend from A1 (0.00) to A2 (0.75) and A3 (1.67) demonstrated that partially correct responses increased as argument structure complexity increased. A1 and A2 (IQR=0.50) showed comparable variability to A3 (0.33) which showed slightly lower variability. Overall the IQR values suggested minimal variability and thus consistent performance across the participants of this age group.

For total correct responses, the median values showed comparable performance across A1 (8.00) and A2 (8.63) to A3 (7.93) which showed declined performance. A1 showed greater variability (IQR=1.25) compared to A2 (IQR=0.75) and A3 (IQR=0.67) which showed reduced variability thus indicating consistent performance as argument structure complexity increased.

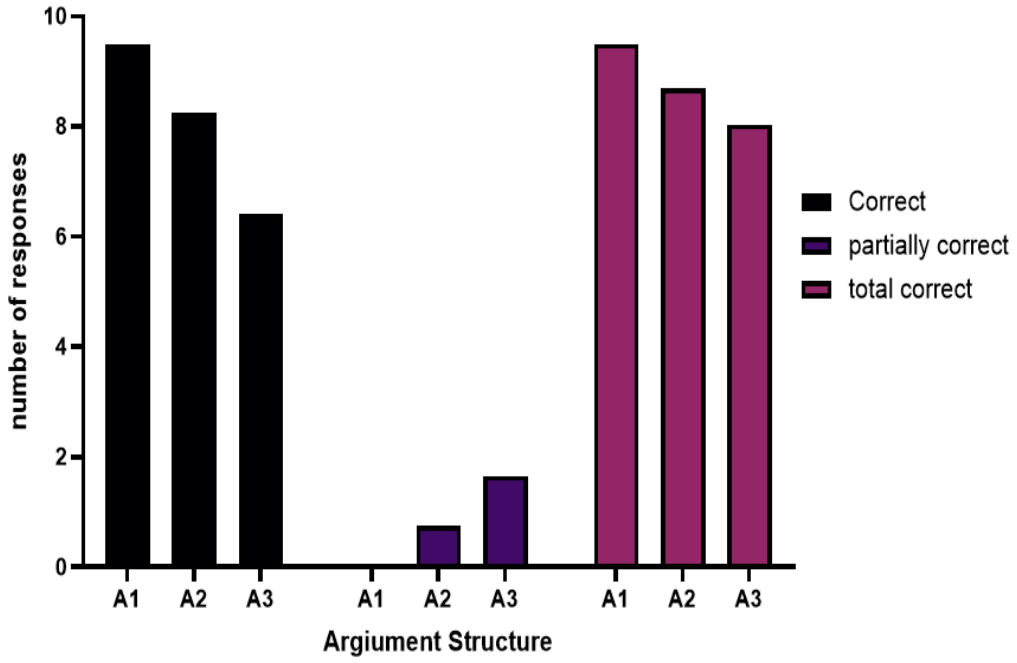
To determine whether there was significant difference across the three argument structure A1, A2 and A3 within 61-70 years age group, Kruskal-Wallis test was performed and the analysis revealed a significant differences for correct (χ^2=34.76, p<0.05), partially correct (χ^2=46.97, p<0.05) and total correct responses (χ^2=19.58, p<0.05). Since significant differences were obtained, pairwise comparisons were conducted using the Mann-Whitney U test. For correct responses, no significant differences was found between A1 and A2 ($|Z|$=0.19, p>0.05).

However, significant differences was found between A1 and A3 ($|Z|$=5.13, p<0.05) and A2 and A3 ($|Z|$=5.02, p<0.05) showed reduced correct responses in A3 compared to A1 and A2. For partially correct responses, a significant difference was found between A1 and A2 ($|Z|$=4.31, p<0.05) with higher partial responses in A2. The significant differences also observed between A1 and A3 ($|Z|$=5.55, p<0.05) and between A2 and A3 ($|Z|$=5.21, p<0.05)

showed progressive increased trend from A1 to A3. For total correct responses, significant difference was found between A1 and A2 ($|Z|$=2.76, p<0.05) and between A2 and A3 ($|Z|$=4.57, p<0.05) while no statistically significant differences was found between A1 and A3 ($|Z|$=0.85, p>0.05 thus showed a comparable performance across A1 and A3, with A2 showed a comparatively higher number of total correct responses. Overall the findings suggested that correct responses decreased as complexity increased and partially correct responses increased as argument complexity increased with total correct responses which showed mixed findings.

Figure 4.20

Median values for A1, A2 and A3 for all three responses across all four age group



Note. A1= One-argument; A2= Two-argument; A3= Three-argument

In Figure 4.20, participants across all age groups for A1 argument structure showed the highest accuracy in performance of correct and total correct responses with median value

of 10.0 in younger age groups (18-30 years, 31-45 years), indicating consistent verb retrieval performance for one-argument. Partially correct responses showed a consistently low median (0.00) across all age groups. Overall A1 showed the minimal age related decline thus indicating that simpler argument structure showed well preserved performance with increased age.

For A2, a gradual decline in median with increased age was seen. The median for correct responses decreased from 9.25 in the 18-30 years age group to 7.50 in the 46-60 years age group, and increased to 8.62 in the 61-70 years age group. For partially correct responses, the median increased from 0.37 in the 18-30 years age group to 0.75 in the 31-45 years age group to 1.00 in 46-60 years age group and decreased to 0.75 in the 61-70 years age group indicated a shift from correct to partially correct responses with increased age. The total correct responses showed decline in median from 9.26 in the 18-30 years age group to 9.25 in the 31-45 years age group to 8.75 in the 46-60 years age group, and decreased to 8.62 in the 61-70 years age group which showed that performance decreased with age but relatively maintained.

For A3 there was a more apparent decline in median scores across all age groups. The median for correct responses reduced from 8.00 in the 18-30 years age group to 5.33 in the 46-60 years age group, with a rise of 6.33 in 61-70 years age group. The median for partially correct responses increased from 1.00 in the 18-30 years age group to 1.66 in the 31-45 years age group and 2.00 in the 46-60 years age group, decreased to 1.66 in the 61-70 years age group thus showed more partially based responses with increased age for A3 argument structure. The total correct responses also showed decreased median across age groups, from 8.91 in the 18-30 years age group to 8.16 in the 31-45 years age group and 7.41 in the 46-60 years age group, increased to 7.91 in the 61-70 years age group thus overall showed greater

decline in performance compared to A2, indicated that as age increased performance declined and A3 showed greater decline compared to the A2 and A1.

Objective 3: To determine inter-rater and test–retest reliability by analyzing 10% of the collected data

Table 4.7

Cronbach's alpha values by three rater for A1, A2 and A3 across all type of responses

Response type	A1 (α)	A2(α)	A3 (α)	Interpretation
Correct	0.985	0.976	0.992	Excellent reliability
Partially correct	0.828	0.962	0.988	Good to excellent
Total correct	0.994	0.954	0.990	Excellent Reliability

Table 4.7 presents Cronbach's alpha values to determine the consistency between raters across A1, A2 and A3. For the correct response Cronbach's alpha values were high for A1 (α=0.985) and A2 (α=0.976), and A3 ((α=0.992) indicating excellent inter-rater agreement.

For the partially correct responses, Cronbach's alpha values were high for A1 (α=0.828), A2 (α=0.962), and A3 (0.998) indicated good to excellent agreement. Similarly, for total correct responses Cronbach's alpha values were high for A1 (α=0.994) and A2 (α=0.954), and A3 (0.990) indicating excellent agreement among the raters.

Table 4.8

Cronbach's alpha values by the rater for A1, A2 and A3 on two test occasions

Response type	A1	A2	A3	Interpretation
Correct	0.966	0.927	0.979	Excellent
Partially correct	0.516	0.902	0.975	Low to excellent
Total correct	0.990	0.872	0.984	Excellent to good

The above table 4.8 shows that test-retest reliability results to determine the consistency of performance on Action -Verb Naming. The test was administered at two different time points on 8 participants as testing 1 and testing 2 with a time gap of more than 1 month. The scores obtained from both administrations were analyzed using Cronbach's alpha to measure stability of the test over time. The Cronbach's alpha value for partially correct responses in A1 (α=0.516) was low, showed moderate to low variability suggesting inconsistency in scoring across time or inconsistency in participant's performance. For correct responses, Cronbach's alpha values were high across all arguments as A1 (α = 0.966); A2 (α = 0.927); A3 (α = 0.979) indicating excellent reliability. Similarly for total correct responses, alpha values were high across all argument structures as A1 (α = 0.990); A2 (α = 0.872); A3 (α = 0.984) indicating good to excellent test-retest reliability.

In summary, three objectives were considered for the phase 2 of present study. The first objective was to compare the number of correct, partially correct and total correct responses across different age groups (18-30 years; 31-45 years; 46-60 years and 61-0 years) in Action-Verb Naming task, for which Kruskal-Wallis followed by Mann-Whitney U test were employed. The findings indicated that there were statistically significant differences across age groups for all three responses. A decline in correct and total correct responses

were observed with increasing age, while the partially correct showed an increasing trend. Pairwise comparison showed that younger age groups (18-30 and 31-45 years) showed significantly higher correct and total correct responses while the middle (46-60 years) and older adults (61-70 years) showed relatively higher partially correct responses. No significant differences were observed between the two older age groups (46-60 years and 61-70 years), suggesting a similar pattern of performance in later adulthood.

The second objective was to compare the argument structure differences (A1-one-argument; A2-two-argument; and A3-three-argument) across the four age groups (18-30 years; 31-45 years; 46-60 years and 61-0 years) , for which Kruskal- Wallis followed by Mann-Whitney U test were employed. Significant differences were observed for all argument structures (A1, A2 and A3) across all age groups. For correct and total correct responses, performance of naming action verbs decreased with increasing complexity (A1>A2>A3), while the partially correct responses increased. Pairwise comparisons showed significant differences across all argument structures, although A1 and A2 showed comparable performance for correct responses in the 61-70 years. Overall A1 remained relatively preserved, whereas A2 and significantly A3 showed more apparent age-related decline, indicating an interaction between aging and argument structure complexity.

The third objective was to determine inter-rater and test-retest reliability on 10% of the data. Inter-rater reliability showed excellent agreement across all response types with Cronbach's alpha values ranging from α=0.954 to α=0.994 for correct and total correct respectively. Alpha values ranged from 0.828 to 0.988 for partially correct responses in A1, A2 and A3 argument structures. Test- retest reliability for correct response and total correct responses with all values exceeding α=0.80, indicating good to excellent reliability. However, partially correct responses showed higher alpha values in A2 (α=0.902) and A3 (α=0.975),

indicating excellent test-retest reliability except lower Cronbach's alpha value in A1 (α=0.516), indicating less consistency in scoring or participants' performance over time.

Qualitative Analysis

A qualitative analysis was carried out to determine the complexity gradient of Action Verb Naming stimulus items. Each response was scored as 1 for correct, 0.5 for partially correct and 0 for incorrect. The aim of carrying out this analysis was to identify which items received maximum and minimum correct responses and check performance varied across the argument structure. The stimulus included a total of 30 stimulus items in one-argument, two-argument and three-argument structure with 10 items in each argument.

Table* 4.9*: Complexity Gradient of Stimuli

Table 4.9.1

% of correct and incorrect responses for One-Argument Structure

Argument Structure (A1)	% Correct response	% incorrect responses
S1	96.25	3.75
S2	96.25	3.75
S3	97.25	2.75
S4	97.25	2.75
S5	96.25	3.75
S6	100	0
S7	100	0
S8	100	0
S9	100	0
S10	100	0

In Table 4.9.1, For A1, participants showed correct responses for most of the items with above 96% accuracy (stimulus 1,2,3,4,5) and 100% accuracy for the remaining items in one-argument with minimal incorrect responses indicating they were relatively easier for the participants.

Table 4.9.2

% of correct and incorrect and mixed responses for Two-argument Structure

Argument structure	**% Correct response**		**% Incorrect responses**		**%Mixed responses**
A2	V1	V2	V1	V2	
S11	100	100	0	0	0
S12	97.25	96.25	2.5	3.75	0.25
S13	100	98.75	0	1.25	0
S14	100	97.5	0	2.5	0
S15	100	100	0	0	0
S16	98.75	98.75	1.25	1.25	0
S17	100	100	0	0	0
S18	98.75	96.25	1.25	2.5	1.25
S19	100	97.5	0	2.5	0
S20	100	98.75	0	1.25	0

In Table 4.9.2, For A2, participants showed accuracy above 95% for both verbs (V1 and V2) in all stimulus items thus indicating that stimuli in this argument structure were easier for the participants. However, A2 stimuli showed more variability in responses compared to A1 especially in stimulus 12 and 18 where both incorrect and mixed responses were obtained. The reduction in percentage accuracy was also seen compared to A1 and thus

indicated increased cognitive demands for two-argument structure. The participants were able to retrieve the verb but with increased response time.

Table 4.9.3

% of correct and incorrect and mixed responses for Three-argument Structure

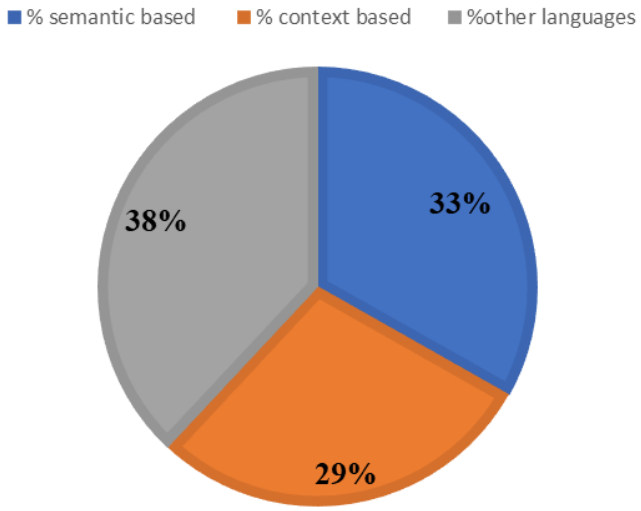
Argument structure	**% correct**			**% incorrect**			**% mixed response**
A3	V1	V2	V3	V1	V2	V3	
S21	100	100	98.75	0	0	1.25	0
S22	100	100	100	0	0	0	0
S23	100	98.75	97.5	1.25	1.25	1.25	0
S24	100	97.5	100	0	2.5	0	0
S25	100	98.75	100	0	1.25	0	0
S26	100	100	97.5	0	0	1.25	0
S27	100	100	100	0	0	0	0
S28	100	100	100	0	0	0	0
S29	100	100	100	0	0	0	0
S30	100	100	100	0	0	0	0

In Table 4.9.3, For A3, overall items showed higher accuracy responses indicating that stimulus items used in this argument structure were easier for participants to recognize and retrieve the verb but more variability was observed across the V2 and V3. Some items like stimulus 23, 24 and 25 showed increased incorrect and mixed responses indicating higher inconsistencies in responses across the verb conditions compared to A1 and A2.

This pattern suggested that when argument structure complexity increased, the participants required greater effort in retrieving the verbs.

Figure 4.21

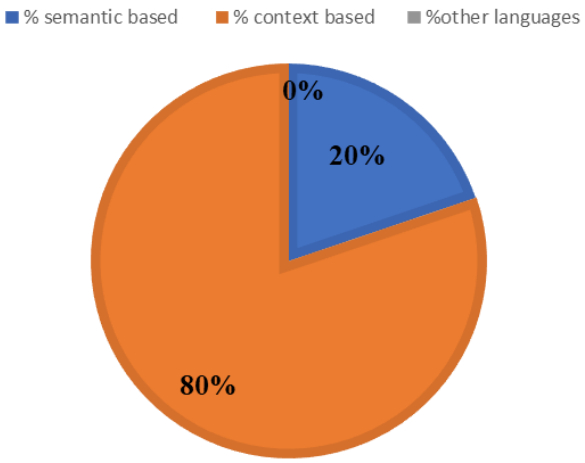
Percentage distribution of Semantic, contextual and other language responses in the One-argument structure



As shown in Figure 4.21, in the One-argument structure, responses in other language, which constituted the highest proportion (38%; n = 78), semantic based responses were 33%; n=68) while the context based responses were minimal (29%; n= 59).

Figure 4.22

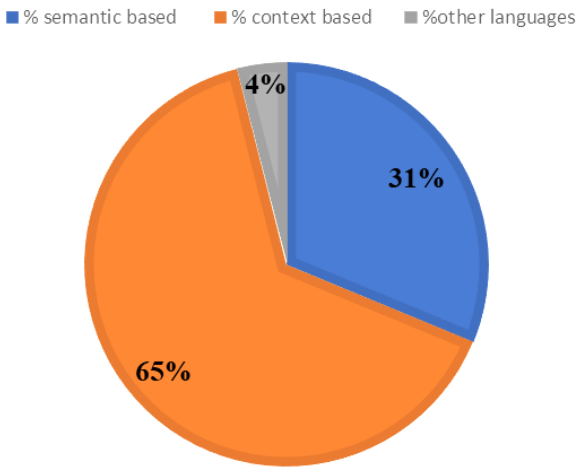
Percentage distribution of Semantic, contextual and other language responses in the Two-argument structure



As shown in Figure 4.22, in the Two-argument structure, contextual responses constituted the highest proportion (80%; n = 409), semantic based responses were 20%; n=101) while the responses in other languages were minimal (0%; n= 0).

Figure 4.23

Percentage distribution of Semantic, contextual and other language responses in the Three-argument structure



As shown in Figure 4.23, in the Three-argument structure, contextual responses constituted the highest proportion (65%; n = 413), semantic based responses were 31.24%; n=199) while the responses in other languages were minimal (4%; n= 25).

Chapter 5

Discussion

The aim of the study was to develop an Action-Verb Naming Test in Hindi and examine the verb retrieval naming patterns across different age groups. The first objective was to determine the content validity of the developed Action- Verb Naming Test tool for verb naming performance according to the argument structure.

The development and validation of AVNT-H taps onto an important gap in existing assessment tools, as most naming tests are available on noun naming and not verb naming which is more representative of the everyday communication. The study by Morrison et al., 1992 showed that noun and verb naming acts as two separate grammatical components. In a study on picture- naming norms in English language bySnodgrass& Yuditsky, 1996 relied on indirect methods of content validation such as stimulus selection, name agreement percentages and measures of naming consistency (H- Statistics) along with comparisons to established normative databases, showed that content validation was inferred not systematically measured quantitatively which is crucial for a culturally and linguistically appropriate tool for a Hindi-speaking population. The study by Ahmed et al., 2022 developed and validated the verb pictures in Kannada using a sample of 120 healthy adults aged 18-80 years of age range based on argument structure taxonomy using the psychometric measures like naming accuracy, argument agreement and participant's familiarity and complexity ratings. The present study extends the existing methodologies by incorporating a structured experts evaluation process and providing direct and quantitative based evidence for the developed tool, addressing this limitation by systematically designing and validating the content of Action-Verb Naming Test in Hindi (AVNT-H), which strengthens the AVNT-H's appropriateness for evaluating the verb naming performance in Hindi-speaking population. The present study CVI measures (both I-CVI and S-CVI) to ensure that all the stimuli are

linguistically accurate, culturally meaningfully and functionally relevant for the target population. In the current study during the stimulus development, a total of 34 verbs were systematically selected across the one-argument (13), two-argument (13) and three- argument structure (8) based on the theoretical premise that increasing argument structure complexity places greater semantic and syntactic demands on lexical retrieval. Rating was done by a total of 5 raters across 7 domains, which were iconicity, appearance, imageability, flexibility, concreteness, relevance and stimulability. Content validity was established using both Item level content validity (I-CVI) and scale-level content validity (S-CVI) to establish a quantitative evaluation of the test items. The I-CVI was used to assess the relevance of each individual item based on expert ratings. On the other hand, the Scale level content validity index (S-CVI) was calculated to check universal agreement over the validity of the contents of the test, which reflects the degree to which scale adequately represents the construct of items. The combined use of I-CVI and S-CVI is consistent with the recommended practices in instrument development to ensure precision and overall adequacy of the developed tool. Based on the I-CVI values and qualitative feedback, modifications were done to refine the stimulus set. In the one-argument category, item 6 was removed as it showed no expert agreement while item 7 and 13 were excluded to balance the difficulty level in one-argument category. In two-argument structure, items 19 were excluded with lower agreement and ambiguity in pictorial representation with multiple verb responses. Additionally, item 22 and 26 were reclassified into a three-argument structure category with some contextual modifications based on expert's feedback. These refinements ensured that only items with adequate clarity, representativeness and culturally appropriate were retained. Items 6,7,13 and 19 were removed from the stimulus set with some modifications in item 32 (I-CVI=0.6) and a final stimulus set of 30 verbs with 10 verbs in each one-argument, two- argument and three-argument included, ensuring the balanced number of stimuli across each argument structure

thereby strengthening the structural integrity of the tool. Overall the process of item validation involved both qualitative and quantitative feedback from the experts, thereby enhancing the robustness of the developed tool. All retained items showed I-CVI values above the cut-off score of 0.78 thus findings indicate that all items met the acceptable I-CVI criterion(Polit & Beck, 2006). Overall the finding supports the content validity of AVNT-H as a reliable tool for assessing the verb retrieval performance across the argument structure and thus provides a strong base for further testing and validation of the tool in the clinical population.

The second objectivewas to compare the verb retrieval performance across the four age groups (18-30 years, 31-45 years, 46-60 years and 61-70 years). Descriptive analysis revealed that correct and total correct responses had the highest median values across all four age groups, indicating their predominance even in older groups. However, the correct and total correct responses decreased with increasing age and increase in partially correct responses observed with increasing age. The findings demonstrated higher accuracy and greater consistency in correct responses in younger adulthood. In contrast, the older adults showed more partially correct responses and also variability in responses compared to younger age groups, indicating the age related changes in naming performance. While the naming abilities were stable across the younger age groups, a noticeable decline in the number of correct responses with more variability and increase in partially correct responses with less variability was observed in older age groups (46-60 years and 61-70 years).

The findings of the current study infers that age is an important contributor to naming action verbs, is concordant with previous longitudinal research on verb naming in normal aging by Ramsay et al., 1999 which shows that while younger age groups maintain stable performance, older adults showed reduced spontaneous and immediate retrieval of verb naming abilities rather than loss of semantic knowledge and cohort differences, as individuals

often benefit from cues and continue to show relatively preserved overall performance with decline becomes more evident after 50 years of age and continues with advancing age. In contrast to previous findings by Morrison, C. M., hirsh, K. W., & Duggan, G. B., 2003 which showed significant decline in number of correct responses after 70+ years of age, the present study demonstrates that there is a decline in performance beginning at 46-60 years of age, suggesting a more gradual age related decline starting from above 40 years of age and shows further decline with increasing age.

With respect to statistical findings (Kruskal-Wallis followed by Mann- Whitney) statistically significant differences for correct, partially correct and total correct responses were observed across age groups ($p<0.05$). Specifically significant differences were found on comparing first group with second, third and fourth age groups for all response types with younger adults showing more correct and total correct responses while older adults showing relatively more partially correct responses. Similarly, on comparing second age groups with third and fourth groups, significant differences for correct and total correct responses ($p<0.05$) were found but not for partially correct responses ($p>0.05$). In contrast, no statistically significant differences were observed between 46-60 years and 61-70 years age groups for correct, partially correct and total correct responses, indicating a similar pattern of performance in later adulthood. This suggests that verb retrieval performance declines with age, with a shift from correct responses in younger adulthood to increased partially correct responses in older adults.

The study on Developmental and Psychometric Evaluation of Alternate Short Forms of Action-Naming Test by Pinto-Grau et al., 2021have incorporated cueing hierarchy including phonemic and semantic cueing to facilitate verb retrieval in healthy population of 34 to 89 years of age showed that older individuals demonstrated fewer spontaneous correct responses (without cueing) which supports the findings of current study that as age increases

the number of correct responses decreases and partially correct responses (semantically or contextually related responses) increases. However, the scoring pattern of the current study differs from the previous study because the responses elicited with the help of semantic and phonemic cues were considered correct and were given a complete score of 1 in the previous study while in the present study the responses elicited with the help of cues were considered partially correct and were given a score of 0.5. The existing literature suggests that age has minimal effect on response accuracy after cueing, indicating that retrieval difficulties increase with age but can be facilitated by prompts. The findings of the present study suggest that older adults demonstrate more partially correct responses (semantically and contextually related responses), can be meaningfully interpreted with existing literature, that preserved semantic knowledge with age but reduced efficiency in lexical retrieval. The present study complements the previous research findings by providing indirect evidence that older adults retain conceptual information, while experiencing difficulties in verb retrieval. Based on earlier studies that cueing facilitates naming performance and reduces age- related differences, it is likely that many of partially correct responses could have been converted into fully correct responses if cues had been provided in the present study and thus absence of cues reflects more direct reflection of intact lexical retrieval abilities with age related differences in healthy individuals and establishes a baseline data for Action-Verb Naming Test in Hindi due to limited or no availability of standardized tools and normative data.

The third objective of the present study was to compare the age related agreement differences across the four age groups (18-30, 31-45, 46-60 and 61-70 years). Descriptive analysis based on median values revealed that verb retrieval performance varies across the argument structure and age groups. Across all age groups, A1 (One-Argument) showed highest median values with minimal variability for both correct and total correct responses while lower median value for partially correct responses, indicating that One-Argument

structure which contains a single verb remains relatively preserved with correct responses and more stable with increasing argument complexity.

For A2 (Two-Argument), a gradual decline in verb retrieval performance was seen with slight reduction in median values of correct and total correct responses while an increase in partially correct responses was observed . However, performance remained relatively stable compared to more complex argument structure.

In contrast, A3 (Three-Argument) showed a more pronounced decline across the age groups with decline in correct and total correct responses whereas increase in partially correct responses, particularly in middle and older age groups. This indicates that increased argument complexity places greater cognitive and linguistic demands and reduced accuracy in retrieval of verbs.

Inferential statistics (Kruskal-Wallis followed by Mann- Whitney) revealed that statistically significant differences ($p<0.05$) were present across all age groups (18-30 years; 31-45 years and 46-60 years) except 61-70 year of age group for A1, A2 and A3 for all response types. Verb retrieval performance for A1 (One-Argument) was relatively preserved across all age groups, suggesting that simpler verb representations with fewer thematic roles remain unaffected despite normal aging.

The findings in the oldest age group (61-70 years) showed mixed findings. For correct responses, pairwise comparisons revealed no statistically significant differences ($p>0.05$) between A1 and A2. However, statistically significant differences ($p<0.05$) between A1 and A3 and between A2 and A3 showed a decrease in response accuracy with increasing complexity, and more decline compared to A1 and A2.

For partially correct responses, significant differences were found across all pairwise comparisons, indicating an increase in partially correct responses as complexity in argument structure increases from A1 to A3.

For total correct, statistically significant differences between A1 and A2, and between A2 and A3 ($p<0.05$), While no statistically significant difference between A1 and A3. Overall, the pattern indicates increase in partially correct responses and decrease in correct responses as argument complexity increases, while total correct responses showed comparable performance within this group as partially correct responses may have compensated for decreased accuracy in verb retrieval.

The findings of a previous study by den Ouden et al., 2009 showed that verbs showed greater variability than nouns particularly as argument complexity increases, affecting naming accuracy and consistency due to increased processing load. Performance becomes more difficultwith increased complexity of argument structure due to the demands of representing multiple participants and thematic roles, requiring more precise and detailed grammatical and cognitive processing thus primarily affecting the retrieval with preserved underlying semantic representations. The preserved semantic representations in older healthy aging individuals (Schmitter-Edgecombe et al., 2000) leads to more partially correct responses, which are the responses without cueing in the present study. The findings of the present study are consistent with the existing literature (Thompson et al., 2007) on naming action verbs and effects of argument complexity on naming performance, showing that variability increases as argument complexity increases. The existing literature on Development of Norms for Action-Naming Test in Malayalam in the healthy participants from 20-60+years of age range (Muralikrishna & Paul, 2025) suggests that more variability in scores with increasing healthy aging and better consistency for correct responses and scores in younger and middle adulthood. The study demonstrated that correct response involved response elicited without cues (spontaneous naming) and was given a score of 2 and score of 1 for responses with phonemic or semantic cueing that differs from the current study. However, findings of the present study cannot be directly compared for the aforementioned

study as it not only explores the effect of age but also investigates the effect of increasing argument complexity on naming performance. In the present study, the argument complexity involved verbs with single verb in One-argument, two verbs in Two-argument and three verbs in Three-argument structure and thus introduces a distinct scoring pattern, where each verb within the sentence is considered individually, enables a close examination by probing the interaction between lexical retrieval and syntactic processing, providing deeper insights into verb naming performance. The study by Ahmed et al., 2022 on Development and Validation of a novel corpus of 269 Verb pictures in Kannada based on argument structure taxonomy. This study involved 120 healthy Kannada speaking adult participants in the 18-80 years of age range in three age groups (18-40 years, 41-60 years and 61-80 years) for establishing the normative data for psychometric properties of verb pictures which differs from the current study as the latter involves a distinctive scoring pattern and focuses on participant's performance for verb retrieval for each argument structure.

Overall, the present study demonstrates that the correct responses show increased variability whereas partially correct responses with increasing complexity show reduced variability with normal aging as the responses may be compensated through semantic and context based responses leading to more partially correct responses in older adults.

The study by Schmitter-Edgecombe et al., 2000 have suggested that use of context in pictures may lead to better consistency in naming performance despite increasing argument complexity. Interestingly, the present study also showed that participants in the older age group (61-70 years) found less variability in responses for A3 compared to A1 and A2. The findings may be explained by richer contextual cues due to involvement of three action verbs that are culturally relevant and embedded in familiar scenarios for Hindi speaking population, providing better consistency in response.

The study by Berman et al., 1989; Snodgrass & Yuditsky, 1996 have primarily evaluated agreement measures (name agreement, image agreement, visual complexity agreement etc.) as psychometric validation. Such validations measure the adequacy of the developed stimuli and not the retrieval performance across the participants. The present study examines the verb retrieval performance and variability not only in accuracy (with cue and without cues) but the nature of responses (correct, partially correct and total correct) in the absence of cues using a graded scoring pattern, suggesting that even when stimuli are psychometrically robust, underlying responses may vary significantly with increasing age and with argument complexity. In the current study, argument complexity was manipulated by presenting picture stimuli representing a single action verb in One-argument, two actions in Two-argument and three actions in Three-argument structure, highlights the increased cognitive-linguistic demands due to multiple verb representations in argument structure contributes to greater variability in responses, particularly for partially correct responses. In the current study, it was observed that when picture stimuli with multiple verb representations were presented, older participants showed an increased tendency to use semantic and context based cues, if provided or depicted in the picture.

The fourth objective of the study was to determine inter-rater and test–retest reliability by analyzing 10% of the collected data. The present study examined both inter-rater reliability and test-retest reliability using intra-class correlation coefficient (ICC) and Cronbach's alpha.Zenk et al., 2007showed that inter-rater reliability and test-retest reliability provide complementary perspectives on the consistency of an assessment tool. While inter-rater reliability reflects the degree of agreement between different evaluators, test-retest reliabilities indicate stability of performance over time. Examining both the dimensions together provide deeper insights into the robustness of the AVNT-H and also factors influencing the response variability. Reliability was examined using the intra-class correlation

coefficient (ICC). ICC and Cronbach's alpha values of >0.9 were considered excellent, 0.75-0.9 as good, 0.40-0.50 as fair, and <0.50 as poor(Koo & Li, 2016;George & Mallery, 2024).

Cronbach's alpha values reflect inter-rater reliabilityacross all response types and argument structure (A1, A2 and A3). In the current study, Cronbach's alpha and ICC values for correct response ranged from 0.976 to 0.992, while total correct responses showed even higher consistency with Cronbach's alpha and ICC values ranging from 0.954 to 0.994, indicating excellent inter-rater reliability. Cronbach's alpha and ICC values for partially correct responses ranged from 0.828 to 0.988, with slightly lower in A1 compared to A2 and A3, indicating good to excellent agreement. In the present study, high agreement across raters suggests that the scoring system was based on clear operational definitions and raters were adequately trained. The findings indicate that the responses were clearly identifiable and consistently interpreted, minimizing subjectivity in scoring as the value was more than the values mentioned by the aforementioned proponents.

To explore test- retest reliability, the test was administered twice in 8 randomly selected healthy participants (2 participants from each age group). The duration between two-test points was approximately 1-1.5 months. Reliability was done using intra-class correlation coefficient (ICC) and Cronbach's alpha values. The Cronbach's alpha and ICC values for correct ($\alpha = 0.927$ to 0.979) and total correct responses ($\alpha = 0.872$ to 0.990), indicating good to excellent consistency over repeated administration. A noticeable decline was observed for partially correct responses in A1 ($\alpha = 0.516$), indicating low reliability. However, A2 and A3 showed high reliability ($\alpha = 0.902$ to 0.975). Overall the findings of current study show strong reliability across raters and over time, particularly for correct and total correct responses. While there is some variability in partially correct responses, especially in simple argument structure (One-Argument), indicating the diverse and complex nature of action-verbs when semantic and contextual information or approximations are involved. These

psychometric properties are not directly measured in the studies tapping verb argument structure, hence limiting its direct comparison.

The high inter-rater reliability and test-retest reliability observed in the present study supports the psychometric strength of the developed tool (AVNT-H) as a reliable tool to measure verb retrieval performance across argument structure taxonomy in the clinical and research settings.

Overall, the findings of present study indicate that decline in verb retrieval performance occurs with normal aging, particularly from middle adulthood. In contrast, no statistically significant differences were observed between 46-60 years and 61-70 years of age group for different response types (correct, partially correct and total correct), thus performance declines from younger adulthood to older adulthood, with more persistent/consistent response patterns across the middle and older adulthood.

Although, with respect to argument structure complexity, correct and total correct responses were predominant across all age groups, the increase in partially correct responses with age, particularly in the middle and older adulthood. This pattern is consistent with the existing Levelt's model of speech production that verb retrieval includes multiple processing levels (Levelt, 2001), thus the performance gets affected by complexity of argument structure due to increasing cognitive-linguistic demands at different levels of production.

5.1 Practical guidelines for Development and administration of the test

Based on the findings of present study, certain practical guidelines can be considered for future administration and standardization of the Action-Verb Naming Test.

The present study includes a total of 30 stimuli distributed equally in one-argument, two-argument and three- argument structure for verb retrieval performance with healthy aging. The distribution of stimuli across the argument structure can be modified in future studies based on participant's characteristics, severity and type of neurogenic disorder. Since, various types of aphasia are associated with deficits in lexical retrieval, syntactic processing, semantic organization and sentence level formulation, analysis of argument structure may provide deeper clinical insights into severity-specific and disorder-specific breakdown patterns. In everyday language, one-argument verbs which only require a subject (e.g., sleep, run, cry etc.) and two-argument verbs which require both agent and object (e.g., eat food, wash clothes etc.) occur more frequently, are generally acquired earlier and processed easily compared to three-argument verbs. For milder impairments, inclusion of one-argument and two-argument can be included for assessing subtle deficits and for moderate to severe impairments inclusion of only one argument verbs should be considered , as may demonstrate deficits for simpler verb structure. For different types of aphasia, argument structure analysis provides clinically relevant information. Individuals with Broca's aphasia may demonstrate better performance on one-argument but demonstrate difficulty at two and three-argument due to difficulty in grammatical encoding. In Wernicke's aphasia, all argument structure can be included but demonstrates deficits across all argument structure with increased semantic substitution, irrelevant responses and impaired thematic role assignment as complexity increases thus helps in identifying disorder-specific breakdown patterns.

The everyday functional communication relies on use of action verbs involving agent, action and object therefore reflects difficulty in constructing meaningful and grammatically

correct sentences that can provide insights into real life communication difficulty beyond single word retrieval. The analysis of argument structure performance in neurogenic disorders helps in identifying the level of communication breakdown, planning functionally relevant intervention goals and developing rehabilitation approaches that better reflect real life communication demands than focusing solely on isolated word retrieval. Future adaptation of the tool may need modifications for the stimulus line drawings, representing different action verbs according to the cultural practices, attire, objects, food items etc. to reduce the cultural bias and to maintain the ecological validity of the developed tool.

5.1.1 Administration of test

In the present study, participants were instructed to carefully observe the picture and verbally produce the first action that came to their mind with multiple actions in two and three-arguments. Although no examples related to actual test stimuli were provided, some older participants required additional clarification regarding the concept of action verbs prior to testing. Therefore, the future studies may improve administration procedure by introducing a brief familiarization phase before the actual testing. The familiarization phase may include demonstration of simple action verbs directly observable in the immediate environment, or can incorporate practice items related to one-argument, two-argument and three- argument structure to help participants understand the task without affecting the verb performance. The participants may be asked to confirm their understanding of the task before initiation of testing, especially in older participants to facilitate better comprehension of the task without affecting the spontaneous verb retrieval performance. In the present study, the participant responses were documented in response sheet form however the response sheets may not have captured the latency,

fluency, self-corrections especially in the neurogenic population. Therefore, future studies particularly involving neurogenic population should incorporate the audio/video recordings of participant's response enhancing the accuracy and clinical relevance of the findings. In the studies involving neurogenic population, multiple trials may be considered for better insights into cue responsiveness, error patterns and retrieval abilities.

5.1.2 Scoring and Response

In the present study involving a healthy aging population, the response categories of correct, partially correct and total correct were found to be appropriate as most of the healthy participants predominantly produced correct or partially correct responses therefore a separate category for incorrect responses was not included for comparison across the different age groups and across the argument structure complexity. However, in the neurogenic population, particularly in individuals with aphasia, a separate category for incorrect responses should be included due to impairments in lexical retrieval, semantic organization, , grammatical encoding and sentence formulation. Such responses may include neologism, preservation, irrelevant responses and absence of response, helping in identifying the severity and nature of breakdown patterns in disordered populations. Future studies may also incorporate cueing hierarchy to examine the types of cues required with increasing argument complexity and also determine the pattern of cues across different age groups with increasing argument complexity. Accordingly, the future scoring pattern may be modified with highest score for responses without cues, reduced score for responses with cues and lowest score for incorrect responses.

Cross-sectional and translational development of present AVNT-H should be carefully considered in future modifications. Since the test was developed across the participants with similar language exposure and proficiency in Hindi. Future adaptation of the tool across different Indian languages and regional dialects should ensure linguistic equivalence, semantic familiarity, frequency of usage, cultural relevance, imageability and argument structure compatibility of the selected stimuli and it should be validated. Stimuli selected should also be suited to their own culture, as the semantic organisation can be affected by environmental exposure, educational experiences, traditions, and language use and the same has been reflected in future directions.

Studies can investigate the utility of tool clinical populations such as dementia, aphasia, traumatic brain injury, and other cognitive communication disorders. According to the cognitive and linguistic abilities of specific clinical populations, alterations in stimulus complexity and administrations may be required. These modifications can give us information on age-related slowing from pathological conditions.

Chapter 6

Summary and Conclusion

Lexical-semantic organisation refers to the manner in which words, concepts, and meanings are stored, connected, and accessed within the mental lexicon. Different processes get affected according to the specific conditions, like normal aging, mild cognitive impairment, or dementia. Confrontation naming is an important component of lexical-semantic processing for retrieval abilities, as it provides insights into lexical access, semantic memory, word retrieval abilities, visual recognition and phonological processing. Naming action verbs are considered effective in tapping lexical-semantic retrieval, syntactic processing, thematic role assignment and sentence level language production, as they closely reflect functional communication used in everyday life. Thus, naming tests have been utilized for a long time in psycholinguistic research as an effective means of exploring the structure and organisation of the mental lexicon.

The present study aimed to develop a Hindi-specific Action Verb Naming Test in phase 1 and examine age-related differences in verb retrieval patterns among healthy adults and elderly individuals in phase 2 of the study. Participants across clearly defined four age groups (18-30 years; 31-45 years; 46-60 years and 61-70 years) were administered an Action-Naming Test using verb stimuli in One-Argument structure, Two-argument structure and Three-argument structure respectively. Responses were classified into correct, partially correct (context, semantic based responses etc.) and totally correct and both descriptive and inferential statistics were carried out.

The first objective in phase 2 was to compare the verb retrieval performance across the four age groups (18-30 years, 31-45 years, 46-60 years and 61-70 years).The findings revealed statistically significant differences in correct, partially correct and total correct responses across age groups. Statistically significant differences were observed between younger and older age groups demonstrating higher correct and total correct responses in younger age groups and higher partially correct responses in older age groups. However, no significant differences were observed between older age groups (46-60 years and 61-70 years), suggesting a similar pattern of verb retrieval performance in later adulthood.

The second objective of phase 2 of the present study was to compare the age related agreement differences across the four age groups (18-30, 31-45, 46-60 and 61-70 years). The findings indicated that there were statistically significant differences across argument structures for all age groups except 61-70 years age group. The findings in the 61-70 years age group showed mixed patterns across argument structures for different responses. For correct responses, no statistically significant difference was observed between A1 and A2, whereas significant differences between A1 and A3 and between A2 and A3. For partially correct responses, significant differences were found across all argument structures. For total correct responses, significant differences between A1 and A2 and between A2 and A3 whereas no significant differences observed between A1 and A3. The response pattern for all age groups on different argument structure showed that simpler argument structure(A1) remained relatively preserved with aging whereas increasing argument complexity affected retrieval accuracy and response consistency, particularly in middle and older adulthood. The middle and older age groups showed an increased number of partially

correct responses with comparable total correct responses, suggesting that partially correct responses may have compensated for reduced retrieval accuracy.

The third objective of phase 2 of the study was to determine inter-rater and test–retest reliability by analyzing 10% of the collected data. Reliability analysis was done using Intra-class correlation coefficient (ICC) and Cronbach's alpha. The results of inter-rater reliability showed excellent agreement for correct and total correct responses whereas for partially correct responses, the results showed good to excellent agreement with slightly lower reliability for one-argument verbs. Test-retest reliability also showed good to excellent consistency for correct and total correct responses however partially correct responses for one-argument showed comparatively lower reliability. Overall, the findings demonstrated strong inter-rater and test-retest reliability of the AVNT-H, supporting the psychometric strength of the developed tool (AVNT-H) as a reliable tool to measure verb retrieval performance across argument structure taxonomy in the clinical and research settings.

Findings of the study clearly highlights that verb retrieval changes with healthy aging and with increasing argument structure complexity, with higher correct responses in younger adulthood and increase in partially correct responses with less variability particularly in middle and older adulthood as responses gets compensate by context and semantic based responses , affecting not only accuracy but variability across responses also changes, indicating that both age and argument structure complexity affects the verb retrieval performance with normal aging, particularly significant changes occurs after 40 years of age.

Merits of the study

The present study demonstrates several advantages when compared to few existing studies on the Action-Naming test. Most of the Verb naming research primarily focuses on single word verb production while the present study involves naming performance across argument structure where verbs are embedded in the real world contexts depicted in visual picture stimuli. The involvement of argument structure in naming performance provides deeper insights into semantic and syntactic processing not only lexical retrieval and thus deeper understanding of language processing. The present study employs a structured classification and graded scoring pattern for the responses given by participants. Furthermore, unlike many previous studies that primarily focus on psychometric validation for normative data on action verbs and decline in verb performance across different age groups, the present study focuses on verb retrieval performance and change in response trends for different response types across age groups according to argument structure complexity, highlighting that decline is seen not only with aging but also with increasing argument complexity due to increased cognitive demands and processing load. The study establishes the baseline data for different age groups across the Hindi speaking population, and serves as a valuable tool for clinical assessment and research purposes due to the lack of standardized assessment tools for Action-Naming in Hindi.

Limitations of the study

Although the study provides many important insights into verb retrieval performance, there are few limitations. The results cannot be treated as normative as it is restricted to a specific dialect and cultural group. Also because the participants were not chosen through random sampling unlike normative group design which follows random sampling. Although the present study included balanced representation across clearly defined age groups, the

sample size may still limit the broader applicability of the findings. The study cannot be generalized to populations with neurological conditions, as the study was conducted only on healthy participants. The argument structure involves equal distribution of stimulus which may not reflect real world distribution .The present study, being a cross-sectional design, limits its ability to reflect true developmental changes; a longitudinal study design is more suitable to track the shift in thematic to taxonomic response typology.

Clinical implication

The study provides preliminary data for verb performance across various age groups in healthy Hindi speaking population, further assist clinicians to differentiate normal age related changes with verb performance changes in neurogenic population.The obtained findings of the present study demonstrates that verb retrieval performance is not only affected by age but also by increasing argument structure complexity which highlights the importance of assessing verb retrieval in semantic-syntactic context rather than relying only on single word verb retrieval. Results can give insights into the type of response with healthy aging and also insights into comparison across different age groups and argument structures for responses. The use of partially correct responses in older age groups with more consistency gives clinicians a picture of the dominant response pattern they can expect from normals.

Future Directions

Future study should extend the effect of age and argument structure complexity in verb retrieval performance to neurogenic population, particularly individuals with aphasia, where impact of cueing and detailed error analysis would be of prime importance. Future studies should include larger and more diverse samples to establish the normative data and improve the generalizability of findings across different populations, since the specific

sociocultural and linguistic backgrounds can have a significant impact on the responses provided by the participants.

Future studies may compare verb retrieval performance between native Hindi proficient and non-native Hindi proficient participants to examine the effect of proficiency on verb retrieval.

It is also notable that irrelevant responses are least likely to be obtained from an adult with normal cognitive function. Unlike neurotypical participants, where most of the responses are correct or partially correct, responses in aphasia are characterized by errors like semantic substitutions, verb omissions, preservations etc. The detailed analysis of these errors will help in identifying the underlying linguistic deficits. The systematic use of cueing hierarchies (phonemic, semantic and contextual cues etc.) can further help in differentiating between impaired lexical retrieval and access deficits hence will be enhancing both diagnostic accuracy and intervention planning. The cueing hierarchies can also examine the facilitated verb retrieval performance.

It is notable that argument structure complexity affects verb retrieval performance in a normal aging population. The use of argument structure (one-argument) for the neurogenic or aphasia population to improve clinical utility of the tool, will serve as an important role in understanding the subtle cognitive-linguistic deficits, particularly for mild to moderate aphasia populations. Although, One-argument structure which involves a single verb may appear comparable to single word Action-Verb Naming tests available, use of argument structure will provide additional information regarding the syntactic organization and thematic role assignment. The use of two and three- arguments can be selected based on an individual's baseline performance and severity of the disorder.

Another important variable to investigate is reaction time or response time during verb retrieval performance as a function of age and argument structure, should incorporate the objective measures such as reaction time and response latency to understand the temporal dynamics, thus differentiating between slower processing and actual retrieval deficits with more precise insights into cognitive-linguistic processing demands with verb retrieval.

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APPENDIX I

All India Institute of Speech and Hearing
(An autonomous Institute under the
Ministry of Health and Family Welfare, Govt. of India)
Center of Excellence - Assessed & Accredited by NAAC with 'A' Grade
ISO 9001:2015 Implemented Institute
Manasagangothri, Mysuru-570006

ಅಖಿಲ ಭಾರತ ವಾಕ್ ಮತ್ತು ಶ್ರವಣ ಸಂಸ್ಥೆ
ಮಾನಸಗಂಗೋತ್ರಿ, ಮೈಸೂರು-570006
अखिल भारतीय वाक् श्रवण संस्थान
मानसगंगोत्री, मैसूरु - 570 006

INSTITUTE REVIEW BOARD (IRB) APPROVAL FOR BIO-BEHAVIOURAL RESEARCH PROPOSAL INVOLVING HUMAN SUBJECTS AT AIISH

AIISH Institute Review Board (IRB)

Ref: SH/IRB/M.5/SLP.23/2025-26 **Date: 11.03.2026**

Title of the Dissertation	: Development and Validation of Action-Verb Naming Test in Hindi (AVNT-H)
Name of the Student	: Ms. Manisha Jakhar
Guide	: Dr. Abhishek BP
Co-Guide (if any)	:Dr. Brajesh Priyadarshi
Proposed Duration of the Project	: 06 months
Source of funding	: Non-funded Master's dissertation
Estimated budget	: Nil
Reference Number of the Project	: Nil
Date on which the IRB meeting was held	: 05.03.2026
A clear statement of the decision reached IRB meeting (In the event of the proposal is not APPROVED, a statement of reasons for the same must be indicated)	**: APPROVED**
Advice & suggestions (if any)	: Nil

Signature & Name of the Member Secretary-IRB
Dr. Animesh Barman
Professor of Audiology
All India Institute of Speech and Hearing, Mysore-570006

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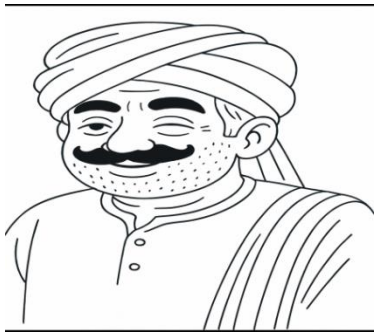
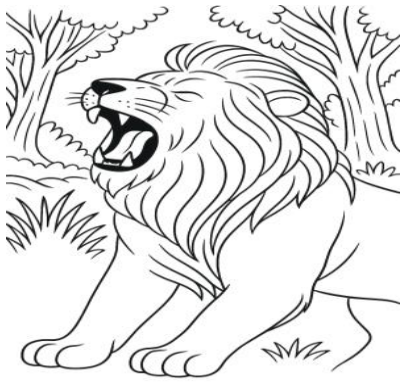
APPENDIX II

ACTION-VERB NAMING TEST-HINDI (AVNT-H)

I. TEST STIMULUS:

A. One Verb Argument

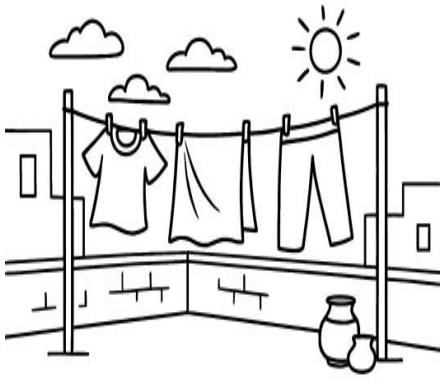
S. No	Stimulus	Target verb
1.		आदमी आंख मार रहा है। /aːd̪miː aːŋkʰ maːr rəɦaː ɦɛː/

2.		शेर दहाड़ रहा है। /ʃeːr dəˈɦaːɽ rəˈɦaː hɛ/
3.		लड़का पेड़ से गिर रहा है। /ləɽ.kaː peːɽ seː gɪr rə.haː hɛ/

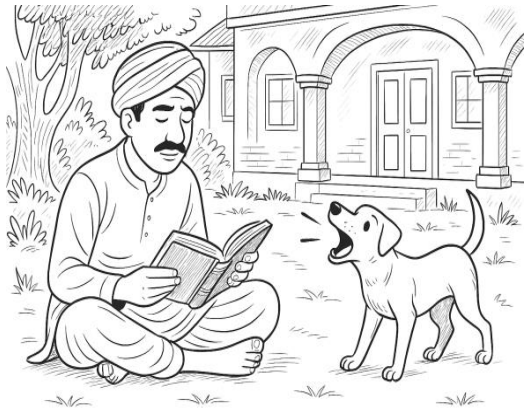
4.		अलार्म घड़ी बज रही है। /əlɑːrm gʱəɖiː bəʄ rəhiː hɛ/
5.		लड़की स्केटिंग कर रही है। /ləɽ.kiː skeː.ʈɪŋ kər rəhɪː hɛː/

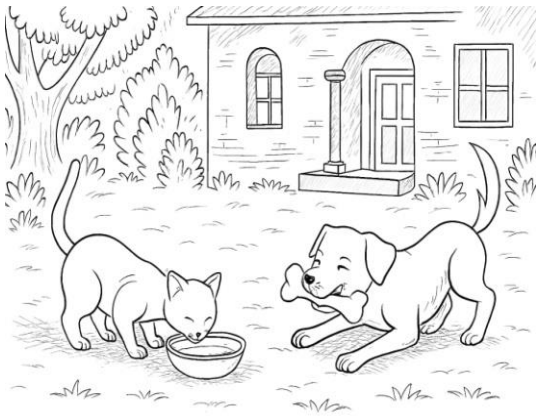
6.		पक्षी उड़ रहा है। /pəkʃi: ʊɽra: hɛ:/
7.		एक आदमी सीढ़ियाँ चढ़ रहा है। /e:ka:d̪mi: si:ɽʱijã: tʃəɽʱ rəɦa: ɦɛ/

8.		लड़की दरवाज़े की घंटी बजा रही है। / ləɽkiː ɖərʋaːze kiː gʱənʈiː bəɟaː ɾəhiː hɛ/
9.		महिला स्वेटर बुन रही है। /məˈɦiːlaː sʋeːʈər ˈbun rəˈɦiː ˈɦɛ/

10.		कपड़े धूप में सूख रहे हैं। /kəpɽeː ɖ̤ʱuːp meː suːkʰrɛː hɛ̃/

B. Two verb argument

S.No	Stimulus	Target Verb
1.		आदमी पढ़ रहा है, उसके पास कुत्ता भौंक रहा है। /ɑːɖmiː pəɽ ɾəɦaː hɛː, ʊskeː paːs kʊʈʈaː bʱõːk rəɦaː hɛː/
2.		आदमी तैर रहा है और महिला गोताखोरी कर रही है। /ɑːɖmiː ʈɛːr rəɦaː hɛː ɔːr məhilaː goːʈaːkʰoːriː kər rəɦiː hɛː/

3.		महिला लड़की के बाल संवार रही है और बेटी मोबाइल देख रही है। /məˈɦi.la ˈlɜʈ.ki keː bɑːl sə.nʊɑːr rə.ɦiːɦɛː ɔːrˈbeː.ʈiː moːˈbɑɪ.l ɖeːkʰ rə.ɦiː ɦɛː/
4.		बिल्ली दूध पी रही है ,कुत्ता हड्डी खा रहा है। /bɪl.liː duːdʰ piː rə.hiːhɛː, kʊt.tɑːɦəd.diː kʰɑː rə.hɑː hɛː/

5.		एक आदमी फर्श पोछ रहा है और एक महिला कुर्सी पर बैठी है। /ek ɑːɖ̪miː fərʃ poːtʃ rəhaː hɛː ɔːr ek məhilaː kursiː pər bəʈʰiː hɛː/
6.		महिला सेब तोड़ रही है और लड़की उन्हें टोकरी में रख रही है। /məˈɦiːlaː seːb ʈoːʈ rəˈɦiː hɛː ɔːr ləʈˈkiː ʊnˈheː ʈoːkˈriː meː rəkˈrəˈhiː hɛː/

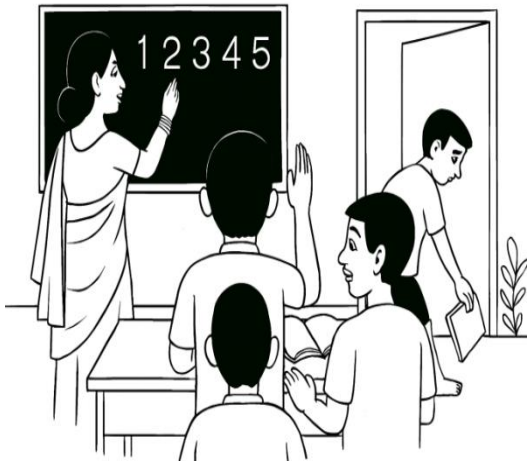
7.		महिला खाना पका रही है, और नौकरानी फर्श पर झाड़ू लगा रही है। /məɦiːlaː kʰaːnaː pəkaː rəhiː hɛː ɔːr nɔːkəraːniː fərʃ pər ʈʰaːɽuː lagaː rəhiː hɛː/
8.		दूधवाला दूध डाल रहा है और औरत पैसे निकाल रही है। /d̪uːd̪ʱʋaːlaː d̪uːd̪ʱ ɖaːl rəɦaː hɛː ɔːr ɔːrət̪ pɛːseː nɪkaːl rəɦiː hɛː/

9.		महिला बर्तन धो रही है, और गैस चूल्हे पर दूध उबल रहा है। /məˈɦiːlaː ˈbərtən d̪ʱoː rəˈɦiː hɛː, ɔːr gɛːs ʧuːlʰeː pər duːd̪ ʊbəˈl rəˈɦaː hɛː/
10.		लड़की पेड़ पर चढ़ रही है, और आदमी उसकी मदद कर रहा है। /ləɽkiː peːɽ pər ʧəɽ rəhɪː hɛː, ɔːr ɑːdmiː uskiː mədəd kər rəhɑː hɛː/

C.Three Verb Argument

S.No	Stimulus (three-argument)	Target verb
1.		महिला चाय पी रही है और कहानी की किताब पढ़ रही है, लड़की कॉपी में लिख रही है। /məɦila: tʃa:j pi: rəɦi: ɦɛ: ɔ:r kəɦa:ni: ki: kita:b pəɽʱ rəɦi: ɦɛ:, ləɽki: kɔ:pi: me: likʰ rəɦi: ɦɛ:/
2.		एक औरत नाच रही है ,दूसरी औरत गा रही है औरत तबला बजा रही है। /ek ɔ:rət na:tʃ rəɦi: hɛ:, du:sri: ɔ:rət ga: rəɦi: hɛ: ɔ:r təbˈla: bəˈdʒa: rəɦi: hɛ:/

3.		एक लड़का सीढ़ी चढ़ रहा है, दूसरा दीवार रंग रहा है, और तीसरा पेंट का डिब्बा लिए खड़ा है। /ek ɭəɽkaː siːɽʱiː tʃəɽ rəhaː hɛː, d̪usraː d̪iːʋaːr rəŋg rəhaː hɛː, ɔːr t̪iːsraː peːnʈ kaː dɻbːaː liːeː kʰəɽaː hɛː/
4.		लड़का पानी में कागज़ की नाव तैरा रहा है।लड़की छाता लेकर खड़ी है।एक बच्चा बारिश में कूद रहा है। /ləɽkaː pɑːniː meː kɑːgədʒ kiː nɑːʊ tɛːrɑː rəhɑː hɛː. ləɽkiː tʃʰɑːtɑː leːkər kʰəɽiː hɛːeːk bətʃːɑː bɑːriʃ meː kuːd rəhɑː hɛː/

5.		एक फलवाली फल काट रही है, एक ग्राहक केले पकड़े हुए है और एक बच्चा फलों की ओर इशारा कर रहा है। /ɛk pʰəlʊa:li: pʰəl ka:ʈ rəɦi: hɛ:, ˈɛk grɑ:ɦək ke:le: pəkʈe: hu:e: hɛ: ɔ:r ˈɛk bət͡ʃa: pʰəlo: ki: o:r ɪʃa:ra: kər rəɦa: hɛ:/
6.		अध्यापिका ब्लैकबोर्ड पर लिख रही हैं एक छात्र जमीन से किताब उठा रहा है, दूसरा छात्र हाथ उठा रहा है। /əɖ̪jɑ:pɪka: blɛkbo:rɖ̪ pər lɪkʰ rəhɪ: hɛ: ək tʃʰɑ:trə zəmi:n se kɪta:b uʈʰa: rəhɑ: hɛ:, ɖ̪usrə tʃʰɑ:trə hɑ:tʰ uʈʰa: rəhɑ: hɛ:/

7.		आदमी खा रहा है, महिला परोस रही है, लड़का प्लेट पकड़े हुए है। /a:d̪mi: kʰa: rəha: hɛ: məhila: pəro:s rəhi: hɛ: ləɽka: pɾe:ʈ pəkɽe: hu:e: hɛ: /
8.		बच्चे झूला झूल रहे है, फिसलपट्टी से फिसल रहे हैं, और एक-दूसरे के पीछे भाग रहे हैं। /bət͡ʃ:e: d͡ʒʱu:la: d͡ʒʱu:l rəhe: hɛ: fɪsəlpəʈʈi: se: fɪsəl rəhe: hɛ: ɔ:r e:k d̪u:sre: ke: pi:t͡ʃʰe: bʱa:g rəhe: hɛ: /

9.		किसान खेत में हल चला रहा है, बीज बो रहा है और पानी दे रहा है। /kɪsɑ:n kʰe:t me: ɦəlt͡ʃəla: rəɦa: ɦɛ:, bi:d͡ʒbo: rəɦa: ɦɛ: ɔ:r pa:ni: de: rəɦa: ɦɛ:/
10.		औरत दीये जला रही है, आदमी लड़के को मिठाई दे रहा है और लड़का पटाखे फोड़ रहा है। /ɔ:rət d̪i:je d͡ʒəla: rəhɪ: hɛ, a:d̪mi: ləɽke ko: mɪʈʰa:i: d̪e: rəhɑ: hɛ: ɔ:r ləɽka: pəʈa:kʰe: ʈʰo:ɽ rəhɑ: hɛ:/

APPENDIX III

3. a Response Form 1

Stimulus No.	RESPONSE											
	1 AGREEMENT		2 AGREEMENT				3 AGREEMENT					
	C	PC	Verb1		Verb 2		Verb 1		Verb 2		Verb 3	
			C	PC	C	PC	C	PC	C	PC	C	PC
1.												
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20.												
21.												
22.												
23.												

NOTE: C- Correct; PC-Partially correct

3.b Response Form 2 (Qualitative Analysis)

Stimulus No.	Response	Remark
1.		
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Appendix IV

DEVELOPMENT OF ACTION-VERB NAMING TEST (AVNT-H)

To the evaluator,

Myself, Ms. Manisha J, II MSc SLP student, pursuing dissertation under Dr. Abhishek B. P., Assistant Professor, Centre of Speech- Language Sciences, All India Institute of Speech & Hearing, Mysore. We are developing an Action-Verb Naming Test (AVNT-H). This study aims to develop an Action Verb Naming Test in Hindi and to examine the developed test with respect to age-related differences in verb retrieval patterns among healthy adults and elderly individuals across four age groups (18-30 years, 31-45 years, 46-60 years, and 61-70 years). This test material will aid clinicians in identifying and quantifying deficits in retrieving and producing action verbs related to specific brain areas and cognitive functions.

Given your expertise in speech and language disorders, I would greatly appreciate your input in validating this test material. This validation ensures that the tool accurately captures the intended information and effectively serves its purpose. Your insights will be crucial in refining the material for its eventual use. I have attached the stimulus material below for your review. Please review the tool and share your feedback.

Thank you very much for considering my request. Your contribution will have a significant impact on the quality of this stimulus material.

Instructions: Please rate any number between 0-3 to rate each statement across various parameters.

The parameters, operational definitions, and 3-point ratings for the questions are as follows:

Iconicity: The picture stimuli appear to be recognizable and representational (1- Hard to recognize the action; 2- somewhat resembles the intended action; 3- clearly depicts the intended action)

Appearance: Picture stimuli are appropriate in terms of dimension (1- Poor visual clarity; 2- minor ambiguities; 3- visually clear and well drawn)

Imageability: Quality of image that gives high probability of evoking a clear image in the mind of the speaker (1-not memorable; 2-somewhat distinct, partially memorable; 3-easy to recall)

Flexibility: Stimulus can be easily modified or not (1-very specific to particular context/ setting/ group; 2-some adaptability as can be understood in a few contexts, but interpretations may vary; 3-can be used in multiple contexts easily

Concreteness: How clearly and directly a picture represents real, observable action (1-picture is abstract, unclear, and hard to name without cues; 2-action is somewhat clear, may have multiple interpretations, thus requires moderate effort to name; 3-clear, specific, real-world action with no ambiguity)

Relevance: picture stimulus is culturally and ethically acceptable (1- not suitable for the target population; 2-somewhat relevant; 3-appropriate and culturally relevant)

Stimulability: Stimulus material elicits responses from the individual (1-unlikey to prompt a response or naming; 2-may evoke a response with cues; 3-readily elicits the desired response)

	Stimulus	Iconicity	Appearance	Imageability	Flexibility	Concreteness	Relevance	Stimulability	Suggestions
Single Argument									

1.	Man is winking **आदमी आंख मार रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

2.	Lion is roaring **शेर दहाड़ रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

3.	Boy is falling from tree **लड़का पेड़ से गिर रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

4.	Alarm clock is ringing **अलार्म घड़ी बज रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

5.	The girl is skating **लड़की स्केटिंग कर रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

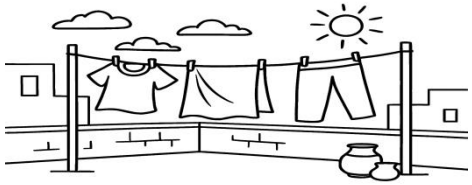
6.	Dog is Biting **कुत्ता काट रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

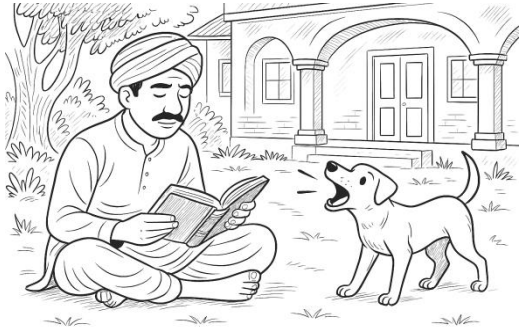
7.	A girl is wearing a watch **एक लड़की घड़ी पहन रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	
8.	Bird is flying **पक्षी उड़ रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

9.	A man is climbing stairs **एक आदमी सीढ़ियाँ चढ़ रहा है।।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

10.	Girl is ringing the door bell **लड़की दरवाज़े की घंटी बजा रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

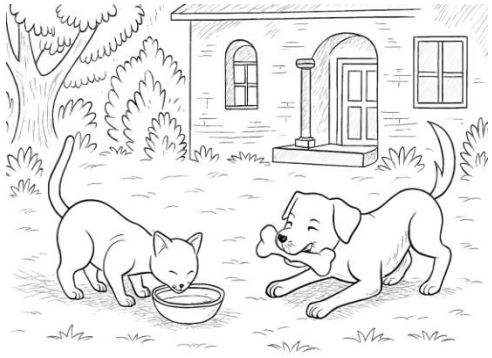
11.	The lady is knitting the sweater **महिला स्वेटर बुन रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

12.	The clothes are drying in sun **कपड़े धूप में सूख रहे हैं।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**
13.	The bird is sitting on tree **पक्षी पेड़ पर बैठा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**
Two-Argument								

14.	Man is reading, dog next to him is barking **आदमी पढ़ रहा है, उसके पास कुत्ता भौंक रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

15.	Man is swimming and the women is diving **आदमी तैर रहा है और महिला गोताखोरी कर रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

16.	Lady is combing the girls hair and daughter is watching mobile **महिला लड़की के बाल संवार रही है और बेटी मोबाइल देख रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

17.	Cat is drinking milk, dog is eating bone **बिल्ली दूध पी रही है, कुत्ता हड्डी खा रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

18.	A man is mopping the floor and a lady is sitting on a chair **एक आदमी फर्श पोछ रहा है और एक महिला कुर्सी पर बैठी है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	
19.	The boy blowing the bubbles and girl is looking at bubbles **लड़का बुलबुले बना रहा है, और लडकी उन्हें देख रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

20.	The women is plucking apple and girl is putting them in basket **महिला सेब तोड़ रही है और लड़की उन्हें कटोरी में रख रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

21.	The woman is cooking food, and the maid is cleaning the kitchen **महिला खाना पका रही है, और नौकरानी रसोई साफ़ कर रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**
22.	The man is talking on the phone, and the women next to him is cutting vegetables. **आदमी फोन पर बात कर रहा है, और उसके पास बैठी महिला सब्ज़ियां काट रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

23	The milkman is pouring milk, and the woman is taking out the money **दूधवाला दूध डाल रहा है और औरत पैसे निकाल रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	
24.	The woman is washing utensils, and milk is boiling on the gas stove **महिला बर्तन धो रही है, और गैस चूल्हे पर दूध उबल रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

25.	Girl is climbing a tree and Man is helping **लड़की पेड़ पर चढ़ रही है, और आदमी उसकी मदद कर रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**
26.	Boy is flying the kite and girl is clapping **लड़का पतंग उड़ा रहा है और लड़की ताली बजा रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

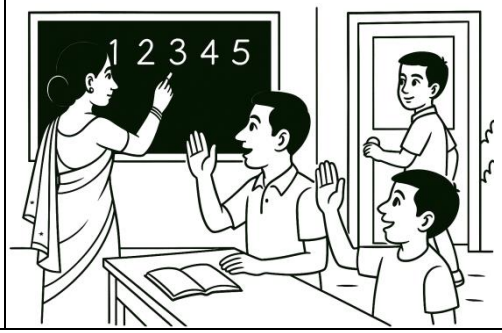
27.	Women is drinking tea and reading storybook, Girl is writing in notebook **महिला चाय पी रही है और कहानी की किताब पढ़ रही है, लड़की कॉपी में लिख रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**
Triple Argument								

28.	One women is dancing, Second women is clapping and singing **एक महिला नाच रही है, दूसरी महिला ताली बजा रही है और गा रही है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

29.	One boy is climbing the ladder, another is painting the wall, and a third is holding the paint **एक लड़का सीढ़ी चढ़ रहा है, दूसरा दीवार रंग रहा है, और तीसरा पेंट का डिब्बा पकड़ रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

30.	The boy is floating a paper boat on the water. The girl is standing with umbrella. A child is jumping in the rain **लड़का पानी में कागज़ की नाव तैरा रहा है।लड़की छाता लेकर खड़ी है।** **एक बच्चा बारिश में कूद रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

31.	A vendor is cutting fruits, a customer is holding bananas, and a child is pointing at fruits **एक फलवाला फल काट रहा है, एक ग्राहक केले पकड़े हुए है और एक बच्चा फलों की ओर इशारा कर रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

32.	Teacher is writing on blackboard, Student is closing the classroom door, Other student is raising hand **अध्यापक ब्लैकबोर्ड पर लिख रहा हैं ,एक छात्र कक्षा का दरवाज़ा बंद कर रहा है ,दूसरा छात्र हाथ उठा रहा है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

33.	Man is eating,Women is serving, Boy is holding a plate **आदमी खा रहा है, महिला परोस रही है, लड़का प्लेट पकड़े हुए है।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**

34.	Children playing on swings, slides, and chasing each other **बच्चे झूले पर खेल रहे हैं, फिसलपट्टी से फिसल रहे हैं, और एक-दूसरे के पीछे भाग रहे हैं।** 	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	**Choose an item.**	

If you have any suggestions/comments, please mention them below:

-Comments on the overall structure and organization of stimulus material

-Ideas for additional items that could enhance the stimulus's validity and usefulness

APPENDIX V

INFORMED CONSENT FORMS

4. a. Informed Consent form in English

Informed consent

I have been informed about the procedures of the study. The possible risks and benefits of my participation as a human subject in the study are clearly understood by me. I understand that I have a right to refuse participation as a subject or withdraw my consent at any time. I am also aware that by subjecting this investigation, I must give more time for assessments by the investigating team and that these assessments may not benefit me. I have the freedom to write to Chairman AEC, in case of any violation of these provisions, without the danger of my being denied any rights to secure the clinical services at this institute.

I, _____ the undersigned, give my consent to be aparticipant in this investigation/study/program.

Name and signature of Investigator (participant/caregiver):

Date:

Name and signature of Investigator (Student):

Date:

4. b. Informed Consent form in Hindi

सहमति पत्र

मुझे इस अध्ययन/शोध की पूरी प्रक्रिया के बारे में जानकारी दी गई है।मुझे यह भी समझाया गया है कि इसमें भाग लेने से मुझे क्या लाभ और क्या जोखिम हो सकते हैं।मैं समझता/समझती हूँ कि मुझे इस अध्ययन में शामिल न होने या बीच में ही अपनी सहमति वापस लेने का पूरा अधिकार है।

मुझे यह भी बताया गया है कि इस अध्ययन में भाग लेने पर मुझे जाँच करने वाली टीम को थोड़ा ज़्यादा समय देना होगा और यह जाँचें मेरे लिए सीधे तौर पर फायदेमंदन भी हो सकती हैं।

अगर मुझे लगे कि इन नियमों का पालन नहीं किया जा रहा है, तो मुझे AEC के चेयरमैन को लिखने की पूरी स्वतंत्रता है, और ऐसा करने से मुझे इस संस्थान में मिलने वाली क्लिनिकल सेवाओं से वंचित नहीं किया जाएगा।

मैं, _____, नीचे हस्ताक्षर करने वाला/वाली, अपनी इच्छा से इस अध्ययन/कार्यक्रम में भाग लेने की सहमति देता/देती हूँ।

प्रतिभागी/अभिभावक का नाम व हस्ताक्षर:

तारीख:

जांचकर्ता (छात्र) के हस्ताक्षर:

मनीषा जाखड़

तारीख: