THE ROLE OF APHASIA RESEARCH IN THAI LINGUISTICS[1]

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Introduction

In his introductory linguistics text, *Aspects of Language*, Bolinger[2] makes the interesting observation that it has been only fairly recently in the history of science that man has turned to investigate the natural phenomena which are closest to him. Astronomy, the oldest of the sciences, is the study of the most remote objects in the universe whereas psychology, probably the newest science of them all, is concerned with the most intimate- the mind of man. A parallel development has occurred in the field of linguistics, and even, it could be argued, in the sub-field of Thai linguistics, where we have witnessed an early interest in historical linguistics, which is concerned with language data that is both physically and historically remote from the language user. But recently, we have seen interest in such new fields as generative semantics and neurolinguistics, which are concerned with the intimate and immediate- the linguistics composition and characterization of the very mind of the language speaker. This present paper, tentative and postulatory though it may be, is written to provide a historical counterpart to the rich literature already existing in historical and comparative Thai linguistics, and to suggest the possibility that Thai can provide exciting and relevant data to the search for neurological models of man's linguistic competence. In fact, the paper could appropriately be subtitled, "Future directions in Thai neurolinguistics" and thus be aptly paired with Gedney's well-known summary of historical and comparative studies, "Future directions in comparative Tai linguistics."

Because of the novelty of neurolinguistics compared to the established vocabulary and techniques of older disciplines such as comparative linguistics or phonetics, it is necessary to begin with a brief introduction to the neuroanatomy of language and to the nature of aphasia- currently the most salient interest of present-day neurolinguistic research. From this, we can proceed to a discussion of the relationship of aphasia research in Thai to the fields of neurology and neurolinguistics and its role in linguistics in Thailand.

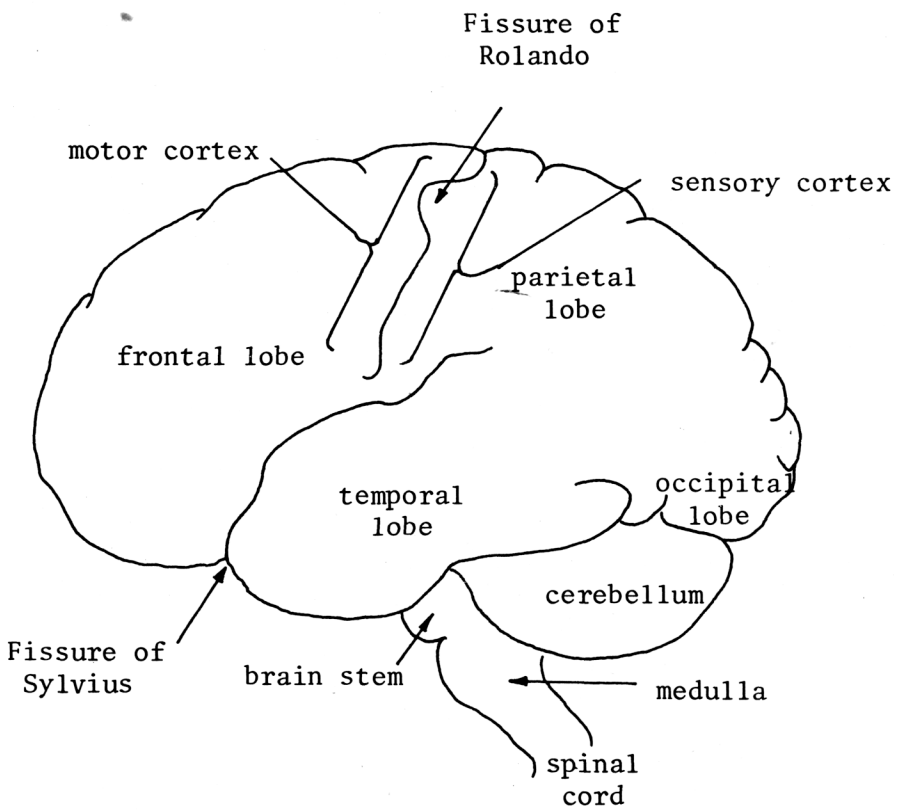
The neuroanatomic basis of language

The brain has been likened to a telephone switchboard where connections are made between "incoming calls," sensory stimuli arriving via

afferent nerve pathways and "outgoing calls," motor responses sent via efferent pathways. It should be realized, however, that this analogy is extremely simplistic. One reason why the brain is such a complex organ, one that has defied scientific investigation for so long, is that it is not a static receipient and transmitter of electrical impulses but a constantly active organ- a virtual sea of electrochemical activity where tides, currents, waves, and ripples intermingle in continuous agitation. The dynamic nature of the central nervous system is one reason why controversies pervade the basic hypotheses of neurology and psychology and has led one distinguished neurologist[3] to deplore that the field of aphasiology is like Arnold's "darkling plain, where ignorant armies clash by night!"

FIGURE 1

Saggital view of the Central Nervous System



Looking at Figure 1, we see depicted a left saggital view of the human brain. The subcortical organs- the spinal cord, medulla, cerebellum, brain stem, and associated organs, do not concern us here; they are essentially limited to automatic functions and, as such, are not related directly to language production and comprehension, although

even this broad and unprovocative observation is a simplification. It is of interest to note in passing that as one ascends the central nervous system anatomically, one also ascends the phylogenetic tree of man from lower animal life to advanced primate. That is, all animals possess the organs of the lower brain, but only primates have an enlarged cerebrum (the "upper brain"), and it is only man, the most advanced primate, that boasts of the most developed cerebrum. It is not a coincidence then that man's unique ability to reason and to speak is linked to the evolution of the cerebrum and its cortical surface.

The cerebrum is divided into four lobes: the frontal, the parietal (separated from the frontal by the Fissure of Rolando), the temporal (separated from the frontal by the Fissure of Sylvius), and the occipital. Traditionally, certain intellectual functions have been localized to these anatomical divisions, although it must be remembered that there is disagreement over the nature and extent of this localization. The frontal lobe is linked to memory, the parietal to spatial organization, the temporal to hearing, and the occipital to sight. In addition, the strip of cortical area paralleling and immediately preceding the Fissure of Rolando is linked to motor innervation and hence called the motor cortex. Similarly, the cortical area paralleling and immediately behind the Fissure of Rolando, is concerned with sensory stimuli and consequently is called the Rolando, is concerned with sensory stimuli and consequently is called the sensory cortex. The lobes are not only intricately connected to the body by different efferent and afferent pathways, but also to each other via association pathways.

One interesting aspect of the way neural pathways are linked to the cortex is that the amount of cortical area devoted to these tracts from and to a particular organ of the body is not directly proportional to the physical size of that particular organ, but to the behavioral importance of the organ. Thus, the amount of sensory and motor cortex concerned with the sensation and innervation of the legs and feet is much smaller than the amount devoted to the sensation and innervation of the hands and fingers. Even though they are inferior in size to the legs and feet, the hands and fingers require a far greater amount of cortical control because they are of such behavioral importance in man, "the tool maker." Similarly, the musculature of the oral, laryngeal, and pharyngeal cavities is scant compared to that of the thoracic and abdominal cavities, but the former require a far greater amount of cortical localization because of the importance of speech in the evolution of man. In fact, it is interesting to see that the traditional Thai belief in the prominence and reverence of the head in comparison to the inferior status of the feet has a neuroanatomical basis. The head commands the largest amount of cortical control whereas the feet demand the least.

Not only are certain functions localized to particular areas of neural control within the cerebral hemispheres, but there is general agreement that the left cerebral hemisphere plays a particularly important role in the organization of language. This notion

that the left side of the cerebrum dominates the perception and production of language is an important underpinning of aphasia research and of any neurolinguistic model of language behavior. Because of the importance of its linguistic function, the left cerebral hemisphere is usually referred to in the literature as the dominant hemisphere, but its role in language perception and production as well as its relationship to the right, or nondominant hemisphere, is controversial and subject to intense investigation. We shall observe later on that research into the speech of Thai aphasics may provide clues to the nature and extent of cerebral dominance in man.

The nature of aphasic disability

Let us turn now to a brief introduction to aphasia. Schuell has defined it as "a reduction of available language that crosses all language modalities and may or may not be complicated by perceptual or sensorimotor involvement, by various forms of dysarthria, or by other sequelae of brain damage."[4] It should be stressed that the language reduction is not a reduction of the patient's language repertoire but a limitation of his ability to retrieve linguistic information. It must be pointed out that aphasia results from organic brain damage and should be clearly differentiated from functional illnesses such as neurosis or psychosis. As the definition indicates, there are related disorders often co-occurring with aphasia, but which are traditionally distinguished from aphasic disabilities. Among these are: dysarthria, a disability in innervating the speech musculature- usually due to a lesion in subcortical areas; apraxia of speech, a disorder in the sequencing and firing of speech musculature- usually due to lesions in the motor cortex; confused language, language that is vague and irrelevant to linguistic context- usually due to non-localized traumatic injuries to the entire cerebrum; and generalized intellectual impairment, an overall loss of intellectual ability affecting language- usually caused by atrophy of nervous tissue in the entire brain. In contrast to the organic causes of these related disorders which are almost always either subcortical (below the cerebrum), bilateral (involving both hemispheres), or pervading the entire cerebrum, the etiology of aphasic disorders is usually confined to lesions which are cortical, unilateral (involving the dominant hemisphere in this case), and located in the general area of the confluence of the frontal, parietal, and temporal lobes. Strokes, tumors, and traumatic head injuries are the most common causes of aphasia.

Although aphasic nomenclature is replete with ambiguity, redundancy, and controversy, many clinicians accept certain classifications as useful generalizations for diagnosis and therapy. The two classic terms, Broca's aphasia and Wernicke's aphasia, are named after the eighteenth century neurologists who first isolated these syndromes. The former is typified by labored, "telegraphic" speech with a severe lack of grammatical markers; the latter refers to rapid-flowing speech with many inadvertant word substitutions and

grossly lacking in specific information content. Of the several variables which affect the degree of aphasic disability a patient experiences, regardless of the type of aphasia he is afflicted with, the most important is age- the younger the age the better and the more rapid the prognosis for recovery. The brain of a child is so resilient that aphasia is rare among children and permanent aphasic disability in the young is almost unknown. Conversely, aphasia is commonly found in older adults, especially among the aged, where the incidence of strokes is high and language disability is often severe and permanent.

The role of Thai linguistics in aphasiology

Now that we have described the neuroanatomy of language and the major aspects of aphasia, it is time to narrow our focus to one particular language and discuss the role of aphasia research in Thailand, especially as it relates to three fields of special pertinence to speech aphasiology, neurolinguistics, and linguistics. It must be understood that the following discussion is postulatory and, except for a few examples drawn from the author's limited experience, the discussion centers on the anticipated results of neurolinguistic research currently being initiated in the Thai language.

At this point, it may be appropriate to turn the title of this paper around and ask what role Thai linguistics plays in aphasia research- in other words, how can the linguist assist the aphasiologist in distinguishing aphasic disabilities from related speech disorders and diagnosing the nature and extent of language deficit? The most important contribution which Thai linguistics can make is in the development of a standardized linguistic test for the differential diagnosis of aphasia in Thai speakers. Not only would such an instrument be of great benefit to Thai neurologists, but it is the sine qua non for any serious neurolinguistic research into the nature of aphasia in Thai speakers. In a sense, the relationship between aphasia research and linguistics is mutually beneficial- each contributes to and benefits from the other in reciprocal fashion. Ideally, other disciplines are also involved in the relationship because a well-designed standardized aphasia test demands the expertise of neurologists, testing specialists, and psychometricians, as well as linguists.

The linguist's contribution is especially important for at least two reasons. First, since the test must be designed as a measure of language ability, it is crucial that the patterns and structures of the language are accurately reflected in the testing categories- that is, the test must be valid. A Thai test, for example, should include the perception and production of vowel length and tones, features which would be irrelevant to an aphasia test for English speakers. Conversely, an English test should measure grammatical markers such as tense inflections and article usage--items whicl would not be incorporated into a diagnostic test for Thai

speakers. A linguist assists in distinguishing the levels of linguistic analysis from each other, pinpointing the phonological, syntactic, and semantic structures which are unique to the language, and devising subtests which can accurately measure the patient's ability to comprehend and manipulate these structures in communicative speech with others.

Secondly, the linguist can create a sensitivity to the different levels of language usage which different Thai patients will employ. This can be done both by ensuring that the examiner is aware of different social and geographical dialects, and that the testing instrument itself is flexible enough to measure a rather wide range of sociolinguistic variation. This variation, fortunately enough, is confined almost exclusively to phonology and vocabulary. It is important that the patient is tested for his performance and competence in his native social and geographical dialect and that the vocabulary which he is confronted with in the testing situation is commensurate with his educational level. A linguist can point out that the simplification of /r/ or /l/ consonant clusters in Thai is not symptomatic of any aphasic disability in the speech of many non-standard speakers. For example, consider the results of a short dictation test given to a 33 year old female patient diagnosed with a meningioma in the left parietal region and exhibiting some symptoms of aphasic disability in speech. The woman was from a rural district in Pitsanulok province and had only a fourth grade education. Looking at the excerpt from the dictation subtest displayed in Figure 2, dialectal factors probably account for errors underlined once; educational factors probably account for errors underlined twice, and only those errors underlined three times could be legitimately linked to aphasic disability.

FIGURE 2

Case 1 : Example of aphasic disturbance in a dictation subtest in standard Thai

Original dictated passage

ไทยเรามีประเพณีว่า ชายหนุ่มอายุ ๒๑ แล้ว ควรจะบวช เสียอย่างน้อยพรรษาหนึ่ง

Printed version of patient's dictation

ไทยเรามีปะเพณีว่า ชาย นุ่มอายุ ๒๑ แล้ว ควรจะบวช เสียอย่างน้อยษรรสาหนึ่ง

single underlining = dialectal variation
double underlining = errors due to educational background
triple underlining = errors due to aphasic disability

It can be readily observed from just this simple illustration that the linguist has an important role in the design and interpretation of the diagnostic test.

The contribution of linguistics to aphasiology extends beyond testing however; it should play a role in the development and administration of rehabilitative speech therapy. In a developing nation such as Thailand, it is to be expected that esoteric endeavors like aphasia testing and rehabilitative speech therapy for aphasics are in an embryonic stage; nevertheless, there is one source of linguistic expertise from which techniques and materials can be adapted quite easily for speech therapy. This is the field of foreign language teaching where a large amount of literature and advice lies available in Thailand from which many valid applications can be made in the development of drills, techniques, and exercises for aphasia patients as a form of rehabilitative speech therapy. The similarity between the problems of an aphasic undergoing therapy and a person studying a foreign language has been pointed out by some aphasiologists already,[5] and there is reason to believe that an important contribution from applied linguistics can be made to aphasia therapy in Thailand. By adopting this pre-existing body of knowledge, much valuable time can be saved and redundant effort can be eliminated.

Implications of aphasia research for neurolinguistics

In the introduction, it was stated that one of the most salient and controversial notions of neurolinguistic research is the concept of dominance- that the left hemisphere plays a unique role in human language. It must be emphasized that dominance is quantitative rather than qualitative in Smith's words[6] and that the original concept of total laterality of language function has evolved into the more recent belief that the two hemispheres exhibit what Teuber calls "reciprocal specialization."[7] The left hemisphere specializes predominantly in language functions while the right specializes in pattern recognition, spatial organization, and possibly music.[8] Because Thai is a tonal language and will probably be the first tonal language to provide data gleaned from a standardized aphasia test, the speech of Thai aphasics could present interesting evidence concerning the role the two cerebral hemispheres play in the production and perception of linguistic pitch.

One would suspect that since tone is a linguistic phenomena, any disability in the perception or production of tones among Thai aphasics would be caused by lesions in the dominant hemisphere and that a disability in the perception or production of nonlinguistic pitch, for example, musical patterns, would be localized to lesions in the right hemisphere. Two bits of evidence seem to support this hypothesis. First, a study conducted by Monrad-Krohn[9] described a Norwegian aphasic who could not distinguish minimal pairs of Norwegian words containing pitch/stress differences after traumatic injury to the left hemisphere; yet, she was able to sing several songs without melodic disturbance, indicating that her intact nondominant hemisphere was con-

trolling musical pitch. The other evidence stems from dichotic listening experiments which were performed on Thai normals and which indicated that the perception of tones had a strong right ear preference (i.e. indicating left hemisphere dominance).[10] It will be of interest to see if tonal disturbances in the speech of Thai aphasics continues to support left hemisphere dominance or if it leads to other explanations of localization.

Another issue of relevance to neurolinguistics is the long-held distinction between propositional and automatic speech. The former includes almost all of everyday language and is always affected by lesions to the "speech areas" of the dominant hemisphere: the latter refers to overlearned language such as counting, stock greetings, and emotional exclamations and curses and are rarely affected by lesions in the dominant hemisphere. There is a classic story of how Jackson, the nineteenth century British neurologist who first studied this dichotomy, demonstrated these two different modes of speech to some medical colleagues by asking an aphasic patient to say, "damn!" after the patient failed to respond to this simple task of using propositional speech, Jackson quickly nudged the patient in an aggrivating manner, immediately elciciting a "damn!" and consequently demonstrating that the patient's automatic speech was intact. It would be interesting to see to what extent automatic speech patterns remain unaffected in the speech of Thai aphasics and to observe what areas of the brain are damaged in the speech of those whose automatic speech is impaired. This information might help us to determine whether automatic speech is processed bilaterally or subcortically. The Thai language does contain several pairs of propositional and automatic words that could provide data for a modern analysis of Jackson's concept. ตาย, when spoken with mid tone is an example of propositional speech whereas ต๊าย, spoken with high, emphatic stress is an example of automatic speech.

Another implication that aphasia research in Thai will have for neurolinguistics is in providing more information about the nature of aphasic disturbance in bilinguals. Thailand has an unusually high population of bilinguals, and research conducted in Thailand could contribute in important ways in answering questions about how bilingual speech is impaired. Is the disturbance selective or mutual to both languages; is the degree to which one language is spared related to the age at which it was learned or to the degree it is used by the patient; what kind of interference exists between the two languages? The range of bilingual information could be quite broad; although most bilingual patients would be Swatow-Thai speakers, depending on the geographical location, Cambodian-Thai, Malay-Thai, and tribal languages-Thai speakers could also be found. It might be added that bidialectism is a related source of information and that the aphasic speech of patients who are fluent in both Central Thai and a regional dialect might provide additional date to supplement that collected on bilingualism.

The relationship of aphasia research to Thai linguistics

Most pertinent to those of us who are interested in the patterns, structures, and theoretical models of the Thai language is the relationship of aphasia research to Thai linguistics. In many ways the Thai language appears to be especially designed to support the study of aphasic disturbances because at each level of language analysis, there appear to be structures which would serve as important measures of linguistic dysfunction.

To begin with, the Thai writing system contains several features that are amenable to an investigation of aphasic disturbances because they depend on left-right ordering. These include the placement of several vowel sounds and of the "leading letters" (อักษรนำ) such as อ and ห. Observe the following spelling error in a dictation subtest given to a 30 year old male patient with suspected aphasia.

FIGURE 3

Case 2 : Example of aphasic disturbance in a dictation subtest in standard Thai

Original dictated passage

1. มา 2. หมา 3. ม้า 4. มหา
5. หย่า 6. ทราบ 7. ผีเสื้อ 8. เสด็จ
9. พฤษภาคม 10. เฉพาะ

Printed version of patient's dictation

1. มา 2. *มหา 3. ม้า 4. มหา
5. อย่า 6. ทราบ 7. ผีเสื้อ 8. *เส-
9. *พฤศจิคม 10. *-ะเลาะ

* errors due to aphasic disability

Notice that the patient incorrectly reversed the two initial consonants in หมา when the word was dictated orally, so that it was the same as item 4, มหา. Notice also that since หมา preceded มหา, the transposition of the two consonant letters cannot be attributed to a perseverated mistake. In addition, interference from a disability in auditory comprehension can be ruled out since the patient made perfect scores in an auditory discrimination subtest; furthermore, the auditory cues for these two words is quite distinct- item 2 has one syllable and item 4 contains two. This disability in left-right sequential ordering is common in aphasia and is easily detectable in Thai orthography.

Another example of agraphia (aphasic disability in writing a language) is seen in Case 1, cited in Figure 2. Referring to the failure of the patient to write ห as a leading consonant for the word หนุ่ม, we can see again that the Thai orthographic system is particularly revealing in exposing agraphic errors. Although there is a possibility of auditory involvement, the most probably explanation based on just the small evidence in front of us is that the patient is exhibiting an agraphic dysfunction- the failure to provide ห as a leading consonant not only changes the tone of the word (หนุ่ม /nùm/ becomes นุ่ม /nûm/) so that it does not match the acoustic cue given in the oral dictation, but it also changes the meaning of the word (หนุ่ม /nùm/ "young" becomes นุ่ม /nûm/ "to be soft") so that it does not fit the semantic context of the dictated phrase either. Besides the examples given above, agraphic errors are evidenced in words containing rarely used consonants and words based on Indic loan words. Returning to Figure 3, note that the patient is able to cope fairly well with the monosyllabic words of Tai origin, but fails with item 8 (เสด็จ) and item 9 (พฤษภาคม). Both of these words are non-Tai origin, use more atypical spellings, and are of less frequent usage. We can see that agraphic mistakes in Thai tend to support our linguistic presuppositions about the patterning of aphasic errors in Thai orthography.

The phonology of Thai is another area of great interest in discussing the role of aphasia research in Thai linguistics. We have already seen how the study of the perception and production of tones by Thai aphasics may be important in contributing to our understanding of how language is localized in the cerebral hemispheres. In addition to this, since length is an important feature of Thai vowels, aphasia research in Thai may enlarge our understanding of how vowel length is processed in the brain. If evidence can be found of a consistent and stabilized disability in the recognition or production of vowel length in the speech of a Thai aphasic, and if this aphasic disability can be localized to a lesion in a specific area of the cerebrum, we might have a better understanding of the neurological basis of this important linguistic feature. In addition, it would be fruitful to discover if errors in vowel length are contingent upon or related to other phonological features such as tone, syllable shape, or initial consonant. Any evidence of an interrelationship would contribute to our understanding of the phonological system of Thai as a whole.

One simple example of a phonological error in the speech of a Thai aphasic is offered here to illustrate how aphasic speech is closely related to normal speech in that both are rule-governed behavior. The ordering or the type of rules may differ, but upon linguistic analysis, the speech of aphasics is much less hapazard than a linguistically naive appraisal would suggest. Several mistakes were made by Case 2 in confrontation naming tasks. For example, ไม้บรรทัด /máay banthát/ "ruler" was ไบ้บรรทัด /báay banthát/ and กุญแจ /kuncɛɛ/ "key" was จุญแจ /cuncɛɛ/. The mistakes can be accounted for in terms of progressive assimilation, where the initial consonant of the word assimilates to the initial consonant of the second syllable of the word. This phenomenon is a common linguistic occurrence and, in fact, often accounts for "slips of the tongue" in the speech of normals.

Another grammatical level to be considered in our discussion of the relationship between aphasia research and Thai linguistics is syntax. Since Thai lacks grammatical inflection, it is impossible to measure aphasic disability in the use of tense or plural markers, for example, as has been done in studies of English aphasics;[11] nevertheless, there are several grammatical patterns which might be vulnerable to aphasic disruption. Among these are: passive constructions (เขาถูกครูตี /kháw thùuk khruu tii/ He was beaten by the teacher."), the order of modifiers (ใจดี /cay dii/ "good-natured" vs. ดีใจ /dii cay/ "happy"), reduplication (เว้า ๆ แหว่ง ๆ /wáwwáw wèɛŋwèɛŋ/ "concave"), nominalizations of states and activities (ความเห็น /khwaam hěn/ "opinion" vs. การเห็น /kaan hěn/ "seeing"), and negation of modals (เขาไม่ต้องทำ /kháw mây tôŋ tham/ He doesn't have to do it." vs. เขาต้องไม่ทำ /kháw tôŋ mây tham/ He must not do it.").

Turning to the final level of analysis, semantics, we again encounter several structures which are uniquely relevant to the investigation of aphasia. Most prominent among these is the system of classifiers where a noun in Thai is counted by using a classifier which marks the particular semantic set to which the noun happens to belong (e.g. กระดาษสองแผ่น /kràdàat sɔ̌ɔŋ phèɛn/ "two sheets of paper"). Because aphasic speech often disrupts the semantic categorization of linguistic structures, or, to reverse the phrase, the linguistic structure of semantic categories, the Thai classifier system should be a rich source of information about the nature of aphasic interference in Thai and even perhaps about the semantics of Thai nouns.

Another example of the interrelationship between aphasia research and Thai linguistics concerns the semantic analysis of Thai nouns. The incorrect use of words in confrontation naming tasks or in free speech is an extremely important symptom of aphasic speech, for it pervades almost every type and degree of aphasic deficit. This misnaming is not chaotic or random, however, and the errors are most frequently restricted to the substitution of a different lexical item within the same semantic category as the intended word. Patient number 3 exhibited this type of confusion on a confrontation naming task of ten items: knife, pencil, scissors, ring, comb, spoon, needle, chopsticks, eraser, and key. When asked to name these ten items as they were pointed out to him, he was able to answer correctly for all but two of the items; he substituted *needle* for pencil and *knife* for needle. Although these items do differ in size and usage, note that there is considerable semantic overlap. All three items are inanimate nouns, common household objects, manual tools, and are sharp-pointed. The patient's errors were in a narrow range of semantic context considering the vast semantic field available to him and did not contain words which violated the semantic categories cited above. The mutual concerns of aphasiology and linguistics are apparent here. On the one hand, the aphasia data provides the linguist interested in semantics with some clues as to the semantic structure of Thai nouns; the linguist discovers this evidence from the regularity of the errors which the aphasic commits. Note again that since aphasic speech is language, albeit disrupted or skewed,

it is rule governed and subject to scientific investigation. On the other hand, we have some linguistic studies of the semantics of Thai which should be of great value in the construction and interpretation of aphasia tests for Thai speakers. Gething's *Aspects of Meaning in Thai Nominals* comes immediately to mind as a linguistic work which could be of great assistance to the field of aphasiology in Thailand.

Conclusion

Considering the relatively modest size and cultural importance of the Thai language within the vast scope of Asian geography and history, Thai linguistics has been an unusually productive field. Much has been published in historical and comparative Tai, Thai phonetics, and Thai syntax. There has been more recent work in semantics and sociolinguistics. Let us hope that forthcoming neurolinguistic studies, particularly those that deal with aphasia research will follow in this established tradition and will contribute in some small measure to our appreciation of Thai and to our understanding of how language is conceptualized in the human mind.

NOTES

[1] The author wishes to express his gratitude to the Ford Foundation for support of his current research to develop a diagnostic aphasia test for speakers of Thai. Most of the contents of this paper stems from the author's current investigation of aphasia testing in Thailand.

[2] Bolinger, p. 184.

[3] Geschwind, p. 756

[4] Schuell, p. 4

[5] Sarno, p. 21.

[6] Smith, p. 46.

[7] Tueber, p. 212.

[8] Smith and Burkland, p. 3.

[9] Monrad-Krohn, "Dysprosody or altered melody of language," Brain 70, 1947.

[10] Van Lancker, 1974. "Heterogeneity in language and speech: neurolinguistic studies," Ph. D. dissertation, UCLA.
Donna Erickson and Arthur Abramson of the University of Connecticut are currently conducting a set of dichotic listening experiments on

Thai normals. Hopefully, the results of these experiments will appear in forthcoming publications.

[11] Goodglass et alia, 1972. "Some linguistic structures in the speech of a Broca's aphasic," Cortex 8.

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