Visual Recognition abilities in Individuals with Aphasia

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May, 2017

CERTIFICATE

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This is to certify that this dissertation entitled **“Visual Recognition abilities in Individuals with Aphasia”** is a bonafide work submitted in part fulfilment for degree of Master of Science (Speech-Language Pathology) of the student Registration Number: 15SLP024. 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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DECLARATION

This is to certify that this dissertation entitled “**Visual Recognition ability in Individuals with Aphasia** is the result of my own study under the guidance of Dr. Shyamala. K.C, Professor in Language pathology, Department of Speech Language Pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore, **Registration No. 15SLP024**

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Dedicated to Appa and Amma for their endless love, blessings and encouragement.

A special dedication to my guide Dr. Shyamala Madam without whose immense support and guidance this wouldn't have been possible.

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Chapter I

INTRODUCTION

Human information processing system is viewed as a mechanism that encodes stimuli from environment, operates on understanding of these stimuli, stores the results in memory, and allows retrieval of previously stored information (Nelson, 1998; Owens, 2005). Information processed will be in a different manner for each individuals. This is because of structural differences in individual's brains and by learned differences.

Humans process information through different modes namely: auditory, visual and tactile. The information from the environment are processed through each or combination of all these processes. Each of these mode has its own pathway and particular area in the brain where the information is processed. Based on the type of external environmental stimulus different modes of information gets activated. In certain conditions that cause damage to the brain such as CVA, trauma, tumour etc, can lead to impairment in the processing of information in any of these processes. The degree to which information processing is affected depends on the type and extent of brain damage. Such deficits may directly or indirectly affect comprehension and production of language.

Recent literature reports that individuals with acquired brain damage usually are accompanied by some form of visual processing deficits along with deficits in other processing. Fisk, Owsley, & Mennemeier (2002); Azouvi, Bartolomeo, Beis, Perennou, Diehl, & Rousseaux , (2006); Lachapelle, Bolduc-Teasdale, Ptito, & McKerral, 2008) ; Berryman, Rasavage, & Politzer, (2010); and Beaudoin, Fournier, Desrosiers, & Caron (2013) reported significant visual perception deficits and visual processing problems in individuals with brain injury. Hence, it is important to assess different modes of information processing which would in turn help in management of individuals with brain damage. To assess the cognitive-linguistic performance in individuals with brain damage, image processing play a major role. Visual image processing can be assessed through recognition task, which includes either identification or naming of an image. Hence through recognition task with help of image we can assess cognitive – linguistic performance of individuals with and without brain damage.

Recognition is the awareness of having previously experienced target item when that target item is presented (Bagozzi & Silk, 1981). Recognition requires not only a judgment about familiarity but an identification of item in the context in which an individual have encountered the item and naming it. Recognition of stimulus can be in any modes like auditory, visual, tactile etc. Recognised information gets stored in different memory based on the modes of information processed in brain. Many neuroscience studies have found that auditory processing of information is faster than visual processing whereas visual memory is superior to that of auditory memory (Cohen, Horowitz & Wolfe, 2009). Recognition of stimulus can be assessed either by identification or through naming tasks.

Naming: Naming of objects or pictures is a cognitive linguistic task which involves different stages for activating the name of the target stimulus. (Humphreys, Riddoch & Quinlan, 1988) defines naming as a hierarchical process which involves accessing to prior stored structural knowledge, semantic knowledge and phonological knowledge of objects or pictures. Naming can be either bottom up or top down process based on the familiarity of the objects or images. Brain injury can result in naming difficulty due to impairment in accessing any of these stored information Humphreys, Riddoch & Quinlan, (1988). This condition is usually noticed in individuals with aphasia. One of the main symptoms of aphasia includes naming difficulty. Hence assessing naming abilities in these individuals will in turn assess their cognitive linguistic abilities in individuals with aphasia. Hence naming abilities can be assessed using confrontation naming tasks.

In the task of image naming in neuro-typical individuals and in individuals with brain damage, factors which mainly influence naming is the type of image i.e, whether to use black and white line drawings or coloured images. There are also several other factors that influence recognition of an image, namely: image size, shape, colour, luminance, distance, angle at which image is presented etc. Early studies have found faster lexical access for colour images than line drawings (Humphreys, Riddoch & Quinlan, 1988). However several other studies recommend to use simple line drawings or iconic symbols to emphasise key points and also to avoid visual distractions which is noticed when presented with colour photographs (Kagan & LeBlanc, 2002; Pound, Parr, & Woolf, 2002).

Using these different types of stimuli, one can assess the recognition abilities of an individual by measuring reaction time and accuracy through naming task. This will assess the cognitive linguistic ability of both neuro typical individuals and also in individuals with brain damage. Many brain imaging studies have found that visual deficits are common in individuals with brain injury like persons with aphasia , TBI , RHD etc, affecting visual processing efficiency (Fisk et al., 2002;Azouvi et al., 2006; Lachapelle et al., 2008; Beaudoin et al., 2013;) and visual perception (Berryman et al., 2010) . Hence assessing their cognitive linguistic ability is quiet challenging and the type of stimulus used for assessing is also one of the major factor affecting naming. Studies have found that use of simple line drawings would reduce distraction, especially in multiple-choice displays and in turn facilitate visual processing (Heuer & Hallowell, 2009). But there are other authors who are against this view and they recommend use of context-rich photographs to support reading comprehension (Dietz, Hux, Mckelvey, Beukelman , & Weissling , 2009). However Indian studies intervening specific variables of image on image recognition is not been studied much.

Need for the study

Visual deficits are acquired in individuals with brain injury affecting visual perception and visual processing efficiency. These processing deficits have an impact on image recognition ability, when images are presented with different physical stimulus characteristics. Studies have been done to measure image recognition ability through eye tracking, eye movements, visual attention, etc by varying different physical stimulus characteristics such as colour, size, line drawings, shape, distance, angle of image orientation on different geometric shapes and on lexical categories, which involves in assessing more of cognitive domain of individuals. But only few studies have attempted to measure image recognition through naming task focusing on cognitive linguistic abilities in individuals with aphasia.

From a Speech Language Pathologists perspective, it is important to understand different physical stimulus characteristics influencing naming ability, as they involve in assessment and management of individuals with aphasia, TBI, RHD etc who have cognitive linguistic deficits. Few studies have been done on individuals with aphasia to assess their image recognition abilities by using different type of stimulus. The debate is still on-going whether to use images with black and white line drawings or colour photographs for assessment and management in individuals with aphasia. But there is a dearth of Indian studies, in investigating these findings in individuals with aphasia. This highlights the need to explore the impact of these physical image characteristics on image recognition. Hence, the present study tries to determine the influence of physical stimulus characteristics such as colour and size on image recognition which taps on cognitive linguistic ability in individuals with aphasia and in neuro typical individuals.

Aim of the study

The purpose of the study is to determine whether image recognition is influenced by physical stimulus characteristics of images in both individuals with aphasia (IA) and in neuro typical (NT) individuals.

Chapter 2

REVIEW OF LITERATURE

2.1 Human Information Processing: Human information processing is a cognitive approach which involves perception of the environmental stimulus, analyzing and interpreting these perceived stimuli and in turn storing this processed information in the memory. Perception of environmental stimulus takes place through sensory modalities such as auditory, visual, tactile etc.

a) **Auditory processing** is the process in which any acoustic information through auditory pathway reaches auditory cortex were in auditory input is encoded, processed and stored in the auditory memory later retrieved when necessary.

b) **Visual processing** is the process in which any visual information through the visual pathway reaches visual cortex were in visual input is encoded, processed and stored in the visual memory later retrieved when necessary.

c) **Tactile processing** is the process in which any tactile information through the sensory pathway reaches somatosensory cortex were in tactile input is encoded, processed and stored in the tactile memory later retrieved when necessary.

These processed information will be stored in brain in different forms of memory like visual memory, auditory memory, tactile memory etc. These stored information can be retrieved when necessary. This output of processing can be measured using recognition task or through naming tasks.

2.2 Recognition: Recognition is a cognitively derived process which involves identifying and localizing the environmental stimulus. It involves discriminating one stimulus from the other and correctly identifying the target stimulus. Any process of learning will involve recognition of stimulus from environment in different sensory modalities. Based on neurophysiological studies it is found that in human brain, majority of the sensory cortex is contributed to process visual information especially to visual images. Studies have also found that visual memory is superior to that of auditory memory (Cohen, Horowitz & Wolfe 2009). Hence visual learning or visual information processing is more effective than others.

Werner (1979) reported that recognition ability is a developmental process which emerges in the early infancy period itself. Developmental studies on recognition abilities in infants have found that newborns are more favourable to attend to any visual input similar to face which later forms the base to recognize objects. By around 3-4 months of age infants start to extract the physical characteristics of objects (such as shape, size, colour etc) around them and recognize three dimensional objects and gradually recognition of two dimensional objects, shapes, pictures develops. As they grow by around 6-9 years of age the recognition ability is more adult like. They can discriminate and correctly recognize and name all common visual inputs, objects etc. Recognition of complex visual stimulus improves as the brain matures. However recognizing and naming complex and abstract images and objects develops till adolescence and beyond (Bova, Fazzi, Giovenzana, Montomoli, Signorini, Zoppello&Lanzi (2007); Kraebel, West &Gerhardstein 2007).

2.3. Image naming in neuro-typical adults: Naming is an act of recognizing a desired item or object by retrieving the stored knowledge of physical characteristics of object or picture, semantic information and articulatory program for oral output (Laiacona, Luzzatti, Zonca, Guarnaschelli & Capitani, 2001).

Humphreys, Riddoch& Quinlan, (1988) described that brain has three main abstract representational units which helps in retrieving names of recognized objects or pictures such as stored structural description unit which contains information about physical image characteristics such as shape, size, colour etc. Next representation is semantic representation unit were in mediating of picture naming takes place through the functional and associative characteristics of object or picture. Next is the phonological description unit here it specifies the name of the picture or object. All these representations get activated while naming objects or pictures. Hence naming involves flow of information from these discrete stages in a continuous cascaded manner. Impairment in any of these levels can result in naming difficulty which is usually seen in individuals with brain damage like TBI, RHD, Aphasia patients etc.

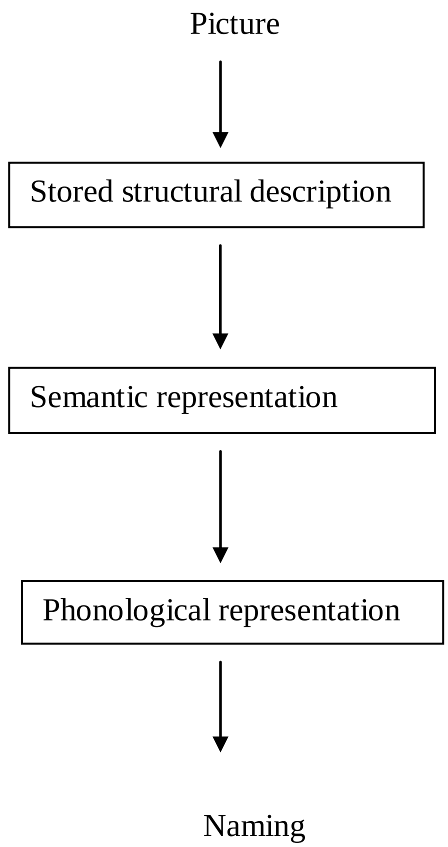


Fig 2.1 A discrete stage account of picture naming. Adapted from *"Cognitive neuropsychology,"* by *(*Humphreys, Riddoch & Quinlan, 1988).

Naming can involve activation of either bottom-up or top down or the combination of both these process. However there are many factors affecting naming. Naming abilities and speed of naming varies among each individual. As the age increases word retrieval ability or naming ability can deteriorate due to decline in the memory which can be attributed to brain morphological changes seen in normal aging process.

2.3.1.Bottom-up activation process: Bottom - up process involves feature extraction process wherein each surface features of object or pictures like colour, size, shape etc is extracted. When the naming task is involved human brain tries to do feature mapping were in brain differentiates one object or picture from the other by analyzing surface feature of the objects and recognize the object or pictures. Usually for recognizing unfamiliar or less familiar objects or pictures bottom – up process gets activated.

2.3.2. Top-down activation process: Top-down process is a user-driven attempt wherein brain directly uses prior knowledge or stored information about objects or pictures to recognize the object or pictures. Rossion & Pourtois (2004) describes top – down process as a cognitively mediated process .Top-down activation process is found to be faster than bottom up process. However, recognition of images can involve either or combination of bottom –up or top down process i.e. interactive activation process based on the familiarity of the image or object.

In the human brain around one-third of the cortex controls visual anatomy and majority of the sensory cortex is contributed to process visual information particularly to visual images (Kapoor & Ciuffreda, 2002). Hence any damage to brain due to TBI, Brain tumour, CVA, RHD etc can frequently cause visual perception and visual processing problems. Many of the studies have reported that image naming can be affected in individuals with brain damage. Commonly encountered visual impairments in these individuals include visual neglect, colour blindness, hemianopia, visual agnosia, double vision etc. (Berryman, Rasavage, &Politzer, 2010).

Also, the visual impairments in individuals with brain damage will have a severe impact on the activities of their daily living. It may have adverse effect on reading, writing, recognizing objects or pictures around them in their daily life. Hence it can be inferred that naming deficits are commonly encountered by these individuals. Naming impairment can also be solely due to impairment in retrieval of stored object or picture knowledge, lexical & phonological knowledge due to loss of language without any visual impairment. This condition is referred to as anomia, which is usually seen in individuals with aphasia secondary to CVA. Studies also reveal that individual with aphasia shows modality specific naming difficulty. Hence it is important to consider the modality and also the form in which objects are presented while assessing individuals with aphasia.

Aphasia can be defined as "the disturbance of any or all of the skills, associations and habits of spoken or written language produced by injury to certain brain areas that are specialized for these functions (Goodglass, & Kaplan, 1983). Aphasia is usually caused due to CVA. Aphasia can also be caused due to brain tumours, diffuse or focal lesions to brain. Aphasia can be broadly classified into fluent and non-fluent type of aphasia. Individuals with aphasia will have impairment in comprehension and expression of spoken and written information, naming difficulty, repetition etc. These symptoms vary based on the site of the lesion (Goodglass, & Kaplan, 1983). Naming difficulty or anomia is seen in individuals with aphasia irrespective of type of aphasia. This could be due to loss or impairment in stored knowledge of objects or pictures or due to retrieval difficulty for lexical and phonological information.(Humphreys, Riddoch& Quinlan, 1988). Hence naming abilities in individuals with aphasia can be assessed using confrontation naming task using objects or pictures.

2.4. Naming in individuals with brain damage: Many studies have been conducted to explore naming in individuals with brain damage. Riddoch & Humphreys, (2007) did a case study on a person with anomic aphasia who had difficulty in naming visually presented stimuli. Based on neurological examination he was diagnosed as having optic aphasia. Whichever object the patient could not name he was able to gesture appropriately. This shows access to knowledge of structure of objects is intact. Further when the patient was asked to discriminate between objects similar both in semantically and visually he had difficulty in naming. This indicated problem in accessing semantic knowledge of the object. Authors conclude that due to impairment in accessing semantic information from vision patient exhibited naming difficulty but he had intact stored structural knowledge of objects.

Similar case study was also reported by (Kwon & Lee, 2006) where patient who was diagnosed as having anomic aphasia due to stroke showed naming difficulty of objects when presented visually but he was able to name when presented through tactile mode. Detailed assessment revealed that patient to had optic aphasia. Hence naming deficits can be modality specific. As individuals with anomic aphasia exhibit a characteristics of naming difficulty even if they have any visual deficits it might go unnoticed. Hence it is important to assess in different modalities.

2.5. Factors affecting image naming abilities: Factors affecting naming can be broadly classified into subject related factors and stimulus related factors. Participants related factors include age, level of education, general health status, visual ability etc. Stimulus related factors include stimulus shape, colour, size, imagebility and familiarity etc.

2.5.1. Participant related factors:

a. Age: Studies on lexical naming fluency in normals have shown poorer naming fluency in older individuals than younger ones. This could be attributed decline in executive functions lexical retrieval abilities in older individuals due to aging (Benton, 1967) (Buckner, 2004) reports no such differences between younger and older individuals.

b. Education: Individuals with higher education level found to have more vocabulary than individuals with low or no education (Laine & Martin, 2006). Laws et al. (2007) found less correlation with years of education on naming performance.

c. General health status: Overall physical and psychological factors (medical health issues, depression, emotional status etc.) have an influence on naming particularly when assessing older individuals (Laine& Martin, 2006). If there is any general health issues this can lead to poor attention towards the task which can in turn affect the naming ability.

d. Visual abilities: Visual deficits such as visual neglect, hemianopia, colour blindness, visual agnosia etc has a significant adverse effect on image naming. Even though the individuals are able to name, due to visual impairments there could be modality specific naming difficulty (Riddoch& Humphreys, 2007).

2.5.2 Stimulus related factors:

a. Stimulus shape: (Bisiach 1996) reported three dimensional objects and pictures are named better than two dimensional objects due to its naturalistic representations.

b. Stimulus size: Studies on stimulus size is researched less. (Benton, Smith & Lang, 1972) reported no much of significant difference in naming small versus big images. Whereas Biederman & Cooper (1992) found difference in performance for different size of images. They also recommended stimulus size presented at 4° to 6° range would be optimal.

C. Colour : A Lot of studies have been done on effect of colour images for naming and it is found that colour helps in quicker lexical access than Black & White line drawings (Mohr, 2010).But few studies are against this view which supports line drawings are better than colour images as colour acts as a distracter while naming (Kagan& LeBlanc, 2002; Pound, Parr, & Woolf, 2002).

d. Imagebility: Imagebility is quality of the stimulus to convey the desired semantic information. More the imagebility faster the image recognition abilities (Loftus, Kaufman, Nishimoto, & Ruthruff, 1992).

e. Familiarity: Familiarity is the frequency or early visual experience to visual stimulus. Familiar the image or object faster is the recognition ability (Cuetos et al., 1999; Kremin et al., 2003)

Among these factors influencing naming abilities, one of the major factor considered to significantly influence on naming is the type of the stimulus i.e, use of colour images or black and white line drawings has a better performance on object or picture recognition.

Early reviews suggest to use black and white line drawings as it has the simplest way of depicting objects or picture. But there are also studies which are in favour of using colour images as it depicts the surface details of objects or pictures.

2.6. Colour images: Colour images are the images which are represented in different colours which help in better recognition of objects or pictures as they have richer representation in our memory. In human visual system Colour images helps to segment complex images faster and more efficiently in turn helping to recognize the object or image accurately . This phenomenon of colour helping in recognition memory is called as sensory facilitation which in turn helps in quick lexical access (Ostergaard and Davidoff 1985). Neurophysiological research provides evidence that a significant amount of visual processing is committed to the analysis of colour information. Chaparro et al. (1993) found that for humans coloured stimuli are identified 5-9 times better than the best luminance spot. Early studies on normal's and in individuals with aphasia have found that colour helps in attention, segmentation and categorization. Due to visual richness of colour studies reveals colour helps in picture recognition memory.

Humprhrey, Goodale & Jackobson (1994) conducted a study to investigate role of colour and other surface characteristics in object recognition. Individual with aphasia and age and gender matched normals were recruited for the study. Stimulus considered included actual objects, line drawings, colour images, and inappropriate colour images of both natural and manufactured items which were presented randomly. Subjects were instructed to name the presented stimulus. Results indicated better performance for normal's than individuals with aphasia. Results also indicated better performance for real objects followed by colour images than other stimulus. Naming was better for natural objects than manufactured objects. For objects with similar shapes in natural objects it was found that colour facilitated naming as natural items like fruits, vegetables etc has their own natural colours .This findings suggest that stored coloured knowledge helped to differentiate and correctly identify the natural objects . Hence, colour influences recognition memory. But colour was not found to facilitate naming for similar shaped manufactured objects as they don't they are made with different colours and they don't have any specific colours as in natural items. Hence authors conclude that colour and other surface details of objects facilitates in lexical access.

In order to compare image recognition and naming accuracy in individuals with aphasia a study was carried out in three different types of images. 9 individuals with aphasia were selected for study. They considered stimuli as 30 coloured line drawings, 30 black-and-white line drawings, and 30 black-and-white line drawings with superimposed distortions in the form of lines drawn across the picture. The results revealed that there was a significantly higher scores for coloured line drawings compared to black-and-white and distorted images. The author concluded that information about colour provides additional semantic information and help in lexical access which in turn facilitates in better image recognition whereas the distorted images inhibit image recognition (Bisiach, 1966).

In Similar lines study was conducted with the aim to determine the influence of colour in object naming. The study consisted of two groups, control group which consisted of 70 normal individuals and experimental group which consisted of 31 individuals with aphasia. Stimuli consisted of colour and black and white photographs and also high- and low-colour diagnostic common objects. Images consisted categories such as fruits and vegetables, animals and human made objects and participants were asked to name. The results revealed that both the groups named significantly faster and accurately for colour photographs than black and white objects. Between the groups, control group performed faster and accurately than compared to persons with aphasia. They also found no much of significant difference in influence of high colour diagnositicity for naming in colour or black and white photographs. The study also revealed that individuals in control group had slower naming for living things than compared to human made objects. No such difference was noticed in individuals with aphasia. The reason which author gives is that natural objects are more similar looking and hence it makes difficult to distinguish between natural objects with similar features. Hence it requires more effort on natural object recognition processes, which in turn slows down the response naming time (Mohr, 2010).

Heuer (2015) conducted a study with the aim to see the difference in object recognition of line drawings versus photographs by measuring the eye tracking ability, and difference in the eye movements for low colour diagnostic human-made objects versus high-colour diagnostic natural objects in 19 normal adults. They presented 66 multiple-choice image displays of black-and-white line drawings and colour photographs with a verbal stimulus to the participants. Target images included low-colour diagnostic human-made objects and high-colour diagnostic natural objects. Results revealed that there were greater proportions of fixation duration and first-pass gaze duration to the photographs compared to line drawings, but there was no significant differences observed for colour diagnosticity (in terms of high colour diagnosticity - natural object versus low colour diagnostisity –man-made objects) within the black-and-white line drawing or colour display (Heuer , 2015).

2.7. Black and white line drawings: Black and white line drawings are images with straight or curved black lines on a plain background without any colour . Face recognition abilities using line drawings reveals that fine grain processing of facial configurations informations are not adequately depicted in line drawings (Leder, 1996; Davies, Shepperd & Ellis, 1978). However, line drawings are used widely as they offer minimal visual representation with less distraction and iconic in nature (Cole, Sanik, Carlo, Finkelstein, Funkhouser, Rusinkiewicz & Singh, 2009) Studies have found that infants even at the age of 9 months were able to perceive line drawings (Baniani & Schmuckler 2010).

To investigate naming abilities in individuals with aphasia a study by (Smith & Lang, 1972) was carried out were in 18 individuals with anomic aphasia were recruited. Sixty six stimuli was divided into 3 different sets .each set consisted of 3D objects and same 2D representation of objects in small and big line drawings . Results indicated significant & accurate naming for 3D objects than line drawings. But within line drawings there was no significant difference for small versus big line drawings in individuals with aphasia. The results suggest that the form in which objects are presented will influence the naming accuracy in individuals with aphasia.

To check whether surface details of objects like, shape, colour etc facilitates recognition memory, recognition memory task was carried out in normal population. Study included twenty five subjects in 4thgrade , twenty one subjects in 8th grade, and twenty one college students were recruited for the study. Stimulus consisted of 48 images which was divided into 4 sets of images. Each set of images consisted of 12 images of familiar items. 4 sets of images included colour photographs, black and white photographs, line drawings and one word label of the items .All these stimulus were randomly presented with distracters. Each stimulus were presented to participants for around 10 sec and after 8th week the same stimulus was presented to all participants. Task of the participants was to discriminate between presented stimulus from the distracter which was previously presented. Results revealed that subjects performed better for black and white photographs. However the study did not find any facilitation of colour for picture recognition memory (Anglin & Levie,1985).

Early study was attempted to test the hypothesis whether colour has advantage over line drawings and also to check lexical accessing memory for colour photographs. The study consisted of 58 images which was divided into equal half's of colour photographs and line drawings. Four image of natural objects and remaining images were of man-made objects were included in the study. Study was carried on neuro-typical individuals .There were two experiments one was on naming and the other task was verification. Task of the subject was to name the images in first experiment and in verification task they had to verify whether the objects name by pressing yes or no on micro switch. Overall reaction time and percentage of error rates were calculated for both the images. The results revealed that there was no significant difference for naming colour versus line drawings. Line drawings were identified as quickly and accurately as colour photographs. It was also found that colour was diagnostic only for images like banana , fish, frock etc, but for other images like pen, chair etc colour was not found to be diagnostic in image recognition. Authors conclude that naming of images involves matching of edge –based representation of images with the stored structural knowledge. This edge-based representations are sufficient for retrieving the names of objects. (Biederman and Ju, 1988).

In similar lines study was conducted to see if there is any difference in performance between of colour and black and white line drawings on normal individuals. Stimulus consisted of living and non-living objects in both colour and black and white line drawings. Participants had to classify objects into living and non-living objects. The results indicated that there was no significant differences for performance between colour and black and white line drawings. And also colour did not help in categorizing objects into living and non-living (Davidoff &Ostergaard1988).

To investigate the speed and accuracy with which individuals with and without aphasia derive main action, background, and inferential information from high-context images. Twenty people with and twenty people without neurological impairment were considered for the study. High-context images were used as the stimulus and participants were asked to match with spoken sentences conveying main action, background, or inferential information for one out of four images. They measured accuracy and speed and compared between participant groups and among the three stimulus sentence conditions. Results revealed that participants with aphasia took about twice as long to respond on average as participants without aphasia. They found that participants with aphasia were significantly less accurate and slower when selecting high-context images to match sentences relaying background and inferential information than ones relaying main action information. Whereas significant decrease in accuracy only for inferential sentences and significantly different response speeds among all sentence conditions were found for participants without aphasia indicating need to provide processing time when interacting with persons with aphasia. (Wallace, Hux, Brown & Porter , 2014).

Indian Studies

Sunil Kumar et al, (2010) had conducted Action Naming Test on ten bilingual aphasics and ten age and gender matched normal bilinguals were recruited for the study. The participants had Kannada (L1) as the first language and English (L2) was the second language. To explore the nature of action naming deficits, reaction time for action naming stimuli using DMDX software was measured. Results indicated normals performed individuals with aphasia. However in normal individuals there was no significant difference found for reaction time measures between L1 and L2 whereas, there was significant difference between the reaction time for L1 and L2 in individuals with aphasia.

Abhishek &Prema (2014) investigated the naming abilities among different types of aphasia who were bilinguals. 18 Kannada-English bilingual aphasics between the age range of 25 to 75 years were recruited for the study. Out of the 18 participants with aphasia, 7 were broca's aphasia, 7 were anomic aphasia and 4 other types (2 wernicke's aphasia, 1conduction aphasia and 1 transcortical motor aphasia). Action Naming Test was administered as one of the tests. Findings reveals persons with anomic aphasia performed better compared to those with other types of aphasia, followed by persons with broca's aphasia. Performance was better in Kannada compared to English.

All these studies are highlighting that there is an influence of surface features of objects or images on naming abilities. Though many researches support the use of colour images in both normal's and in individuals with aphasia, the results are still not conclusive. There are Indian studies done on assessing naming abilities in individuals with aphasia. But Indian studies specifically intervening physical stimulus characteristics of objects or images such as colour size, shape etc has not been carried out. Hence all these findings suggest that there is dearth in Indian studies in investigating stimulus characteristics on naming in individual with aphasia. This necessitates need for carrying out the present study.

Chapter 3

METHOD

Recognition is the awareness of having previously experienced target item when that target item is presented. Type of the stimulus used is one of the factor affecting recognition skills both in neuro-typical and in individuals with aphasia. Hence the present study is taken up with the aim to determine whether image recognition is influenced by physical stimulus characteristics of images in both individuals with aphasia and in neuro typical individuals.

Objectives of the study:

To compare the performance between individuals with aphasia and neuro typical individuals for image recognition through naming task when variability is induced in terms of

- Black and white line drawings and coloured photographs
- Size i.e. small versus big images.

Participants:

The study was carried out in 2 groups, group I consisted of ten individuals with mild form of aphasia and group II consisted of thirty individuals with neuro typical individuals. Participants in group I included subjects in the age range of 25 – 67years. Participants considered for the study were administered a standardized test in Kannada named Western Aphasia Battery (WAB) (Shyamala, Vijaya, Shree & Ravikumar, 2001) for the diagnosis of mild form of aphasia (Anomic aphasia, Conduction aphasia, Transcortical Sensory aphasia). WAB is sensitive enough to distinguish normal controls from subjects with Aphasia. Group II included thirty neuro typical individuals in the age range of 25 – 65 years. Both the group consisted participants who are native speaker of Kannada. Informed consent was taken from all the participants.

Inclusion criteria

Group 1:

- Participants who are diagnosed as having any mild form of aphasia by a Speech Language Pathologist based on scores obtained from Western Aphasia Battery (Shyamala, Vijaya, Shree, & Ravikumar, 2001) and also by verifying these individuals who are diagnosed medically as aphasic were considered for the study.
- Participants with normal or corrected vision and normal hearing was considered and also, informal visual and hearing screening was done to rule out visual neglect, colour blindness and hearing loss .
- Participants with intact auditory sentence comprehension for understanding instructions.

Group 2:

- Participants with normal speech & language skills were considered for the study
- Participants with normal or corrected vision and normal hearing were considered.

Exclusion criteria

Group 1:

- Participants with poor expressive speech were excluded from the study.

- Participants with severe naming difficulty were excluded.
- Participants with visual deficits such as colour blindness and visual neglect were excluded from the study.

Group 2:

- Participants with history of brain damage were excluded from the study.

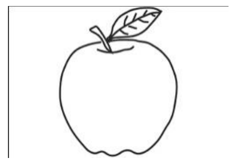
Table 1   Demographic details of the participants in Group 1

Participants	Age/Gender	Diagnosis
1	67 years / Male	Conduction aphasia
2	33 years/Male	Transcortical sensory aphasia
3	30 years/Male	Brocas aphasia
4	51 years/ Male	Anomic Aphasia
5	25 years/Female	Conduction Aphasia
6	39 years/ Male	Anomic Aphasia
7	40 years/ Male	Conduction Aphasia
8	64 years/Male	Conduction Aphasia
9	44 years/ Female	Anomic Aphasia
10	53 years/ Male	Anomic Aphasia

Stimulus: Present study consists of two variables, colour and size. Hence the study was carried out in two subtasks.

Task I: Test stimuli consist of images of different lexical categories such as fruits, animals, vegetables, common objects and vehicles. Total of sixty images was considered which was divided into 2 sets, one set of image consists of thirty black and white line drawings and another set consists of same thirty colour Images These images will be randomly presented. All the images had the dimension (432 x 288 pixels) with the resolution of 28.346 pixels/centimeter.

Example for task I



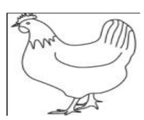
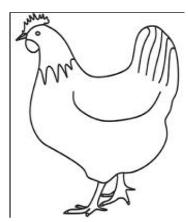
Colour Image of apple   Line drawing of apple

Task II: Task II consisted images of different lexical categories such as fruits, animals, vegetables, common objects and vehicles. It included sixty images which was divided into two sets of image , one set consisted of thirty colour images which included fifteen small colour images and same fifteen big colour images. On the other hand another set consisted of thirty different line drawings which included fifteen small black and white line drawings and same fifteen big line drawings. These images will be randomly presented. All small images had the dimension of (144 x 144 Pixels) and all big images had the dimension of (360 x 360 pixels) and all image had resolution of 28.346 Pixels/Centimeter.

Example for task II

Tomato: Small color Tomato: Big color

Hen: Small Line drawing Hen: Big Line drawing

Instrumentation:

In both tasks all colour images were downloaded from Google images and for line drawings a software called CorelDraw x8 Version 18.1.0.661 was used to trace the colour images and create a line drawings of the same colour images. CorelDraw x8 is a vector graphics editor used to edit two- dimensional images. Further images were resized according to the task specifications using Adobe Photoshop CS6 Extended version which is a raster graphic editor software. All the images were saved in JPG format.

The images were programmed in HP laptop of screen width 15.6 inches using DMDX software a windows based freely downloadable software which was used for visual presentation of images and programmed for recording vocal response of participants which was saved in VLC file. Stimulus was programmed in such a way that each stimulus was presented for 8000ms and inter-stimuli interval was programmed for 3000ms in both the task. A software called Check vocal which is inbuilt in DMDX was used to measure the reaction time and accuracy of verbal responses of the participants.

Procedure:

Testing was carried out in a quiet room with minimal noise and visual distraction. Participants were made to sit in the chair comfortably. During the initial stages rapport was built by engaging participants with general conversation which also helped to rule out hearing loss and auditory comprehension deficits. This was followed by informal screening for visual deficits like colour blindness and visual neglect. For testing colour blindness colour identification and accuracy colour perception was carried out. In Colour Identification task , examiner placed multicolor set of crayons in the visual field of participants and participants were asked to pick a particular crayon as said by the examiner and give it to examiner. For testing Accuracy of Colour Perception examiner used different sets of coloured flashcards wherein each set had four same coloured flashcards. These flashcards were jumbled and placed on table in the visual field of participants and they were asked to sort different flashcards into set of same coloured flashcards. These tests were modified and informally carried out for the convenience of the present study which was taken from "Colouring of Picture Test"(DeRenezi , Spinnler, Scotti and Fagloini 1972) . In both colour tests common colours such as red, yellow, green, blue, black, orange, white and brown colours were used. To check for visual neglect participants were asked to close one eye and then visual stimulus was presented (common objects like pen, book etc) and participants were asked to name them, same thing was carried out by closing other eye. Any participants who could not do the activity correctly were excluded from the study. After screening for vision and hearing deficits the test was carried out. Participants were made to sit comfortably on the chair and they were instructed to verbally name the presented stimulus. Stimulus was presented using at a distance of 30cm through HP laptop with the width of 15.6 inches using DMDX software. The verbal response of participants was recorded using microphone which is inbuilt in the laptop and these responses for each stimulus were saved in VLC files. Initially task I was presented i.e. naming of black and white line drawings and colour photographs followed by task II i.e. naming small and big images of both colour and line drawing. Initially for two participants in group I phonemic cueing was given after 3000ms when they were not able to name but it was found that this was helping them to facilitate in naming other set of images , as this would act as a variable and affect the performance of task phonemic cueing was not given for other participants. Check vocal software was used to analyze verbal response to measure reaction time and accuracy on naming of participants.

Scoring and Analysis:

Score of '1'was given for correct naming and score of '0' for incorrect or no response in both task. The verbal responses of participants were analyzed using Check vocal software to calculate reaction time and accuracy. Incorrect response were indicated by '–'ve reaction time values. For analyses only +ve reaction time values i.e. reaction time and accuracy of only correct responses were considered. Analyzed data were tabulated and subjected for appropriate statistical analysis using SPSS software version 21.0.

The data was subjected to following statistical procedures:

- Descriptive statistics to compute mean, median and standard deviation
- Parametric tests such as mixed ANOVA , independent sample test and paired sample test
- Non-parametric tests such as Mann Whitney test and Wilcoxon signed rank test.

Chapter 4

RESULTS AND DISCUSSION

The aim of the study was to investigate if image recognition is influenced by physical stimulus characteristics of images in both individuals with aphasia (IA) and in neuro-typical (NT) individuals. Two tasks were considered for the study. Task I included naming black and white line drawings and colour images and task II included naming small colour images and big colour images and naming small line drawings versus big line drawings in individuals with aphasia (IA) and in neuro-typical (NT) individuals. Total of forty participants were recruited for the study and they were divided into two groups. Group I consisted of ten participants with mild forms of aphasia in the age range of 25-67 years included both males and females. Group II consisted of thirty neuro-typical (NT) individuals in the age range of 25-67 years included both males and females. Reaction time (RT in ms) and accuracy (in percentage) measures obtained from both tasks were tabulated and statistically analyzed using Statistical Package for Social Sciences (SPSS) software version 21.0. The data was subjected to test of normality by using Shapiro Wilk's test. Based on the results obtained appropriate statistical tests such as parametric or non-parametric tests were selected for analyzing the data.

Objectives of the study

To compare the performance of individuals with aphasia (IA) and neuro-typical (NT) individuals and for image recognition through naming task when variability is induced in terms of:

- Black and white line drawings and colour images

- Size i.e., small versus big images.

The results of the present study are discussed under the following headings;

Objective I:

To compare the reaction time and accuracy measures between colour versus line drawings in both individuals with aphasia (IA) and neuro-typical (NT) individuals and

a. Comparing between groups for colour images versus black and white line drawings
b. Comparing colour images versus black and white line drawings in individuals with aphasia (IA)
c. Comparing colour images versus black and white line drawings in neuro-typical (NT) individuals.

Objective 2:

To compare the reaction time and accuracy measures between small and big images in both individuals with aphasia (IA) and .neuro-typical (NT) individuals and

a. Comparing between groups for small versus big colour images
b. Comparing small versus big colour images in individuals with aphasia (IA).
c. Comparing small versus big colour images in neuro-typical (NT) individuals.
d. Comparing between groups for small versus big black and white line drawings.
e. Comparing small versus big black and white line drawings in individuals with aphasia (IA).
f. Comparing small versus big black and white line drawings in neuro-typical (NT) individuals.

For statistical analysis, SPSS (Statistical Package for the Social Sciences) – Version 21.0 software was used. Shapiro-wilk's test of Normality was conducted to check the normality of data. For data which satisfied the normality condition parametric tests was carried out and for data which did not satisfy normality condition non-parametric test was carried out. Descriptive statistics, parametric and non-parametric tests were used to derive statistical values. Descriptive statistics was employed to calculate the mean and standard deviations of the reaction time (RT in ms) and accuracy measures. The normality was observed for the reaction time (RT in ms) measures for participants in both task I and task II hence parametric tests such as Mixed ANOVA, independent two sample t- test, and paired sample t-test were used to analyze the data. However, for accuracy measures normality was not observed. Hence non-parametric tests were carried out for accuracy measures. Non-parametric test – Mann-Whitney U Test was carried out to see the significant difference between neuro-typical individuals and in individuals with aphasia for both tasks. Non-parametric test – Wilcoxon Signed Ranks Test was employed to verify if there was any the significant difference between colour versus line drawing in task I and small versus big images of both colour and line drawings in task II.

Objective I:

To compare the reaction time and accuracy measures between colour versus line drawings in both Individuals with aphasia (IA) and neuro-typical individuals (NT)

The mean and standard deviation scores of Group I and Group II on reaction time (RT in ms) measures for colour versus line drawings in task I were calculated. Details are depicted in Table 4.1 and figure 4.1

Table 4.1

Mean and SD for reaction time in Group I (n=10) and Group II (n=30) for task I

Reaction Time in ms				
	Group I IA		Group II NT	
Stimulus	**Mean**	**SD**	**Mean**	**SD**
CRTT1	2140.89	526.70	1424.39	328.27
LDRTT1	2193.69	461.44	1515.98	351.20

Note: CRTT1= Colour images reaction time task 1, LDRTT1= Line drawing reaction time task 1

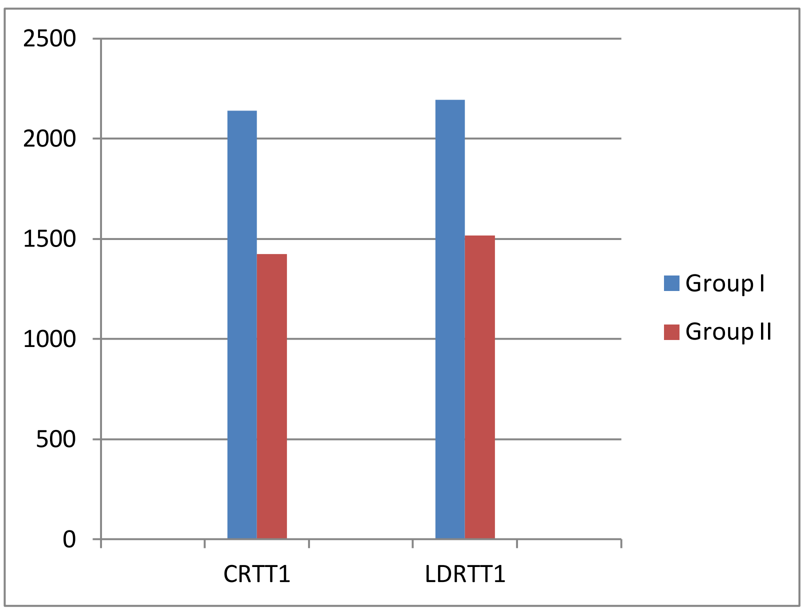


Figure 4.1. Mean scores of reaction time in Group I (n=10) and Group II (n=30) for task I

As depicted in Table 4.1 the mean reaction time taken by the group II for naming colour images and black and white line drawings was lesser than that of group I. Within both group I and group II, it can be observed that the mean reaction time scores for naming of colour images is lesser compared to naming of black and white line drawings.

The mean, standard deviation and median scores in both groups for accuracy measures in both tasks were calculated. Details are depicted in Table 4.2

Table 4.2

Overall Mean, SD and Median for accuracy in Group I (n=10) and Group II (n=30) for both the tasks.

Accuracy scores in %						
	Group I (IA)			Group II (NT)		
Stimulus	**Mean**	**SD**	**Median**	**Mean**	**SD**	**Median**
CAT1	84.97	13.33	88.30	97.54	4.71	100.00
LDAT1	77.97	17.07	81.65	91.85	7.45	93.30
SCAT2	70.62	16.97	69.95	91.52	7.22	93.30
BCAT2	72.63	15.52	73.30	92.86	9.10	93.30
SLDAT2	72.64	16.16	80.00	86.63	10.50	86.60
BLDAT2	76.62	11.43	76.65	87.97	10.11	93.30

Note: CAT1= Colour images accuracy task 1, LDRTT1= Line drawing accuracy task I, SCAT2= Small colour accuracy task 2, BCAT2= Big colour accuracy task 2,SLDAT2= Small line drawings accuracy task2, BLDAT2 = Big Line drawing accuracy task 2.

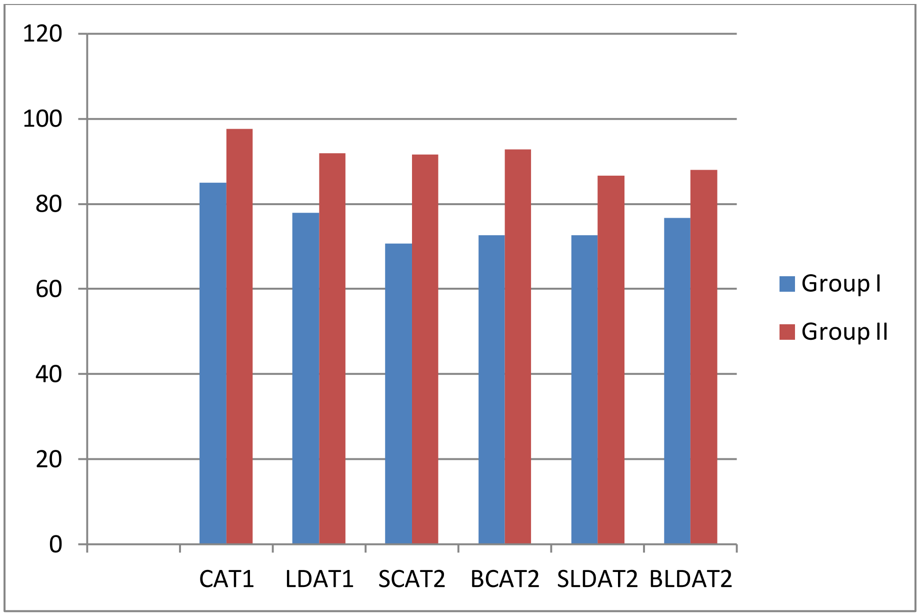


Figure 4.2.Mean scores of accuracy measures in Group I (n=10) and Group II (n=30) for both the task.

As depicted in Table 4.2 and Figure 4.2 in task I the mean accuracy scores of group II for both naming colour images and black and white line drawings was higher than that of group I. However, within both group I and group II, it can be observed that the mean accuracy scores for naming colour images is higher compared to naming of line drawings.

From table 4.2 and Figure 4.2 it is evident that in task II, the mean accuracy scores of group II for naming small and big colour images was higher than that of group I. Within both group I and group II, it can be observed that the mean accuracy scores for naming of big colour images was higher compared to naming of small colour images. Similar pattern was also seen for line drawings also. The mean accuracy scores taken by the group II for naming small and big line drawings was higher than that of group I.

Within both group I and group II, it was observed that the mean accuracy scores for naming of big line drawings was higher compared to naming of small line drawings.

Table 4.3

Results of Mixed ANOVA

Source	df	F	Sig.
Stimuli	1	7.879	.008*
stimuli * Groups	1	.569	.455

Note: (indicates significance at p<0.05level)*

Table 4.4

Results of Mixed ANOVA

Source	df	F	Sig.
Groups*	1	25.795	.000*

Note: (indicates significance at p<0.05level)*

Further, for reaction time measures Mixed ANOVA was carried out to see the main effect of group (neuro-typical individuals versus individual with aphasia), type of the stimulus (Colour versus Line drawings) and interaction effect between groups (neuro-typical individuals versus aphasia) and type of the stimulus (Colour images versus black and white Line drawings).The results revealed there was a significant main effect of group i.e. [F(1, 38) = 25.795, $p<0.01$] for type of stimuli i.e. [F(1, 38) = 7.879,

p<0.01] but there was no significant difference for interaction effect [F(1, 38) = .569, p = .455] as depicted in the Table 4.4.and 4.3.

a. **Comparing between groups for colour images versus black and white line drawings**

Table 4.5

Results of Independent Sample Test to check for reaction time between groups.

Stimulus	t	df	Sig.
CRTT1	-5.101	38	.000*
LDRTT1	-4.881	38	.000*

*Note: CRTT1= Colour images reaction time task 1, LDRTT1= Line drawing reaction time task *indicates significance of p<0.05level.*

Similarly on comparing mean reaction time measures between groups it was found that (NT) individuals had lesser mean (RT) for naming colour images (Mean = 1424.39) and black and white line drawings (Mean = 1515.98) compared to (IA) for colour images (Mean= 2140.89) and line drawings (Mean= 2193.68). Further to check for the significance between groups for reaction time measures i.e. in individuals with aphasia (IA) and neuro-typical (NT) individuals Independent two sample t-test was carried out and the results revealed that there was a significant difference between groups for both colour images, CRTT1 [t(38) = -5.101, $p < 0.01$] and line drawings, LDRTT1 [t(38) = -4.881, $p < 0.01$] as depicted in table 4.5. Lesser the reaction time taken , better is the performance. Hence by comparing mean values and statistical significance values it is evident that group II (NT) performed better than group I (IA).

Likewise on comparing mean accuracy measures between groups it was found that (NT) individuals had higher mean (RT) for naming colour images (Mean = 97.54) and line drawings (Mean = 91.85) compared to (IA) for colour images (Mean= 84.97) and line drawings (Mean= 77.97). To check for the significance between groups for accuracy measures i.e., between Individuals with aphasia (IA) and in neuro-typical (NT) individuals Mann-Whitney U test was administered. The results revealed that there was a significant difference between groups for both CAT1 $|Z| = 3.433$, $p<0.01$ and LDAT1 $|Z|= 2.459$, $p<0.05$. Hence by comparing mean accuracy values and statistical significance values it is evident that group II (NT) has performed better than group I (IA).

To summate neuro-typical (NT) individuals performed better than individuals with aphasia (IA) in terms of reaction time (RT in ms) and there was a statistically significant difference ($p<0.01$). Neuro-typical (NT) individuals performed better than individuals with aphasia (IA) even when the accuracy measures as there was a significant difference of ($p<0.05$) for both colour images and black and white line drawings in task I.

b. **Comparing colour images versus black and white line drawings in individuals with aphasia (IA).**

Table 4.6

Results of Paired sample Test for reaction time measures between stimulus for GroupI

		t	df	Sig. (2-tailed)
Pair1	**CRTT1 - LDRTT1**	-1.080	9	.308

Note: CRTT1= Colour images reaction time task 1, LDRTT1= Line drawing reaction time task 1

In Similar lines, on comparing mean reaction time measures between stimulus it was found that (IA) had lesser mean (RT) for naming colour images (Mean = 2140.89) compared to line drawings (Mean = 2193.69). Further to check for the significance between stimulus for reaction time measures Paired sample test was carried out and the results revealed that there was no significant difference between colour images and black and white line drawings, CRTT1 - LDRTT1 [t(9) = -1.080, p = .308] as depicted in table 4.6 .Though the reaction time measures showed better performance for colour images than line drawings in individuals with aphasia (IA) the results was not statistically significant.

Likewise on comparing mean accuracy scores between stimulus it was found that (IA) had higher accuracy scores for naming colour images (Mean = 84.97) than that of line drawings (Mean = 77.97). Further Wilcoxon Signed Ranks Test was carried out to see the significance between accuracy measures between stimulus in individuals with aphasia (IA).The results revealed that there was a significant difference for accuracy measures between colour images versus line drawings , LDAT1-CAT1 |Z|= 2.492, $p<0.05$.

In summary for (IA), statistically significant difference was seen only for accuracy measures between colour images and black and white line drawings ($p<0.05$).Whereas statistically significant difference was not seen for reaction time (RT in ms) measures between colour images and line drawings in (IA) ($p>0.05$).

c. **Comparing colour images versus line drawings in neuro-typical (NT) individuals.**

Table 4.7

*Results of Paired Sample Test for reaction time measures between stimulus in Grou*pI

		t	**df**	**Sig. (2-tailed)**
Pair1	**CRTT1 - LDRTT1**	-3.679	29	.001*

*Note: CRTT1= Colour images reaction time task 1, LDRTT1= Line drawing reaction time task I *indicates significance of p<0.05level.*

In similar lines comparing mean reaction time measures between stimulus it was found that (NT) individuals had lesser mean (RT) for naming colour images (Mean = 1424.39) compared to line drawings (Mean = 1515.98) . Further to check for the significance between stimulus for reaction time measures Paired sample t test was carried out. The results revealed that there was a significant difference between colour images and line drawings CRTT1 - LDRTT1 [t(29) = -3.679, p<0.01] as depicted in table 4.7. Lesser the reaction time taken, better the performance.

On comparing mean accuracy scores between stimulus it was found that neuro-typical (NT) individuals had higher accuracy scores for naming colour images (Mean = 97.54) than that of line drawings (Mean = 91.85) . Further Wilcoxon Signed Ranks Test was carried out to see the significance between stimulus for accuracy measures. The results revealed that there was a significant difference for accuracy measures between colour images versus line drawings ,LDAT1-CAT1 |Z|= 4.370, p<0.01 in (NT) individuals.

To summate for (NT) individuals statistically significant difference was seen between colour images and line drawings on both reaction time and accuracy measures. Overall in task I neuro-typical (NT) individuals naming performance was significantly better than individuals with aphasia (IA) in both reaction time and accuracy measures. Among individuals with aphasia (IA) accuracy measures was statistically significant between colour images and black and white line drawings .Whereas reaction time measures were not statistically significant between colour images and black and white line drawings in (IA). However, overall naming abilities were better and more accurate for colour images in (IA). And in neuro-typical (NT) individuals naming abilities was significantly better for colour images and black and white line drawings in both reaction time and accuracy measures.

It was also observed that inaccurate responses were more for structurally similar images in naturally coloured items in both (IA) and in (NT) individuals. Eg (Carrot for Radish, Horse for Donkey , Raw banana for Banana etc). In these conditions colour facilitated accurate naming. All these findings suggest that colour enhances faster retrieving of words for naming task than black and white line drawings and colour is an intrinsic feature for accurate naming, especially for structurally similar objects or pictures.

These findings are in consensus with the Humprhrey, Goodale & Jackobson's (1994) study who found that naming abilities in normals were significantly better than individuals with aphasia. They also found normal's performed better than individuals with aphasia for naming for colour images than that of line drawings. And authors reported colour facilitated naming structurally similar natural objects.

Similar findings were obtained by Mohr, 2010 wherein he also found that better naming abilities for colour photographs than line drawings in both normals and in individuals with aphasia. And also normals performed better than individuals with aphasia. He concludes saying that colour is a prime factor for naming livings things as each living things are recognized mainly by their intricate colour.

Objective II:

To compare the reaction time and accuracy measures between small and big images in both individuals with aphasia (IA) and neuro-typical (NT) and individuals and

The mean and standard deviation scores of Group I and Group II on reaction time (RT in ms) measures between small and big colour images were calculated. Details are depicted in Table 4.8

Table 4.8

Mean and SD for reaction time in Group I (n=10) and Group II (n=30) for task II

Reaction Time (RT in ms)				
	Group I (IA)		**Group II (NT)**	
Stimulus	**Mean**	**SD**	**Mean**	**SD**
SCRTT2	2453.53	671.74	1728.31	387.35
BCRTT2	2370.49	575.62	1616.39	377.47

Note: SCRTT2= Small colour images reaction time task2, BCRTT2= Big colour images reaction time task 2.

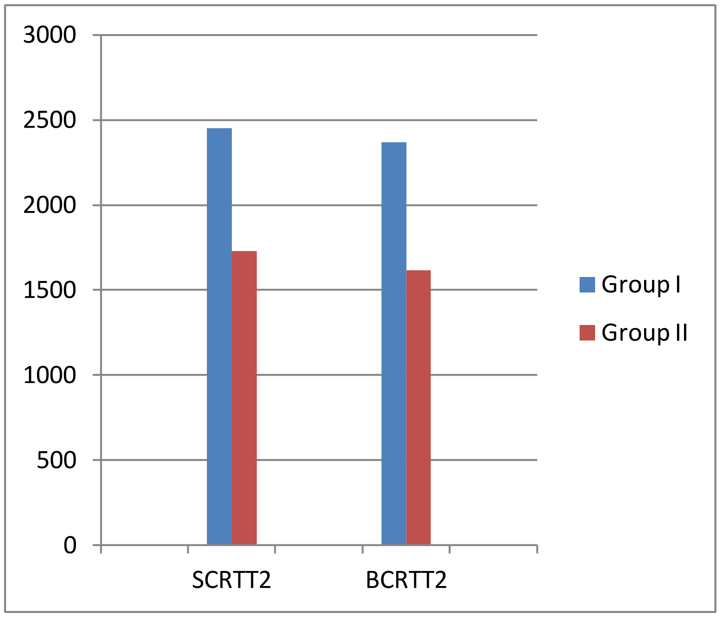


Figure 4.8. Mean scores for reaction time in Group I (n=10) and Group II (n=30) for task II

As depicted in Table 4.8 and Figure 4.8 the mean reaction time taken by the group II for naming small and big colour images was lesser than that of group I. Within both group I and group II, it can be observed that the mean reaction time scores for naming of big colour images were lesser than that of small colour images.

Table 4.9

Results of Mixed ANOVA

Source	df	F	Sig.
Sizes	1	4.033	.052*
Sizes*Groups	1	.089	.002*

*Note: (*indicates significance p<0.05level)*

Table 4.10

Results of Mixed ANOVA

Source	df	F	Sig.
Groups	1	21.986	.000*

*Note: (*indicates significance $p<0.05$level)*

Mixed ANOVA was done to verify the main effect of group (neuro-typical individuals versus individuals with aphasia), type of the stimulus (small versus big images) and interaction between groups (neuro-typical individuals versus individuals with aphasia) and type of the stimulus (small versus big images).The results revealed there was a significant main effect of group i.e. [F(1, 38) = 21.986, $p<0.01$] and also for type of stimulus i.e. [F(1, 38) = 4.033, $p<0.05$]interaction effect showed a significant difference [F(1, 38) = .089, $p<0.01$] as depicted in the Table 4.10 and 4.9.

a. Comparing between groups for small versus big colour images

Table 4.11

Results of Independent sample test for reaction time between groups in task II

	t	df	Sig. (2-tailed)
SCRTT2	-4.221	38	.000*
BCRTT2	-4.773	38	.000*

*Note: SCRTT2= Small colour images reaction time task2, BCRTT2= Big colour images reaction time task 2.*indicates significance of $p<0.05$level.*

Similarly on comparing mean reaction time measures between groups it was found that (NT) individuals had lesser mean (RT) for naming big colour images (Mean = 1616.39) and small colour images (Mean = 1728.31) compared to (IA) for big colour images (Mean= 2370.49) and small colour images (Mean= 2453.53). Further to check for the significance between groups for reaction time measures i.e. in individuals with aphasia (IA) and in neuro-typical (NT) individuals Independent two sample t-test was carried out and the results revealed that there was a significant difference between group for both small colour images, SCRTT2 [$t(38) = -4.221$, $p < 0.01$] and big colour images, BCRTT2 [$t(38) = -4.773$, $p < 0.01$] as depicted in table 4.11. Lesser the reaction time taken better is the performance. Hence based on mean reaction time measures and statistical measures it is evident that group II (NT) has performed better than group I (IA).

Likewise on comparing the mean accuracy measures between groups it was found that (NT) individuals had higher mean accuracy scores for naming big colour images (Mean = 92.86) and small colour images (Mean = 91.52) compared to (IA) for big colour images (Mean= 72.63) and small colour images (Mean= 70.62). The results revealed that there was a significant difference between groups for both small and big colour images, i.e., SCAT2 $|Z| = 3.582$, $p<0.01$, SBAT2 $|Z| = 3.782$, $p<0.01$. Hence by comparing mean accuracy values and statistical significance values it is evident that group II (NT) has performed better than group I (IA).

To summate neuro-typical (NT) individuals performed better than individuals with aphasia (IA) in terms of reaction time (RT in ms) and also there was a statistically significant difference (p<0.01). In terms of accuracy measures neuro-typical (NT) individuals performed better than individuals with aphasia (IA) and there was a significant difference of p<0.01 for both small versus big colour images in task II.

b. Comparing small versus big colour images in individuals with aphasia (IA).

Table 4.12

Results of P*aired- sample test in Grou*p *I for task II*

	t	df	Sig. (2-tailed)
SCRTT2-BCRTT2	0.771	9	0.460

Note: SCRTT2=Small colour images reaction time task1,BCRTT2 =Big colour images reaction time task 2.

In Similar lines, on comparing mean reaction time measures between stimulus it was found that (IA) had lesser mean (RT) for naming big colour images (Mean = 2370.49) compared to small colour images (Mean = 2453.53). Further to check for the significance between stimulus i.e. small versus big colour images for reaction time measures in (IA) Paired sample test was carried out and the results revealed that there was no significant difference between small versus big colour images, SCRTT2-BCRTT2 [t(9) = .771, p = .460] as depicted in table 4.12. Though the reaction time measures showed better performance for big colour images than small colour images in individuals with aphasia (IA) the results was not statistically significant.

Likewise on comparing mean accuracy scores between stimulus it was found that (IA) had higher accuracy scores for naming big colour images (Mean = 72.63) than small colour images (Mean = 70.62). Further Wilcoxon Signed Ranks Test was carried out to see the significance between stimulus for accuracy measures. The results revealed that there was no significant difference for accuracy measures between small versus big colour images, BCAT2-SCAT2 /z/= -.938, *p*= .348.

In summary for (IA) reaction measures did not show any statistically significant difference for small versus big colour images ($p>0.05$). Also, accuracy measures did not show any statistically significant difference between small versus big colour images ($p>0.05$).

c. Comparing small versus big colour images in neuro-typical (NT) individuals.

Table 4.13

Results of Paired- sample test in Group II

	t	df	Sig. (2-tailed)
SCRTT2-BCRTT2	.2576	29	.015*

*Note: SCRTT2= Small colour images reaction time task2, BCRTT2= Big colour images reaction time task 2. .*indicates significance of p<0.05level.*

In similar lines, comparing mean reaction time measures between stimulus it was found that (NT) individuals had lesser mean (RT) scores for naming big colour images (Mean = 1592.47) compared to small colour images (Mean = 1806.13) . Further to check for the significance between stimulus for reaction time measures in (NT) individuals Paired sample t test was carried out. The results revealed that there was a significant difference between small and big colour images, SCRTT2-BCRTT2 [$t(29) = .2576$, $p < 0.05$] as depicted in table 4.13.

On comparing mean accuracy scores between stimulus it was found that neuro-typical (NT) individuals had higher accuracy scores for naming big colour images (Mean = 92.86) than that of small colour images (Mean = 91.52). Further Wilcoxon Signed Ranks Test was carried out to see the significance between stimulus. The results revealed that there was no significant difference for accuracy measures between small versus big colour images, BCAT2-SCAT2 $|Z| = 1.499$, $p = 0.134$.

In summary for (NT) individuals between small versus big colour images statistically significant difference was seen for reaction time measures ($p<0.05$).Whereas accuracy measures were not statistically significant ($p>0.05$) between small versus big colour images.

Overall, in task II neuro-typical (NT) individuals naming performance was significantly better than individuals with aphasia (IA) in both reaction time and accuracy measures. Among individuals with aphasia (IA) both reaction time and accuracy measures were not statistically significant between small versus big colour images . However, overall naming abilities were better and more accurate for big colour images in

(IA). Among neuro-typical (NT) individuals naming abilities was significantly better for reaction time measures but not for accuracy measures. However, in (NT) individuals' overall accuracy of naming were better for big colour images than small colour images. In this task participants did not have any confusions with structurally similar images which was found in task I .This could be because both small and big images were presented in colour itself hence there was no room for confusions. All these findings indicate that naming performances were better for big colour images than small ones.

The mean and standard deviation scores of Group I and Group II on reaction time (RT in ms) measures for small versus big line drawings in task II were calculated. Details are depicted in Table 4.14.

Table 4.14

Mean and SD for reaction time in Group I (n=10) and Group II (n=30) for small versus big line drawings in task II

Reaction Time (RT in ms)				
	Group I IA		**Group II NT**	
Stimulus	**Mean**	**SD**	**Mean**	**SD**
SLDRTT2	2668.92	665.66	1806.13	386.63
BLDRTT2	2417.53	814.36	1592.47	317.17

Note: SLDRTT2= Small line drawings reaction time task1, BCRTT2= Big line drawings reaction time task 2.

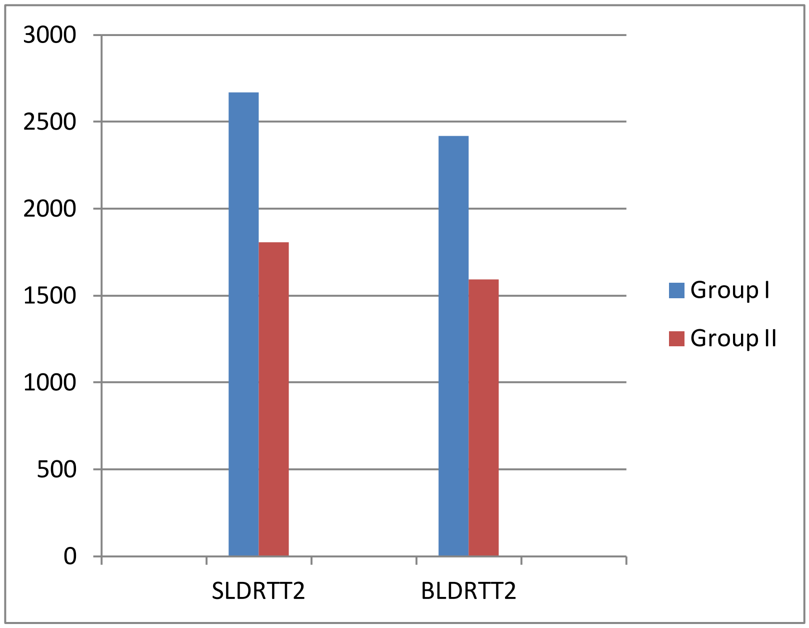


Figure 4.14.Mean scores for reaction time in Group I (n=10) and Group II (n=30) for task II

As depicted in Table 4.14 and figure 4.14 the mean reaction time taken by the group II for naming small line drawings and big line drawings was lesser than that of group I. Within both group I and group II, it can be observed that the mean reaction time scores for naming of big line drawings is lesser than that of small line drawings.

Table 4.15

Results of Mixed ANOVA

Source	df	F	Sig.
Sizes	1	11.482	.002*
Sizes*Groups	1	.076	.785

*Note: (*indicates significance p<0.05level)*

Table 4.16

Results of Mixed ANOVA

Source	df	F	Sig.
Groups	1	27.948	.000*

*Note: (*indicates significance* p*<.05 level)*

To see the main effect of group (neuro-typical individuals versus individuals with aphasia), type of the stimulus (small versus big line drawings) and interaction between groups (neuro-typical individuals versus aphasia) and type of the stimulus (small versus big line drawings) the data was subjected to Mixed ANOVA test .The results revealed there was a significant main effect of groups i.e. [F(1, 38) = 27.948, p <0.01] and also for type of stimulus i.e. [F(1, 38) = 11.482, p <0.01] but there was no significant difference for interaction effect[F(1, 38) = .076, p = .785] as depicted in the Table 4.16 and 4.15.

d. Comparing between groups for small versus big line drawings.

Table 4.17

Results of Independent sample test between groups in task II

Stimulus	t	df	Sig. (2-tailed)
SLDRTT2	-5.049	38	.000*
BLDRTT2	-4.672	38	.000*

*Note: SLDRTT2= Small line drawings reaction time task1, BCRTT2= Big line drawings reaction time task 2.*indicates significance of p<0.05level.*

Likewise on comparing mean reaction time measures between groups it was found that (NT) individuals had lesser mean (RT) for naming big line drawings (Mean = 1592.47) and small line drawings (Mean = 1806.13) compared to (IA) for big colour images (Mean= 2417.53) and small line drawings (Mean= 2668.92). To investigate the significance between groups for reaction time measures i.e., in individuals with aphasia (IA) and neuro-typical (NT) individuals Independent two sample t-test was carried out. The results revealed that there was a significant difference between group for both small line drawings SLDRTT2 [$t(38) = -5.049$, $p<0.01$] and big line drawings BLDRTT2 [$t(38) = -4.672$, $p<0.01$] as depicted in table 4.17. Lesser the reaction time taken, better is the performance. Hence by comparing mean reaction time measures and statistical significance values it can be noticed that group II (NT) has performed better than group I (IA).

In similar lines on comparing mean accuracy measures between groups it was found that (NT) individuals had higher mean (RT) for naming big line drawings (Mean = 87.97) and small line drawings (Mean = 86.63) compared to (IA) for big line drawings (Mean= 76.62) and small colour images (Mean= 72.64).The results revealed that there was a significant difference between groups for both small and big line drawings i.e., SLDAT2 $|Z|= 2.485$, $p<0.01$, BLDAT2 $|Z|= 2.702$, $p<0.01$. Hence by comparing mean accuracy values and statistical significance values it is evident that group II (NT) has performed better than group I (IA).

Overall neuro-typical (NT) individuals performed better than individuals with aphasia (IA) in terms of reaction time (RT in ms) as there was a statistically significant difference (p<0.01). And also in terms of accuracy measures neuro-typical (NT) individuals performed better than individuals with aphasia (IA) as there was a significant difference of (p<0.01) for both small versus big line drawings images in task II.

e. Comparing small versus big line drawings in individuals with aphasia (IA).

Table 4.18

P*aired- sample test for Grou*p *I in task II*

	t	**df**	**Sig. (2-tailed)**
SLDRTT2-BLDRTT2	2.074	9	.068

Note: SLDRTT2= Small line drawings reaction time task1, BLDTT2= Big line drawings reaction time task 2.

Similarly on comparing mean reaction time measures between stimulus it was found that (IA) had lesser mean (RT) for naming big line drawings (Mean = 2417.53) compared to small line drawings (Mean = 2668.92). To investigate for the significance between stimulus for reaction time measures in (IA) Paired sample t test was carried out. The results revealed that there was no significant difference between small versus big line drawings SLDRTT2-BLDRTT2 [t(9) = 2.074, p = .068] as depicted in table 4.18. Though the reaction time measures shows better performance for big line drawings than compared to small line drawings in individuals with aphasia (IA) the results was not statistically significant.

Likewise on comparing mean accuracy scores between stimulus it was found that (IA) had higher accuracy scores for naming big line drawings (Mean = 76.64) than that of line drawings (Mean = 72.64). Further Wilcoxon Signed Ranks Test was carried out to see the significance between stimulus for accuracy measures. The results revealed that there was no significant difference for accuracy measures between small versus big line drawings, BLDAT2-SLDAT2 /z/= -653, *p*= 0.514.

In summary, for (IA) reaction time measures did not show any statistically significant difference for small versus big line drawings (p>0.05), also accuracy measures did not show any statistically significant difference between small versus big line drawings (p>0.05).

f. Comparing small versus big line drawings in neuro-typical (NT) individuals.

Table 4.19

P*aired- sample test for within stimulus in Grou*p *II*

	t	**df**	**Sig. (2-tailed)**
SLDRTT2-BLDRTT2	3.133	29	.004*

Note: SLDRTT2= Small line drawings reaction time task1, BLDRTT2= Big line drawings reaction time task 2.

In similar lines comparing mean reaction time measures between stimulus it was found that (NT) individuals had lesser mean (RT) for naming big line drawings (Mean

=1592.47) compared to small line drawings (Mean = 1806.13) . To investigate the significance between stimulus for reaction time measures Paired sample test was carried out . The results revealed that there was a significant difference between small versus big line drawings, SLDRTT2-BLDRTT2 [t(29) = 3.133, *p*<0.01] as depicted in table 4.19.

On comparing mean accuracy scores between stimulus it was found that neuro-typical (NT) individuals had higher accuracy scores for naming big line drawings (Mean = 87.97) than that of small line drawings (Mean = 86.63). Further Wilcoxon Signed Ranks Test was carried out to see the significance between accuracy measures between stimulus in neuro-typical (NT) individuals .The results revealed that there was no significant difference for accuracy measures between small versus big line drawings BLDAT2-SLDAT2 |Z|= 1.897, *p*=0.058.

In summary for (NT) individuals between small versus big colour images statistically significant difference was seen for reaction time measures (*p*<0.05).Whereas accuracy measures were not statistically significant (p>0.05) between small versus big colour images.

In summary, in task II neuro-typical (NT) individuals naming performance was significantly better than individuals with aphasia (IA) in both reaction time and accuracy measures. Among individuals with aphasia (IA) reaction time measures was not statistically significant between small versus big line drawings. Accuracy measures also showed no statistical significant difference between small versus big line drawings (IA). However, overall naming abilities were better and more accurate for big line drawings in (IA). Within neuro-typical (NT) individuals naming abilities was statistically significant for reaction time measures for small versus big line drawings. Accuracy measures were also not statistically significant for small versus big line drawings. In general both (IA) and (NT) individuals naming performance was better for big line drawings than small line drawing .

All these findings indicate that naming performance was better for big line drawings than small line drawings in both the groups. The findings also revealed that accuracy of naming reduced for structurally similar items or images. E.g., (Tomato for Orange, chayote for papaya, ladies finger for chilly etc.). These errors were seen especially when the images were presented in small line drawings and for some the errors were same even for the big line drawings.

Through these findings we can infer that, though in big images there was an improved naming, still for few structurally similar big sized images there was poor accuracy in naming. This could be because as in both the conditions images were presented in black and white line drawings and not in colour. Hence this lack of colour information between structurally similar images would have led to poor accuracy in naming even in big sized images.

Similar findings were found by Smith and Lang (1972) wherein they tried to assess naming abilities for 3D objects and 2D images which included small versus big line drawings in both normals and in individuals with aphasia. The results showed better performances for 3D objects in both normals and in IA. But there was no significant difference for naming performances between small and big line drawings.

To summarize in objective II two major stimulus variables, i.e. colour and size were considered. First the results of reaction time and accuracy measures for small and big colour images were compared between and within both the groups. The results reveals that between groups neuro-typical (NT) individuals performed better that individuals with aphasia (IA). Within individuals with aphasia (IA) both reaction time and accuracy measures did not show any significant difference for naming small versus big colour images. In general both (IA) and (NT) individuals reaction time and accuracy of naming performance was better for big colour images.

Secondly, the results of reaction time and accuracy measures for small versus big line drawings were compared between and within groups. Between groups again neuro-typical individuals performed better than individuals with aphasia (IA). Within individuals with aphasia (IA) both reaction time and accuracy measures were not statistically significant for small versus big line drawings. Within neuro-typical (NT) individuals both reaction time measures and accuracy measures were statistically significant for small versus big line drawings. In general both (IA) and (NT) individuals performed better for big line drawings.

Only few studies have tried to compare naming abilities between sizes in neuro-typical (NT) individuals and in individuals with aphasia (IA). Based on available studies and based on the present study results, it can inferred that among the variables colour and size, size is not an intrinsic factor for image naming when images are presented with colours. Whereas when images are presented with only line drawings, bigger sized images will enhance naming. Hence colour is found be a sensory facilitator in image naming.

In a nutshell, among the variables considered in the study i.e. colour and size colour was found to be an intrinsic factor than size for image naming. Hence from the present study it can also be inferred that colour helps in accurate and faster lexical retrieval. Findings also suggest colour majorly helps to distinguish structurally similar natural colour objects or images. This sensory facilitation happens through the prior stored structural or colour knowledge of objects or images.

4.20 Summary of the overall findings :

Objectives	Groups	Parameters	Statistics applied	Results
Objective I				
Performance for Stimulus- black and white line drawings (LD)and color images	**Between groups** i.e., between (IA) and neuro-typical (NT) individuals	Reaction time and accuracy measures	**RT:** Independent sample t test **Accuracy:** Mann-Whithney U test	(NT) individuals were better than (IA)
Between Stimulus – CI & LD	**Within group** In individuals with aphasia (IA)	Reaction time and accuracy measures	**RT:** Paired sample t-test **Accuracy:** Wilcoxon Signed Rank test	**Individuals with aphasia (IA)** **RT:** Not statistically significant **Accuracy:** Statistically significant
Between Stimulus – CI & LD	**Within group** In (NT) neuro-typical individuals	Reaction time and accuracy measures	**RT:** Paired sample t-test **Accuracy:** Wilcoxon Signed Rank test	**In(NT) Individuals** **RT:** Statistically significant **Accuracy:** Statistically significant

Objective II				
Performance for (SC) versus Big color (BC) images	**Between groups** i.e., between (IA) and neuro-typical (NT) individuals	Reaction time and accuracy measures	**RT:** Independent sample t test **Accuracy:** Mann-Whithney U test	(NT) individuals were better than (IA)
Performance Between Stimulus small color (SC) & Big color BC images	**Within group** In individuals with aphasia (IA)	Reaction time and accuracy measures	**RT:** Paired sample t-test **Accuracy:** Wilcoxon Signed Rank test	**Individuals with aphasia (IA)** **RT:** Not statistically significant **Accuracy:** Not Statistically significant
Performance Between Stimulus-Small (SC) versus Big color (BC) images	**Within group** In (NT) neuro-typical individuals	Reaction time and accuracy measures	**RT:** Paired sample t-test **Accuracy:** Wilcoxon Signed Rank test	**In(NT) Individuals** **RT:** Statistically significant **Accuracy:** Not Statistically significant
Performance for (SLD) versus Big (BLD) line drawings	**Between groups** i.e., between (IA) and neuro-typical (NT)	Reaction time and accuracy measures	**RT:** Independent sample t test **Accuracy:** Mann-	(NT) individuals were better than (IA)

	individuals		Whithney U test	
Performance Between Stimulus - Small (SLD) versus Big (BLD) line drawings	**Within group** In individuals with aphasia (IA)	Reaction time and accuracy measures	**RT:** Paired sample t-test **Accuracy:** Wilcoxon Signed Rank test	**Individuals with aphasia (IA)** **RT:** Not statistically significant **Accuracy:** Not Statistically significant
Performance Between Stimulus Small (SLD) versus Big (BLD) line drawings	**Within group** In (NT) neuro-typical individuals	Reaction time and accuracy measures	**RT:** Paired sample t-test **Accuracy:** Wilcoxon Signed Rank test	**In(NT) Individuals** **RT:** Statistically significant **Accuracy:** Not Statistically significant

Chapter 5

SUMMARY AND CONCLUSIONS

Human information processing system is viewed as a mechanism that encodes stimuli from environment, operates on understanding of these stimuli, stores the results in memory, and allows retrieval of previously stored information (Nelson, 1998; Owens, 2005). Information from the environment will be processed in different sensory modalities like auditory, visual tactile etc.

Once the environmental stimulus is processed in any or all of these modes, the stimulus can be recognized. This processing and recognition of environmental stimulus takes place within a fraction of time in neuro-typical individuals. But early studies have found that if there is any damage to brain then it can result in impairment of processing in any or all of these sensory modes of processing information. Recent literature reports that individuals with acquired brain damage due to TBI, CVA or tumours usually are accompanied by some form of visual perception and processing deficits Berryman, Rasavage, & Politzer, (2010) .Recognition is the awareness of having previously experienced target item when that target item is presented (Bagozzi & Silk,1981). Recognition of stimulus can be in any modes like auditory, visual, tactile etc. Recognition of stimulus can be assessed either by identification or through naming tasks.

Naming is a cognitive linguistic task which involves accessing information from prior stored structural knowledge, semantic knowledge and phonological knowledge of objects or pictures Humphreys, Riddoch & Quinlan (1988). Damage to brain can result in accessing in any of these informations which can in turn result in significant naming difficulty. This condition is usually encountered in individuals with aphasia which is usually caused due to CVA.

Aphasia can be defined as “the disturbance of any or all of the skills, associations and habits of spoken or written language produced by injury to certain brain areas that are specialized for these functions (Goodglass & Kaplan, 1983). Irrespective of type of aphasia naming difficulty is commonly seen in individuals with aphasia. This feature of anomia is more predominant in mild form of aphasia. Naming abilities in these individuals can be assessed through confrontation naming of objects or pictures.

There are many factors which influence picture naming which includes type of the stimulus like colour, shape, size, distance, luminance of object or images etc. Among these physical characteristics colour is found to be a significant factor in image naming. However early studies done on individuals with aphasia reveals that colour images acts as a distracter while naming. Hence several studies suggest for using line drawings as they are simple, iconic and has less distraction in it.

In contrast there are other groups of studies which suggests using colour images in individuals with aphasia as they help in quick lexical access and in turn facilitates better naming. However the results are still inconclusive. And also there is dearth in Indian studies investigating these findings. Hence the present study was taken up with the aim to investigate whether image recognition ability is influenced by physical stimulus characteristics in both individuals with aphasia and in neuro-typical individuals.

The objectives of the study were to compare the performance between individuals with aphasia and neuro-typical individuals for image recognition through naming task when variability is induced in terms of:

- Black and white line drawings and coloured photographs
- Size i.e., small versus big images.

The study was carried out in 2 groups, group I consisted of ten individuals with mild form of aphasia and group II consisted of thirty individuals with neuro typical individuals. Participants in group I included subjects in the age range of 25 – 67years. Participants who were diagnosed as having any mild form of aphasia by an SLP were selected for the study. Group II included thirty neuro typical individuals in the age range of 25 – 65 years. Both the group consisted participants who were native speaker of Kannada. Informed consent was taken from all the participants.

Present study consisted of two variables, colour and size. Hence the study was carried out in two subtasks.

In task I, test stimuli consisted of images of different lexical categories such as fruits, animals, vegetables, common objects and vehicles. Total of sixty images was considered, which were divided into 2 sets, one set of image consisted of thirty black and white line drawings and another set consisted of same thirty colour photographs. These images were randomly presented. All the images had the dimension (432 x 288 pixels) with the resolution of 28.346 pixels/centimeter.

In task II, images of different lexical categories such as fruits, animals, vegetables, common objects and vehicles were used. It included sixty images, which was divided into two sets of image , one set consisted of thirty colour images which included fifteen small colour images and same fifteen big colour images. On the other hand another set consisted of thirty different line drawings which included fifteen small black and white line drawings and same fifteen big line drawings. These images were randomly presented. All small images had the dimension of (144 x 144 Pixels) and all big images had the dimension of (360 x 360 pixels) and all image had resolution of 28.346 Pixels/ Centimeter.

All the images were programmed in HP laptop of screen width 15.6 inches using DMDX software and it was used for visual presentation of images and programmed for recording vocal response A software called Check vocal which is inbuilt in DMDX was used to measure the reaction time and accuracy of verbal responses of the participants. The obtained results were calculated for reaction time and accuracy measures of naming and the results were subjected to appropriate statistical measures using SPSS software version 21.0.

The primary objective was to compare naming performance between individuals with (IA) and (NT) individuals for colour versus line drawings. Parametric test was carried out for reaction time measures and for accuracy measures non-parametric test was carried out. The overall mean, standard deviation (SD) were calculated for the performance of Group I (Individuals with aphasia) and Group II (Neuro-typical individuals) across the two tasks for both mean reaction time and accuracy.

For reaction time measures in both the tasks parametric tests such as Mixed ANOVA was administered to check for the main affect and interaction effect between groups and stimulus. Independent sample t test was carried out to investigate if there is any significance between groups and Paired sample t test was administered to check for significance between stimulus in each group. For accuracy measures Mann-Whitney U test, Wilcoxon Signed Rank Test was carried out. For accuracy measures in both the task non-parametric tests such as Mann-Whitney U Test was carried out to check for the significance between groups. Wilcoxon Signed Rank Test was administered to investigate the significance between stimulus in each group.

The results of the primary objectives revealed that in task I neuro-typical (NT) individuals naming performance was significantly better than individuals with aphasia (IA) in both reaction time and accuracy measures. Among individuals with aphasia (IA) accuracy measures was statistically significant between colour images and black and white line drawings .Whereas reaction time measures were not statistically significant between colour images and black and white line drawings in (IA).

However, overall naming abilities were better and more accurate for colour images in (IA). In neuro-typical (NT) individuals naming abilities was significantly better for colour images and black and white line drawings in both reaction time and accuracy measures. It was also observed that inaccurate responses were more for structurally similar images in naturally coloured items in both (IA) and in (NT) individuals. E.g. (Carrot for Radish, Horse for Donkey , Raw banana for Banana etc). In these conditions colour facilitated accurate naming. All these findings suggests that colour enhances faster retrieving of words for naming task than black and white line drawings. And also it suggests that colour is an intrinsic feature for accurate naming, especially for structurally similar objects or pictures.

The second objective was to compare naming performance between individuals with aphasia (IA) and (NT) individuals for small versus big images. Firstly, the results of reaction time and accuracy measures for small and big colour images were compared between and within both the groups. The results revealed that between groups neuro-typical (NT) individuals performed better that individuals with aphasia (IA). Within individuals with aphasia (IA) both reaction time and accuracy measures did not show any significant difference for naming small versus big colour images. In general both (IA). Among neuro-typical (NT) individuals naming abilities was significantly better for reaction time measures but not for accuracy measures. However, in (NT) individuals' overall accuracy of naming were better for big colour images than small colour images.

Secondly, the results of reaction time and accuracy measures for small versus big line drawings were compared between and within groups. Among between groups again neuro-typical individuals performed better than individuals with aphasia (IA). Within individuals with aphasia (IA) both reaction time and accuracy measures were not statistically significant for small versus big line drawings. Within neuro-typical (NT) individuals both reaction time measures were statistically significant for small versus big line drawings. Accuracy measures were not statistically significant. In general both (IA) and (NT) individuals performed better for big line drawings.

Only few studies have tried to compare naming abilities between sizes in neuro-typical (NT) individuals and in individuals with aphasia (IA). Based on available studies and based on the present study results it can inferred that among the variables colour and size, size is not an intrinsic factor for image naming when images are presented with colours. Whereas when images are presented with only line drawings, bigger sized images will enhance naming. Hence colour is found be a sensory facilitator in image naming.

In a nutshell, among the variables considered in the study i.e. colour and size colour was found to be an intrinsic factor than size for image naming. Hence the present study also infers that colour helps in accurate and faster lexical retrieval. Findings also suggest colour majorly helps to distinguish structurally similar natural colour objects or images. This sensory facilitation happens through the prior stored structural or colour knowledge of objects or images.

Implications of the study:

- The present study aids in understanding the influence of physical stimulus characteristics of image such as colour and size in image recognition through naming.
- These findings also helps in using appropriate stimulus of images for assessing cognitive linguistic abilities in both individuals with aphasia and in neuro typical individuals.
- The findings of the present study can be implemented in both assessment and management of individuals with aphasia

Limitations:

- Data collection was carried out on a small group of participants which prevents the generalization of the obtained findings.

Future implications:

- The study can be done on large population for generalizing the results.
- The study can also be done on other communication disordered population.

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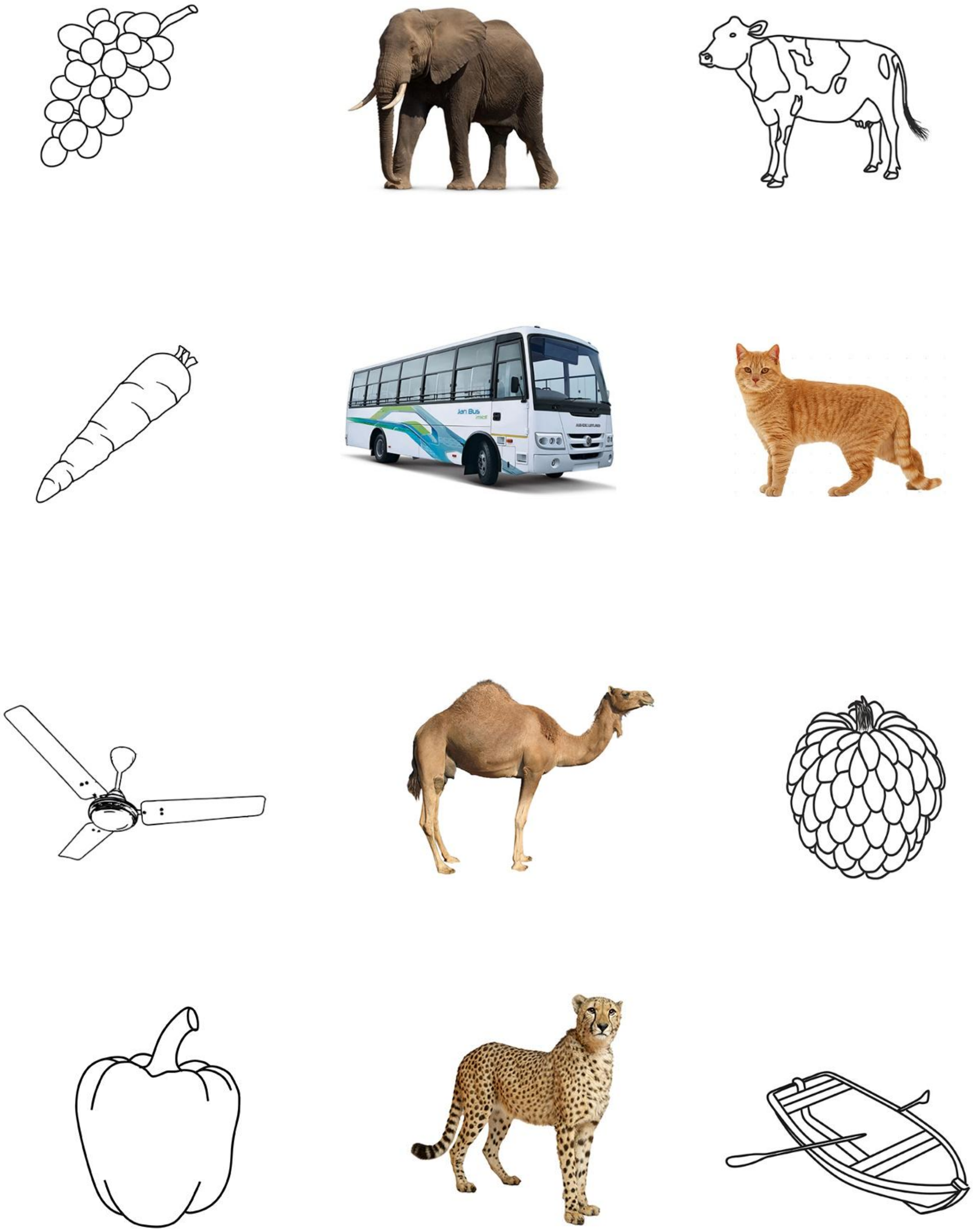
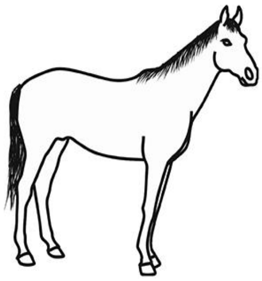
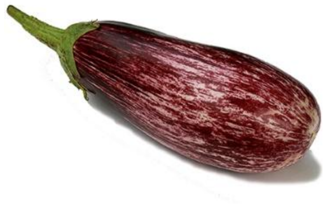
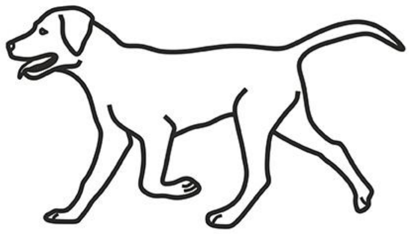
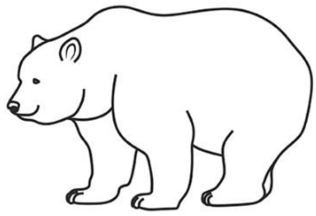
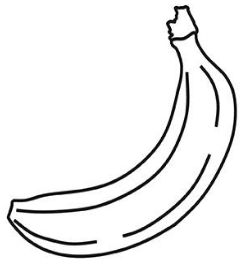
APPENDIX 1

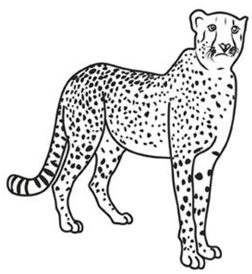
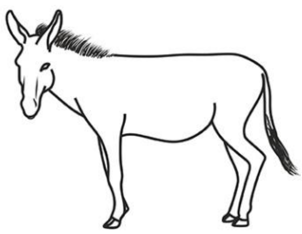
Task 1 (Colour versus line drawing)

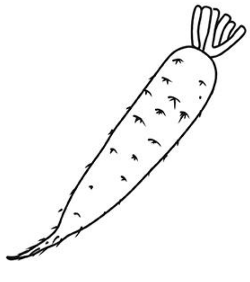


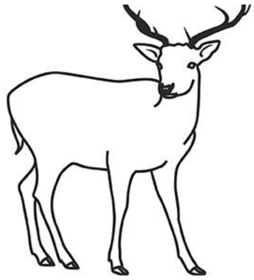
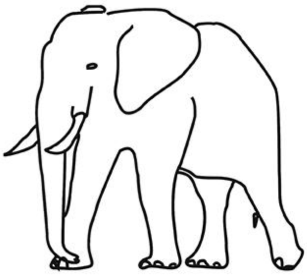


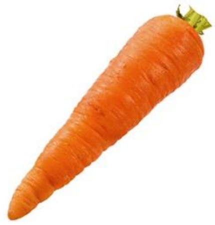



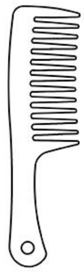



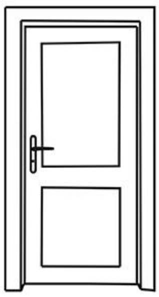
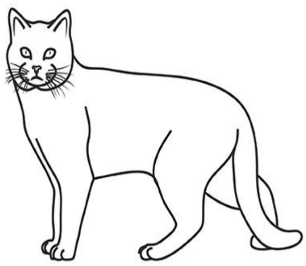


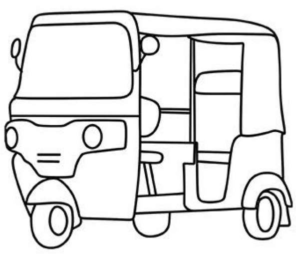


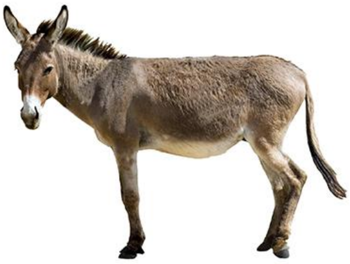




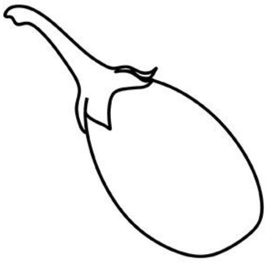




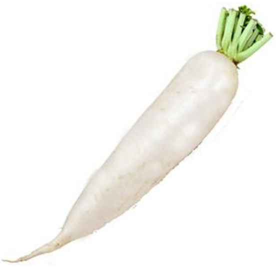
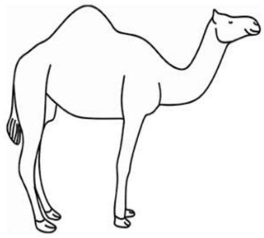




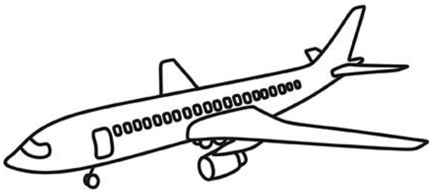


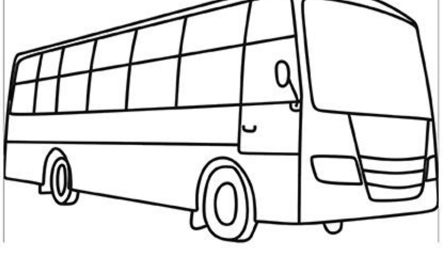
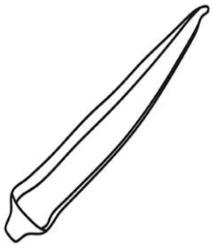





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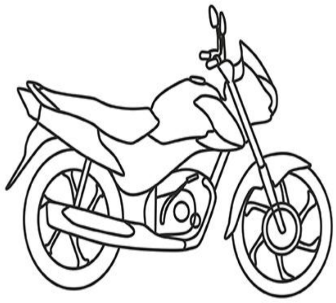

Task-2 small and big images