Development and Standardization of Boston Naming Test in Bilinguals (Kannada – English and Telugu – English)

Project under AIISH Research Fund (ARF) 2009-10

(Ref: SH/CDN/ARF/3.42/KCS/2009-10

with total funds of Rs. 4,06,000.00)

Department of Speech Language Pathology

All India Institute of Speech and Hearing

Manasgangothri, Mysore – 570006

September 2010

DEVELOPMENT AND STANDARDIZATION OF BOSTON NAMING TEST IN BILINGUALS (KANNADA – ENGLISH AND TELUGU – ENGLISH)

Project under AIISH Research Fund (ARF) 2009-10

(Ref: SH/CDN/ARF/3.42/KCS/2009-10 with total funds of Rs. 4,06,000.00)

Principal Investigator

Dr. Shyamala. K. C.

Prof. & OC-DHLS,

Department of Speech Language Pathology

All India Institute of Speech and Hearing

Manasgangothri, Mysore ï 570006

Research Officer

Mr. Sunil Kumar. Ravi.

Research Assistant

Mrs. Vijayetha. S.

Department of Speech Language Pathology

All India Institute of Speech and Hearing

Manasgangothri, Mysore – 570006

September 2010

Acknowledgements

We thank Dr. Vijayalakshmi Basavaraj, Director, All India Institute of Speech and Hearing, Manasagangothri, Mysore for sanctioning the project and for providing financial support from AIISH Research Fund.

We extend our sincere thanks to Dr. Jaydip Ray, HOD, Dept. of Neurology, Yashoda Hospitals, Hyderabad for allowing us to do data collection and Ms. Sonal Chitnis, Speech Language Pathologist, Yashoda Hospitals, Hyderabad for helping us in getting aphasic participants.

We would like to thank all the participants of the study for their co-operation during the study.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEVELOPMENT AND STANDARDIZATION OF BOSTON NAMING TEST IN BILINGUALS (KANNADA – ENGLISH AND TELUGU – ENGLISH)

Abstract

Introduction: The Boston Naming Test (BNT) (Kaplan, Goodglass & Weintraub, 1983) is the single most frequently used test of visual confrontation naming in Western countries. The BNT has been used in the evaluation of patients with focal left and right CVAs, with diffuse brain damage resulting from head injury, anoxia or progressive dementia such as Alzheimer's disease. The BNT published norms include 84 normal adults (ages 18 – 59) with scores grouped according to those with greater or less than 12 years of education, and 82 aphasic adults with performance divided into 6 severity levels. The BNT has been modified and standardized in many languages like Spanish, and has been used with patients with aphasia, dementia, etc. Despite the diagnostic usefulness of confrontation naming tasks in investigating the visual perception and lexical – semantic abilities across a range of neurogenic communication deficits, it is difficult to interpret the results obtained from patients whose demographic profile is not reflected in the normative data.

There are several studies which suspect that naming difficulty will be correlated to pre-morbid variations in language proficiencies, reflecting the age at which L2 was acquired and the contexts in which each language is currently used (Goggin, Estrada, & Villarreal, 1994). These factors within individuals will interact in turn with cultural-linguistic variables such as word frequency and familiarity. Clearly normative data for diverse populations and studies which explore the validity of frequently employed neurolinguistic assessment measures with these culturally and linguistically diverse groups are needed to support both research and clinical practice.

Aim: the primary aim of the current project is to develop and establish preliminary normative data on the BNT for Kannada –English and Telugu – English bilingual speakers in Karnataka and Andhra Pradesh states of India.

Method: Four groups of subjects were taken in each language group (Kannada – English & Telugu – English) in which three groups of typical adults in the age ranges of 20-40 years (n=35), 40-60 years (n=35) and above 60years (n=30) and the fourth group comprised of 13

Kannada-English and 20 Telugu – English bilingual individuals with aphasia diagnosed by a neurologist and a speech language pathologist based on Western Aphasia Battery (Kertesz, 1982) test results. To overcome cultural and linguistic bias, the Boston Naming Test material developed by Shanthala and Shyamala (1997) was taken and was developed in Telugu language. This includes a set of 57 line drawings and these were displayed on a 4"x6" cards. This test was administered in their respective native language and also in English. Language History Questionnaire (Ping Li, Sepanski, S. & Zhao, X., 2006) was used to measure the language proficiency in each language of all the participants.

Results and Discussion: The results of Kannada – English normal bilingual groups revealed significant difference ($F(2, 97)=3.916$, $p<0.05$) between the three groups and on Bonferri post hoc analysis, significant difference was found between young adults and geriatric groups ($p<0.05$); middle aged adults and geriatrics($p<0.05$). However, there was no significant difference ($p>0.05$) found between young and middle age typical adult groups. These results indicated a significant deterioration in the abilities of naming as the age increased.

The analysis of Telugu – English normal bilingual groups revealed significant difference ($F(2, 97)=5.641$, $p<0.05$) between the three groups and on Bonferri post hoc analysis, significant difference was found between young adults and middle aged adult groups ($p<0.05$); middle aged adults and geriatrics ($p<0.05$). However, there was no significant difference ($p>0.05$) found between normal young and geriatric groups. These differences can be attributed to the familiarity of the words and imageability of the stimuli.

The analysis of Kannada – English bilingual aphasics revealed that the Subcortical aphasics performed better on naming followed by Wernicke's aphasia, anomic aphasia, Broca's aphasia and Transcortical aphasia. Global aphasics obtained the least scores on BNT. The analysis of Telugu – English bilingual aphasics revealed that the transcortical motor aphasics performed better on the naming test followed by Broca's aphasia, transcortical sensory aphasia, anomic aphasia, subcortical aphasia, and wernicke's aphasia. Global aphasics obtained least scores on BNT.

Conclusion: This is a standardized test material for the clinical population of Indian bilingual population in two major languages, Kannada - English, Telugu - English. This test can be used along with regular speech and language test batteries in assessment of aphasia, dementia and other neurogenic communication disorders. Along with the regular usage in clinical settings, BNT for Indian English, Kannada - English and Telugu - English speakers would

also prove useful for basic research on the brain bases of language and language disorders in these populations. As the stimuli for this test is being selected by considering the cultural and language influences, this test will be more appropriate for the respective cultures and language groups. Although, there are many attempts/studies on naming abilities in monolingual and bilingual adults, the role of these naming deficits in neurogenic language disorders like aphasia, dementia, etc. are not well studied in Indian context. Future investigations exploring assessment strategies and or issues with bilingual geriatric population are needed with more focus on clinical populations.

INTRODUCTION

India has 22 constitutionally accepted languages with four languages having classical language status, while there are about 1652 languages / dialects spoken in and around the country. The major language families in India include Indo – Aryan (74.3%), Dravidian (23.9%), Austro – Asiatic (1.2%) and Tibeto – Burman (0.6%). Some languages have scripts while many do not have. Indian multilingualism is characterized by a very interesting scene: more languages are now involved as participants in the current increase in bilingualism and tri-lingualism; more than one script is used to write many languages, and many scripts used to write a single language; many Indian languages share a similar set of linguistic features across the language families, etc.

The major languages under Dravidian family are Kannada and Telugu languages. These are the two major languages that are widely being spoken in two states of south India namely Karnataka and Andhra Pradesh respectively. Around 50 million people of Karnataka state have Kannada language as their native language and along with these; at least half of them know English. There are several bilinguals and multilinguals who know Kannada language, (besides English) even though their mother tongue is not Kannada. In the same manner, around 75 million people of Andhra Pradesh state have Telugu as their native language and along with these there are many bi and multilinguals who know Telugu (besides English) even though their mother tongue is not Telugu.

In addition, the elderly population in these states has been identified as the nation's most rapidly growing ethnic minority. Along with this increase, the number of geriatric individuals who suffer with an acquired neurological disability secondary to cerebrovascular accident (CVA), head trauma, infection or chemical toxicity is also increasing. Therefore, the role of various professionals has been increased in terms of assessment and management of these disorders. The adequate assessment and differential diagnosis of normal adults with

disordered population with neurogenic communicative disorders presents clinicians with a substantial challenge.

Rosenbek, LaPointe, & Wertz (1989) reported that there are three primary sources of data used by the clinical professional in this challenging process. They are (1) patient medical history and neurological examination results, (2) biographical information, and (3) individual performance on a battery of speech, language and cognitive appraisal measures. The results of neurological examination may support or confirm the diagnostic impressions gained from the behavioural assessment done using the available speech and language test batteries. Demographical information is used to determine premorbid levels of language, cognitive and communicative functioning and to ascertain relevant individual, demographic, and cultural – linguistic information, which should in turn, assist the professional in the proper administration and interpretation of individual performance on specific speech, language and cognitive appraisal measures.

In order to achieve this behavioural assessment and differential diagnosis of adults with suspected neurogenic communicative disorders, the differences between divergent cultural – linguistic factors and the potential effects of brain damage must be adequately determined (Paradis, 1997).

A fundamental challenge in making this determination between neurolinguistic deficits and cultural – linguistic differences in a given individual is the lack of normative data on widely employed language assessment measures. Clearly, there is a pressing need to obtain normative data on general language measures reflecting the demographic diversity of Indian population, while simultaneously exploring the validity of standardized diagnostic instruments across diverse clinical groups.

Confrontation naming has long been recognized as one of the most sensitive tasks for identifying and quantifying neurogenic language deficits. The Boston Naming Test (BNT)

(Kaplan, Goodglass & Weintraub, 1983) is the single most frequently used test of visual confrontation naming in Western countries. The BNT has been used in the evaluation of patients with focal left and right CVAs, with diffuse brain damage resulting from head injury, anoxia or progressive dementia such as Alzheimer's disease. The BNT published norms include 84 normal adults (ages 18 – 59) with scores grouped according to those with greater or less than 12 years of education, and 82 aphasic adults with performance divided into 6 severity levels. The BNT has been modified and standardized in many languages like Spanish, and has been used with patients with aphasia, dementia, etc. Despite the diagnostic usefulness of confrontation naming tasks in investigating the visual perception and lexical – semantic abilities across a range of neurogenic communication deficits, it is difficult to interpret the results obtained from patients whose demographic profile is not reflected in the normative data.

The ability to represent objects with names provides the basis for human language. Referring to things by name is, largely, an automatic process people typically take for granted unless something falters and we cannot access the right word at the right time. When this happens, we are often certain that the word is within our memory, that the word is present, but we are unable to access it, maybe temporarily or maybe indefinitely. Questionnaire studies indicate that word-finding problems occur regularly with most people and that healthy older people report more frequent difficulties with word finding in everyday activities as age increases (Lezak, 2004; Schmitter-Edgecombe, Vesneski, & Jones, 2000). Some researchers view word-finding problems as a natural part of cognitive aging that does not become clinically or statistically significant until late in life (Nicholas, Barth, Obler, Au, & Martin, 1997).

Other research support a view in which there may be a natural decline with age for a few individuals (Van Gorp, Satz, Kiersch, & Henry, 1986) but that in general, naming

deficits are not a universal occurrence with aging because many individuals retain excellent word-finding abilities throughout old age (Cruice, Worrall, & Hickson, 2000; MacKay, Connor, & Storandt, 2005). Compared with other cognitive domains, changes in language skills are often small. If changes are present, the changes are rather subtle. In fact, in healthy aging recognition vocabulary often increases through the 50's and lexical comprehension may not change at all (Burke & MacKay, 1997).

Research points to word-finding problems in conversation as the biggest complaint elders have about the effects of aging on cognition (Nicholas et al., 1997). Ninety-five percent of older adults interviewed by Lovelace and Twohig (1990) reported ever experiencing failure to find a word in a conversation, and 42% reported to experiencing it weekly. Although word-finding problems have also been found for younger adults and young head-injured adults (Sunderland, Watts, Baddeley, & Harris, 1986), subjective complaints about them increase with age (Lovelace & Twohig, 1990; Martin & Zimprich, 2003). The effect that word-finding problems can have on aging individuals is considerable. Social isolation, depression and other consequences may occur when individuals have insecurities or embarrassment (Lovelace & Twohig, 1990) about their ability to converse with others. Because word-finding problems could be an early indicator of more serious impairment, such as dementia (Calero, Arnedo, Ruiz-Pedrosa, & Carnero, 2002; Goodglass, Kaplan, & Barresi, 2001), it is a serious and valid concern for both the individual as well as the clinician.

Wording-finding abilities are measured primarily using confrontational naming tasks (Gordon, 1997; Goulet, Ska, & Kahn, 1994; Lezak, 2004; Lopez, Arias, Hunter, Charter, & Scott, 2003; Nicholas et al., 1997) and the Boston Naming Test (BNT) is the most commonly used instrument of this kind (Calero et al., 2002; Schmitter-Edgecombe et al., 2000; Van Gorp et al., 1986). Administration of confrontational naming tasks most commonly involves presenting a person with a card showing a picture and asking for the name of the object

shown on the card. The task requires a person to visually identify the object on the basis of an iconic representation, and then mentally retrieve the correct word; hence it is often referred to generically as a "word finding" task.

More specifically, these are "naming" tasks. Naming involves associating a concept—generally a concrete object that can be pointed to in the environment—with a specific noun. Because a well formed response to a naming task consists of a one-word utterance involving the singular form of a concrete noun given in an unmarked citation case, naming tasks are especially useful in linguistic investigations of lexical access and retrieval, where complexity arising from morphological, syntactic and discourse level effects must be controlled for. In the remainder of this paper, the term "word-finding" will refer to a person's general ability to produce the appropriate word in a given communicative setting. The term "naming" will refer to a particular type of word-finding scenario in which a subject is prompted to name a visually presented object or picture.

Many variables can affect word-finding ability in naming tasks – individual variables such as age, gender, education, intelligence, and health status; and, environmental variables such as exposure time of the stimulus, priming effects, and properties of the target word. All of which influences the many cognitive processes involved in efficient speech production.

Despite the numerous studies that have found decreased naming abilities with age (Fastenau, Denburg, & Mauer, 1998; Kent & Luszcz, 2002; LaBarge, Edwards, Knesevich, 1986; MacKay, Connor, Albert, & Obler, 2002; Tsang & Lee, 2003), studies have found no relationship with healthy aging (Hickman, Howieson, Dame, Sexton, & Kaye, 2000; Kent & Luszcz, 2002; Nicholas, Brookshire, MacLennan, Schumacker, & Porrazzo, 1989; Tombaugh & Hubley, 1997) and others have found the decline to be only minor (Van Gorp et al., 1986). Borod, Goodglass, & Kaplan (1980) were one of the early researchers who found a quantitative decline in naming ability with increasing age in healthy adults. Their method of

measuring naming ability was with the BNT. Since then other research with the BNT (Albert, Heller, & Milberg, 1988) confirmed Borod et al.'s (1980) findings, showing both significant differences in naming among age groups, and observing a sharp decline for individuals in their 70s, or 80s (Kent & Luszcz, 2002). Conversely, others believe neurocognitive functions remain relatively stable over time (Hickman et al., 2000) and naming difficulties, in particular, are not a general trend in healthy aging (MacKay et al., 2005) because many of the oldest individuals continue to score near ceiling levels, and many methodological flaws have been identified in the research involving naming ability and age (Feyereisen, 1997; Goulet et al., 1994). In fact, some studies have even found improved naming performances with age in both a normal population (Cruice et al., 2002; Farmer, 1990; Schmitter-Edgecombe et al., 2000) and in a clinical population (Thomson & Heaton, 1989).

Despite the fact that naming is often treated as a straightforward operation (Gordon, 1997), there is actually quite a bit of controversy regarding the precise etiology of naming difficulties. Most cognitive research on word-finding has tended to focus on isolating points of failure during the phase of linguistic processing referred to as lexical retrieval, with special attention being paid to anomia, dysnomia, and tip-of-the -tongue (TOT) phenomenon. While cognitive models of lexical access differ in many specifics, they agree with respect to their framing of the problem. First, it is generally accepted that lexical access involves a circumscribed region of the brain, specifically, the left perisylvan areas (Kemeny et al., 2006). Second, all of the models employ two distinct systems corresponding to semantic and phonological levels of representation linked by a third generally referred to as the "mental lexicon". Finally, it is universally acknowledged that lexical access occurs extremely rapidly, and that latencies in excess of approximately one second represent a failure of lexical access (Brown, 1991).

REVIEW OF LITERATURE

1.0. BOSTON NAMING TEST (BNT)

The range of published articles using the BNT is extensive, and the number of studies providing normative data exemplifies its popularity (Lezak, 2004). The BNT has been investigated for both clinical and experimental purposes (Feyereisen, 1997, and Goulet et al., 1994). Therefore, examination of individual studies must occur before drawing definitive conclusions or making generalizations. The results from many studies are mixed because the methods and aims of the studies vary in many respects--the version of the BNT utilized; whether they included age, education, gender, or intelligence as factors or variables; the age range and number of participants; and the method of administration and scoring–all of which must be considered prior to interpretation and comparative analyses.

The BNT has been used in numerous studies to explore the efficiency of naming ability in various normal and clinical samples (Mitrushina et al., 1999). However, the studies vary in many respects. Several aspects of each study should be examined before any formative conclusion or generalization is made. First, the version of the BNT utilized is important. Currently there are many existing versions of the BNT: experimental 85-item version, 80-item version, standard 60-item version, as well as several shortened versions (Fastenau et al., 1998; Williams, Mack, & Henderson, 1989; Mitrushina et al., 1999 and Kent & Luszcz, 2002) and versions for speakers of French, Spanish, Korean and Chinese (Kim & Na, 1999; Roberts et al., 2002; Tsang & Lee., 2003, respectively). Many of the shortened forms have been successfully validated for both normal controls and persons with dementia (Lansing et al., 1999) and with longitudinal data from a large sample (Kent & Luszcz, 2002). Second, the sample from which the normative data was derived must reflect the population being assessed for a measurement to be valid; otherwise there is a substantial

risk of misdiagnosing naming impairment (Hawkins & Bender, 2002). Third, one must consider factors of age, education, intelligence or gender before clinically using test results, and these variables have not been thoroughly investigated in naming performances (Randolph et al., 1999). Fourth, administration procedures vary (Lopez et al., 2003), especially when determining a "failed" item (Ferman, Ivnick, & Lucas, 1998) or stimulus cue provisions (Mitrushina et al., 1999). The disagreement among neuropsychologists about administration approaches is so great that differing methods have produced significant differences in total score (Lopez et al., 2003). Fifth, attention must be given to the aspect of performance that is reported (Mitrushina et al., 1999). Some studies report the *percentage of correct responses per item, others report total score or scaled score, and some report error analyses with different error classification systems*. Finally, different age intervals are used by different studies. Some studies primarily use decade age intervals and others use shorter age intervals. Smaller age intervals between comparison groups may conceal potential age effects (Au et al., 1995). With all of the variations between the studies on the BNT, it was no surprise there was mixed results. However, the plethora of published information concerning the BNT can be very useful after all of the aforementioned perspectives are carefully considered.

1.1. *History of BNT Versions*

In the most current BNT test manual, Dr. Harold Goodglass states: "The obvious method of testing patients for word finding difficulty is to present pictures or questions requiring the selection of a particular word in response" (Goodglass et al., 2001, p. 7). In 1960, Dr. Harold Goodglass received a grant from the National Institute of Health to test people with the original form of the Boston Diagnostic Aphasia Examination (BDEA) for aphasia. The first version of the BNT was published in 1978 by Kaplan, Goodglass, and Weintraub. This original version of the BNT (Kaplan et al., 1978) was considered an "experimental version" consisting of 85 line drawings intended to supplement the BDAE. In

1983, a modified version was published that included 60 of the original 85 drawings, arranged in order of increasing difficulty, and was still considered a supplement to, rather than a part of, the BDEA (Kaplan, Goodglass, & Weintraub, 1983). The most current, third edition of the BNT, published in 2001 (Goodglass, Kaplan, & Barresi, 2001), incorporates the BNT in the new version of the BDEA which helps examiners determine the extent to which aphasic individuals can recognize the pictures that they are unable to name.

In addition to being used as a stand-alone test, or as part of the BDEA, the BNT has also been part of several neuropsychological batteries (Lezak, 2004): Halstead Russell Neuropsychological Evaluation System (HRNES) (Russell & Starkey, 1993); California Neuropsychological Screening Battery-Revised (CNS-R) (Bowler, Thaler, Law, & Becker, 1990); and, using the Spanish version of the BNT, Neuropsychological Screening Battery for Hispanics (NeSBHIS) (Pontón, Satz, Herrera, et al., 1996).

1.2. Existing Normative Data

A great deal of normative data is available for the BNT; only a few select norms will be presented. Mitrushina et al. (1999) published a comprehensive review of 19 norm sets, many of which are not presented here. Again, the large number of studies contributing normative data for the BNT is considered further testament to its popularity (Lezak, 2004). Normative data for the 85-item experimental edition of the BNT (Kaplan, et al., 1978) was first published by Borod, Goodglass, and Kaplan (1980) using 147 normal males, grouped into five age categories (25-39, 40-49, 50-59, 60-69, and 70-85). More norms for this version have been published subsequently for individuals at different age levels (LaBarge et al., 1986; Nicholas et al., 1985).

The second edition of the BNT (Kaplan, et al., 1983) provided normative data on the 60item version for 84 normal adults, aged 18 through 59 years of age, broken down into two educational groups and five age groups; and for 82 aphasic patients grouped by aphasia

severity level. Heaton et al. (1991) and Thompson and Heaton (1989) found high correlations between the 85-item experimental version and the 60-item versions of the BNT. Van Gorp et al. (1986) subsequently published normative data on this edition for 78 normal adults, extending the age perimeters to include 59 to 95 year olds. However, the Van Gorp et al. normative data has been scrutinized because of its "superhuman" population which included only very high-functioning older adults (e.g., Mean Full-Scale IQ = 122).

The country of origin of members of both the normative sample and corresponding population being assessed must be considered before using published BNT norms (Kent & Luszcz, 2002). Different versions of the BNT with accompanying norms are available for diverse populations. Korean (Kim & Na, 1999), Australian (Worrall et al., 1995), and Chinese (see Tsang & Lee, 2003) norms are available, and Ross & Lichtenberg (1997) offer norms for an American, elderly, urban medical sample.

1.3. Shortened Versions

Several shortened versions of the BNT are available to offer a more streamlined measure, to reduce the demands on severely impaired or elderly patients, and for test-retest purposes (Fastenau et al., 1998; Lansing, et al., 1999; Mack et al., 1992; Williams, Mack, & Henderson, 1989; see Kent & Luszcz, 2002 for review and a table of norms for several shortened versions). Mitrushina et al. (1998) presented reviews for many of the available shortened forms at the time of their publication. Goodglass, Kaplan & Barresi (2001), the authors of the most recent version of the BNT, present restandardized normative data from their previous norms and offer a 15-item short form of the BNT that is bound in the beginning of the BNT stimulus booklet as well as an updated standardization of normative data derived from 85 aphasic subjects and 15 normal elderly volunteers from the community. Fastenau et al. (1998) present normative data for four existing 15-item and two 30-item shortened versions for the Boston Naming Test that were validated using 108 healthy adults,

ages 57-85. Kent and Luszcz (2002) judged the shortened versions' normative data to be "inadequate" (p. 561) for assessing naming ability over time and produced normative data from longitudinal data for four shortened versions of the BNT with a large population of community-dwelling Australians.

1.4. BNT in Bilingual population

Kohnert, Hernandez and Bates (1998) have studied the performance of Spanish - English bilinguals and reported norms from 100 young adult educated bilinguals on both Spanish and English versions of BNT. They have reported that there are variations between the performances of different regions and with the amount of language exposure. In this study, the authors found the performance for these bilinguals was significantly better in English than in Spanish, a direct comparison of the obtained English scores with those of the available monolingual norms is not warranted.

2.0. Anomia and other naming deficits

The *INS Dictionary of Neuropsychology* (1999, p. 13) defines anomia as "The impaired ability to name objects or retrieve words." Anomia refers to a pathological word-finding difficulty rather than normal word-finding difficulties or vocabulary limitations. Difficulty with word finding is one of the most common speech production disorders for individuals with neurological pathology and for normal individuals with functional impairments (Geschwind, as cited in Georgieff et al., 1998). A great deal of research into word finding difficulties has been driven by the belief that careful analysis of word-finding failures may provide information concerning the process of lexical retrieval and the structure of lexical storage in healthy young adults (Brown & McNeill, 1966; Mitrushina, Boone, & D'Elia, 1999), how these processes and structures are affected in normal aging (Brown &

Nix, 1996; Burke et al., 1991), and their role in aphasia (Kohn & Goodglass, 1985).

"Aphasia" is an "acquired disorder of symbolic language processing" (Loring, 1999) characterized by a combination of deficiencies in processes involved with language (e.g., comprehension, fluency, repetition), and includes "anomia." Anomia is observed in virtually all types of aphasia (Goodglass et al., 2001), but *not* all subjects who experience word-finding problems are aphasic (Lambon Ralphe, Moriarty, & Sage, 2002). "Anomia" is the clinical term used when the ability to name is pathologically impaired. Anomia denotes difficulty in saying or writing particular words that are appropriate to the situation (Brookshire, 1971), where the speaker cannot produce specifically sought words either during regular conversation or during naming tasks (Loring, 1999). Goodglass et al. (2001) states there is a "qualitative difference between the general restriction of vocabulary, common to most aphasic patients, and the selective loss of ability to evoke specific words, which is called 'anomia'". Individuals with pure anomia require more time to retrieve a selected word but their comprehension and other language processes are intact (Lambon Ralphe et al., 2002). Anomia often remains a residual impairment even after considerable neurological restoration has occurred following a brain insult (Dunn et al., 1989). However, it is rare for anomia to be an isolated symptom in aphasia (e.g., "classic anomia") but it is not unusual for anomia to be an isolated symptom of Alzheimer dementia (Georgieff et al., 1998). The terms "dysnomia" and "anomia" are not synonymous although the terms are often used interchangeably. Dysnomia signifies a less severe naming impairment than anomia (Loring, 1999).

Georgieff et al., (1998) reported that normal people are considered to experience dysnomia or anomia when they experience the inability to find a word accompanied by the characteristic feeling of having a word on "the tip of the tongue" or TOT experience. Brown and McNeill (1966) were first to empirically define the TOT phenomenon when they

demonstrated that individuals without impairment could experience anomia after being presented with definitions of rare words in a word-finding test. It appears that anomia exists on a continuum where, on one end, normal individuals experience occasional *intermittent* TOT "states" and, on the other end, those with aphasic disorders and severe clinical anomia experience a *perpetual* TOT "state."

2.1. TIP – OF – TONGUE Phenomenon

Brown and McNeill (1966) described TOTs as a "TOT state". The insinuation that the experience is "separate from normal waking consciousness" (Brown, 1991) was deliberately in response to William James (1893), who is recognized as the author of the first published description of the TOT experience:

"The state of our consciousness is peculiar. There is a gap therein; but no mere gap. A gap is intensely active. A sort of wraith of the name is in it, beckoning us in a given direction, making us at moments tingle with the sense of our closeness and then letting us sink back without the longed-for term. If wrong names are proposed to us, this singularly definite gap acts immediately to negate them. They do not fit into its mould. And the gap of one word does not feel like the gap of another, all empty of content as both might seem necessarily to be when described as gaps".

Brown, (1991) reported that this description fits with the subjective turmoil people convey while struggling for the intangible word. Sunderland et al., (1986) in their study on a list of 28, the TOT experience was listed as the most frequent memory difficulty among older adults, further illustrating the emotional or agitation that is associated with TOT (Brown & McNeill, 1966).

Research methods to study TOTs have involved definitions (R. Brown & McNeill, 1966), self-assessment questionnaires (Sunderland et al, 1986), diary methods (Burke,

MacKay, Worthley, & Wade, 1991), laboratory techniques (Burke et al., 1991). A thorough review of TOTs by Brown (1991) listed consistent findings from TOT research: TOTs increase with age; TOTs occur in all ages, including children; TOTs appear to be universal; a person can guess the first letter of the target word 50% of the time, and often the last letter can be guessed (better than chance), but not the letters in between; and, within one minute following the failure, about 50% of TOTs are resolved.

2.2. Factors Affecting Naming Ability

Many authors reported that it is important to consider all of the factors that may influence the ease in which a person finds lexical retrieval when investigating the naming abilities. Many factors can affect a person's ability to find the correct word at the correct time. Budd (2007) reported that the prior research has isolated several variables potentially related to word-finding ability: age (Albert, Heller, & Milberg, 1988; Farmer, 1990; Nicholas et al., 1997; Randolph et al., 1999; Welch, Doineau, Johnson, & King, 1996); education (Calero et al., 2002; Farmer, 1990; Kent & Luszcz; Kim & Na, 1999; Nicholas et al., 1985; Randolph et al.; Thompson & Heaton, 1989; Welch et al., 1996); IQ (Albert et al., 1988; Thomas & Heaton; Thomas et al., 1977); health status (Albert et al., 1988; Thomas et al., 1977); memory (Albert et al., 1988; Burke & MacKay, 1997; Schmitter Edgecombe et al., 2000); verbal fluency (Albert et al., 1988; Calero et al.; Dunn et al., 1989; Goodglass et al., 2001); stress (Brookshire, 1971); properties of the target word (Hodgson & Ellis, 1998; Le Dorze & Durocher, 1992; Mitchell, 1989; Poon & Fozard, 1978; Thomas, Fozard, & Waugh, 1977); caffeine (Lesk & Womble, 2004), gender (Kent & Luszcz; Kim & Na; Randolph et al.; Welch et al., 1996), and priming (Brookshire, 1971; Thomas et al., 1977). Important findings from the studies listed above can be categorized according to whether they focus on variables intrinsic to the individual or on environmental factors affecting naming.

2.3. Individual Variables

The following is a general overview of variables concerning the individual that may affect naming performance as reviewed by Budd (2007).

2.3.1. Age

Age is frequently included as a variable in word-finding studies because many suspect that age does have a significant effect (Albert et al., 1988; Borod et al., 1980; Fastenau et al., 1998; Kent & Luszcz, 2002; LaBarge et al., 1986; MacKay et al., 2002; Tsang & Lee, 2003), and there is little dispute that subjective reports of word-finding problems increase with age (Lovelace & Twohig, 1990; Nicholas et al., 1985; Sunderland et al., 1986). In general, a subjective complaint about one's overall cognitive functioning increases with age (Martin & Zimprich, 2003). Although most research indicates little relationship between the level of functioning and subjective complaints in both normal (Martin et al, 2003) and brain-damaged individuals (Ponds, van Boxtel, & Jollies, 2000), age related declines have been documented in different domains of cognitive functioning (Smith & Rush, 2006) and speed of information processing (Salthouse, 1996). With respect to cognitive tests that show increased variability in the oldest age groups, Randolph et al. (1999) states "it is unclear whether the increased variance simply represents the greater range of scores available as the mean moves away from the ceiling, or whether the increased variability should be interpreted as indicating that old age can be considered a disease state of sorts"**.** Before concluding word-finding problems are an inevitable consequence of natural aging, researchers (MacKay et al., 2005) recommend using caution, especially because the results in the literature on naming ability and aging are mixed (Goulet et al., 1994) and appear to be dependent on the research design used (Cruice et al., 2000). The age-related decline found in naming ability may be simply due to slower response times (Thomas et al., 1977), or cohort effects (Cruice et al., 2002), and not naming impairment. Nonetheless, normative data should determine if an elderly person with a low score on a naming test is showing signs of cognitive impairment or

normal aging.

2.3.2. Gender

The nature-nurture question continues to be an uncertainty when discussing differences between males and females in cognitive abilities (Lezak, 2004). While gender differences have been found in brain anatomy, the effects of socialization and education clearly also play a role (Geary, 1989). The effects of gender on naming performances are mixed, and gender is typically considered a weak variable in relation to naming abilities (Lezak, 2004). However, gender differences observed in performances for specific BNT items are noteworthy.

2.3.3. Education and IQ

Although there are studies that did not find education to be related to naming performances (Albert et al., 1988; Farmer, 1991; Fastenau et al., 1998; LaBarge et al., 1986; Nicholas et al., 1985), an individual's ability to name common objects may be influenced by education or intelligence (IQ). It is reasonable to expect individuals with higher education to have larger vocabularies and to perform better on naming tasks than less educated individuals. Indeed, several other studies have found significant relationships between level of education and picture-naming abilities (Borod et al., 1980; Hawkins et al., 1993; Henderson et al., 1998; Tombaugh & Hubley, 1998; Kent & Luszcz, 2002; Kim & Na, 1999; Lansing, Ivnick, Cullum, & Randolph, 1999; Nicholas et al., 1989; Spreen & Strauss, 1998; Thomas et al., 1977; Thompson & Heaton, 1989; Welch et al., 1996; Whitfield et al., 2000; Worrall, Yiu, Hickson, & Barnett, 1995). Welch et al. (1986) suggested that a person's naming ability was retained into the 80s if they had more than 12 years of education.

Cognitive functioning related to intelligence has been associated with naming ability, especially in the case of vocabulary aptitudes (Albert et al., 1988). The higher scores

correlated with higher education was hypothesized to exist because better-educated people have a larger vocabulary base which increases naming ability (Henderson et al., 1998).

2.3.4. Vocabulary

Hawkins et al.'s (1993) findings best exemplify the influence of lower educational level, and of limited vocabulary in particular, on published norms for the BNT (using version from Kaplan et al., 1983). Hawkins and colleagues discovered high false-positive rates on BNT performances when participants had low reading vocabulary scores. Normal participants in their sample scored nearly two standard deviations below the means published with the BNT norms. The average education level for these subjects was 12 and 13 years, probably representative of the population at that time. This study also reports a strong correlation between a vocabulary test and BNT scores (r = .81, and .83 when illiterate subjects were excluded), which could suggest, "that in some circumstances the BNT essentially measures vocabulary" (Hawkins & Bender, 2002, p. 1143). When applying the norms used in Hawkins et al., caution is especially warranted with individuals with lower-than-average reading ability (Spreen & Strauss, 1998). Other studies have found verbal intelligence, as measured by WAIS-R vocabulary scores, to highly correlate with naming performance on the BNT (Albert et al., 1988; Thompson & Heaton, 1989).

2.3.5. Verbal Fluency

The relationship between age-related changes in verbal fluency and word-finding ability is not clear (Garcia & Orange, 1996), however, a few studies have shown a weak relationship between measures of verbal fluency and word-finding abilities (Albert et al., 1988; Schmitter - Edgecombe et al., 2000). Verbal fluency was used as an appropriate variable for naming ability in Albert et al.'s (1988) study, but verbal fluency was not incorporated in the final statistical model of contributors to naming ability after the researchers concluded it was not a related factor in naming for healthy adults. Schmitter-

Edgecombe et al. (2000) did not find a significant correlation between poor performance on a verbal fluency test and poor performance on a discourse test used to measure word-finding abilities. However, this same study found a significant correlation (r = .33) between individuals' performances on a verbal fluency test (category, animals) and BNT naming scores. Similarly, Calero et al. (2002) also found a significant correlation (r = .42) between a verbal fluency test (both semantic and phonemic cues, e.g. conceptually related nouns and words that begin with letter *p*) and BNT scores. As an individual variable, one's verbal fluency may not influence performance on a naming task that requires selection of one specific word (Brookshire, 1997).

2.3.6. Age of Acquisition

The age in which one learns a word is called the "age of acquisition." The age in which an object's name was first learned affects the vulnerability of that name to retrieval failure (Hodgson & Ellis, 1998). The earlier the age at which a word was acquired, the more robust it is to word-finding failure (Lezak, 2004), and words acquired earlier are more resistant to some types of brain injury than words acquired later (Ellis, Lum, & Lambon Ralph, 1996). Likewise, later age of acquisition is associated with more errors. Age of acquisition is an individual variable that directly affects one's speed and ability to name a target word (Barry, Morrison, & Ellis, 1997; Hodgson & Ellis, 1998).

2.3.7. Memory

When older people complain about memory problems, they are often referring to reduced word-finding ability (Burke & MacKay, 1997; Lezak, 2004). While some researchers have speculated as to whether word retrieval in the case of naming and other memory subtypes are actually very different (Albert et al., 1988), others presented a clearer distinction between memory functions and naming functions (Lezak, 2004). Many systems are apparently involved with both naming ability (Lambon Ralph, Moriorty, & Sage, 2002) and

memory functions (Lezak, 2004) and deficits in processes outside these systems can affect either naming ability or memory functioning, or both. For example, attention and concentration are processes outside the system for naming and the system for memory, yet deficits in attention and concentration can affect performances in one or both domains. An example more specific to naming, a person can have difficulty recalling episodic memories but not have difficulty in retrieving common words or names consistently (Lezak, 2004). When conceptualizing test findings and theory, maintaining terminological distinctions between aspects of a particular function (e.g. naming) and other functions necessary for efficient functioning (e.g. episodic memory) can help dissociate two related functions.

Specifically to BNT research, Schmitter-Edgecombe et al. (2000) found little evidence to support word-finding problems was worsened by poorer memory. Schmitter-Edgecombe et al study found no correlation between two memory measures (list learning and Delayed list memory) and two word-finding measures; BNT naming scores and discourse test performance was not related to these measures of memory. On the other hand, in the same study verbal fluency scores were related to these measures of memory.

A general processing theory called "new connection formation" helps clarify some of the findings in the literature relating memory, aging and language. This theory states that declines in memory systems with aging occur only when "new connections," or new formations, between memory representations are required, and that existing memory systems are spared (Burke & MacKay, 1997). For example, episodic memory system (ability to remember events situated over time and place; e.g. placed keys) has been deemed a separate memory system and one at risk in aging (Mitchell, 1989). However, closer inspection of studies shows an age-linked decline primarily happens to new or recent events (or laboratory experiences), and no difference between aging occurs when retelling past events or experiences at a younger age. The new connections theory of memory and aging challenges

the multiple memory systems theory that is often included in discussions on age effects and memory. For example, multiple systems theory could suggest episodic memory declines with age, but semantic memory is stable. The new connections theory would state that both types of memory are stable for existing memory representations, but age changes occur with the formation of *new* memory representations. New semantic information (Burke & MacKay, 1997), for example, shows typical age-related declines. The new connections theory could explain Hickman et al.'s (2000) overall finding of neurocognitive stability in age despite an observation that older participants in their longitudinal study did not exhibit practice effects like the younger participants. The new connections theory has been empirically demonstrated with episodic, explicit memory, and semantic memory (Burke & MacKay, 1997).

Naming is most often thought of as involving semantic memory. *The INS Dictionary of Neuropsychology* (1999) defines semantic memory: Memory that is context-free, reflecting general knowledge of symbols, concepts, and the rules for manipulating them. In contrast to episodic memory, semantic memories rarely concern specific information about situations in which they were learned … Impairments in semantic memory generally do not occur unless there is an acute confusional state, dementia of at least moderate severity, or focal lesions affecting specific aspects of linguistic function. As implicitly stated in the definition, semantic memory is rather robust and remains relatively unimpaired with natural aging. Tests of general knowledge (Nyberg, Backman, Erngrund, Olofsson, & Nilsson, 1996) or vocabulary (McGurn et al., 2004) show age consistency through adulthood. This supports our hypothesis that no age-related decline will be observed with the semantic aspects of word retrieval, but that age changes may be reflected in other aspects of word-retrieval that may be indicated by measuring latencies on naming tests rather than by measuring accuracy alone.

2.3.8. Health

Issues of poor health complicate attempts to understand aging effects on cognition,

especially when older individuals are more likely to have chronic medical problems than younger individuals (Hickman et al., 2000). Poor control for the health of the participants has been considered a possible source for the mixed results in the literature concerning aging and naming (Albert et al., 1988; Goulet et al. 1994; Kent & Luszcz, 2002). Some studies recognized this potential to confound, especially in an older cohort, and attempted to control for it by using only "optimally healthy individuals" in their attempts to investigate differences in naming ability. In each of these, the age differences in naming performance remained (Hickman et al.; Randolph, 1999; Whitfield et al., 2000). MacKay et al. (2005) ruled out dementia as an explanation for decreased BNT scores in older adults. Whitfield et al. (2000) examined health status, health habits, physical functioning, and speed of performance and BNT performance and found three predictors of BNT scores for European Americans: fewer reported symptoms of depression, higher peak expiratory flow, and smoking. An individual's health status may affect overall cognitive abilities, especially with elderly populations. The heterogeneity of health levels in an elderly population must be considered when assessing this population and using normative data. This is necessary in order to discern whether changes in cognitive functioning are due to disease processes or to the aging process itself.

2.3.9. Stress

Using a naming task other than the BNT, Brookshire (1971) concluded that stress was a factor for differences in naming ability in his participants. Specifically, he found that the exposure time of the stimulus affects performance in anomic individuals. Shorter exposure intervals of the stimulus were inferred to create stress which interfered with naming performance. Participants performed best when they were able to pace the exposure time of the stimulus.

3.0. Environmental Variables that may affect Naming

3.1. Exposure Time of Stimulus

When investigating stimulus exposure time and age effects, Thomas et al. (1977) found that older participants required longer presentation time to correctly name the picture stimulus than younger participants. For example, Thomas et al. found on average, 19-26 year olds needed 84 msec (0.084 seconds) and 56-74 year olds needed 115 msec (0.115 seconds) to correctly name a picture. Interestingly, several studies have found significant correlations between naming accuracy and stimulus presentation time even when measured using timescales using increments several orders of magnitude longer than that used by Thomas et al. In addition to finding anomic patients had the best naming performance when they were able to self-pace the time of stimulus exposure, Brookshire (1971) recorded exposure times in normals to determine the least amount of exposure time needed for a correct naming response. Most subjects named an item correctly with presentation of the stimulus for 10 seconds, and performance slightly improved for some subjects when the stimulus was presented for 30 seconds. Similarly, using a technique in which the subject controls the presentation time (up to 15 seconds) by page turning, Hodgson and Ellis (1998) reported younger adults provided more correct responses to a naming task with stimulus presentation in the range of 0-5 seconds than older adults, and older adults responded correctly with presentations in the 5-10 second range more than younger adults. Overall, these results show that elderly people had less accuracy and required longer presentation of the stimulus to name objects compared to younger individuals. None of the studies above used the BNT to obtain their findings.

Most studies using the BNT have not placed additional limits on either the duration of stimulus presentation, presenting the stimulus for an unlimited time (Albert et al., 1988) or allowing 20 seconds per test item (Spreen & Strauss, 1998). Based on latency studies not using the BNT, it appears that the effects of different exposure time may not be significant if

stimulus exposure was at least 15 seconds; exposure time to stimulus cards in previous research has shown no affect on response times or accuracy after 15 seconds of exposure to the picture (Brookshire, 1971).

3.2. Priming

The semantic priming paradigm is the most common technique for assessing the processes of word organization and meanings in semantic memory (Burke & MacKay, 1997). The semantic priming paradigm refers to the reduction in time needed to state a target word due to a semantically related or semantically unrelated word preceding it. For example, the target word *doctor* may be identified quicker following a semantic prime *nurse* as opposed to an unrelated semantic prime *chair*. Priming is considered as an automatic process that is not under conscious control. Support for the existence of priming effects on word finding is generally available for normals (Burke et al., 1991) and anomics (Lambon Ralph et al. 2000), but one study did not find naming practice helpful in improving naming performance in individuals with aphasia (Brookshire, 1971). Lambon Ralph et al. (2000) demonstrated both the positive and negative effects of priming on individuals with classic anomia. In this study, Lambon Ralphe and colleagues demonstrated that strategic priming is effective and could either make anomia better or worse. Anomia was made better by facilitating resolution of a TOT with repetition priming or by providing the first phonetic cue. Anomia was made worse by suppressing naming by providing an incorrect phonemic cue.

No findings support priming effects change with age, suggesting a basic integrity of language comprehension in aging (Laver & Burke, 1993). Priming effects also decreased the effects of aging in one study (Thomas et al., 1977). These two findings would support the hypothesis that automatic lexical processing is not affected by aging, and that priming would help facilitate controlled processing which could level off any age differences.

3.3. Properties of Target Word

The properties of the target word (i.e. word length or word frequency) have known effects on naming latency for picture tasks (Hodgson & Ellis, 1998).

4.0. COGNITIVE MODELS OF NAMING

4.1. Background

In ordinary conversation, it is generally estimated that people produce words at the rate of about two to four a second (Levelt, 2001). This feat is performed unconsciously and without effort except in the extremely rare case where one is suddenly unable to “find” the right word. The ease with which human beings are able to use words tends to mask the real complexity of the task of referring to things – a task that has intrigued linguists for literally thousands of years.

In the twentieth century, the problem of reference has been vigorously investigated in fields as diverse as philosophy, computer science, neuroanatomy and the various branches of linguistics. One result of this proliferation of research from such a variety theoretical perspectives has been to confuse a great deal of the common terminology. Therefore, before discussing cognitive models of word finding, it is necessary to first clarify what words are generally thought to be.

4.2. *What's in a Name?*

First, words are symbols, that is, they refer to something other than themselves. A natural impulse might be to say that words refer to objects; "cup" refers to the object from which one drinks liquids like coffee. Obviously, though, the world contains more than one physical object suited to this purpose. Furthermore, words like "unicorn" refer to things that do not strictly exist, so it is more accurate to view words as referring to mental categories or "concepts" rather than things in themselves. The linguistic term for a word's conceptual

referent is its semantics.

Second, as Ferdinand de Saussure is famous for having pointed out, a word's form is arbitrary with respect to the concept to which it refers (Saussure, 1986). If, on a whim, a three year old decides that "snigleygoo" means "tomato," once the members of her family have learned the new word, they are free to use snigleygoo at will in place of tomato. In other words, the form of a word cannot be inferred from its meaning and vice versa. The question this begs is what constitutes a word's form?

It is common to think of words as having a particular spelling, or to point to groups of letters delimited by white space on a printed page as examples of words. This is misleading, though, since writing is an invented technology used to store words in a non-volatile form, not an innate ability like walking and talking. Likewise, overt marking of word boundaries with white space has no acoustic analog (pauses between words) in fluent speech. The fact that a spoken utterance consists of a single unbroken stream of sound in which discrete words cannot be isolated solely on the basis of their acoustic properties also means that it would be incorrect to characterize word forms in terms of their manifest acoustical contour (as measured using sound spectrograph). Instead, linguists employ the notion of phonemic representation, or phonology.

The formal definition of a phoneme is that it is a mental representation of a contrasting segment in a given language (Spencer, 1996). In other words, a phoneme refers to mental representations of speech sounds and not to sounds themselves. A phonological segment is the basic building block from which language is constituted; for segments to contrast means that they are distinguishable from one another on the basis of their phonetic (acoustic/articulatory) expression in a given phonetic context. For example, consider the phoneme /s/ used as the plural suffix "-s" expressed phonetically as [s], [z] or [əz] depending on its phonetic context as illustrated in the following examples:

"cat" + "-s" [kæts]

"cow" + "-s" [kaùz]

"fox" + "-s" [fùksəz]

While the phoneme /s/ is expressed variously as either the sound [s], [z] or [əz] depending on the sound that precedes it, the segments /s/ and /z/ constitute separate phonemes since they occur in contrasting distributions; they are distinguishable when they occur in identical contexts: "sip" expressed [sùp] and "zip" expressed [zùp]. It may seem like nit picking to distinguish so elaborately between the sound of a word and what a word sounds like to a person, but it is important to acknowledge here that the term phoneme refers to a mental representation at the perceptual level. The phonology of a language, therefore, refers to the inventory of phonemes available to that language, each of which represents an articulatory program that produces a distinctive pattern of phonetic expression in overt speech.

In practice, the term phonology is frequently used more generically to include suprasegmental phonology – syllabification and stress – otherwise referred to as prosody, and even, as is often the case in neurolinguistics, as a sort of shorthand for the whole gambit of linguistic processes involved in mapping an item in the "mental lexicon" to a corresponding articulatory gesture.

Words, therefore, can be viewed as entries in a “mental lexicon,” each having a form, a mental representation at the phonological level, and a meaning, or mental representation at the semantic level. The following discussion of models of lexical access and naming presents a distillation of the common aspects of a variety of such models. In order to avoid unnecessary confusion that might result from small inconsistencies in terminology surrounding the mental lexicon itself, the lexical level will occasionally be referred to simply as the post-semantic prephonological level of representation.

4.3. *Lexical Access*

The basic picture of the word finding process that emerges from this general notion of what words are is one involving three levels of representation: a semantic representation specifying a concept, a phonological representation specifying an articulatory program, and an intermediate lexical representation that maps a particular set of semantic features to a set of grammatical features (including syntactic and morphological properties) referred to in most neurolinguistic research as its phonological representation. Clarke, Johnson and Pavio (1996) note the close correspondence between this idea of word finding and our intuitive sense of our own volitional capacities with respect to naming familiar objects. They remark that while *recognizing* an object is essentially involuntary, there is some choice involved in deciding what to call it, and likewise, it is certainly possible to know what something is called without actually uttering its name.

Cognitive models of word finding attempt to specify a biologically plausible mechanism by which the brain maps a lexical concept (a concept or bundle of semantic features for which a lexical item exists) to a corresponding phonological form. Many of these models are based on studies of picture naming, a task for which many complicating factors, such as syntactic and morphological complexity found in fluent discourse, can be controlled. One representative model is Levelt's popular *Two Stage Theory of Lexical Access* (Levelt, 2001).

Levelt's model, based largely on stimulus onset asynchrony (SOA) studies of speakers' word production latencies, presents a naturalistic neural network able to map a given lexical concept to a corresponding articulatory gesture. Much of the evidentiary support for the model comes from the power of A. Roelofs' WEAVER++ implementation of the model to predict relative changes in response latencies corresponding to the co-presentation of various distracter stimuli.

Levelt's network comprises two distinct subsystems, "lexical selection" and "form encoding," which operate in series. The lexical selection network consists of two strata. Nodes in the uppermost strata represent "lexical concepts," concepts for which the mental lexicon contains a corresponding "lemma" or syntactic description. The second strata consist of nodes representing the lemmas themselves.

In the preparatory phase known as "perspective taking," a subject begins to "focus on a concept whose expression will serve a particular communicative goal" (Levelt, 1996). This results in coactivation of semantically related lexical concept nodes which in turn spread activation to corresponding lemmas. The time required for lemma selection to occur depends on the amount of coactivation from related concept nodes, and the target lemma is said to be "selected under competition" (Levelt, 2001). Coactivation of conceptually related lemmas accounts for semantic priming effects. In the second stage, the “form encoding,” only the selected lemma begins to spread activation to the phonological nodes of the form encoding network specified for that lemma. With the activation of the appropriate phonological nodes, the form encoding stage proceeds with “incremental syllabification,” “phonetic encoding” and “articulation.”

In addition to serial two-stage models such as Levelt's, there are also cognitive theories of lexical retrieval that employ interactive-activation models, as well as cascade models involving parallel distributed processing (PDP) principles (Ralph, Sage, Roberts, 1999).

The salient feature of all of the models with respect to clinical naming tests such as the BNT is that they all support categorizing failures in lexical retrieval as resulting from either semantic deficit, post-semantic pre-phonological deficit, or phonological deficit. This provides the theoretical rationale for offering semantic cues during administration of the BNT in order to reduce false positives resulting from conceptual mischaracterization of the objects

depicted in the test items, as well as for supplying phonological cues following missed items in order to clarify the nature of the linguistic deficit.

4.4. Other Tasks Involved with Naming

Despite the fact that investigations into the nature of word finding typically employ naming tasks to provide a window on the process of lexical retrieval, it is important to remember that lexical retrieval *per se* is a relatively brief component in the process of naming a pictured object. Before retrieval of a lexical item can proceed, the subject must visually identify the object and, in the case of picture naming, decipher what object the image depicts. A subject who fails to recognize the object depicted will not only be unable to name the object, but will be unable to explain what it is used for, or to produce semantically related words. Once recognition and interpretation of an image succeeds and lexical retrieval takes place, subjects may hesitate before articulating a response.

There is general agreement that to successfully name a picture, the following cognitive operations must take place: visuoperceptual processes, object recognition and semantic processes, lexical processes, and articulatory processes (Barry et al., 1997; Nicholas, et al., 1997). Visuoperceptual processes involve the ability to see and recognize the item. Perceptual aspects generally are not considered to be large contributors to word-retrieval difficulties (Hodgson & Ellis, 1998), however, some researchers believe perceptual problems in older individuals could account for some of the word-finding difficulties in picture naming tasks (Thomas et al., 1977). Object recognition is highly influenced by "image agreement," or how the picture (image) matches (is in agreement) with the rater's mental image of the object. Barry et al. (1997) were the first to use image agreement as a variable and found pictures rated highly on image agreement were named more quickly than pictures with less image agreement.

4.5. *Processing Models*

Stern, Prather, Swinney and Zurif (1991) apply two discrete processing models in their treatment of naming: automatic processing and controlled processing. Intention or attentional processing does not affect "Automatic processing," assumed not under control of the subject.

Automatic access is fast acting (300-700 msec), and is typically what occurs when lexical retrieval is successful. In contrast, "controlled processing" places demands on processes of attention and is affected by intention, or by use of cognitive strategies. Controlled effects occur when lexical retrieval fails and a person actively searches under conscious control. This begins "post-lexical entry" and can likely be associated with a TOT experience, or when a person is consciously using strategies to locate the correct word. Automatic processing is diminished after 1100 ms (Stern et al.) and subsequent effects can be attributed to controlled processes. This coincides with Dunn et al.'s (1989) finding that the average response time to name a picture was 1.145 s. Responses after this amount of time suggests controlled processing when typical lexical retrieval mechanisms fail and the person is forced to utilize other cognitive processes to access the word.

No age effects were found with automatic processing, routine language processes did not seem to slow with aging in a study conducted by Stern et al. (1991). However, the same study noted age effects were noted in controlled processing, presumably due to the limited processing resources on attention and other cognitive demands involved with aging. Therefore, the locus for age-related slowing found in TOT studies (Brown & Nix, 1996; Burke et al., 1991) and in latency performances on naming tasks (Hodgson & Ellis, 1998; Tsang & Lee, 2003) suggests that word-finding difficulties do not arise in the early, language-specific processing that mediates lexical access, but in later language processing that requires the use of problem-solving strategies and other cognitive resources. This suggests the possibility that the age-related declines in naming latencies and accuracies reflect not age-related declines in lexical retrieval, *per se*, but to differences in strategies and

controlled cognitive processes subsequent to the lexical lookup failure.

4.5.1. Response Latencies

Only a few studies have included latency times when using a picture-naming task to assess word-finding abilities (Brookshire, 1971; Dunn et al., 1989; Hodgson & Ellis, 1998; Thomas et al., 1977; Tsang & Lee, 2003). Increased latencies have been related to age for several words production tasks – reading aloud written words, answering questions, and picture-naming tasks. Unfortunately, most research on naming ability focuses only on accuracy scores. Goulet et al. states that accuracy scores are used over latency scores in most naming studies simply because accuracy scores are what has been most frequently used, they are easily available, and are clinically useful. Furthermore, no norms are available for latency responses on picture naming tests (Goulet et al.; Tsang & Lee). Availability of a clinically useful instrument with normative data on latency times on naming tasks might well spawn more research on this topic, especially since speed of word finding is the complaint stated by most often by the elderly (Lovelace & Twohig, 1990). TOTs would not be a bother or embarrassment if subjects were able to resolve them quickly.

4.5.2. *Properties of Object Names*

Elderly people often struggle to name some objects in a naming task, while easily naming others. Variables within the individual or in the environment have already been described. The properties of the names given to presented objects have been investigated to help identify some of the causes of naming problems in the elderly. One property relates to an individual variable and the others are external variables; all of these can help shed light on age differences found among naming performances. Five common properties have been investigated in this respect: 1) age of acquisition, 2) word length, 3) name agreement, 4) word frequency, and, 5) object familiarity. The effects of each property will be discussed individually; however, considering them in isolation may be misleading because many of the

properties are intercorrelated (Hodson & Ellis, 1998) and disentangling which property is the operative factor is difficult. For heuristic purposes, a brief explanation of each property will be presented in relation to age and its effect on speed of naming, and where possible, with respect to levels of automatic and controlled processing.

4.5.3. *Age of Acquisition*

The age at which an object's name was learned affects the vulnerability of that name to word-finding malfunction (Hodgson & Ellis, 1998; Lezak, 2004). The earlier the age at which a word was acquired, the less likely it will produce word-finding failure (Lezak, 2004), and words acquired later in life (which are often longer, less common words) are associated with more failures.

Age of acquisition emerged from regression analysis as the most robust of three independent predictors of naming success of many variables investigated by Hodgson and Ellis (1998) in a picture-naming task. Age of acquisition produced the highest raw correlation with naming accuracy and displayed the highest ability to predict correct naming for all correct responses made within the first five seconds as well as within a 15 second response range. The other two independent predictors of naming success in this study were "word length" and "name agreement" which will be discussed in the next sections.

Age of acquisition can result in a cohort confound by systematically affecting naming scores of younger people differently from older people. For example, Schmitter-Edgecombe's (2000) study found age-related effects on naming ability; however, the validity of these effects is questionable due to a cohort effect that had nothing to do with naming ability. In this study the majority of younger participants systematically missed four items on the BNT because they did not recognize the target words (yoke, trellis, palette, and abacus), whereas the majority of older participants named the same four items correctly. The authors concluded that these four items had an age bias in favour of older individuals. Part of this bias, or cohort

effect, is likely due to when these words were learned (i.e., acquired) for older versus younger adults. Part of this bias in cohort is likely due to when these words were acquired for older versus younger adults.

Age of acquisition has been an important determinant of picture-naming latency (Barry et al., 1997). Morrison et al. (1992) discovered that age of acquisition does not affect object recognition or object identification, but affects object naming. With the sequential processes required to name a picture, this finding suggests that the locus of effect for age of acquisition is at the post semantic level of processing. Normative data is currently available for age of acquisition for pictured objects; Morrison, Chappell, and Ellis (1997) compared measures of determining age of acquisition and using 220 children reported a set of age of acquisition norms for 297 pictured objects (232 of which came from Snodgrass & Vanderwart, 1980).

4.5.4. *Word Length*

The effect of word length or the length of the target word, on elderly people's ability to name objects remains ambiguous by word length's effects on other variables. Intuitively word length is highly correlated with other word properties that could affect naming performances. For example, one would expect for shorter words to be more common than longer words (word frequency) and more familiar (object familiarity) and for shorter words to be learned at an earlier age (age of acquisition). Hodgson & Ellis (1998) confirmed this intuition with significant correlations between length of word and all aforementioned word properties in an elderly population. As mentioned above, word length emerged from Hodgson and Ellis' regression analysis as a significant independent predictor of picture naming. Longer word items in this same study were named less accurately in both younger and older participants in the 0-5s range. Word length as an independent predictor, however, remained

significant only when responses were produced in the 0-5s response range. After 5 sec, response accuracy was unaffected by word length.

Using models of automatic and controlled processing, the findings above suggest that word length is influential in the early, language-specific process that mediates word retrieval. Continuing in the same model, word length would likely have a lesser effect on processes following lexical failure, when a person is consciously trying to access the correct word. Brookshire (1997) would however, deny the application of word length's affect on automatic processes, but not on controlled processes. Brookshire views word length as contributing to the overall complexity of articulation, and more on the mechanical properties of naming functions, whereas he views other properties (e.g., word frequency or word familiarity) as being more likely to affect word access and retrieval functions.

Regarding age and word length, Le Dorze and Durocher's (1992) found an interaction between age and naming while investigating the effect of the number syllables in a target word in young, middle-aged and elderly participants' naming accuracy. Older participants had more difficulty with longer names than younger participants did. It should be noted that "word length" could be measured in different ways. The fact that some measure word length by number of syllables (Brookshire, 1997; Le Dorze & Durocher, 1992) and others by the number of phonemic segments in a word (Barry et al., 1997) makes this type of research difficult to interpret.

4.5.6. *Word Frequency*

Word frequency is the number of times a particular word is used in common communication. It has been stated that age differences may rely on word length and word frequency (Feyereisen, 1997). Word frequency is similar to word length in that it is highly correlated with other properties discussed. Hodgson and Ellis (1998) found word frequency to be significantly correlated, in descending order of strength of correlation, with: age of

acquisition, naming accuracy at 5s latency, naming accuracy at 15s latency, imageability, visual complexity, and name agreement. Word frequency was not as powerful a predictor as other word attributes. In fact, word frequency was often not a factor in picture naming speed at all in several studies once age of acquisition was accounted for (see Barry et al., 1997 for a discussion). However, a significant interaction of frequency and age of acquisition on picture-naming speed exists: high frequency and early acquisition produces the fastest speeds, and low frequency words and late acquisition generates slower speeds (Barry et al., 1997).

One of the few studies measuring naming latency, Thomas, Fozard, and Waugh (1977) considered word frequency in their assessment of the effects of age on speed of retrieval in a picture-naming task. Older participants from an age range of 25 to 74 years produced longer latencies in naming a picture, but the effect of word frequency on naming was the same for both younger and older participants; no interaction was found for word frequency and age on latency to name a picture in this study. The effects of age of acquisition on naming ability were not considered because they were not known at the time of this study.

Though words with low frequency were the target stimuli for the original study of TOTs (Brown & McNeill, 1966), low frequency words have not produced consistent results in TOT experiences (Brown, 1991). For example, Yaniv & Meyer (1987) found a high rate of TOTs in their experiment despite using higher frequency words. TOTs are not restricted to rare words (Brown & Nix, 1996).

The effects of word frequency seem most relevant when assessing culturally diverse populations (Cruice et al., 2002) where word frequency probably correlates less strongly with many other variables. In general, accurate measures of word frequency are not always available (Barry et al., 1997) and therefore, results obtained on this word property should be interpreted conservatively.

4.5.7. *Object Familiarity*

A classic study on naming and aging, Poon and Fozard (1978) examined naming latency of four categories of objects based on their familiarity to young or old participants. One category of four showed no age differences: naming latencies on "common contemporary" objects (objects used throughout the century pictured in their current form, e.g., phone) did not differ between young and old participants. Older participants were significantly faster on naming objects from two categories that reflected generational familiarity: "common dated" objects (objects used throughout the century but in their dated form, e.g., old camera) and "unique dated" objects (objects that were commonplace when the older participants were younger, e.g., bed pan). Along the same line, younger participants were faster to name the category reflecting their generation, modern objects that arrived during the current decade of the study (e.g., calculator).

Based on Poon and Fozard's findings, it could appear that both age of acquisition and object familiarity can account for some of younger participant's poor performance on the four BNT items found in Schmitter-Edgecombe's (2000) study previously mentioned (yoke, trellis, palette, and abacus). Further supporting this hypothesis is the highly significant correlation (r = .498) between age of acquisition and object familiarity determined by Hodgson and Ellis, 1998.

5.0. LANGUAGE AND AGING

Burke and MacKay (1997) divide the effects of aging on language into two segments: "The Input Side" and "The Output Side" (p.8). The following will illustrate the proposed hypothesis that the affects aging has on word finding is not because of semantic or lexical retrieval failure (semantic level and prephonological level are intact), but due to post-lexical access (the phonological connections mapping the concept to the point of articulation), processes that utilized controlled processing mechanisms.

5.1. Comprehension and Semantic Meaning

The input side refers to the processes of perceiving letters and speech sounds that comprise words and comprehension of the meaning of words and sentences. These skills are robust throughout aging despite sensory deficits (Madden, 1988) and encoding deficits. Studies using the semantic priming paradigm show that older people have the same automatic activation that younger people have following a semantic prime, thus, age differences are not perceptible in the receptive or comprehensive part of speech but differences are noted in the productive aspect (Burke & MacKay, 1997).

5.2. Word Production

The "Output Side" includes language production. While language comprehension has shown resistance to aging (Burke & MacKay, 1997), language production has not (see sections on BNT and aging). As previously stated, older adults frequently complain about not finding the right words (Sunderland et al., 1986). The word they seek is a word in which they know, with no deficit in forming an idea to be expressed. Rather, word-finding problems reflect a problem in mapping the well-defined concept onto its phonological or orthographic form. For example, often in a TOT state a person can describe a word and its meaning, generate alternative words (Cross & Burke, 2004), and can even produce phonological features (Brown, 1991; Lambon Ralphe et al., 2002), yet they cannot generate the desired word.

There were four empirical findings that indicated an age-related decline in word production. One, was that the frequency of TOTs occurred more often as one ages (Brown & Nix, 1996; Burke, et al., 1991). Second, numerous studies showed older adult's slower and poorer picture naming ability compared to younger adults (Kent & Luszcz, 2002; Mitchell, 1989; Tsang & Lee, 2003). Studies on picture naming tasks showing naming deficits with aging also suggests the problem lies with access to phonological information of the word

because subjects improved with phonological cueing (Au et al., 1995) and phonological cues leveled out the age differences (Thomas et al., 1977). Third, older people were observed using more pronouns than common nouns (Burke & MacKay, 1997), were more verbal during a TOT state (Brown & Nix, 1996), and produced more circumlocutions when word-searching during the BNT (Obler & Albert, 1985), all of which is likely because older people were less able to retrieve the proper word than the younger groups.

5.3. Possible Contradictory Findings

Although an increase in TOT probability was found for older adults (Burke et al., 1991), the speed or ability to resolve the TOT was equal to younger adults (Brown & Nix, 1996). The first part of this statement is consistent with the premise of an age decline in word-finding ability. The second part may appear to directly negate the proposed automatic and controlled processing effects on aging, where older people would be expected to be slower in resolving TOTs because TOT resolution would involve controlled processing. Further inspection of the findings provides clues to how these results could have materialized and how our hypotheses remain. First, the older group in Brown and Nix's (1996) experiment had significantly higher verbal ability than the younger group. Higher verbal ability could result in better verbal search strategies, which would even out any differences between older and younger groups' controlled processing. More homogeneous groups may have shown poorer search strategies for older adults and hence, slower TOT resolution speeds, which would also support Hodgson and Ellis' (1998) findings that older adults respond to naming tasks slower than younger adults.

6.0. MEASURING WORD FINDING

It is difficult to experimentally study word selection and production in speech, especially when investigating rare natural occurrences such as TOTs or normal or other

word-finding problems (Brown, 1991). R. Brown and McNeill (1966), the first investigators of TOTs, set the initial framework for this type of study and an eclectic assortment of techniques has been used since. Although verbal fluency and discourse tests have been used clinically and experimentally to assess word-finding abilities, confrontational naming tasks, particularly picture naming, are most common (Gordon, 1997; Lezak, 2004; Nicholas et al., 1997). Studies (Dunn et al., 1989; Schmitter-Edgecombe et al., 2000) have compared picture-naming tests with alternative methods to assess word-finding skills and have drawn their own conclusions. Those who argue for discourse tests comment that discourse tests are more akin to spontaneous conversation and thus more appropriate to assess word-finding problems. Others argue that the neurocognitive process of naming a pictured object is similar to word production in spontaneous speech (Lezak, 2004; Loring, 1999) because both necessarily involve lexical access, a process Barry et al. (1997) refer to, somewhat eccentrically, as "lexicalization", which they define as:

> "the means by which a semantic or conceptual representation (e.g., <small mammal>, <domestic pet>, <can be trained to assist blind people>, <has a highly developed sense of smell>, <barks>, etc.) is used to select the appropriate word, which then makes its phonological form ("dog") available." (p. 560) Normal mapping between concept and lexical representation occurs rapidly and utilizes automatic cognitive processing.

Lexical access is fundamentally what neuropsychologists typically want to assess when they "measure word-finding." Unlike discourse tasks, picture naming test restricts a response to a single, concrete noun, reducing syntactic complexity to a bare minimum, but adding the process of object recognition as a prerequisite. Verbal fluency tests also remove complex syntactic processing by restricting responses and without requiring the process of

object recognition. However, verbal fluency tests do not elicit the specific semantic representation that is characteristic of subjects who report "word-finding" problems. It is the specific element of the searched for word during a TOT or word-finding complaint that is distressing. The current literature on three common methods used to assess word-finding problems will be discussed in the next sections followed by the rationale for selecting a picture naming test, the BNT, to construct a ne w method of measuring word-finding.

6.1. Picture Naming Tests

Naming faculties are commonly measured both clinically and experimentally with picture-naming tasks (Goodglass et al., 2001; Goulet et al., 1994; Lezak, 2004; Loring, 1999), also called confrontational naming. A highly researched instrument, the *Boston Naming Test* (BNT), is the most commonly used measure of word-finding (Lansing et al., 1999; Van Gorp, et al.; Welch et al., 1996), especially for research in a normal aging population (Schmitter Edgecombe et al., 2000). The BNT was originally designed for one purpose, to detect aphasia in a clinical population (Goodglass et al., 2001), even though it is used in both clinical and research settings (Mitrushina et al., 1999) and is considered to be helpful in identifying even mild word finding problems (Thompson & Heaton, 1989). The BNT is a naming task where a person is presented with line drawings of objects ranging of high-frequency, high familiarity objects (e.g., tree) to those that are less frequent, less familiar (e.g., abacus) and is asked to name the picture. A prompting cue (semantic category) is given if the object's name is not perceived correctly. This is followed by a phonemic cue (first sound of the word) if the correct response is still not spontaneously produced. The task requires that a person visually interpret and identify the pictured object, mentally retrieve the correct word with its associated phonological representation and articulate the object's name, hence it is known as a "word-finding" task as well as a "naming" task.

6.2. Verbal Fluency Tests

Word fluency tests are productive naming tests that require that an individual "produce" in a restricted time period (typically one minute) as many words that begin with a specified letter of the alphabet, or to produce as many words as he or she can within functional semantic categories (e.g., foods, flowers). Previous studies have indicated a weak relationship between verbal fluency skills and word-finding abilities in healthy adults (Albert et al., 1988; SchmitterEdgecombe et al., 2000) and moderate correlation between verbal fluency among clinical patients (Thompson & Heaton, 1989). Dunn et al. (1989) found a verbal fluency test (category animals) to be a more sensitive measure than a picture-naming task. Verbal fluency scores, unlike the picture-naming scores, were able to separate individuals without impairment from those with mild impairment in Dunn et al.'s study. In addition, the verbal fluency scores were helpful in distinguishing specific types of aphasia (e.g., fluent from nonfluent dysphasia) in this same study.

6.3. Discourse Tests

Discourse tests are naturalistic tests that measure a person's word-finding ability based on their ability to engage in discourse, or free-flowing conversation. Picture Description is the most common test format for measuring discourse (Brookshire, 1997). Other formats to elicit discourse for assessment include "Story Retelling" and "Interviews and Conversations." Schmitter-Edgecombe et al. (2000) discuss several benefits of using a discourse test over a picture-naming test to assess word-finding ability. First, discourse tests permit an individual to produce a more natural and spontaneous language sample that may more closely mimic the mode in which an individual experiences word-finding problems. Second, discourse tests allow for the identification of several types of word-finding errors (e.g., substitutions, empty words) that could offer clues for effective remediation. In contrast,

naming tasks only require a one-word response, which may less likely to occur in the context in which the subject's word-finding difficulties generally take place.

Need for the Study

Confrontation naming has long been recognized as one of the most sensitive tasks for identifying and quantifying neurogenic language deficits. The Boston Naming Test (BNT) (Kaplan, Goodglass & Weintraub, 1983) is the single most frequently used test of visual confrontation naming in Western countries. The BNT has been used in the evaluation of patients with focal left and right CVAs, with diffuse brain damage resulting from head injury, anoxia or progressive dementia such as Alzheimer's disease. The BNT published norms include 84 normal adults (ages 18 – 59) with scores grouped according to those with greater or less than 12 years of education, and 82 aphasic adults with performance divided into 6 severity levels. The BNT has been translated and standardized in many languages like Spanish, and has been used with patients with aphasia, dementia, etc. despite the diagnostic usefulness of confrontation naming tasks in investigating the visual perception and lexical – semantic abilities across a range f neurogenic communication deficits, it is difficult to interpret the results obtained from patients whose demographic profile is not reflected in the normative data. To date, this BNT has not been standardized in any of the Indian languages. Hence a first step toward accurate interpretation of naming performance of Indian clinical populations is to develop BNT in Kannada and Telugu and obtain normative data on healthy adults who are proficient in Kannada and Telugu languages.

Aside from its practical value for clinical diagnosis, validation and developing normatives of BNT for Kannada and Telugu speakers would also prove useful for basic research on the brain bases of language and language disorders in these populations. Many researchers currently use the BNT as an index of naming ability that can be correlated with

one or more experimental measures. However, one cannot simply assume that BNT is a valid measure for any population other than the one for which that instrument was first developed and normed. If we continue to use the test material which s not standardized to a particular group of population, it may lead to wrong diagnosis and other things.

Of potentially even greater theoretical and clinical significance is the little explored validity of such measures with culturally and linguistically diverse adult populations. Therefore, clearly normative data for diverse populations and studies which explore the validity of frequently employed neurolinguistic assessment measures with these culturally and linguistically diverse groups are needed to support both research and clinical practice.

Hence, the primary purpose of the current project is to develop and establish preliminary normative data on the BNT for Kannada –English and Telugu – English bilingual speakers in Karnataka and Andhra Pradesh states of India.

METHOD

The present project aimed at developing Boston Naming Test (BNT) in Telugu and Kannada and standardizing them for Kannada – English and Telugu – English typical and aphasic bilingual speakers.

Participants

Kannada – English bilingual participants

Four groups of subjects were taken in which three groups of typical adults in the age ranges of 20-40 years, 40-60 years and above 60years and the fourth group comprised of13 individuals with aphasia diagnosed by a neurologist and a speech language pathologist based on Western Aphasia Battery (Kertesz, 1982) test results. Normal participants were tested to form a baseline, which will be considered as normative for this test. The following were the inclusion criteria: native Kannada speakers and had English as their second language for minimum of 10 years, no history of major neurological or psychiatric illness or of alcoholism or drug abuse. Demographic details of the participants of normal groups are given in the Table – 1.

Telugu – English bilingual participants

Four groups of subjects were taken in which three groups of typical adults in the age ranges of 20-40 years, 40-60 years and above 60years and the fourth group comprised of13 individuals with aphasia diagnosed by a neurologist and a speech language pathologist based on Western Aphasia Battery (Kertesz, 1982) test results. Normal participants were tested to form a baseline, which will be considered as normative for this test. The following were the inclusion criteria: native Telugu speakers and had English as their second language for minimum of 10 years, no history of major neurological or psychiatric illness or of alcoholism

or drug abuse. Demographic details of the participants of normal groups are given in the Table – 1.

Table 1: Demographic data of all the groups.

S. No	Group	Kannada-English Bilinguals	Telugu–English Bilinguals
1	Young adults (20 – 40 years)	35	35
2	Adults (40 – 60 years)	35	35
3	Geriatric group (above 60 years)	30	30
4	Aphasic Group	13	20

Tools: The original Boston Naming Test (BNT), developed by Goodglass and Kaplan (1983) has 60 pictures. For each of these pictures, an 'incorrect' response or 'no response' is followed by semantic cueing. If here too, an incorrect response is elicited, then a phonemic cue is given. To overcome cultural and linguistic bias, the test material developed by Shanthala and Shyamala (1997) was taken and was developed in Telugu language. This includes a set of 57 line drawings (Appendix – C) and these were displayed on a 4"x6" cards. The test material and scoring sheets of Kannada and Telugu languages are given in Appendix – A and Appendix – B respectively. Language History Questionnaire (Ping Li, Sepanski, S. & Zhao, X., 2006) was used to measure the language proficiency in each language of all the participants. This scale was used to match aphasics and typical subjects in terms of language use. All the subjects had at least minimal vocational proficiency in English and native proficiency in Kannada and Telugu languages.

Test Administration

The procedure that was followed for administration of the test was as follows:

- The patients were seated in a comfortable position and tested.
- The patient was shown the picture, one at a time and was instructed to name them.
- If 'no response' was elicited in the first 20 seconds time interval, a semantic cue was given.
- A 'no response' or 'incorrect response following semantic cue, is followed by a phonemic cue.
- The instruction given to the patient was "I will show you a picture, and you shall name it". The instruction was given in their native languages.

Response and Scoring

As the main aim of the project is to standardize the test material, responses were recorded in the following sections and the scoring pattern is given in Table 2. The maximum score of the test is 114. The total correct scores were defined as answers given spontaneously or with a semantic cue only. The total number of pictures named in each language were recorded and scored. To get the normative for each group in each language, mean and standard deviation are measured. Finally item analysis were conducted to determine whether the graded design of the BNT was maintained in both the languages.

Table 2: Recording of responses and scoring pattern.

Sl. No	Response	Scoring
1	Correct Response	2
2	Correct response with semantic cue	2
3	Incorrect response with semantic cue	0
4	Correct response with phonemic cue	1
5	Incorrect response with phonemic cue	0
6	Incorrect response	0

RESULTS

The aim of the present study was to develop and standardize the Boston Naming Test in Kannada-English and Telugu-English Bilinguals across different age groups and also on individuals with aphasia.

The results of the present study have been presented under the following sections.

1. Performance of normal Kannada – English bilingual groups on Boston Naming Test in Kannada.
2. Performance of Kannada – English bilingual aphasics on Boston Naming Test in Kannada.
3. Performance of normal Telugu – English bilingual groups on Boston Naming Test in Telugu.
4. Performance of Telugu – English bilingual aphasics on Boston Naming Test in Telugu.
5. Performance of both the groups of Bilingual (Kannada – English and Telugu – English) Aphasics on BNT in English.
6. Performance of different groups on each stimuli – item analysis.

1. Performance of normal Kannada-English bilingual groups on BNT in Kannada

Summary data from the 100 bilingual adults in the current study are presented in Table 3. The overall sample mean (N=100) score in Kannada was 106.48 and the standard deviation is 4.76. The mean score of Kannada young adults in the age range 20 – 40 years is 107.34 and S.D. is 4.99; mean score of normal adults in the age range 40- 60 years is 107.31 and the S.D. is 4.37. The mean score of normal geriatric group is 104.5 and the S.D is 4.47.

Table 3: Mean and S.D of the three groups on BNT.

	Kannada Normal 20-40 yrs	Kannada Normal 40-60 yrs	Kannada Normal above 60 yrs
N (100)	35	35	30
Mean	107.34	107.31	104.5
S.D	4.99	4.37	4.47

One way ANOVA was done to find out the significant differences between the three groups and the analysis revealed significant difference ($F(2, 97)=3.916$, $p<0.05$) between the three groups and on Bonferri post hoc analysis, significant difference was found between young adults and geriatric groups ($p<0.05$); middle aged adults and geriatrics($p<0.05$). However, there was no significant difference ($p>0.05$) found between young and middle age normal adult groups. The graphical representation of mean and S.D of all the three groups are represented in figure 1.

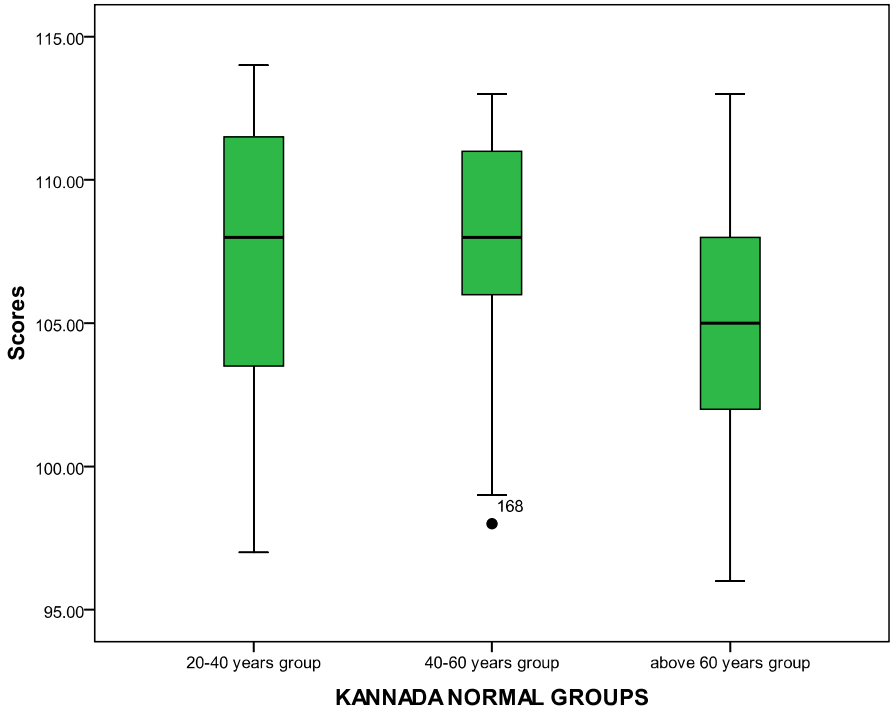


Figure 1: Graphical representation of mean and S.D of three normal Kannada –English groups.

2. Performance of Kannada – English bilingual aphasics on Boston Naming Test in Kannada.

Summary data from the 15 Kannada – English bilingual aphasics in the current study are presented in Table 4. The overall sample mean (N=15) score in Telugu was 58.26 and the standard deviation is 29.63.

Table 4: Mean and S.D of the aphasic groups on BNT.

	N (15)	**Mean**	**S.D**
Anomic	3	64.33	9.71
Brocas	6	59.66	24.71
Global	2	7.00	4.89
SCA	1	102	
TSA	1	60	
WA	2	73.5	34.64

The mean score of Kannada – English bilingual anomic aphasic group (n=3) is 64.33 and the S.D. is 9.71; the mean score of Broca's aphasic group (n=6) is 59.66 and the S.D is 24.71; for global aphasics (n=2), the mean score is 7 and S.D. is 4.89; for subcortical aphasic (SCA) group (n=1), the mean score is 102.0. The mean of Transcortical Sensory Aphasia (TSA) (n=1) is 60.00. The mean and S.D. of Wernicke's aphasics (WA) group (n=2) are 73.5 and 34.64 respectively. The graphical representation of the mean and standard deviation of aphasic groups are shown in figure 2.

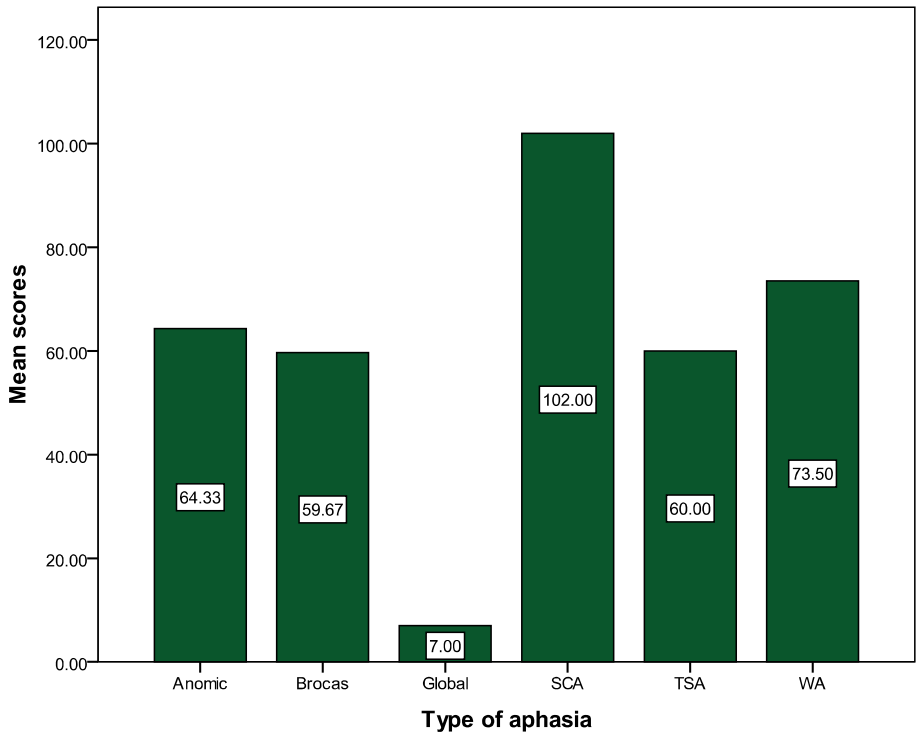


Figure 2: Graphical representation of mean and S.D of Kannada –English bilingual aphasic groups.

3. Performance of normal Telugu – English bilingual groups on Boston Naming Test in Telugu

Summary data from the 100 Telugu – English bilingual adults in the current study are presented in Table 5. The overall sample mean (N=100) score in Telugu was 105.33 and the standard deviation is 4.10. The mean score of Telugu – English bilingual young adults in the age range 20 – 40 years is 104.20 and S.D. is 3.54; mean score of normal bilingual adults in the age range 40- 60 years is 107.11 and the S.D. is 4.17. The mean score of normal geriatric group is 104.56 and the S.D is 4.03.

Table 5: Mean and S.D of the three groups on BNT.

	Kannada Normal 20-40 yrs	**Kannada Normal 40-60 yrs**	**Kannada Normal above 60 yrs**
N (100)	35	35	30
Mean	104.20	107.11	104.56
S.D	3.54	4.17	4.03

One way ANOVA was done to find out the significant differences between the three groups and the analysis revealed significant difference ($F(2, 97)=5.641$, $p<0.05$) between the three groups and on Bonferri post hoc analysis, significant difference was found between young adults and middle aged adult groups ($p<0.05$); middle aged adults and geriatrics($p<0.05$). However, there was no significant difference ($p>0.05$) found between normal young and geriatric groups. The graphical representation of mean and S.D of all the three groups are represented in figure 3.

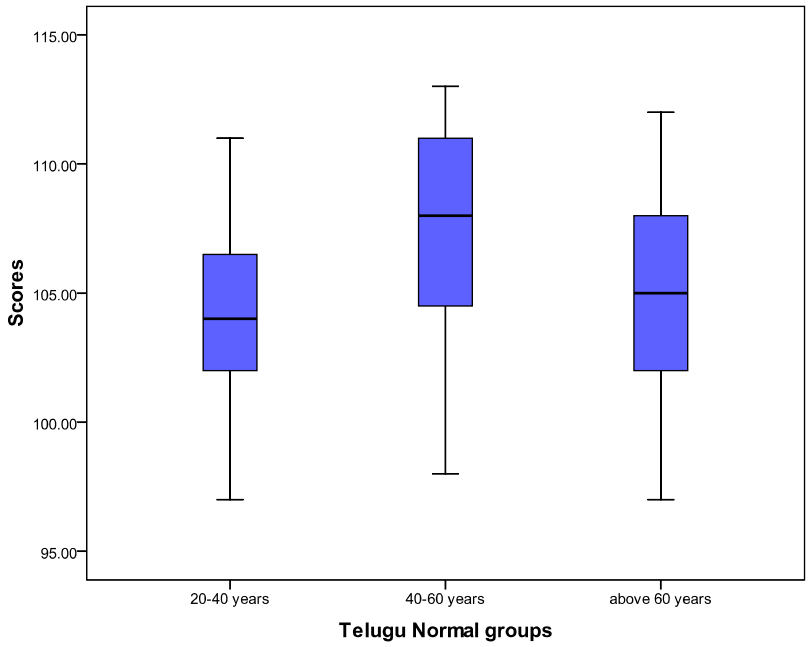


Figure 3: Graphical representation of mean and S.D of three normal Telugu –English groups.

4. Performance of Telugu – English bilingual aphasics on Boston Naming Test in Telugu

Summary data from the 20 Telugu – English bilingual aphasics in the current study are presented in Table 6. The overall sample mean (N=20) score in Telugu was 59.85 and the standard deviation is 38.19.

Table 6: Mean and S.D of the aphasic groups on BNT.

Aphasic group	**N (20)**	**Mean**	**S.D**
Anomic	2	59.00	30.71
Brocas	9	72.11	33.75
Global	1	0	0
SCA	2	42.50	36.06
TMA	2	98.50	0.70
TSA	1	63.00	-
WA	3	28.33	19.85

The mean score of Telugu – English bilingual anomic aphasic group (n=2) is 59.00 and the S.D. is 30.71; the mean score of Broca's aphasic group is 72.11 and the S.D is 33.75; for global aphasics (n=1), the mean score is zero; for Subcortical aphasic (SCA) group (n=2), the mean score is 42.50 and the standard deviation is 36.06. For Transcortical motor aphasics (TMA), the mean score is 98.50 and the S.D is 0.70. The mean of Transcortical Sensory Aphasia (TSA) (n=1) is 63.00. The mean and S.D. of Wernicke's aphasics (WA) group (n=3) are 28.33 and 19.85 respectively. The graphical representation of the mean and standard deviation of aphasic groups are shown in figure 4.

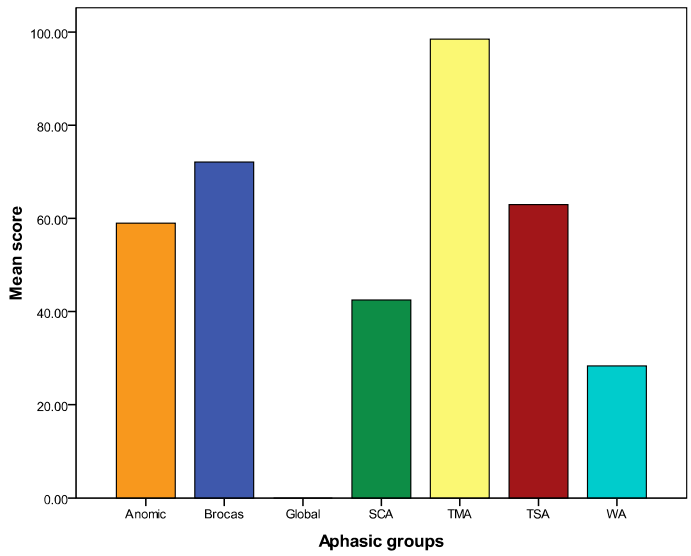


Figure 4: Graphical representation of mean and S.D of Telugu –English bilingual aphasic groups.

5. Performance of normal Kannada – English and Telugu – English bilingual groups on Boston Naming Test in English

Summary data from the 200 Telugu – English bilingual adults in the current study are presented in Table 7. The overall sample mean (N=200) score in Telugu was 101.81 and the standard deviation is 8.18. The mean score of Kannada –English and Telugu – English bilingual young adults (n=70) in the age range 20 – 40 years is 106.83 and S.D. is 4.36; mean score of normal bilingual adults (n=70) in the age range 40- 60 years is 101.11 and the S.D. is 5.71. The mean score of normal geriatric group (n=60) is 97.49 and the S.D is 10.18.

Table 7: Mean and S.D of the three groups on BNT in English.

	Normal 20-40 yrs		**Normal 40-60 yrs**		**Normal > 60 yrs**	
	Kan-Eng	**Tel-Eng**	**Kan-Eng**	**Tel-Eng**	**Kan-Eng**	**Tel-Eng**
N	35	35	35	35	30	30
Mean	104.38	105.82	101.11	103.75	97.49	101.1
S.D	4.36	5.34	5.71	4.95	10.18	8.26

6. Performance of different groups on each stimuli – item analysis

Total number of naming errors was not only counted for each of the 200 normal subjects individually but also for each of the 57 items. Percentages correct per item in Kannada across three age groups are presented in Table 8 and percentage correct per item in Telugu across three age groups is presented in Table 9.

Table 8: Percentage correct per item in Kannada.

Sl. No	Name of the stimuli	Kannada normal 20-40 yrs (in %) N=35	Kannada normal 40-60 yrs (in %) N=35	Kannada normal above 60 yrs (in %) N=30	Average (in %) N=100
1	Flower	100	100	100	100
2	Pencil	100	100	100	100
3	House	100	100	100	100
4	Bed	100	100	100	100
5	Book	100	100	100	100
6	Window	100	100	100	100
7	Whistle	100	100	100	100
8	Comb	100	100	100	100
9	Bus	100	100	100	100
10	Bat	100	100	100	100
11	Flute	91	100	66	85.66
12	Horse	100	100	100	100
13	Brinjal	100	100	100	100
14	Train	100	100	100	100
15	Ear	100	100	100	100
16	Boat	97	100	100	99
17	Shirt	100	100	100	100
18	Eye	100	100	100	100
19	Frock	100	100	100	100
20	Tree	100	100	100	100
21	Scissor	100	100	100	100
22	Cactus	74	88	81	81
23	Rangoli	100	100	100	100
24	Compass	60	74	46	60
25	Wall	100	100	100	100
26	Tortoise	100	100	100	100

27	Socks	91	94	100	95
28	Bicycle	100	100	100	100
29	Camel	100	100	100	100
30	Wheel chair	88	91	87	88.66
31	Drum	91	100	100	97
32	Stethoscope	94	80	100	91.3
33	Snake	100	100	100	100
34	Saw tooth blade	100	100	100	100
35	Rhinoceros	80	88	87	85
36	Crocodile	100	100	100	100
37	Garland	100	100	100	100
38	Peacock	100	100	100	100
39	Apple	100	100	100	100
40	Plate	100	100	100	100
41	Broom stick	100	100	100	100
42	Grapes	100	100	100	100
43	Airplane	100	100	100	100
44	Clock	100	100	100	100
45	Arrow	100	100	100	100
46	Tap	100	100	100	100
47	Leg	100	100	100	100
48	Pen	100	100	100	100
49	Fish	100	100	100	100
50	Pillar	100	100	100	100
51	Lamp	100	100	100	100
52	Garlic	100	97	100	99
53	Globe	66	54	85	68.3
54	Parrot	100	100	100	100
55	Soap	100	100	100	100
56	Brush	100	100	100	100
57	Protector	60	37	46	47.66

In Kannada, 45 items were named by all the participants, i.e., the percent correct for these items are 100%. There are 5 items like garlic, drum, stethoscope, socks and boat were correctly named by above 95% of the participants. Four items (flute, wheelchair, Rhinoceros, cactus) were named correctly by 80-90% of the subjects. Item like compass and protector were named correctly only by 50 – 60% of the participants.

Table 9: Percentage correct per item in Telugu.

Sl. No	Name of the stimuli	Telugu normal 20-40 yrs (in %)	Telugu normal 40-60 yrs (in %)	Telugu normal above 60 yrs (in %)	Average (in %)
		N=35	N=35	N=30	N=100
1	Flower	100	100	100	100
2	Pencil	100	100	100	100
3	House	100	100	100	100
4	Bed	100	100	100	100
5	Book	100	100	100	100
6	Window	100	100	100	100
7	Whistle	97	100	100	99
8	Comb	100	100	100	100
9	Bus	100	100	100	100
10	Bat	100	100	100	100
11	Flute	77	100	81	86
12	Horse	100	100	100	100
13	Brinjal	100	100	100	100
14	Train	100	100	100	100
15	Ear	100	100	100	100
16	Boat	100	100	100	100
17	Shirt	100	100	100	100
18	Eye	100	100	100	100
19	Frock	100	100	100	100
20	Tree	100	100	100	100
21	Scissor	100	100	100	100
22	Cactus	0	77	40	39
23	Rangoli	100	100	100	100
24	Compass	40	71	100	70.3
25	Wall	100	100	100	100
26	Tortoise	100	97	100	99
27	Socks	100	97	100	99
28	Bicycle	100	100	100	100
29	Camel	100	100	100	100
30	Wheel chair	94	94	91	93
31	Drum	94	100	100	98
32	Stethoscope	100	82	100	94
33	Snake	100	100	100	100
34	Saw tooth blade	97	100	100	99
35	Rhinoceros	29	88	100	72.3
36	Crocodile	100	100	100	100

37	Garland	100	100	100	100
38	Peacock	100	100	100	100
39	Apple	100	100	100	100
40	Plate	100	100	100	100
41	Broom stick	100	100	100	100
42	Grapes	100	100	100	100
43	Airplane	100	100	100	100
44	Clock	100	97	100	99
45	Arrow	100	100	100	100
46	Tap	97	100	100	99
47	Leg	100	100	100	100
48	Pen	100	100	100	100
49	Fish	100	100	100	100
50	Pillar	100	100	100	100
51	Lamp	100	100	100	100
52	Garlic	100	97	100	99
53	Globe	51	48	100	66.3
54	Parrot	100	100	100	100
55	Soap	100	100	100	100
56	Brush	97	100	100	99
57	Protector	43	40	100	61

In Telugu, all the participants of the study correctly named 40 items. Around 11 items were correctly named by 95% of the participants. Four items were correctly named only by 60-70% of the participants. ‘Cactus’ was named only by 39% of the participants.

The pattern of correct responses was much more varied throughout the stimulus presentation so that the actual ordering was not a good predictor of naming accuracy. The below tables also show the direction and percentage of change between each item for both Kannada and English as a further indication of variability across consecutive stimulus items. This indicated that the sequential organization of the BNT items was not graded in difficulty (from easiest to hardest) in Kannada and Telugu.

DISCUSSION AND IMPLICATIONS

In the first part of the study, a total of 100 participants in three age groups (20-40 years, 40-60 years and above 60 years) Kannada – English Bilingual adults with > 10 years of formal education in both the languages participated in the study. All participants learned Kannada as a first language in the home environment, and began to learn English before the age of 10 years. The majority of their formal education was in English.

In the second part of the study, a total of 100 participants in three age groups (20-40 years, 40-60 years and above 60 years) Telugu – English Bilingual adults with > 10 years of formal education in both the languages participated in the study. All participants learned Telugu as a first language in the home environment, and began to learn English before the age of 10 years. The majority of their formal education was in English.

Participants considered themselves proficient bilinguals. Individual administration of the Boston Naming Test, a measure of visual confrontation naming, was carried out in both languages to obtain preliminary normative data for healthy bilingual adults. We found that picture naming performance as measured by the BNT was similar in both the languages for this study sample. These findings were consistent with the participant's responses on the language history questionnaires, including self-ratings of relative language skills.

Although BNT performance for these bilinguals was similar in both the languages, a direct comparison of the obtained scores with those of the monolingual norms is not warranted. With respect to the linguistic variability inherent in a bilingual – monolingual comparison, the exception that "dominant" bilinguals will behave like monolinguals is highly suspect on both practical and theoretical grounds (Grosjean, 1992; Gutierrez-Clellen, 1996; Paradis, 1997). It is also, at the very least, uninformative. That is, in comparing the overall group results from the current study to the available monolingual Kannada or monolingual

Telugu normative, little information could be gained which would help differentiate normal from the impaired naming performance. Differences if any in scores between the monolingual norms and the current study results are likely explained by a combination of cultural, linguistic, and experimental variables. Age differences within the adult category across studies may also play a role. It is imperative that representative group normative data be used to adequately interpret performance on the BNT. Given the normal variability in language performance within any bilingual group, it is also important to consider normal individual differences potentially affecting the test performance. In general, the data reported here suggest that patterns of continuing language use may be as important in the acquisition and maintenance of proficiency in two languages as the much-heralded issue of age of acquisition (i.e., the issue that is usually discussed in the framework of critical period theories of second language learning). Certainly, our data suggest that the first language does not necessarily remain the stronger or more fluent language for this population of bilinguals.

In addition, to the need for demographically representative norms for widely used measures and the importance of individual variation within these groups, it is also necessary to explore the validity of these measures themselves. That is, can we appropriate tests constructed on one language group and apply them directly to another? This practice has come under serious scrutiny in research with bilingual children but has rarely been questioned with research and / or clinical practice with proficient bilingual adults. The BNT and related measures of vocabulary assess knowledge of a specific set of lexical items. The pictures and words used to assess knowledge of a specific set of lexical items. In the original BNT, the pictures and words used to assess this lexical knowledge are, by design, graded in difficulty so that language deficits can be identified. Easily named high frequency lexical items are placed at the beginning of the test, followed by lower frequency items that are more difficult to name.

Education level, however, does have some bearing on naming ability, as predicted by data from other studies (Kim & Na, 1999), and this could be related to the low familiarity and imageability of the harder test items. However, this has not been studied extensively in the current study. In our study, age was discovered to be a factor that affected naming ability and this supports the findings of other studies (Albert et al, 1998) and indicates clearly that the older age groups (above 60 years) show some deterioration in naming skills. However, some items like cactus, globe, etc are named correctly by the most of the participants of geriatric group than that of young age group participants. This might be attributed to the lack of exposure to the language in these kinds of words. However, their performance in English resembled similar patterns across three age groups.

In Telugu language, the participants belonged to two regions of Andhra Pradesh namely Telangana (Hyderabad) and Coastal Andhra Pradesh (Vijayawada). Here we found differences in performance between the two regions in terms of the names that they use for the particular object (words such as /pOragADu/ for /abbAyi/ (English word - boy), /manchiga/ as opposed to /bAgA/ (English word - good), /buvva/ (English word - rice) as opposed to /annam/). These differences can be related to dialectal variations and cultural differences.

Comparison with the other BNT versions

Kohnert, Hernandez and Bates (1998) have studied the performance of Spanish - English bilinguals and reported norms from 100 young adult educated bilinguals on both Spanish and English versions of BNT. They have reported that there are variations between the performances of different regions and with the amount of language exposure. In this study, the authors found the performance for these bilinguals was significantly better in English than in Spanish, a direct comparison of the obtained English scores with those of the

available monolingual norms is not warranted. In a study by Kaplan, Goodglass and Weintraub (1983), it was reported that the mean scores of monolingual adults with more than 12 years of formal education was 55.71 whereas, in the study by Kohnert et al (1998) reported mean of BNT total in English for their young adult bilingual sample was 46.66, with a 95% confidence interval of 34-59. These differences in scores between the monolingual norms and the bilingual norms are explained by a combination of cultural, linguistic, and experimental variables. Age differences across studies within the adult category may also play a role in defining the norms. The positive correlation of age and education with both Spanish and English BNT performance found in this study supports the latter notion of increased naming skill in bilinguals, in both their languages, even across the period of young adulthood. The present study on Kannada – English bilinguals and Telugu – English bilinguals also reports the same findings and supports the notion that the naming skills are increased in bilinguals in both languages. Given the normal variability in language performance within any bilingual group, it is also important to consider normal individual differences potentially affecting test performance.

These naming difficulties are common to both normal elderly (Goulet etal. 1994) and elderly with neurological illnesses, such as aphasia (Silver & Halpern 1992) or dementia (Smith et al, 1989). In normal ageing, it is believed that vocabulary skills remain largely intact and may even show improvement with increased age; however it is the process of lexical access and word retrieval which is impaired (Maxim & Bryan 1994). Most cross-sectional studies indicates decreased naming ability with increased age (Welch et al.1996). Accumulated research evidence (Albert et al, 1988) indicates that decline in naming ability is minimal at least until 70 years of age, after which naming difficulties become more apparent. Known as the 70 years of age hypothesis, this is demonstrated when older subjects name significantly fewer pictures than younger subjects, or subjects scores that were previously

stable, shown an abrupt decrease after 70 years old. Opposing this findings are a few studies that suggest the age of significant change may be five to ten years earlier than is currently assumed (Goulet etal 1994).

In contrast, a number of cross-sectional studies report a relationship between age and BNT scores that is not so straight forward (Farmer 1990) reports an age-related trend ($r = 0.29$; $p < 0.05$), though it is in favour of increasing score with increasing age. Nicholas and colleagues (1989) made a definitive statement that age was unrelated to BNT scores and advised against using aged-based cut-off scores. The remaining two studies are a source of confusion in the literature with respect to their position and evidence for or against the age-BNT relationship. Both project qualitative statements that imply no change, such as naming ability 'remain general intact' (Van Gorp et al, 1986) and the elderly show 'remarkably consistent performance across the age range' (LaBarge et al, 1986) or a modest correlational coefficient (Van Gorp et al, 1986).

There are minimal longitudinal data to date which attempt to explain age-related changes in naming ability (Au et al 1995). Au and colleagues (1995) investigated naming in 53 adults aged 30-79 years, using the BNT, three times over the period of seven years. The sample was divided into four groups of 30, 50, 60 and 70 year old subjects. Results are reported to reveal significant effects of age group, time and a significant interaction {$F(6, 98)=2.44$; $p<0.05$}. The 70 year old subjects performed significantly worse than 30 years old subjects on first testing, and worse than all age groups on third testing. Within the groups across time, the decline was greatest for the 70 year old group, equal for 50 subjects. Over the seven year period, the magnitude of the difference in the 70 year old subjects is approximately 8% or 6.8 items using the 85 item version of the BNT, and that of 50 and 60 year old subjects is approximately 2.9% or 2.5 items. Mitrushina and Satz (1995) also reported on a longitudinal analysis of BNT change over three years. Their annual testing of

122 elderly, aged 57 to 85 years, showed high stability or maintenance of BNT scores, measured by Pearson product-moment correlations. A breakdown of subjects into four age groups (57-65, 66-70, 71-75 and 76-85 year groups) revealed that the mean BNT scores for each age group over the three years did not differ greatly within each group, although statistical analysis was not performed. No decline was noted for any age group, unlike the results of the study by Au and colleagues (1995).

In research, an attempt is often made to control influencing factors or confounding variables, by screening subjects for these variables. Some variables are truly extraneous, while others are attribute variables, dependent on subjects. In naming studies, screening attribute variables, is dependent on subjects. In naming studies, screening attribute variables can lead to biased sample selection, such as only including males (Farmer 1990) or subjects with high intelligence quotients and educational levels (Van Goorp etal.1986). These procedures minimize the generalization and interpretation of findings to the general elderly population. Knowledge about factors that influence naming abilities is important in the interpretation of test results.

Cruice, Worrall and Hickson (2000) conducted a longitudinal and cross sectional studies on the performance of 91 healthy older Australians on Boston Naming Test. The results of this study indicate that the results of studies of naming ability are dependent upon the research design used, with respect to the findings of age. The longitudinal analysis showed that naming ability of subjects did not significantly change over four year period. The authors have given several explanations for these results. Firstly, only short period of four years was used. Shorter time periods have been found to produce similar results to the present study (Mitrushina & Satz, 1995), while longer time periods have revealed significant decline (Au et al, 1995). The second explanation refers to the broad age range and uneven representation of ages. The third explanation related to repeated exposure to the stimulus of

BNT. Change scores showed that older elderly did not have greater decline in naming ability than younger elderly, that is change in naming ability was not related to the age of the subject.

The original American BNT was found to penalize Australian elderly, as specific test items are not culturally relevant to the Australian population. Australian subjects performed better on the modified Australian version, when two items of low familiarity were replaced with Australian alternatives. Unlike the study by Worrall et al., (1995) who first used the trial items and found no significant change in scores, the alternative items made a significant difference to Australian subjects' BNT scores in this study.

Similarly, in the current study, some of the items of original BNT version were replaced with culturally specific and language specific items in Kannada and Telugu and the performance was better on the replaced items than on the original items of BNT. The same was found even in English language.

The results from the above study on Australian population and the current study suggest that BNT is susceptible to the cultural effects of word frequency and familiarity, and changes the universality of BNT as a confrontation naming test. Moreover, when the BNT is administered on Indian populations, certain target groups consistently elicit synonyms which are unacceptable if the standard scoring guidelines are followed (ex: /aDagu/ for /dho:ni/, /i:rulli/ for /bellulli/ in Kannada). This indeed is not limited to Kannada, Telugu, or Indian English version.

In a study by Barker-Collo (2001) reported that despite its clinical utility, the content of BNT reflects the cultural context in which it was developed, and may not be applicable to persons from other cultures. Kim and Na (1999) indicate that many BNT items are not applicable to Korean populations, noting that some BNT items (eg., trellis, beaver, pelican)

are not familiar to Korean individuals, whereas, most Koreans are able to easily recognise some of the most difficult BNT items (e.g., abacus).

The findings from the study by Barker-Collo (2001) indicated that some BNT items, particularly those for which large discrepancies were found, are culturally biased and should not be used in determining word retrieval performance in New Zealand samples.

To conclude, in the present study, culturally adapted 57-item Boston Naming test was administered on 100 Kannada – English typical bilingual adults, 15 Kannada – English bilingual aphasics, 100 Telugu – English typical bilingual adults, 22 Telugu – English bilingual aphasics and the mean scores for each group were measured. These mean scores were measured for each age group of 20-40 years, 40-60 years and above 60 years in both the languages.

SUMMARY AND CONCLUSIONS

The present study was taken up to develop Boston Naming Test in Kannada and Telugu and to standardize the test on Kannada – English and Telugu – English bilinguals. The so developed Boston Naming Test consists of 57 black and white line drawings of various lexical items in different levels of familiarity and imageability. All these pictures were shown on 4"x6" inch cards to the participants and they were asked to name the picture in the respective languages. A total of 100 typical Kannada – English bilinguals and 15 Kannada – English bilingual aphasics participated in the study and 100 normal Telugu – English bilinguals and 20 Telugu – English bilingual aphasics served as participants in the study.

Normal participants in both Kannada – English and Telugu – English are divided into three groups based on age range like 20 – 40 years, 40 – 60 years and above 60 years and the normative were collected.

The results of Kannada – English normal bilingual groups revealed significant difference ($F(2, 97)=3.916$, $p<0.05$) between the three groups and on Bonferri post hoc analysis, significant difference was found between young adults and geriatric groups ($p<0.05$); middle aged adults and geriatrics($p<0.05$). However, there was no significant difference ($p>0.05$) found between young and middle age typical adult groups. These results indicated a significant deterioration in the abilities of naming as the age increased.

The analysis of Telugu – English normal bilingual groups revealed significant difference ($F(2, 97)=5.641$, $p<0.05$) between the three groups and on Bonferri post hoc analysis, significant difference was found between young adults and middle aged adult groups ($p<0.05$); middle aged adults and geriatrics ($p<0.05$). However, there was no

significant difference ($p>0.05$) found between normal young and geriatric groups. These differences can be attributed to the familiarity of the words and imageability of the stimuli.

The analysis of Kannada – English bilingual aphasics revealed that the Subcortical aphasics performed better on naming followed by Wernicke's aphasia, anomic aphasia, Broca's aphasia and Transcortical aphasia. Global aphasics obtained the least scores on BNT. The analysis of Telugu – English bilingual aphasics revealed that the transcortical motor aphasics performed better on the naming test followed by Broca's aphasia, transcortical sensory aphasia, anomic aphasia, subcortical aphasia, and wernicke's aphasia. Global aphasics obtained least scores on BNT. However, these results on aphasic groups cannot be generalized as the sample size of each type of aphasia is very less and there can be individual variations within each group depending upon the severity, etiology and site of lesions. In the present study, much variations were found within each group as revealed by standard deviation.

Implications and utilization of the results of this Project:

1. This is a standardized test material for the clinical population of Indian bilingual population in two major languages, Kannada - English, Telugu - English.
2. This test can be used along with regular speech and language test batteries in assessment of aphasia, dementia and other neurogenic communication disorders.
3. Along with the regular usage in clinical settings, BNT for Indian English, Kannada - English and Telugu - English speakers would also prove useful for basic research on the brain bases of language and language disorders in these populations.
4. The same test can be developed and standardized in other languages/ language pairs of India.
5. As the stimuli for this test is being selected by considering the cultural and language influences, this test will be more appropriate for the respective cultures and language groups.

Although, there are many attempts/studies on naming abilities in monolingual and bilingual adults, the role of these naming deficits in neurogenic language disorders like aphasia, dementia, etc. are not well studied in Indian context. Future investigations exploring assessment strategies and or issues with bilingual geriatric population are needed with more focus on clinical populations.

REFERENCES

Albert, M.S., Heller, H.S., & Milberg, W. (1988). Changes in naming ability with age. *Psychology and Aging, 3*, 2 173-178.

Au, R., Joung, P., Nicholas, M., Kass, R., Obler, L.K., & Albert, M.L. (1995). Naming ability across the lifespan. *Aging and Cognition, 2*(4), 300-311.

Azrin, R.L., Mercury, M.G., Millsaps, C., Goldstein, D., Trejo, T., & Pliskin, N.H. (1996). Cautionary note on the Boston Naming Test: Cultural considerations. *Archives of Clinical Neuropsychology, 11*(5), 365-366.

Barker-Collo, L.S. (2001). The 60-item Boston Naming test: Cultural bias and Possible adaptations for New Zealand. *Aphasiology*, 15(1), 85-92.

Barry, C., Morrison, C.M., & Ellis, A.W. (1997). Naming the Snodgrass Vanderwart Pictures: Effects of age of acquisition, frequency, and name agreement. *Quarterly Journal of Experimental Psychology, 50A*(3), 560-585.

Borod, J.C., Goodglass, H., & Kaplan, E. (1980). Normative data on the Boston Diagnostic Aphasia Examination, Parietal Lobe Battery, and the Boston Naming Test. *Journal of Clinical Neuropsychology, 2*, 209-215.

Bowler, R.M., Thaler, C.D., Law, D., & Becker, C.E. (1990). Comparison of the NEW and CNSB neuropsychological screening batteries. *Neurotoxicology, 11*, 451-464.

Brookshire, R.H. (1971). Effects of trial time and inter-trial interval on naming by aphasic subjects. *Journal of Communication Disorders, 3*, 289-301.

Brookshire, R.H. (1997). *Introduction to neurogenic communication disorders* (5th ed.). St.Louis: Mosby.

Brown, A. S. (1991). A review of the tip-of-the tongue experience. *Psychological Bulletin, 109*(2), 204-223.

Brown, A.S., & Nix, L.A. (1996). Age-related changes in the tip-of-the-tongue experience. *American Journal of Psychology, 109*(1), 79-91.

Brown, R., & McMneill, D., 1966. The tip of the tongue phenomenon. *Journal of Verbal Learning and Verbal Behaviors, 5*, 325-327.

Burke, D.M., & MacKay, D.G. (1997). Memory, language and ageing. *Philosophical Transactions of the Royal Society: Biological Sciences, 353*, 1845-1856.

Burke, D.M., MacKay, D.G., & James, L.E. (2000). Theoretical approaches to language and aging. In T.J. Perfect & E.A. Maylor (Eds.) *Models of cognitive aging*. Oxford: University Press.

Burke, D.M., MacKay, D.G., Worthley, J.S., & Wade, E. (1991). On the tip of the tongue: What causes word finding failures in young and older adults? *Journal of Memory and Language, 30*, 237-246.

Calero, M.D., Arnedo, M.L., Navarro, E., Ruiz-Pedrosa, M., & Carnero, C. (2002). Usefulness of a 15-item version of the Boston Naming Test in neuropsychological assessment of loweducational elders with dementia. *Journal of Gerontology, 57b*(2), 187-191.

Christensen, K.J., Multhaup, K.S., Nordstrom, S., & Voss, K. (1991). A cognitive battery for dementia: Development and measurement characteristics. *Psychological Assessment, 3*(2), 168-174.

Cruice, M. N., Worrall, L. E., & Hickson, L.M. H. (2000). Boston Naming Test results for healthy older Australians: A Longitudinal and Cross Sectional Study. *Aphasiology,* 14 (2), 143-155.

Cruice, M.N., Worrall, L.E., & Hickson, L.M.H. (2000). Boston Naming Test results for healthy older Australians: A longitudinal and cross-sectional study. *Aphasiology, 14*(2), 143-155.

Deary, I.J., & Der, G. (2005). Reaction time explains IQ's association with death. *American Psychological Society, 16*(1), 64-69.

Dunn, N.D., Russell, S.S., & Drummond, S.S. (1989). Effect of stimulus context and response coding variables on word retrieval performances in dysphasia. *Journal of Communication Disorders, 22*, 209-223.

Efron B., Tibshirani, R.J. (1993). *An introduction to the bootstrap*. New York: Chapman & Hall.

Ellis, A.W., Lum, C., & Lambon Ralph, M.A. (1996). On the use of regression techniques for the analysis of single case aphasic data. *Journal of Neurolinguistics, 9*, 165-174.

Farmer, A. (1990). Performance of normal males on the Boston Naming Test and the Word Test. *Aphasiology, 4*(3), 293-296.

Farmer, A. (1990). Performance of normal males on the Boston Naming Test and the Word rest. *Aphasiology,* 4, 293-296.

Fastenau, P.S. (1998). Validity of regression-based norms: An empirical test of the comprehensive norms with older adults. *Journal of Clinical and Experimental Neuropsychology, 20*(6), 906-916.

Fastenau, P.S., Denburg, N.L., & Mauer, B.A. (1998). Parallel short forms of the Boston Naming Test: Psychometric properties and norms for older adults. *Journal of Clinical and Experimental Neuropsychology, 20*(6), 828-834.

Felmingham, K.L., Baguley, I.J., & Green, A.M. (2004). Effects of diffuse axonal injury on speed of information processing following severe traumatic brain injury. *Neuropsychology, 18*(3), 564-571.

Ferman, T.J., Ivnick, R.J., & Lucas, J.A. (1998). Boston Naming Test discontinuation rule: Rigorous versus lenient interpretations. *Assessment, 5*, 13-18.

Feyereisen, P. (1997). A meta-analytic procedure shows an age-related decline in picture naming: Comments on Goulet, Ska, and Kahn (1994). *Journal of Speech, Language, and Hearing Research, 40*(6), 1328-1333.

Feyereisen, P., Demaeght, N., & Samson, D. (1998). Why do picture naming latencies increase with age: General slowing, greater sensitivity to interference, or task-specific deficits? *Experimental Aging Research, 24*, 21-47.

Geary, D.C. (1989). A model for representing gender differences in the pattern of cognitive abilities. *American Psychologist, 44*, 1155-1156.

Georgieff, N., Dominey, P.F., Michel, F., Marie-Cardine, M., & Kalery, J. (1998). Anomia in major depressive state. *Psychiatry Research, 77*, 197-208.

German, D.J. (1991). *Test of word-finding in discourse: Administration, scoring, interpretation, and technical manual*. Allen, TX: DLM.

Geschwind, N., (1967). The varieties of naming errors. *Cortex, 3*, 97-112.

Ginsberg, J.P. (2004). Book and tests reviews: Wechsler Test of Adult Reading. *Applied*

Neuropsychology, 10(3), 182-190.

Goldstein, D., Mercury, M., Azin, R., et al. (2000). *Cautionary note on the Boston Naming Test: Cultural considerations*. Paper presented at the 28th annual meeting of the International Neuropsychological Society, Denver, CO.

Goodglass, H., & Wingfield, A. (1997). Word-finding deficits in aphasia: Brain-behavior relations and clinical symptomatology. In H. Goodglass & A. Wingfield (Eds.), *Anomia: Neuroanatomical and cognitive correlates* (pp. 5-27). San Diego, CA: Academic Press.

Goodglass, H., Kaplan, E., & Barresi, B. (2001). *The assessment of aphasia and related disorders* (3rd ed.). Philadelphia: Lippincott Williams & Wilkins.

Goodglass, H., Wingfield, A., & Hyped, M.R. (1998). The Boston corpus of aphasic naming errors. *Brain and Language, 64*, 1-27.

Gordon, (1997). In H. Goodglass & A. Wingfield (Eds.), *Anomia: Neuroanatomical and cognitive correlates* (pp. XX). San Diego, CA: Academic Press.

Goulet, P., Ska, B., & Kahn, H.J. (1994). Is there a decline in picture naming with advancing age? *Journal of Speech and Hearing Research, 37*, 629-644.

Hamby, S.L., Bardi, C.A., & Wilkins, J.W. (1997). Neuropsychological assessment of relatively intact individuals: Psychometric lessons from an HIV+ sample. *Archives of Clinical Neuropsychology, 12*(6), 545-556.

Harrell, F.E., Lee, K.L., & Mark, D.B. (1996). Multivariable prognostic models: Issues in developing models, evaluating assumptions and adequacy, and measuring and reducing errors. *Statistics in Medicine, 15*, 361-387.

Hawkins, K.A., & Bender, S. (2002). Norms and the relationship of Boston Naming Test performance to vocabulary and education: A review. *Aphasiology, 16*(12), 1143-1153.

Hawkins, K.A., Sledge, W.H., Orleans, J.E., Quinlan, D.M, Rakfeldt, J., & Huffman, R.E. (1993). Normative implications of the relationship between reading vocabulary and Boston Naming Test performance. *Archives of Clinical Neuropsychology, 8*, 525-537.

Heaton, R., Grant, I., & Matthews, C. (1991). *Comprehensive norms for an expanded HalsteadReitan Neuropsychological Battery: Demographic corrections, research findings and clinical applications*. Odessa, FL: Psychological Assessment Resources.

Heaton, R.K., Avitable, N., Grant, I.,, & Matthews, C.G. (1999). Further cross validation of regression-based neuropsychological norms with an update for the Boston Naming Test. *Journal of Clinical and Experimental Neuropsychology, 21*(4), 572-582.

Henderson, L.W., Frank, E., Pigatt, T;, Abramson, R.K., & Houston, M. (1998). Race, gender, and educational level effects on Boston Naming Test scores. *Aphasiology, 12*(10), 901-911.

Hickman, S.E., Howieson, D.B., Dame, A., Sexton, G., & Kaye, J. (2000). Longitudinal analysis of the effects of the aging process on neuropsychological test performance in the healthy young-old and oldest-old. *Developmental Neuropsychology, 17*(3), 323-337.

Hodgson, C., & Ellis, A.W. (1998). Last in, first to go: Age of acquisition and naming in the elderly. *Brain and Language, 64*, 146-163.

Hooper, H. E. (1983). *The Hooper Visual Organization Test manual*. Los Angeles: Western Psychological Services.

Hubley, A., & Tombaugh, T.N. (1998). Norms for the 60-item Boston Naming Test (BNT) for cognitively intact individuals aged 25-90 years. [Abstract]. *Archives of Clinical Neuropsychology, 13*(1), 101.

Indefrey, P., & Levelt, W.J.M. (2004). The spatial and temporal signatures of word production components. *Cognition, 92*, 101-144.

J. F. Kroll (Eds.), *Tutorials in bilingualism* (pp. 331–354). Mahwah, NJ: Erlbaum.

James, L., & Burke, D.M. (2000). Phonological priming effects on word retrieval and tip-of-the tongue experiences. *Journal of Experimental Psychology: Learning, Memory and Cognition, 26*(6), 1378-1391.

James, W. (1893). *The principles of psychology: Vol. I.* New York: Henry Holt.

Kaplan, E., Goodglass, H., & Weintraub, S. (1978). The Boston Naming Test, Experimental Edition. Boston: Kaplan and Goodlass.

Kaplan, E., Goodglass, H., & Weintraub, S. (1983). The Boston Naming Test. Philadelphia: Lea and Febiger.

Kemeny, S., Xu, Jian, Park, G.H., Hosey, L.A., Wettig, C.M., & Braun, A.R. (2006). Temporal dissociation of early lexical access and articulation using a delayed naming task – An fMRI study. *Cerebral Cortex, 16*(4), 587-595.

Kent, P.S., & Luszcz, M.A. (2002). A review of the Boston Naming Test and multiple-occasion normative data for older adults on 15-item versions. *Clinical Neuropsychologist, 16*(4), 555-574.

Killgore, W.D., & Adams, R.L. (1998). Vocabulary ability and the Boston Naming Test performance: Interpretative guidelines. [Abstract]. *Archives of Clinical Neuropsychology, 13*(1), 31.

Kim, H., & Na, D.L. (1999). Normative data on the Korean version of the Boston Naming Test. *Journal of Clinical and Experimental Neuropsychology, 21*(1), 127-133.

Kohn, S., & Goodglass, H. (1985). Picture-naming in aphasia. *Brain and Language, 24*, 266-283.

Kohnert, K. J., Hernandez, A. E., & Bates, E. (1998). Bilingual Performance on the Boston Naming Test: Preliminary norms in Spanish and English. *Brain and Language.* 65, 422-440.

LaBarge, E., Edwards, D., & Knesevich, J.W. (1986). Performance of normal elderly on the Boston Naming Test. *Brain and Language, 27*, 380-384.

Lambon Ralphe, M.A., Moriarty, L., & Sage, K. (2002). Anomia is simply a reflection of semantic and phonological impairments: Evidence from a case-series study. *Aphasiology, 16*(1/2), 56-82.

Lansing, A.E., Ivnick, R.J., Cullum, C.M., & Randolph, C. (1999). An empirically derived short form of the Boston Naming Test. *Archives of Clinical Neuropsychology, 1*, 481-487.

Larver, G.D., & Burke, D.M. (1993). Why do semantic priming effects increase in old age? A meta-analysis. *Psychology and Aging, 8*, 34-43.

Le Dorze, G., & Durocher, J. (1992). The effects of age, educational level, and stimulus length on naming in normal subjects. *Journal of Speech and Language Pathology*

and Audiology, 16, 21-29.

Lesk, V.E., & Womble, S.E. (2004). Caffeine, priming, and tip of the tongue: Evidence for plasticity of the phonological system. *Behavioral Neuroscience, 118*(3), 453-461.

Levelt, W.J.M. (2001). Spoken word production: A theory of lexical access. *Proceedings of the National. Academy of Sciences, 98*(23), 13464-13471.

Lezak, M.D. (1991). Emotional impact of cognitive inefficiencies in mild head trauma. *Journal of Clinical and Experimental Neuropsychology, 13*, 23.

Lezak, M.D. (2004). *Neuropsychological assessment* (4th ed.). Oxford: Oxford University Press.

Lopez, M.N., Arias, G.P., Hunter, M.A., Charter, R.A., & Scott, R.R. (2003). Boston Naming Test: Problems with administration and scoring. *Psychological Reports, 92*, 468-472.

Loring, D.W. (1999). *INS dictionary of neuropsychology*. New York: Oxford University Press.

Lovelace, E.A., & Twohig, P.T. (1990). Healthy older adults' perception of their memory functioning and the use of mnemonics. *Bulletin of the Psychonomic Society, 28*(2), 115-118.

Luce, D. (1986). *Response times: Their role in inferring elementary mental organization*. Oxford: Oxford University Press.

Mack, W.J., Freed, D.M., Williams, B.W., & Henderson, V.W. (1992). Boston Naming Test: Shortened versions for use in Alzheimer's disease. *Journal of Gerontology: Psychological Sciences, 47*, 154-158.

MacKay, A., Connor, L.T., & Storandt, M. (2005). Dementia does not explain correlation

between age and scores on the Boston Naming Test. *Archives of Clinical Neuropsychology*.

MacKay, A., Connor, L.T., Albert, M.L., & Obler, L.K. (2002). Noun and verb retrieval in healthy aging. *Journal of the International Neuropsychological Society, 8*, 764-770.

Madden, D.J. (1988). Adult age differences in the effects of sentence context and stimulus degradation during visual word recognition. *Psychology and Aging, 3*, 167-172.

Martin, M., & Zimprich, D. (2003). Are changes in cognitive functioning in older adults related to changes in subjective complaints? *Experimental Aging Research, 29*, 335-352.

Maxim, J. and Bryan, K. (1994). *Language of the Elderly: A Clinical Perspective.* London: Whurr Publishers.

McDonald, R.P. (1999). *Unified test theory*. New Jersey: Earlbaum Associates.

McGurn, B., Starr, J.M., & Topfer, J.A. (2004). Pronunciation of irregular words is preserved in dementia: Validating premorbid IQ estimation. *Neurology, 62*, 1184-1186.

Mehta, K.M., Yaffe, K., Covinsky, K.E. (2002). Cognitive impairment, depressive symptoms, and functional decline in older people. *Journal of American Geriatric Society, 50*, 1045-1050.

Mitchell, D.B. (1989). How many memory systems? Evidence from aging. *Journal of Experimental Psychology: Learning , Memory, and Cognition, 15*, 31-49.

Mitrushina, M.N., Boone, K., B., D'Elia, L.F. (1999). *Handbook of normative data for neuropsychological assessment*. New York: Oxford University Press.

Morrison, C., M., Chappell, T.D., & Ellis, A.W. (1997). Age of acquisition norms for a large

set of object names and their relation to adult estimates and other variables. *Quarterly Journal of Experimental Psychology, 50A*(3), 528-559.

Morrison, C.M., Ellis, A.W., & Quinlan, P.T. (1992). Age of acquisition, not word frequency, affects object naming, not object recognition. *Memory and Cognition, 20*, 705-714,

Mrien, P., Mampaey, E., Vervaet, A., Saerens, J., & De Deyn, P. P. (1998). Normative data for the Boston Naming Test in Native Dutch – Speaking Belgian Elderly. *Brain and Language,* 65, 447-467.

Nicholas, M., Barth, C., Obler, L.K., Au, R., & Albert, M.L. (1997). Naming in normal aging and dementia of the Alzheimer's type. In H. Goodglass & A. Wingfield (Eds.) *Anomia: Neuroanatomical and cognitive correlates* (pp. 166-188). New York: Academic Press.

Nicholas, M., Brookshire, R.H., MacLennan, D.L., Schumacher, J.G., & Porrazzo, S.A. (1989). Revised administration and scoring procedures for the Boston Naming Test and norms for non-brain-damaged adults. *Aphasiology, 3*(6), 569-580.

Nicholas, M., Obler,, L., Albert, M.L., & Goodglass, H. (1985). Lexical retrieval in healthy aging. *Cortex, 21*, 595-606.

Nyberg, L., Backman, L., Erngrund, K., Olofsson, U., & Nilsson, L. (1996). Age differences in episodic memory, semantic memory, and priming: Relationships to demographic, intellectual, and biological factors. *Journal of Gerontology, 51B*, 234-240.

Obler, L.K., & Albert, M.L. (1979). Action Naming Test, (Experimental Edition). Boston: VA Medical Center.

Obler, L.K., & Albert, M.L. (1985). Language skills across adulthood. In J. Birren & K.W.

Schaie (Eds.), *The psychology of aging*. New York: Van Nostrand Reinhold.

Orange, J.B., & Purves, B. (1996). Conversational discourse and cognitive impairment: Implications for Alzheimer's disease. *Journal of Speech Language Pathology and Audiology, 20*, 139-151.

Paradis, M. 1997. The cognitive neuropsychology of bilingualism. In A. M. B. de Groot &

Perbal, S., Couillet, J., Azouvi, P, & Pouthas. (2003). Relationships between time estimation, memory, attention, and processing speed in patients with severe traumatic brain injury. *Neuropsychologia, 41*, 1599-1610.

Ping Li, Sepanski, S. and Zhao, X. (2006). Language history questionnaire: A Web- based interface for bilingual research. Behaviour Research Methods, 38(2), 202-210.

Ponds, R., van Boxtel, M., & Jolles, J. (2000). Age-related changes in subjective cognition functioning. *Educational Gerontology, 26*, 67-81.

Pontón, M.O., Satz, P., Herrera, L. et al. (1996). Normative data stratified by age and education for the Neuropsychological Screening Battery for Hispanics (NeSBHIS): Initial report. *Journal of the International Neuropsychological Society, 2*, 96-104.

Poon, L.W., & Fozard, J.L., (1978). Speed of retrieval from long-term memory in relation to age, familiarity, and datedness of information. *Journal of Gerontology, 33*, 711-71.

Randolph, C., Lansing, A.,E., Ivnick, R.J., Cullum, C.M., & Hermann, B.P. (1999). Determinants of confrontation naming performance. *Archives of Clinical Neuropsychology, 14*(6), 489-496.

Reason, J. T. (1984). Lapses of attention in everyday life. In R. Parasuraman & D.R, Davies (Eds.), *Varieties of attention* (pp. 515-549). San Diego, DA: Academic Press.

Rees, L.M., Tombaugh, T.N., & Boulay, L. (2001). Depression and the Test of Memory Malingering (TOMM). *Archives of Clinical Neuropsychology, 16*, 501-506.

Roberts, P.M., Garcia, L.J., Desrochers, A., & Hernandez. (2002). English performance of proficient bilingual adults on the Boston Naming Test. *Aphasiology, 16*, 635-645.

Rosenbek, J. C., LaPointe, L. L., & Wertz, R. T. 1989. *Aphasia: A clinical approach.* San Diego: Singular.

Ross, T.P., & Lichtenberg, P.A. (1997). Expanded normative data for the Boston Naming Test in an urban medical sample of elderly adults [Abstract]. *Journal of the International Neuropsychological Society, 3*, 70.

Russell, E.W., & Starkey, R.I. (1993). Halstead Russell Neuropsychological Evaluation System (HRNES). Los Angeles: Western Psychological Services.

Salthouse, T.A. (1996). The processing-speed theory of adult age differences in cognition. *Psychological Review, 103*, 403-428.

Schmitter-Edgecombe, M., Vesneski, M., & Jones, D.W.R. (2000). Aging and word-finding: A comparison of spontaneous and constrained naming tests. *Archives of Clinical Neuropsychology, 58*, 397-405.

Shanthala & Shyamala. K. C. (1997). *Naming Deficits in Aphasics*. Unpublished master's dissertation submitted to University of Mysore. Mysore.

Silver, L. S. & Halpern, H. (1992). Word finding abilities of three types of aphasic subjects. *Journal of Psycholinguistic Research,* 21, 317-348.

Smith, G., & Rush, B.K. (2006). Normal aging and mild cognitive impairment. In D.K. Attix and K.A. Welsh-Bohmer (Eds.) *Geriatric neuropsychology: Assessment and*

intervention (pp. 5-55). New York: Guilford Press.

Smith, S. R., Murdoch, B. E. & Chenery, H. J. (1989). Semantic abilities in dementia of the Alzheimer's type. 1. Lexical semantics. *Brain and Language,* 36, 314-324.

Snodgrass, J.G., & Vanderwart, M. (1980). A standardized set of 260 pictures: Norms for name agreement, image agreement, familiarity, and visual complexity. *Journal of Experimental Psychology: Human Learning and Memory, 6*, 174-215.

Spreen, O., & Strauss, E. (1998). *A compendium of neuropsychological tests: Administration, norms and commentary* (2nd ed.). New York: Oxford University Press.

Stern, C., Prather, P., Swinney, D., & Zurif, E. (1991). The time course of automatic lexical access and aging. *Brain and Language, 40*, 359-372.

Sunderland, A., Watts, K., Baddeley, A.D., & Harris, J.E. (1986). Subjective memory assessment and test performance in elderly adults. *Journal of Gerontology, 41*(3), 376-384.

Tartter, V.C. (1998). *Language processing in atypical populations*. London: Sage Publications. Thomas, J.C., Fozard, J.L., & Waugh, N.C. (1977). Age-related differences in naming latency. *American Journal of Psychology, 90*(3), 499-509.

Thompson, L.L., & Heaton, R.K. (1989). Comparison of different versions of the Boston Naming Test. *Clinical Neuropsychologist, 3*(2), 194-192.

Tombaugh, T. N. (1996). Test of Memory Malingering (TOMM). Multi-Health Systems. Toronto, Ontario.

Tombaugh, T.N., & Hubley, A.M. (1997). The 60-item Boston Naming Test: Norms for cognitively intact adults 25-88 years. *Journal of Clinical and Experimental*

Neuropsychology, 19, 922-932.

Tsang, H.L., & Lee, T. M.C. (2003). The effect of ageing on confrontational naming ability. *Archives of Clinical Neuropsychology, 18*, 81-89.

Tsolaki, M., Tsantali, E., Lekka, S., Kiosseoglou, G., & Kazis, A. (2003). Can the Boston Naming Test be used as clinical tool for differential diagnosis in dementia? *Brain and Language, 87*, 185-186.

Van Gorp, W.G., Satz, P., Kiersch, M.E., & Henry, R. (1986). Normative data on the Boston Naming Test for a group of normal older adults. *Journal of Clinical and Experimental Neuropsychology, 8*(6), 702-705.

Vigneau, F., Blanchet, L., Loranger, M., & Pepin, M. (2002). Response latencies measured on IQ tests: Dimensionality of speed indices and the relationship between speed and level. *Personality and Individual Differences, 33*, 165-182.

Vitkovitch, M., & Tyrrell, L. (1995). Sources of disagreement in object naming. *Quarterly Journal of Experimental Psychology, 48A*, 822-848.

Watson, M.E., Welsh-Bohmer, K.A., Hoffman, J.M., Lowe, V., & Rubin, D.C. (1999). The neural basis of naming impairments in Alzheimer's disease revealed through positron emission tomography. *Archives of Clinical Neuropsychology, 14*(4), 347-357.

Wechsler Test of Adult Reading. (2003). San Antonio: The Psychological Corporation, Harcourt Assessment Company.

Welch, L. W., Donieau, D., Johnson, S. and King, D. (1986). Educational and gender normative data for the Boston Naming Test in a group of older adults. *Journal of Clinical and Experimental Neuropsychology,* 8, 702-705.

Welch, L.W., Doneau, D., Johnson, S., & King, D. (1996). Educational and gender normative data for the Boston Naming Test in a group of older adults. *Brain and Language, 53*, 260-266.

Whitfield, K.E., Fillenbaum, G.G., Pieper, C., Albert, M.S., Berkman, L. F., Blazer, D.G., Rowe, J.W., & Seeman, T. (2000). The effects of race and health-related factors on naming and memory. *Journal of Aging and Health, 12*(1), 69-89.

Wilcox, R.R. (1998). How many discoveries have been lost by ignoring modern statistical methods? *American Psychologist, 53*(3), 300-314.

Williams, B.W., Mack, W., & Henderson, V.W. (1989). Boston Naming Test in Alzheimer's disease. *Neuropsychologia, 27*(8), 1073-1079.

Worrall, L. E., Yiu, E. M-L., Hickson, L.M.H. and Barnett, H. M. (1995). Normative data for the Boston Naming test for Australian elderly. *Aphasiology,* 9, 541-551.

Worrall, L.E., Yiu, M.L., Hickson, L.M.H., & Barnett, H.M. (1995). Normative data for the Boston Naming Test for Australian elderly. *Aphasiology, 9*, 541-551.

Yaniv, I., & Meyer, D.E. (1987). Activation and metacognition of inaccessible stored information: Potential bases for incubation effects in problem solving. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 13*, 187-205.

SCORING SHEET FOR BOSTON NAMING TEST (BNT) IN KANNADA

Name: Case Number: Age/Sex:

Date: Clinician: Language of Testing:

Sl. No	Picture Stimuli (Semantic Cues)	Target Word in IPA	Correct without Cue	Latency Cues	With Semantic Cues		With phonemic cues	
					Correct	Incorrect	Correct	Incorrect
1	ಹೂವು (ದೇವರಿಗೆ ಅರ್ಪಿಸುವಂಥದ್ದು)	hu:vu						
2	ಪೆನ್ಸಿಲ್(ಬರೆಯುವ ಸಾಧನ)	pɛnsil						
3	ಮನೆ (ಒಂದು ರೀತಿಯ ಕಟ್ಟಡ)	manɛ						
4	ಮಂಚ (ಮಲಗಲು ಉಪಯೋಗಿಸುವಂಥದ್ದು)	mantʃa						
5	ಪುಸ್ತಕ (ಓದುವ ವಸ್ತು)	pustaka						
6	ಕಿಟಕಿ (ಕೋಣೆಯಲ್ಲಿ ಇರುವಂಥದ್ದು)	kitaki						
7	ಶೀಟಿ (ಶಬ್ದ ಮಾಡುವಂಥದ್ದು)	Si:ti						
8	ಬಾಚಣಿಗೆ (ತಲೆ ಕೂದಲು ಬಾಚುವ ಸಾಧನ)	ba:tʃanige						
9	ಬಸ್ಸು (ಒಂದು ವಾಹನ)	bassu						
10	ಬ್ಯಾಟು (ಆಡುವ ವಸ್ತು)	baɛtu						
11	ಕೊಳಲು (ಸಂಗೀತ ವಾದ್ಯ)	koLalu						
12	ಕುದುರೆ (ಒಂದು ಪ್ರಾಣಿ)	kudurɛ						
13	ಬದನೆಕಾಯಿ (ತರಕಾರಿ)	badanɛkayi						
14	ರೈಲು (ಕಂಬಿ ಮೇಲೆ ಚಲಿಸುವ ವಾಹನ)	raɛlu						

Developed under AIISH Research Fund (ARF) Project titled "Development and Standardization of BNT on Bilinguals (Kannada – English & Telugu – English):
Dr. Shyamala. K.C, Mr. Sunil Kumar. R, Ms. Vijayetha. S

15	ಕಿವಿ (ಕೇಳಲು ಸಹಾಯ ಮಾಡುವ ಅಂಗ)	kivi						
16	ದೋಣಿ (ನೀರಿನ ಮೇಲೆ ತೇಲುವಂಥದ್ದು)	ɖo:ni						
17	ಶರ್ಟು (ಗಂಡಸರ ಉಡುಪು)	ʃʌrtu						
18	ಕಣ್ಣುಗಳು (ನೋಡಲು ಸಹಾಯ ಮಾಡುವ ಅಂಗ)	kʌɳɳugaḷu						
19	ಫ್ರಾಕು (ಚಿಕ್ಕ ಹುಡುಗಿ ಧರಿಸುವ ಉಡುಪು)	phra:k						
20	ಮರ (ನೆರಳು ನೀಡುವಂಥದ್ದು)	mʌrʌ						
21	ಕತ್ತರಿ (ಕತ್ತರಿಸಲು ಉಪಯೋಗಿಸುವ ವಸ್ತು)	kʌṭṭʌri						
22	ಪಾಪಸುಕಳ್ಳಿ(ಮರಳುಗಾಡಿನಲ್ಲಿ ಕಾಣುವಂತಹ ಗಿಡ)	pʌ:pʌsukʌḷḷi						
23	ರಂಗೋಲಿ (ಮನೆಯ ಮುಂದೆ ಬರೆಯುವ ಚಿತ್ರ)	raṇgo:li						
24	ಕೈವಾರ (ಚಿತ್ರ ಬಿಡಿಸುಲು ಉಪಯೋಗಿಸುವಂಥದ್ದು)	kaiva:ra						
25	ಗೋಡೆ (ಕಟ್ಟಡದ ಭಾಗ)	go:dɛ						
26	ಆಮೆ (ಚಿಪ್ಪಿನೊಳಗಿರುವ ಪ್ರಾಣಿ)	a:mɛ						
27	ಕಾಲುಚೀಲ (ಕಾಲಿಗೆ ಉಪಯೋಗಿಸುವಂಥದ್ದು)	ka:lutʃi:la						
28	ಸೈಕಲು (ಎರಡು ಚಕ್ರ ಇರುವ ವಾಹನ)	saikʌlu						
29	ಒಂಟೆ (ಮರಳುಗಾಡಿನಲ್ಲಿರುವ ಪ್ರಾಣಿ)	ontɛ						
30	ಚಕ್ರಕುರ್ಚಿ (ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ನೋಡಬಹುದು)	tʃakrakurtʃi						
31	ತಬಲ (ಒಂದು ಸಂಗೀತ ವಾದ್ಯ)	tabala						
32	ಸ್ಟೆತಸ್ಕೋಪು (ವೈದ್ಯರು ಉಪಯೋಗಿಸುವಂಥದ್ದು)	stɛṭasko:pu						

33	ಹಾವು (ವಿಷಕಾರಿ ಪ್ರಾಣಿ)	ha:vu						
34	ಗರಗಸ(ಮರದ ಆಚಾರಿ ಉಪಯೋಗಿಸುವಂಥದ್ದು)	gʌrʌgʌsʌ						
35	ಫೇಂಡಾಮೃಗ (ಪ್ರಾಣಿ)	genda:mriga						
36	ಮೊಸಳೆ (ನೀರಿನಲ್ಲಿ ಇರುವ ಪ್ರಾಣಿ)	mosaḷɛ						
37	ಮಾಲೆ (ಹೂವಿನಿಂದ ಮಾಡಿದ್ದು)	ma:lɛ						
38	ನವಿಲು (ನರ್ತಿಸುವ ಪಕ್ಷಿ)	navilu						
39	ಸೇಬು (ಒಂದು ಹಣ್ಣು)	sɛ:bu						
40	ತಟ್ಟೆ (ತಿನ್ನಲು ಉಪಯೋಗಿಸುವಂಥದ್ದು)	ṭattɛ						
41	ಪೊರಕೆ (ಸ್ವಚ್ಛಗೊಳಿಸುವ ವಸ್ತು)	pʌrkɛ						
42	ದ್ರಾಕ್ಷಿ (ಹಣ್ಣಿನ ಗೊಂಚಲು)	ḍ̯rʌkʃi						
43	ವಿಮಾನ (ಆಕಾಶದಲ್ಲಿ ಹಾರುವಂಥದ್ದು)	vima:na						
44	ಗಡಿಯಾರ (ಸಮಯ ತೋರಿಸುವಂಥದ್ದು)	gadiyar:a						
45	ಬಾಣ (ಬಿಲ್ಲಿನ ಜೊತೆ ಉಪಯೋಗಿಸುವಂಥದ್ದು)	ba:ṇa						
46	ನಲ್ಲಿ (ನೀರು ಬರುವ ವಸ್ತು)	naḷḷi						
47	ಕಾಲು (ನಡೆಯಲು ಉಪಯೋಗಿಸುವಂಥದ್ದು)	ka:lu						
48	ಪೆನ್ನು (ಬರೆಯಲು ಉಪಯೋಗಿಸುವಂಥದ್ದು)	pɛnnu						
49	ಮೀನು (ನೀರಿನಲ್ಲಿ ಸಿಗುವಂಥ ಜೀವಿ)	mi:nu						
50	ಕಂಬ (ಕಟ್ಟಡದಲ್ಲಿ ಉಪಯೋಗಿಸುವಂಥದ್ದು)	kamba						
51	ದೀಪ (ಪ್ರಕಾಶ ನೀಡುವಂಥದ್ದು)	di:pa						
52	ಬೆಳ್ಳುಳ್ಳಿ (ಒಂದು ತರಕಾರಿ)	bɛḷḷuḷḷi						
53	ಭೂಗೋಳ (ದೊಗೋಳದಲ್ಲಿ ಇರುವ ವಸ್ತು)	ḅu:go:ḷa						

54	ಗಿಣಿ (ಒಂದು ಹಕ್ಕಿ)	giṇi						
55	ಸಾಬೂನು (ಸ್ನಾನ ಮಾಡಲು ಉಪಯೋಗಿಸುವಂಥದ್ದು)	sa:bu:nu						
56	ಬ್ರಶು (ಹಲ್ಲುಜ್ಜುವ ಸಾಧನ)	brʌʃ						
57	ಕೋನಮಾಪಕ (ಕೋನವನ್ನು ಬಿಡಿಸಲು ಉಪಯೋಗಿಸುವಂಥದ್ದು)	konamapaka						

Total Score: ____/114.

Correct without cue:

With Semantic cue:

With Phonemic cue:

Supervisor **Clinician**

SCORING SHEET FOR BOSTON NAMING TEST (BNT) IN TELUGU

Name: Case Number: Age/Sex:

Date: Clinician: Language of Testing:

Sl. No	Picture Stimuli (Semantic Cues)	Target Word in IPA	Correct without Cue	Latency Cues	With Semantic Cues		With phonemic cues	
					Correct	Incorrect	Correct	Incorrect
1	పూవు (దేవునికి సమర్పించేవి)	pu:vu						
2	పెన్సిల్ (వ్రాయుటకు ఉపయోగించునది)	pensil						
3	ఇల్లు (మనుషులు నివసించే భవనం)	illu						
4	మంచం (పడుకోవటానికి ఉపయోగించునది)	mantʃam						
5	పుస్తకం (చదువుకొనేది)	puṣṭakam						
6	కిటికి (ఇంటికి ఉండేవి)	kiTaki						
7	ఈల (శబ్దం చేయుటకు ఉపయోగించునది)	Ila						
8	దువ్వెన (తల దువ్వుకొనుటకు ఉపయోగించునది)	duvvɛna						
9	బస్సు (ఒక వాహనం)	bassu						
10	బ్యాట్ (ఆడుకొనే వస్తువు)	bæt						
11	పిల్లన గ్రోవి (సంగీత వాద్యం)	pillana gro:vi						

Developed under AIISH Research Fund (ARF) Project titled "Development and Standardization of Boston Naming Test on Bilinguals (Kannada – English & Telugu – English): Dr. Shyamala. K.C, Mr. Sunil Kumar. R, Ms. Vijayetha. S

12	గుర్రం (ఒక జంతువు)	gurram						
13	వంకాయి (కూరగాయి)	vanka:ji						
14	రైలు (పట్టాల మీద వెళ్ళేది)	railu						
15	చెవి (వినిపించుకోనుటకు అవసరమైనది)	tʃevi						
16	పడవ (నీళ్ళల్లో వెళ్ళేది)	padava						
17	చొక్కా (అబ్బాయిలు వేసుకొనేది)	tʃokka:						
18	కన్ను (చూడటానికి అవసరమైనది)	kannu						
19	గౌను (చిన్న పిల్లలు వేసుకొనేది)	gounu						
20	చెట్టు (నీడనిచ్చేది)	tʃettu						
21	కత్తెర (కత్తిరించుటకు ఉపయోగించునది)	kaṭṭera						
22	నాగతాళి పొద (ఎడారిలో పెరిగే మొక్కలు)	na:gata:Li poda						
23	ముగ్గు (ఇంటి ముందు వేసేది)	muggu						
24	కైవారము (చిత్రములు గీయుటకు ఉపయోగించునది)	Kaiva:ramu						
25	గోడ (ఇంటిలో ఒక భాగం)	go:da						
26	తాబేలు (బావిలో ఉండేది)	ta:be:lu						
27	సాక్స్ (కాలికి వేసుకొనేది)	sa:ks						
28	సైకిల్ (రెండు చక్రాలు కలిగినది)	saikil						
29	ఒంటె (ఎడారిలో నివసించునది)	onte						
30	చక్రాల కుర్చి (ఆస్పత్రులలో ఉండేది)	tʃakra:la						
31	తబల (ఒక సంగీత వాద్యం)	tabala						

32	స్టెతస్కోప్ (డాక్టర్లు ఉపయోగించునది)	steṭasko:pu						
33	పాము (విషం కలిగినది)	pa:mu						
34	రంపం (చెట్లను కోయుటకు ఉపయోగించునది)	rampam						
35	ఖడ్గమృగం (ఒక జంతువు)	KadgamRugam						
36	ముసలి (నీళ్ళల్లో నివసించే ప్రాణి)	musali						
37	పూల మాల (పూలతో చేసినది)	pu:la ma:la						
38	నెమలి (నాట్యం చేసే పక్షి)	nɛmali						
39	ఆపిల్ (ఒక పండు)	a:pil						
40	ప్లేట్ (తినుటకు ఉపయోగించునది)	plɛ:t						
41	చీపిరి (శుభ్రం చేయుటకు ఉపయోగించునది)	ʧi:piri						
42	ద్రాక్ష (పండ్ల గుత్తి)	ɖra:kʃa						
43	విమానం (ఆకాశంలో ప్రయాణించేది)	vima:nam						
44	గడియారం (సమయం చూపే వస్తువు)	gadija:ram						
45	బాణం (విల్లుతో ఉపయోగించునది)	ba:Nam						
46	కొళాయి/ పంపు (స్నానాల గదిలో ఉండేది)	kola:ji/ pampu						
47	కాలు (నడవటానికి అవసరమైనది)	ka:lu						
48	పెన్ (వ్రాయుటకు ఉపయోగించునది)	pɛn						
49	చేప (నీళ్ళల్లో దొరికే జీవి)	ʧɛ:pa						
50	స్థంభం (కట్టడంలో ఉపయోగించునది)	sthambam						

51	దీపం (వెలుగునిచ్చేది)	di:pam						
52	వెల్లుల్లి (కూరలలో ఉపయోగించునది)	vɛllulli						
53	భూగోళం (భూగోళ శాస్త్రంలో ఉపయోగించునది)	bhu:go:Lam						
54	చిలుక (ఒక పక్షి)	tʃiluka						
55	సబ్బు (స్నానం చేయుటకు ఉపయోగించునది)	sabbu						
56	బ్రష్ (పళ్ళు తోమటానికి ఉపయోగించునది)	braʃ						
57	కోణమాని (కోణం కొలుచటకు ఉపయోగించునది)	ko:Nama:ni						

Total Score: ____/114.

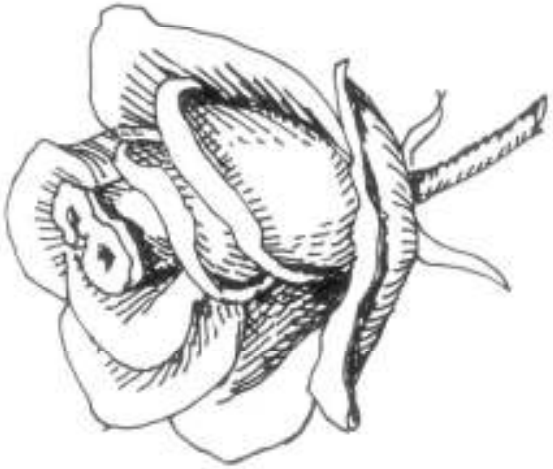
Correct without cue:

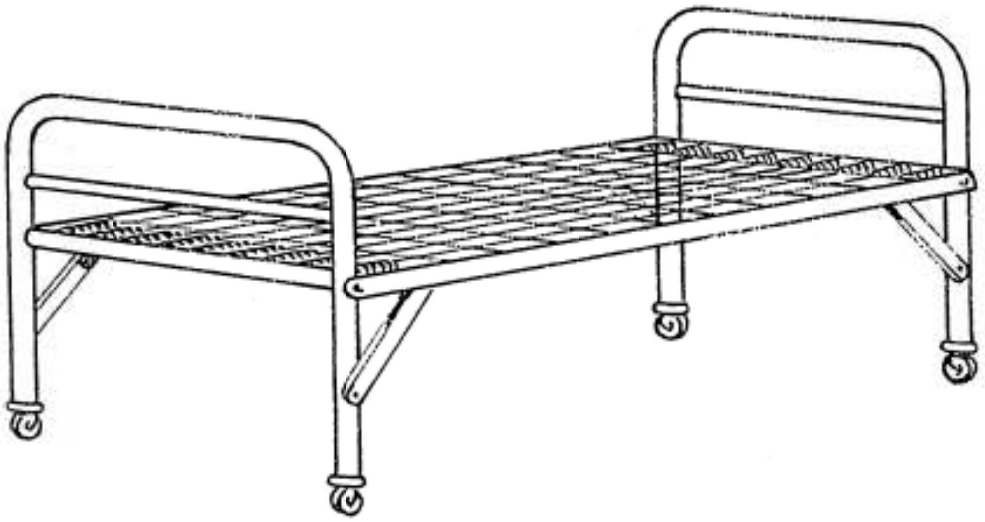
With Semantic cue:

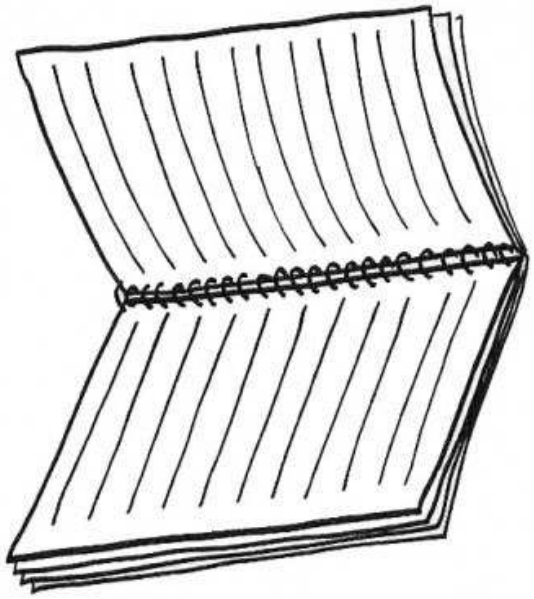
With Phonemic cue:

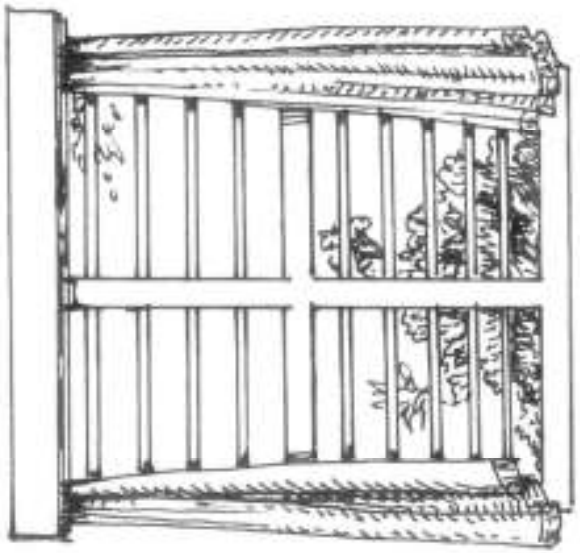
Supervisor **Clinician**

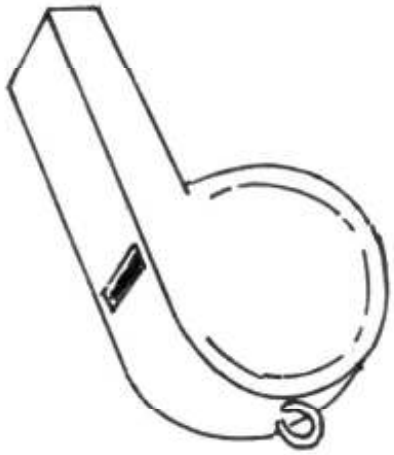
Developed under AIISH Research Fund (ARF) Project titled "Development and Standardization of Boston Naming Test on Bilinguals (Kannada – English & Telugu – English): Dr. Shyamala. K.C, Mr. Sunil Kumar. R, Ms. Vijayetha. S

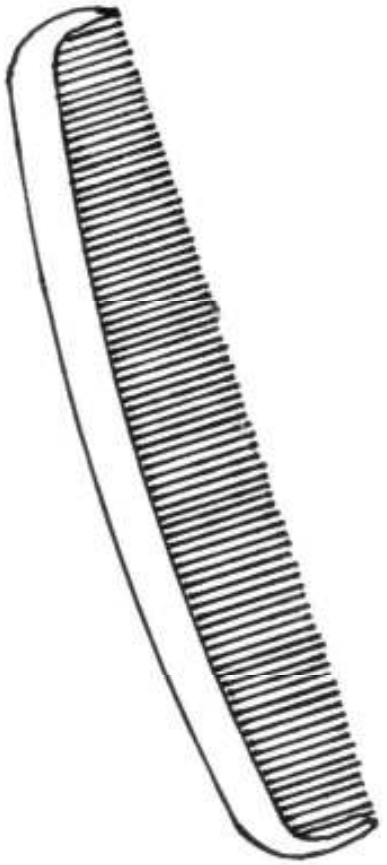


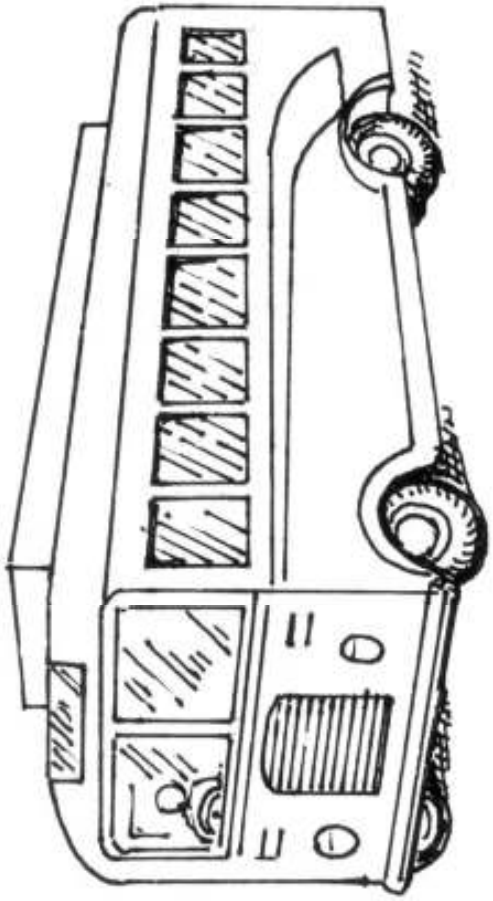


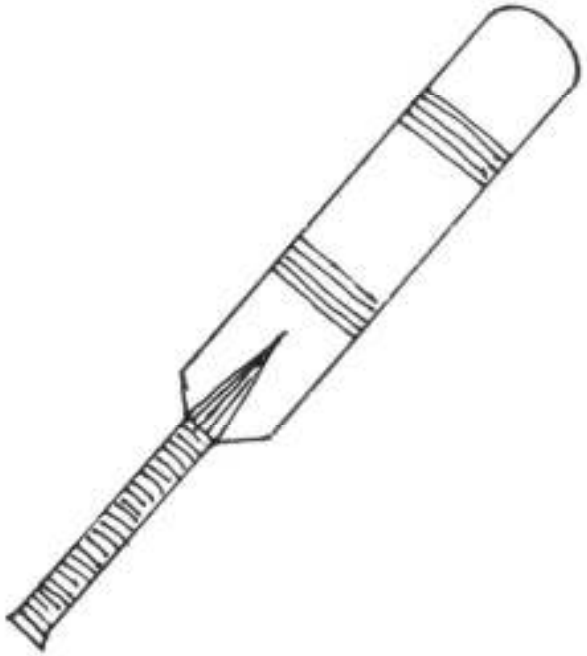


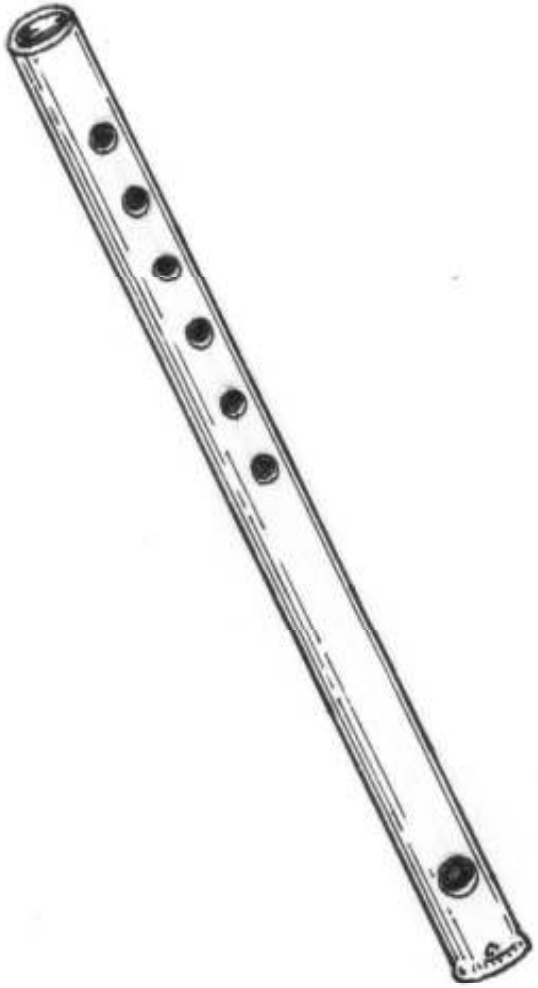


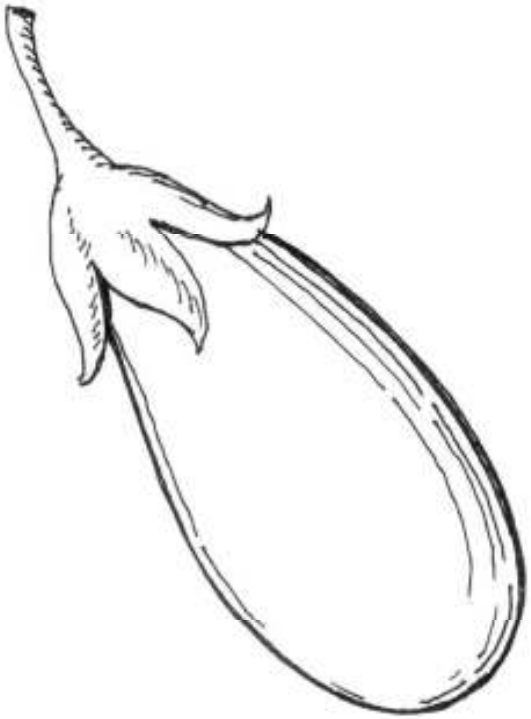


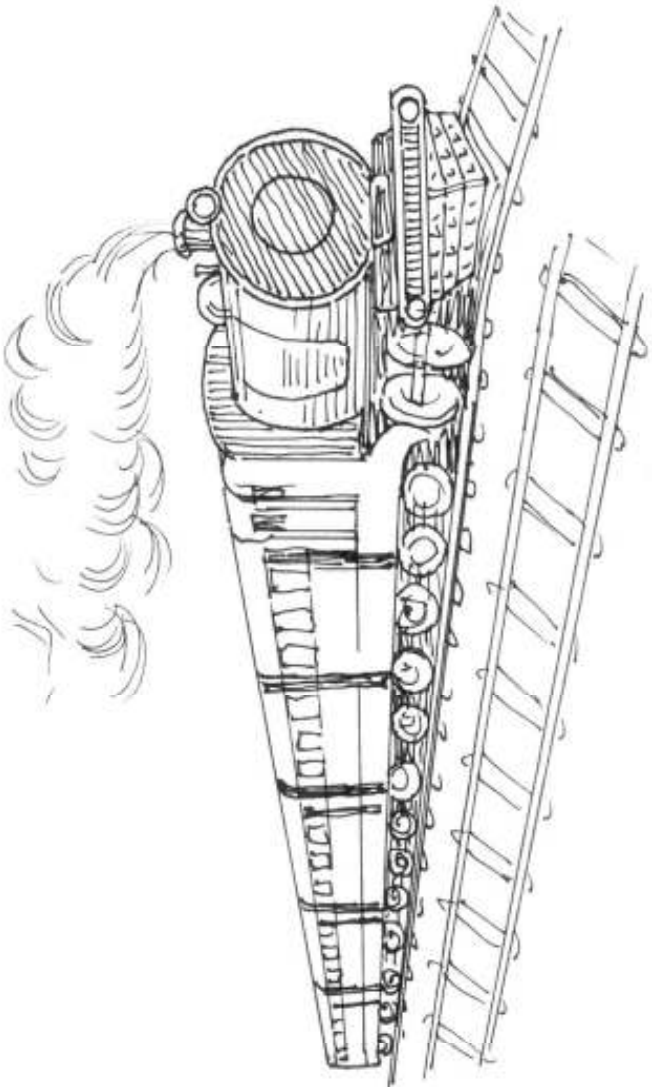


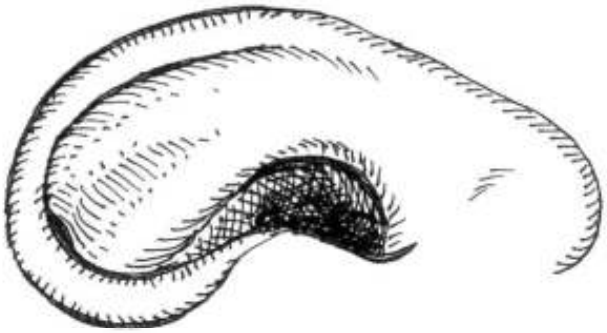


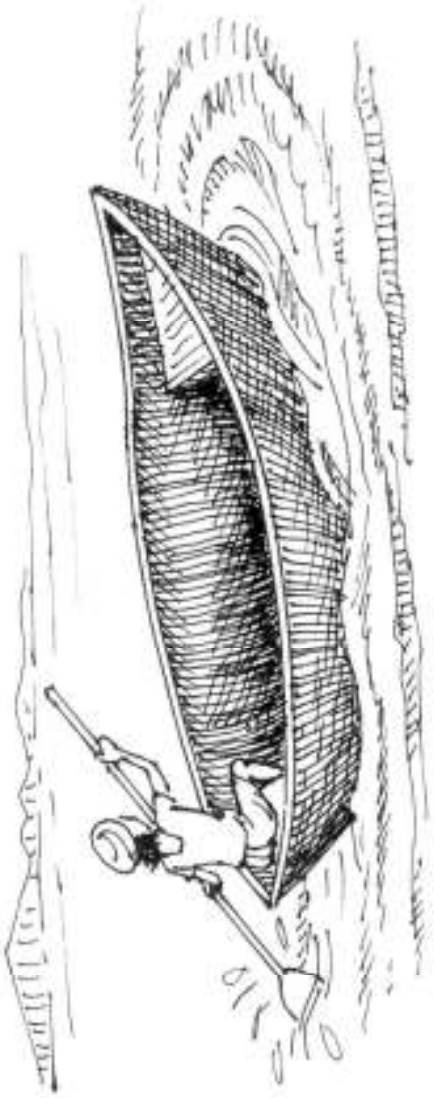


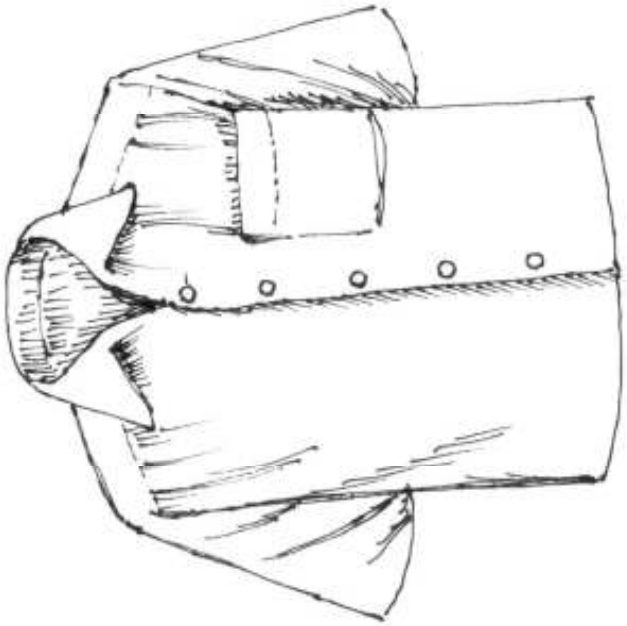


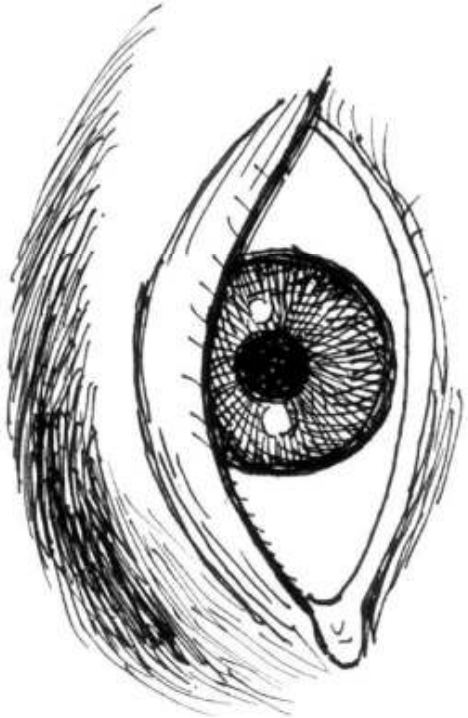


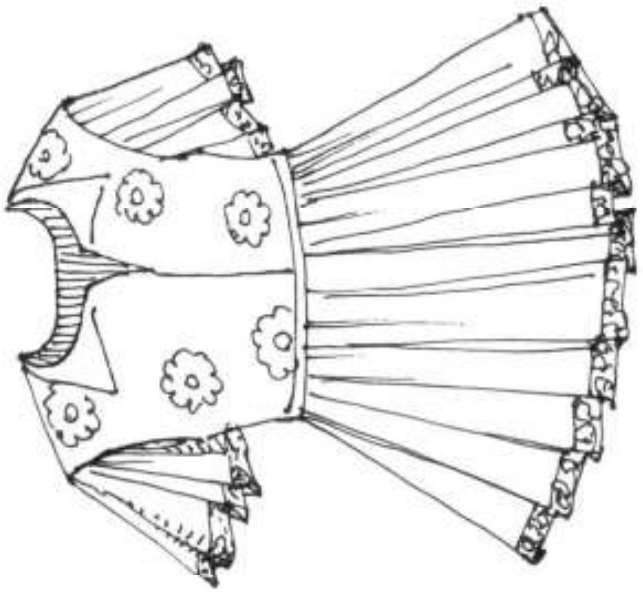


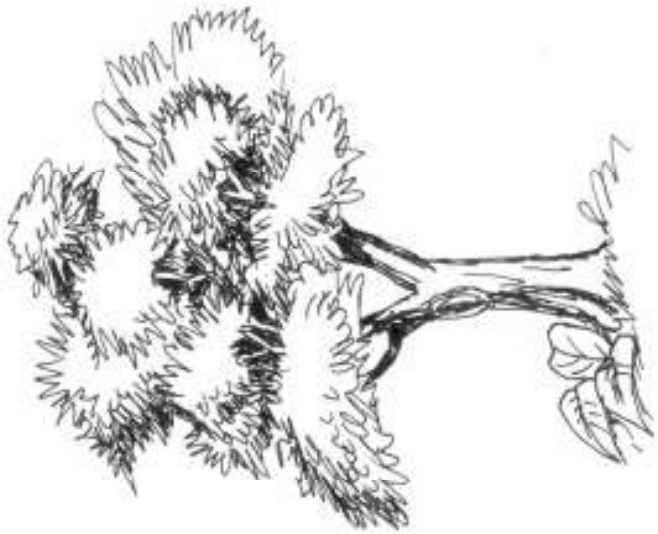


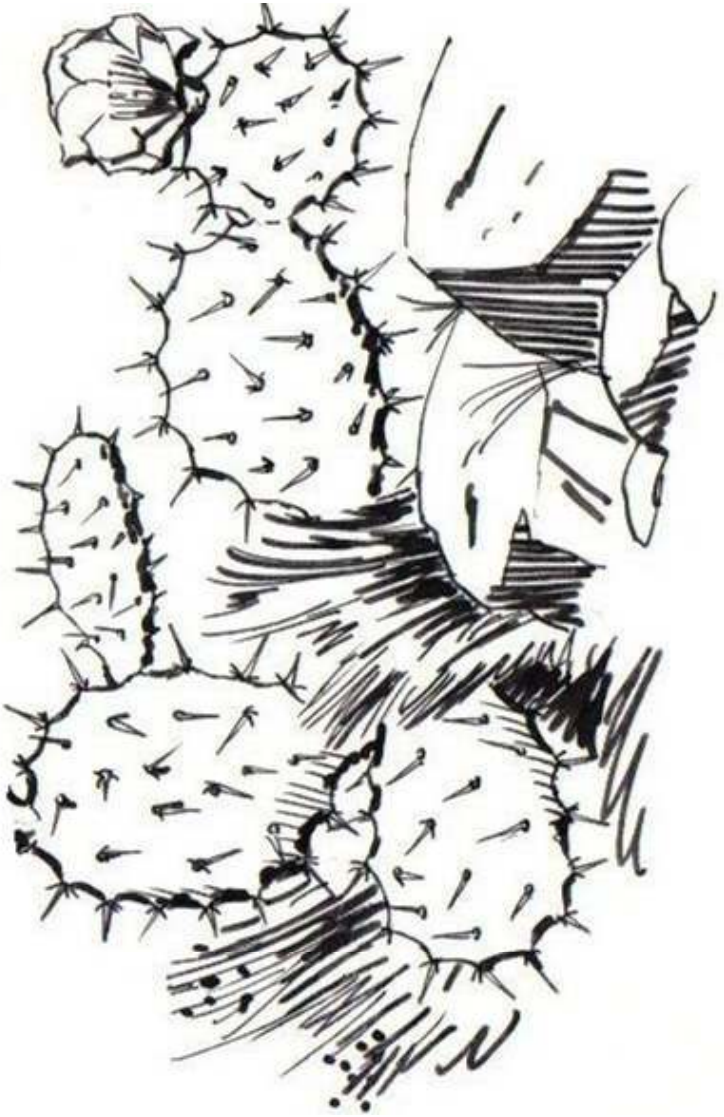


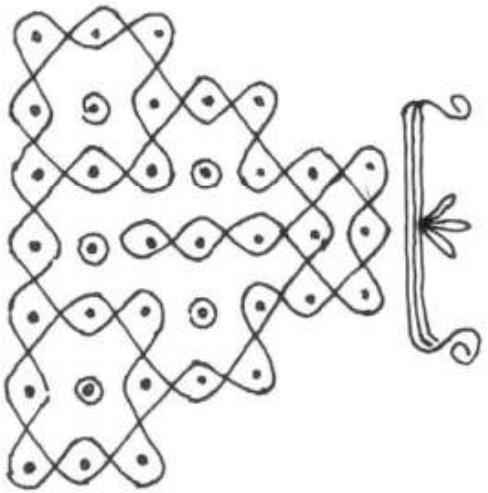


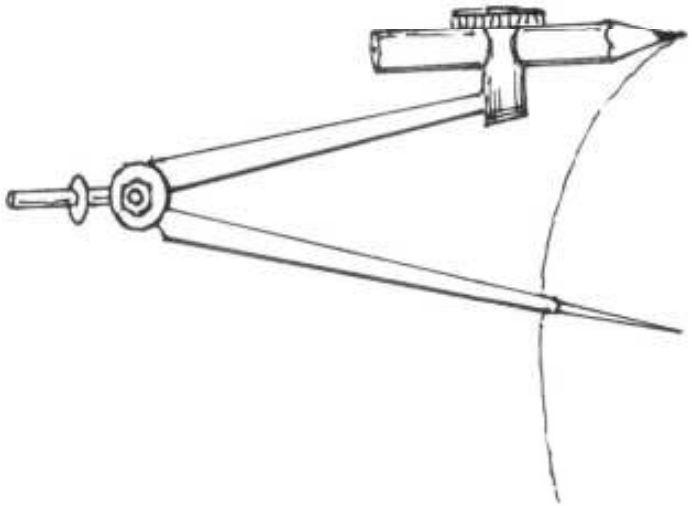


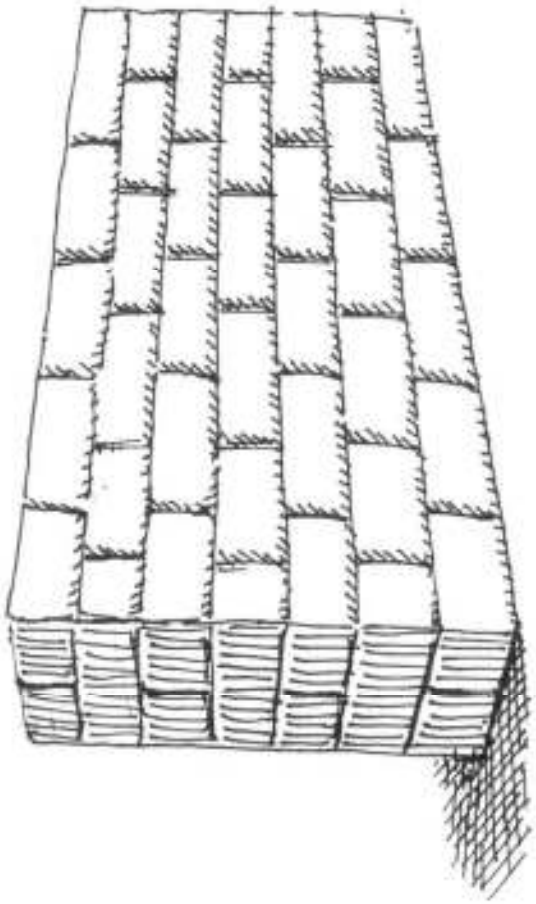


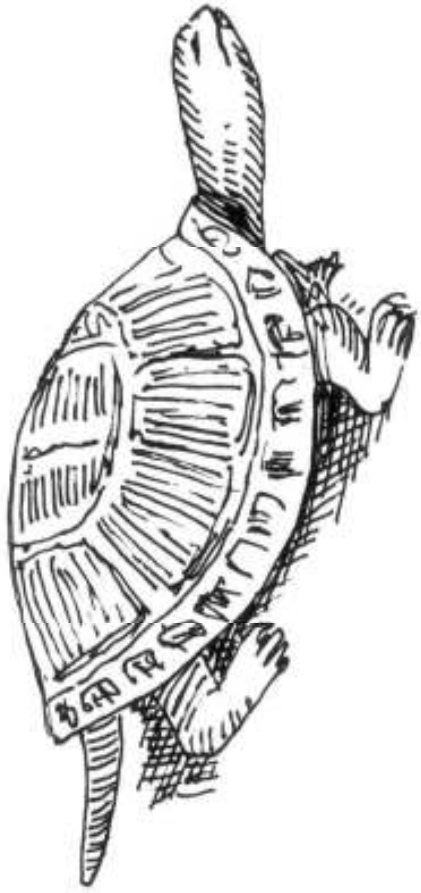


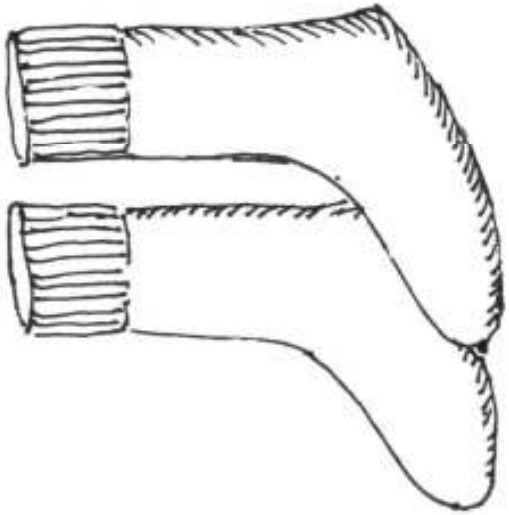


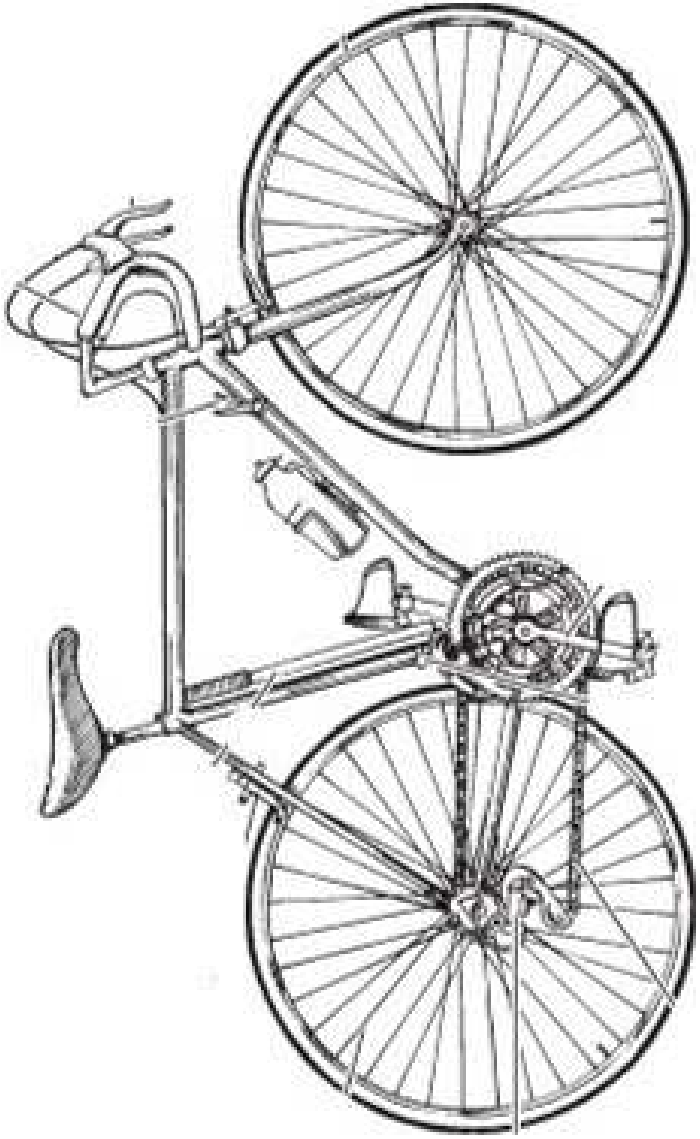


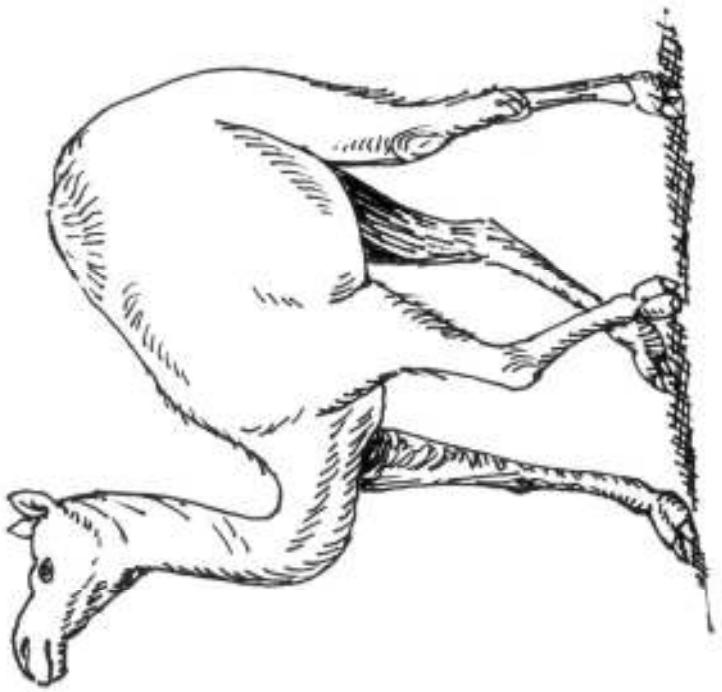


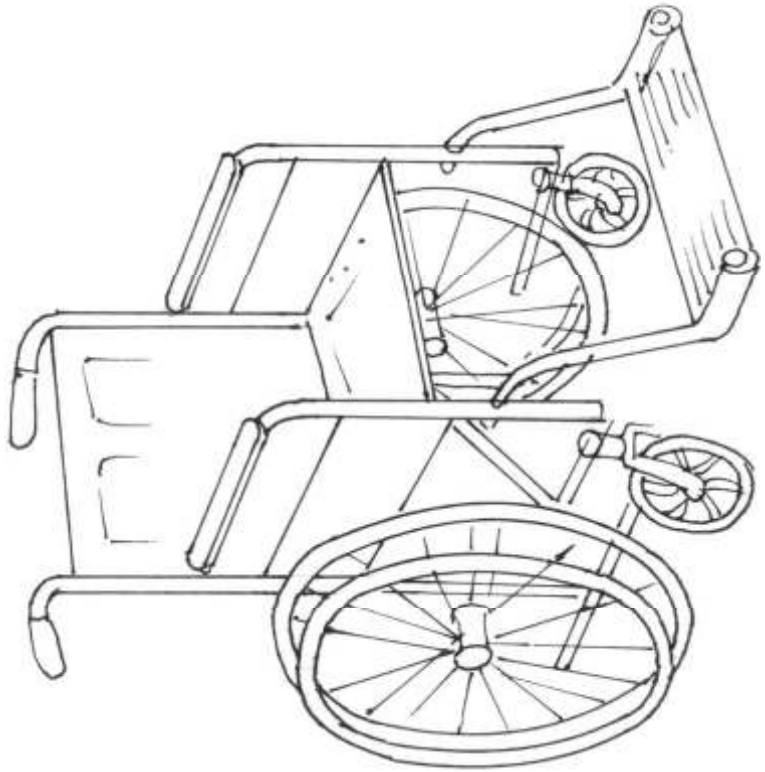


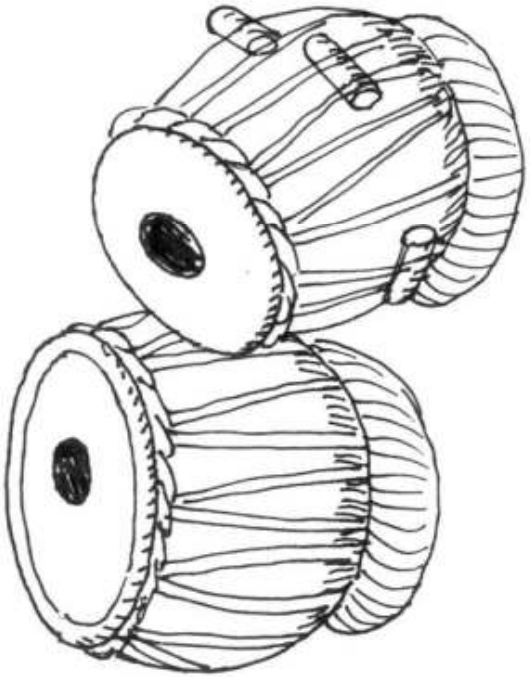


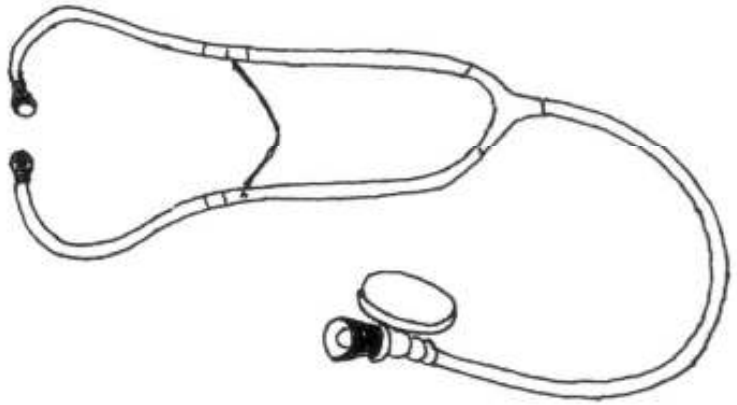


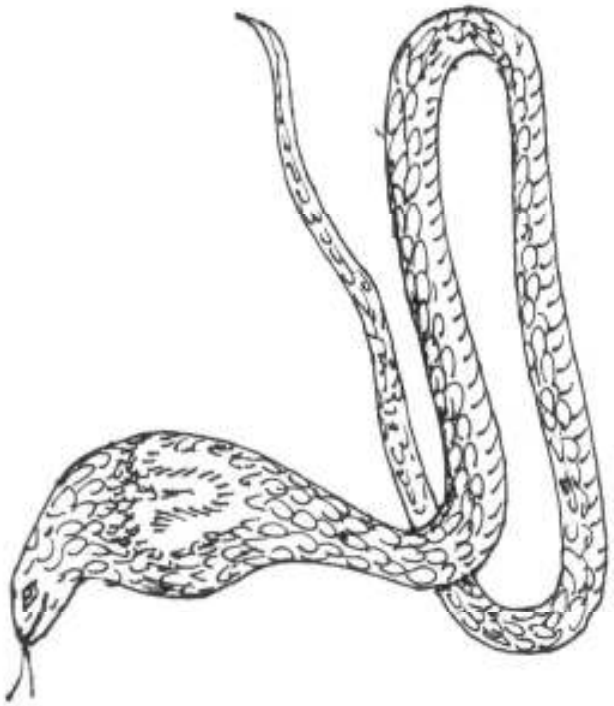


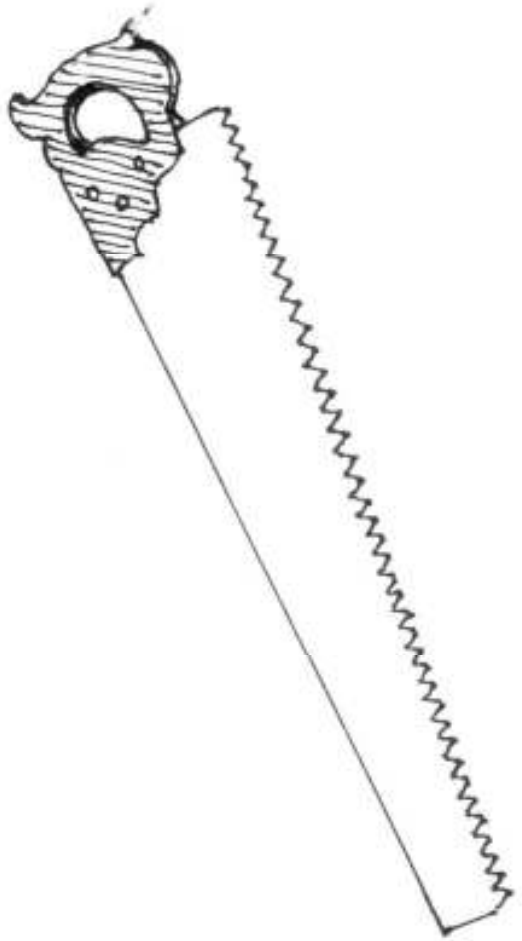


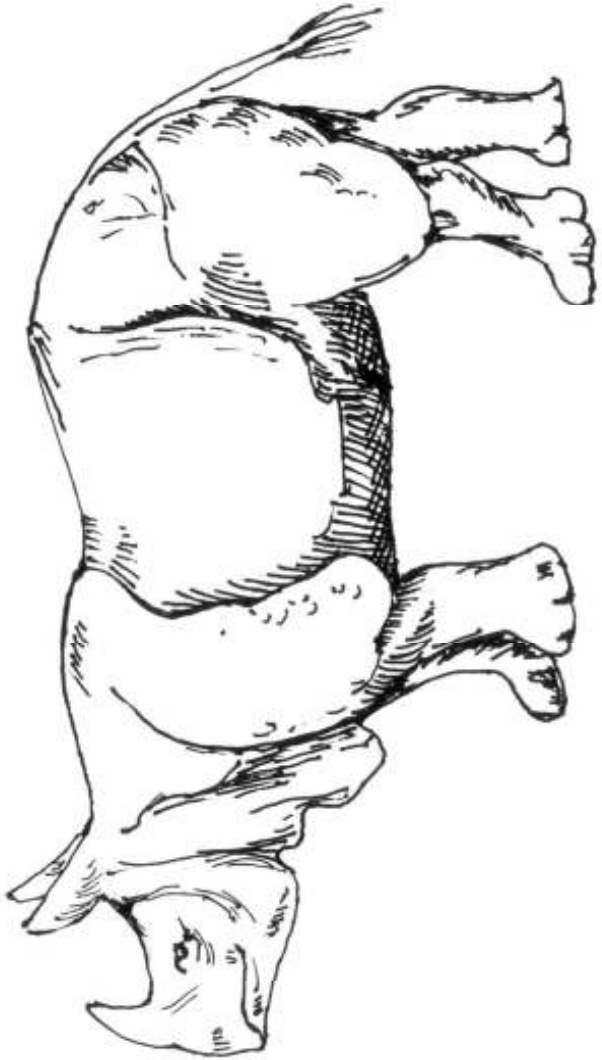


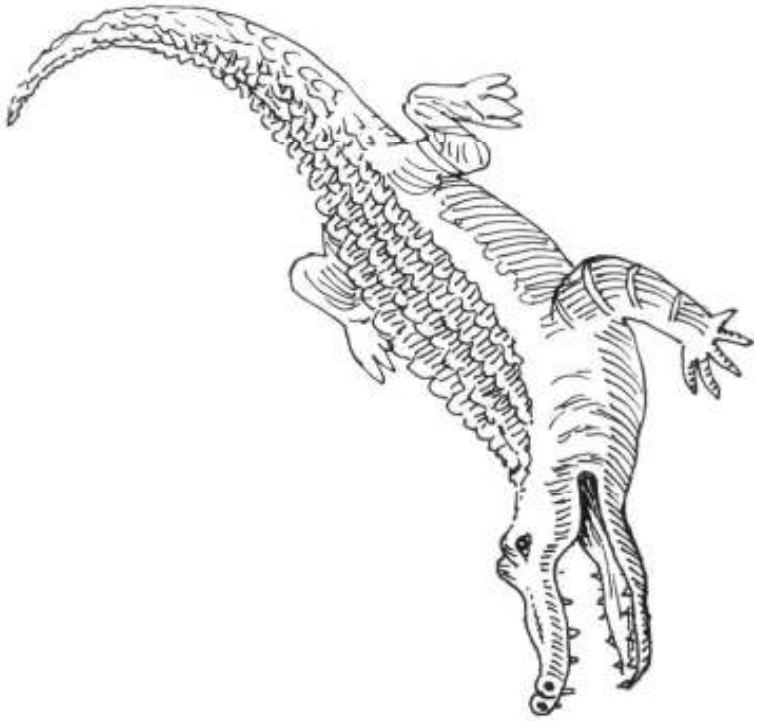


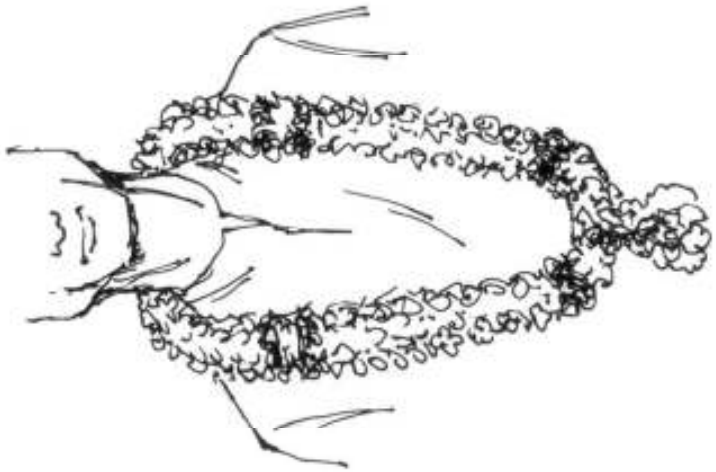


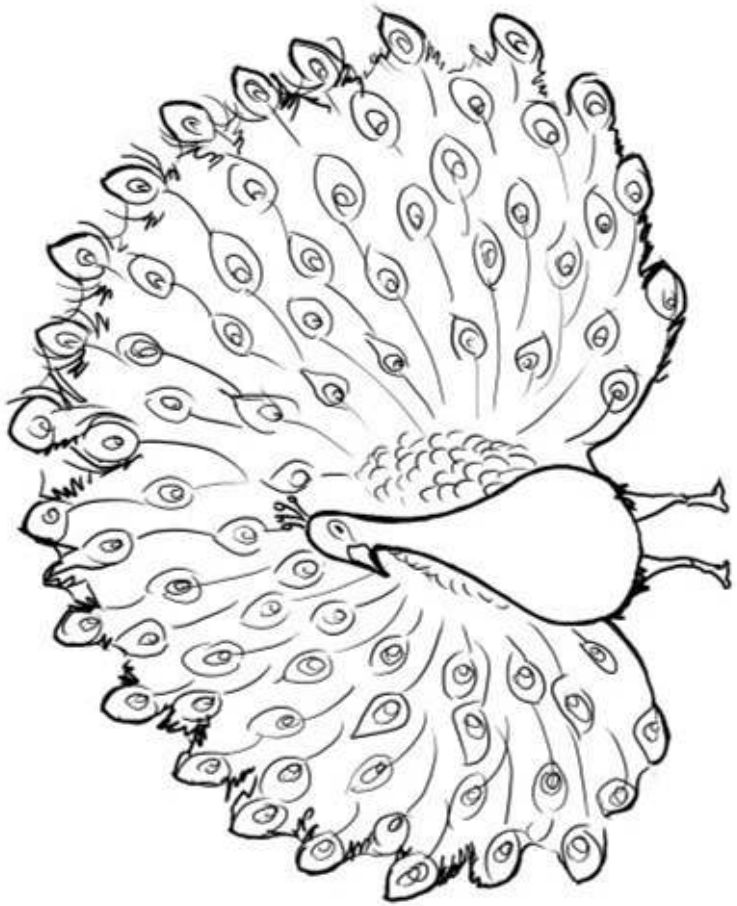


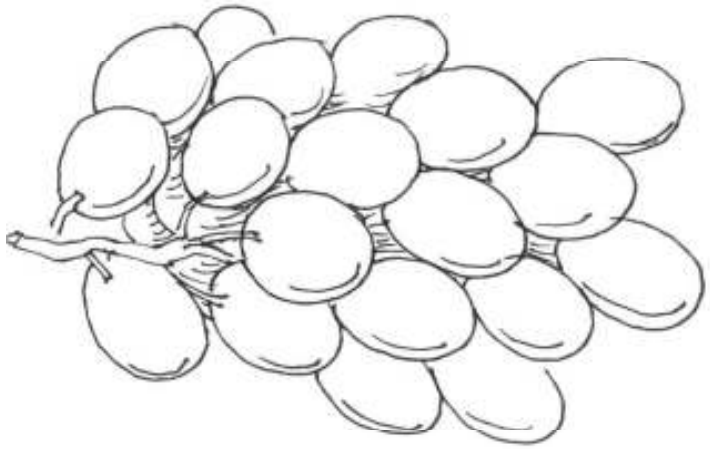


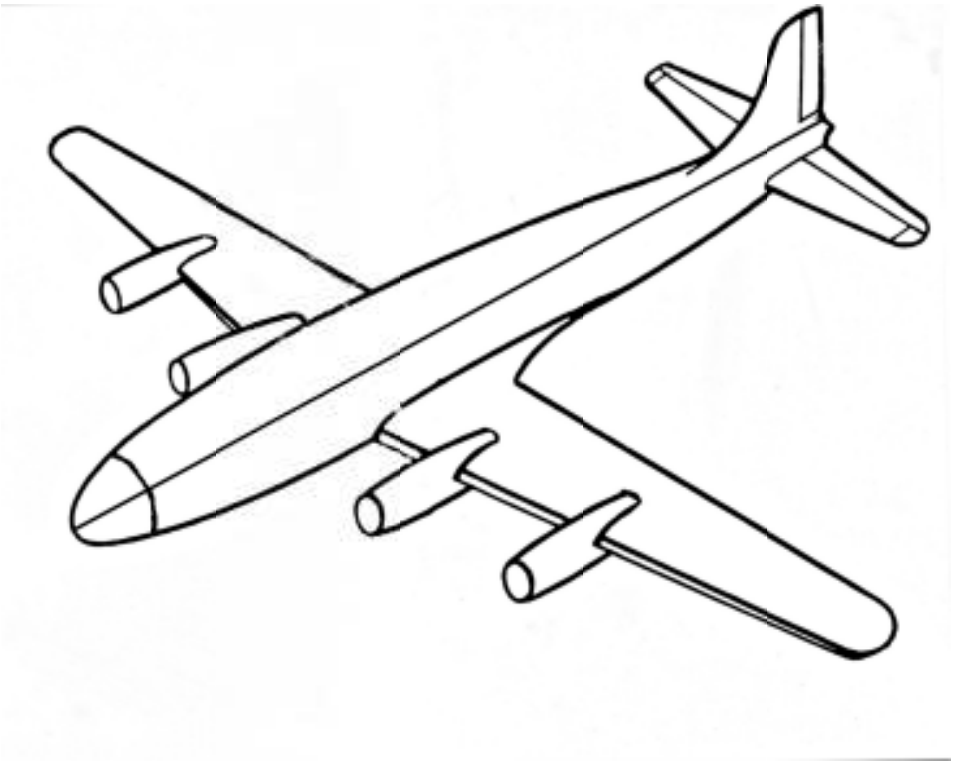


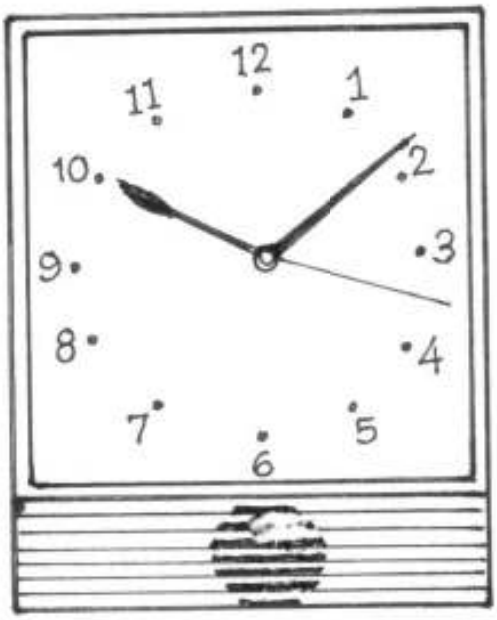


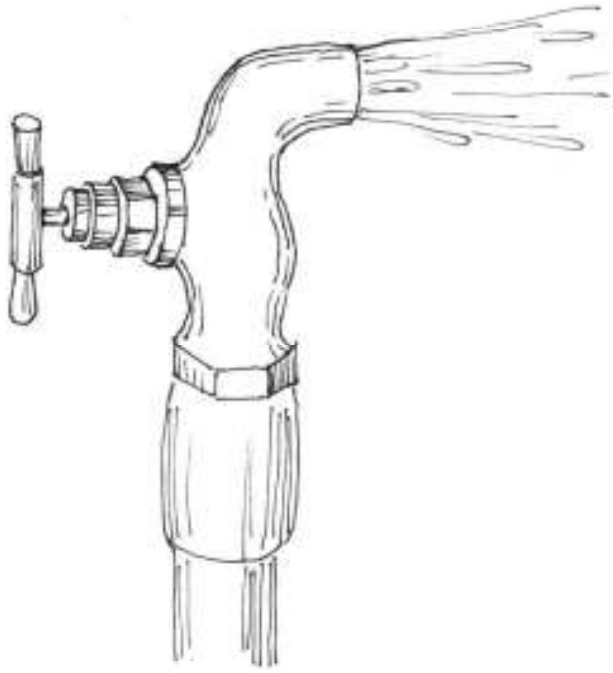


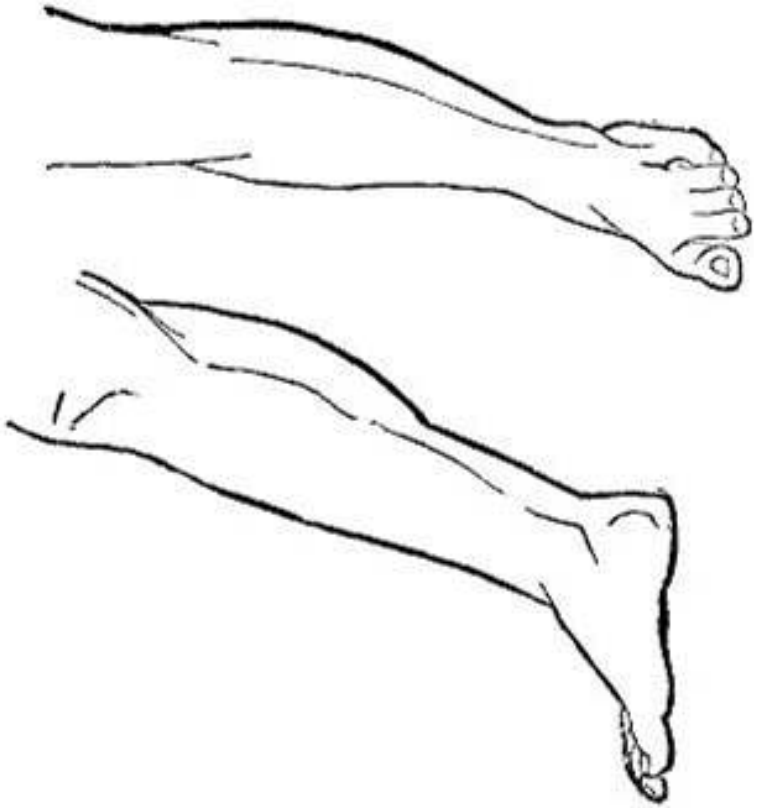


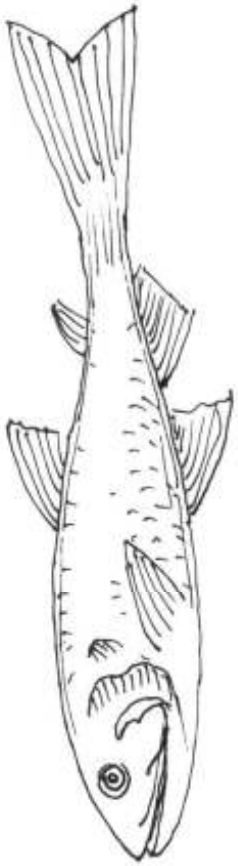


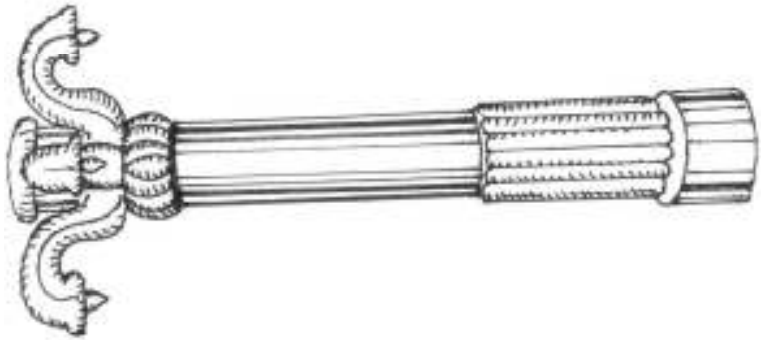


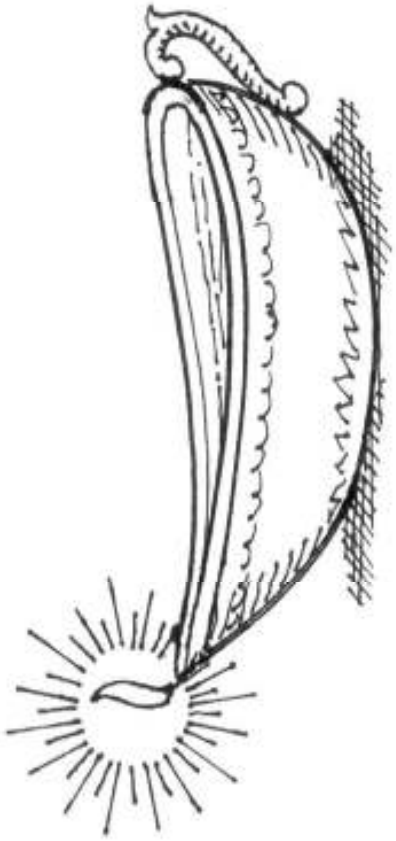

12
1
2
3
4
5
6
7
8
9
10
11

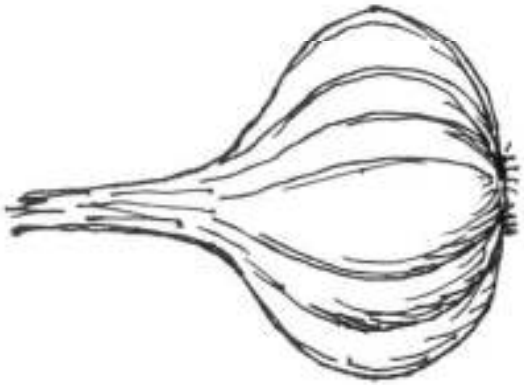


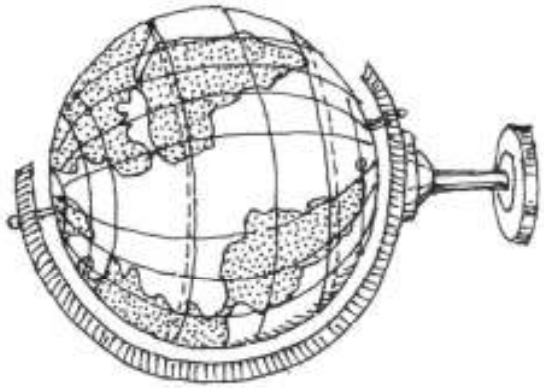


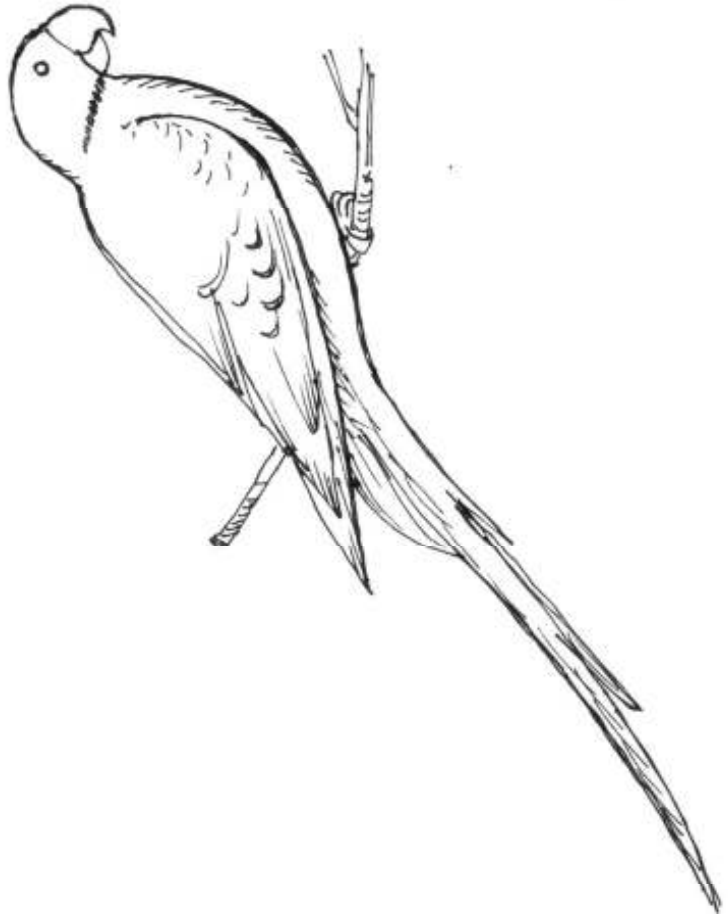


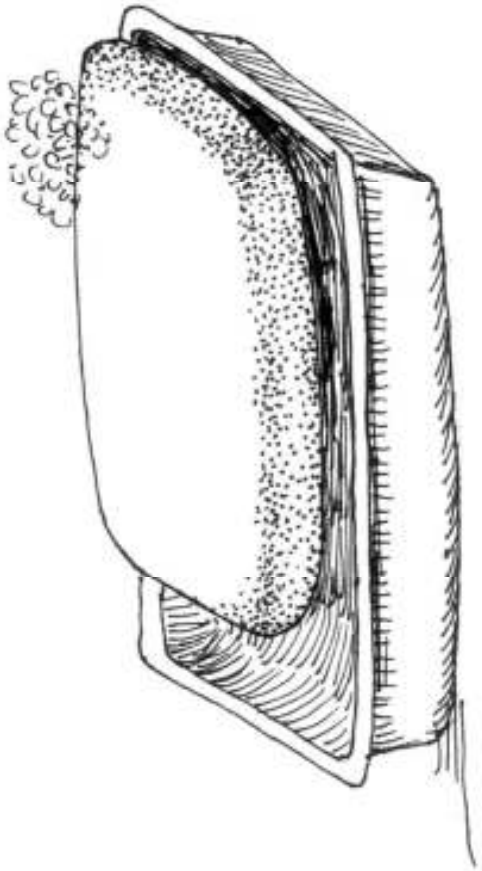


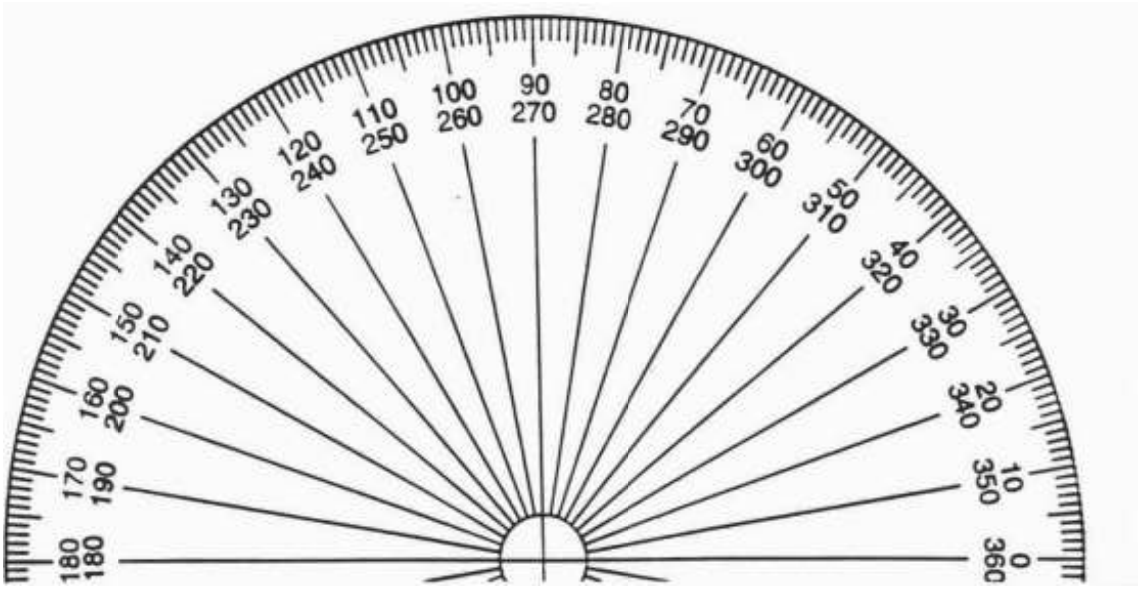











180
180
170
190
160
200
150
210
140
220
130
230
120
240
110
250
100
260
90
270
80
280
70
290
60
300
50
310
40
320
30
330
20
340
10
350
0
360