

A CROSS-LINGUISTIC STUDY
OF BROCA'S APHASIA

by

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ABSTRACT

A comparison is made of the language of Broca's aphasics in English, Russian, Japanese, Turkish, and Zulu. The purpose of the study is to determine whether a particular aphasic syndrome should be analyzed in terms of the grammar of a particular language or as a unitary phenomenon that cuts across these particular grammars. Since the language output of Broca's aphasics is remarkably uniform among different languages, it is suggested that the grammar of this particular aphasic syndrome (and perhaps others) is the same across languages and different from the natural language grammars of any of these languages.

This theory conflicts with current theories of Broca's aphasia in which the grammar of a Broca's aphasic is analyzed as a normal grammar with a deficit in one or more components. The author argues that the language of Broca's aphasic can not be analyzed as a linguistic deficit. Instead, a grammar of Broca's aphasic language should be constructed that will be adequate to describe and explain the similarities in the output of Broca's aphasics across languages.

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INTRODUCTION

In principle, we can distinguish two methods that are used to study aphasic language. One method is to study the differences between aphasic and normal language production. Although it is not inherent in the approach, the people who use this method often assume that a theory of aphasia is equivalent to a theory of normal language with a deficit in one or more components. Another method is to study the principles that govern aphasic language in and of itself, either within an aphasic syndrome correlated with a particular lesion site or between different aphasic syndromes. This method assumes that aphasic language--like normal language is rule-governed and can be so described. But it does not assume that there is necessarily any similarity between a grammar of aphasic language and a grammar of normal language. Ideally, a cross-linguistic study of a particular aphasic syndrome can use both methods at once. We can examine how aphasic language differs from normal language in different languages; at the same time, we can determine the similarities across languages of a particular aphasic syndrome.

What might we expect to find in a cross-linguistic study of a particular aphasic syndrome correlated with a particular lesion site? Several results are logically possible: the aphasic syndrome might be different in every language; the aphasic syndrome might be similar in some languages and different in others; the syndrome might be similar in every language. If the aphasic syndrome is different in some or all languages, we

may attribute this to the fact that knowledge of different grammars is encoded differently (otherwise we would all speak the same language) or to the possibility that different languages are processed differently. In the event that a certain cluster of symptoms is correlated with a particular lesion site in some languages and another cluster of symptoms is correlated with the same lesion site in other languages, it would be important to work out the correspondence between aphasic syndrome and group of languages. Note that there is no reason to presume, a priori, that such a classification schema would correspond to any of the classification schemas that linguists have devised.

On the other hand, suppose we find that a particular lesion causes similar symptoms in every language studied? In this instance, we may hypothesize that the same mechanism is responsible for the post-lesion language production in the various languages. We would want to formulate a theory that could account for this phenomenon, given the fact that at least some aspects of pre-lesion grammar and processing must be encoded differently.

In this thesis, I present cases of Broca's aphasia in Russian, Japanese, Turkish, and Zulu, from which it is evident that Broca's aphasia is a remarkably similar syndrome across very different languages. I shall propose an explanation for this phenomenon, which is supported by data from production and comprehension studies of Broca's aphasics in English. Before

I begin however, there is a terminological distinction that I'd like to clarify.

A theory of language production and comprehension will include both a grammar and processing strategies. The grammar is a theory of an individual's knowledge of a language and the collection of processing strategies is a theory of how that knowledge is put to use. Both of these, it should be noted, are theories of mental representation. Therefore, it is in principle possible for a lesion to damage (or block access to) knowledge of the grammar but not the processing strategies, the processing strategies but not the grammar, or both the grammar and the processing strategies. If only one of the two is damaged, it may be difficult to tell which one it is since presumably each needs the other to function normally. Of course, it may be possible to ascertain which one is damaged from recovery patterns. In this paper, I shall not deal with the question of whether it is knowledge of only the grammar or only the processing strategies that is damaged since I am concerned with describing aphasic language itself, rather than recovery from aphasia. I shall assume that knowledge of either or both grammar and processing strategies may be damaged, but that neither the grammar nor the processing strategies alone is sufficient for normal language production and comprehension. (If one was, they why would we have both?)

FOOTNOTES (TO INTRODUCTION)

1. The evidence that different languages may be processed differently comes from dichotic listening tests. In English, a language in which tonal differences are not phonemic, it has been found that intonational cues in speech are predominantly processed by the non-dominant hemisphere (Blumstein & Cooper, 1974; Zurif, 1974). However, in Thai, a language in which tonal differences are phonemic, intonational cues in speech are processed by the dominant hemisphere (Van Lancker & Fromkin, 1973, 1977).

2. Particularly in a cross-linguistic comparison of an aphasic syndrome, it is essential to have information on both lesion site and aphasic symptoms, since we do not know whether the symptoms will be similar in different languages. Unfortunately, there is very little available literature on aphasics in non Indo-European languages and most of it contains little or no reliable information as to lesion site. Of the case studies in the text, only Luria (1970) provides a precise account of lesion site. For the rest, I have simply accepted the author's diagnosis, using the general criterion that comprehension appears to be relatively less impaired than production.

CHAPTER ONE

Let us begin by briefly reviewing the symptoms of Broca's aphasia in English and several theories that have been proposed to account for them. The effects of a lesion in Broca's area are well known. Such a lesion results in dysprodic speech, loss of grammatical formatives in production and inattentiveness to grammatical formatives in comprehension, simplification or loss of inflectional endings, and phonemic paraphasias. The resulting output has been termed "telegraphic": a Broca's aphasic speaks in words, rather than sentences; these discrete units are primarily uninflected nouns and nominalized verbs. Stress on individual lexical items is usually correct. Comprehension is relatively less impaired than production.

In recent years, two rather different theories have been proposed to account for the cluster of symptoms that result from a lesion in Broca's area: the syntactic deficit theory (Zurif et.al., 1976; Goodglass et.al., 1979; and others) and the phonological deficit theory (Kean, 1977, 1978, 1979). The syntactic deficit theory is probably the more widely accepted of the two and it has received additional support from recent studies of comprehension in Broca's aphasics. These experiments have shown that Broca's aphasics do not attend to purely syntactic cues when processing sentences. For instance, a Broca's aphasic cannot place the adjective with the appropriate noun in (1),

although he can do so in (2), presumably by using extra-linguistic information (Caramazzo & Zurif, 1976).

(1) The girl that the boy is chasing is tall.

(2) The tiger that the boy is chasing is striped.

This and similar results have led to the conclusion that Broca's aphasia "is at least in part a syntactically based disorder manifested most conspicuously in sentence production, but also occurring in auditory comprehension" (Goodglass et.al., 1979).

Marshall (1977) attempts to formulate a more precise account of this syntactic deficit. Because Broca's aphasics may predictably produce some inflectional endings and omit others, he argues that this can be accounted for only if representations at deep structure are well-formed. This means that mistakes occur between deep structure and surface structure or between surface structure and phonological representation. He suggests that errors occur because lexical insertion takes place at too high a node. Although Marshall does not make this explicit, this can be analyzed either as a syntactic deficit (an error in the mapping of deep structure into surface structure) or as a phonological deficit (an error in the mapping of surface structure into phonological representation).

Kean (1977, 1978, 1979) argues that all the symptoms of Broca's aphasia can be described by postulating a phonological deficit only.² "A Broca's aphasic tends to reduce the structure of a sentence to the minimal string of elements which can be lexically construed as phonological words in this language" (Kean, 1978). Because of this phonological deficit, a Broca's aphasic simply does not process unstressed grammatical formatives

and affixes that do not affect word-stress. An advantage of this theory, as Kean notes, is that it is precise enough to make falsifiable predictions about the output of Broca's aphasics in different languages.

Although they offer different explanations and make different predictions, both the syntactic deficit and the phonological deficit theory share the assumption that the language output of a Broca's aphasic is generated by a natural language grammar which is defective in one or more of its components. That is, both accounts crucially depend on the hypothesis that a theory of Broca's aphasic language differs from a theory of normal language only in that the former is a proper subset of the latter. In particular, neither of these accounts supposes that a theory of the language of Broca's aphasia may contain any additional components that a theory of normal language does not have. This is an empirical hypothesis and it may or may not be proved correct. But before we discuss the merits of this hypothesis and of these theories that depend on it, let us turn to an examination of Broca's aphasia in different languages.

FOOTNOTES (TO CHAPTER ONE)

1. I use a theoretical notion of grammatical formative here. In an \bar{X} theory of syntax, all elements are defined in terms of a binary feature matrix, with features N and V. A noun is [+N,-V], a verb is [-N,+V], an adjective is [+N,+V], and a grammatical formative is [-N,-V]. The class of grammatical formatives in a language may include both free morphemes (prepositions or postpositions, specifiers, complementizers, conjunctions) and bound morphemes (nominal and verbal inflections or particles).

2. Kean's phonological deficit theory is, in large part, a more precise formulation of the earlier speech threshold theory of Goodglass (1962, 1968). He suggested that Broca's aphasics have "an abnormally high threshold for initiating speech sequences" (1962). Only "salient" words or sequences of words can pass this threshold. Unstressed words are not salient; since grammatical formatives are normally unstressed, they will not be produced by Broca's aphasics.

Russian

Russian is a member of the Slavonic group of Indo-European languages. It represents grammatical categories and relations by suffixes which are attached to a stem. Word-internal phonological rules may operate across these morpheme boundaries. Nouns are inflected for number, gender, and Case. Verbs are inflected for tense, mood, and aspect. Underlying word order is SVO, but surface word order is relatively free, as is the case with many highly inflected languages.

Luria (1970) describes a monolingual Russian speaker (Cap, case history no. 3069) who suffered a bullet wound in "the middle portion of the left premotor area partially involving the precentral gyrus." For the first five to eight months, the patient had severe trouble in articulating any sequence of phonemes, although he was able to pronounce any single phoneme of Russian. As his articulation improved, it became apparent that the syntax of both his spontaneous speech and repetition of simple sentences was quite abnormal.

The patient would repeat a short sentence as though he were simply enumerating the individual words of which it was composed. He was most likely to enumerate the nouns, which have no predicative function. Verbs and, to an even greater extent, adjectives, conjunctions and pronouns were omitted...Even sentences consisting of two or three words were repeated agrammatically... 'The weather was nice yesterday' as 'Was....weather....sun.' The patient was clearly unable to reproduce the grammatical schemata of sentences (Luria, 1970, pp. 195-196).

months after injury (transliterated from the Cyrillic).

(3)

<u>Patient's output:</u>	pukica	snēsla	zalatoe	jaito
<u>Correct form:</u>	kurica	snēsla	zolotoe	jaico
<u>Translation:</u>	hen	lay	gold	egg
<u>Grammatical Categories:</u>	nominative feminine singular	past fem. agree. marker	nominative neuter singular	nominative neuter singular
<u>Mistakes:</u>	misspelled	none	misspelled, but the patient has spelled it as it is pronounced (unstressed -hi vowels reduce to <u>a</u> after an unpalatalized consonant)	misspelled

<u>Patient's output:</u>	xodein	vzjal	zbil	a	zalotoe	ninasol
<u>Correct form:</u>	xozjain	vzjal	ubil	a	zolotoe	ne nasel
<u>Translation:</u>	master	took	killed	but	gold	(he) did not find
<u>Grammatical Categories:</u>	nominative masculine singular	past	past		nominative neuter singular	present negative marker
<u>Mistakes:</u>	misspelled	none	misspelled	none	misspelled (see above)	negative marker not separated from verb misspelled (aga spelling is correct phoneti cally)

Note: It is not a mistake to omit the subject of "did not find" nor is it incorrect or unusual for the object to precede the verb.

The inflectional morphology is extremely impoverished, compared to normal Russian. All nouns are in the nominative singular, although in the case of neuter nouns, nominative and accusative are identical so that it is impossible to tell whether the object is correctly Case-marked. Tense and agreement markers on verbs are correct. Spelling errors are of two kinds: one, reversals (b/d) or substitutions; or two, errors in vowels where the patient chooses the correct phonetic rather than phonemic representation. Only one free morpheme grammatical formative (a "but") is used. Leaving aside the spelling mistakes, the patient's linguistic deficit can be analyzed as a deep structure deficit. Notice that rather than omitting or using incorrect inflectional endings, he produces simple structures that do not require complex inflections. An impoverished set of phrase structure rules in the base would account for this.

Japanese

Japanese is called an "agglutinative" language: grammatical categories and relations are expressed by postpositions and particles which are attached to the ends of words. In general, these particles and postpositions can be distinguished from inflectional affixes in two respects: one, there is a word boundary between a stem and a particle or postposition (i.e. word internal phonological rules do not apply, although verbal particles in Japanese--and many other languages--are an exception to this

generalization); and two, each particle or postposition expresses a single grammatical category or relation whereas an inflectional affix may express more than one. Underlying word order is probably SOV, but the only constraint on surface word order is that the verb must appear in sentence-final position.

Japanese has two writing systems, Kana and Kanji. Kana is a syllabary, consisting of 48 symbols, each of which stands for a V or CV sequence. Kanji is an ideographic system, which was imported from China in the sixth century. In modern Japan, both writing systems are used: children are taught to read in Kana and gradually learn Kanji characters. Although any word in Kanji may be written in Kana, the opposite does not hold. Some words have no Kanji character and must be written in Kana; furthermore, postpositions and particles are always written in Kana.

Panase and Shimoyama (1955) translate one of Imura's (1943) case studies of a monolingual Japanese speaking Broca's aphasic. (4), below, is a transcription of the patient's response to the question "Do you want to be under continuous care?" four days after a stroke.

(4)

<u>Patient's output:</u>	kutsi	mawaranu.	nyuinshitemo
<u>Correct form:</u>	kutsiga	mawaranai <u>or</u> mawarmasen.	nyuinsureba
<u>Translation:</u>	mouth	turn-not	if I went into the hospital
<u>Grammatical Categories:</u>	missing	literary neg. ending	mood marker
<u>Mistakes:</u>	nominative particle <u>ga</u> omitted	patient uses literary ending instead of the normal neg. particle <u>anai</u> , but the most usual ending in this context is <u>masen</u> "according to my view"	<u>nyuin</u> is a gerund-like noun, meaning "going into the hospital." mood marker is incorrect: the correct ending <u>sureba</u> is more complex, composed of verbalizing particle <u>su</u> and mood marker <u>reba</u>
<u>Patient's output:</u>	kurai	sonouti dandan	kutsikikeru .
<u>Correct form:</u>	donokuraide	sonouti dandan	kutsigakikeruyoni narimasuka.
<u>Translation:</u>	to what degree	soon gradually	mouth-use will I be able
<u>Grammatical Categories:</u>	missing		missing
<u>Mistakes:</u>	the interrogative word <u>dono</u> "which" that should precede <u>kurai</u> "degree" and the particle <u>de</u> that should follow it are omitted		this is a compound verb meaning "speak," composed of noun ("mouth") and verb ("use"). the nominative particle <u>ga</u> after the noun and the suffix <u>yoni</u> after the verb are omitted. <u>yoni</u> is obligatory with the verb <u>narimasuka</u> , which is also omitted
<u>Patient's output:</u>	anata	hitodusake.	mainitsi kamisama inorimasu .
<u>Correct form:</u>	anata	tasuketekudasai.	mainitsi kamisamani inotteimasu.
<u>Translation:</u>	you	please help me	everyday god I pray to
<u>Grammatical Categories:</u>	optional interjective pronoun	missing	missing present tense
<u>Mistakes:</u>		rather than a verb, the patient uses a noun which means "helping people"	dative particle <u>ni</u> omitted present tense is not incorrect, but progressive is more usual in this context

All postpositions and particles except for the present tense marker are omitted or incorrect. The present tense is the unmarked form of the verb in Japanese: infinitives do not appear on the surface and the present tense is used as the citation form of the verb. It should be noted that in colloquial speech, certain particles (the nominative marker, in particular) can be dropped. However, this patient's speech shows no such discrimination as to which endings can be dropped; postpositions and particles on verbs can never be omitted, even in rapid speech. Notice also that Panse[†]Shimoyama's claim that Case infixes are omitted is incorrect. In fact, Japanese is not analyzed as having infixes in the traditional sense of the term. (An infix is an affix which is placed within a morpheme.) However, in a compound word of the form N-V, both the noun and the verb must be followed by the appropriate particle. What happens here is that the patient leaves off the Case particle on a noun in a compound verb of this type.

Imura et.al. (1971) present several cases of agraphia and alexia in Japanese speaking Broca's aphasics. They summarize their results as follows:

Most Kanji in daily-use are written correctly; however, Kana words are not written at all or are spelled incorrectly. Though Kanji are not always written correctly, there is a clear contrast between the degree of agraphia of Kanji and Kana....

In writing sentences, Kana letters are often omitted or misspelled. Namely, particles and postpositions usually written by Kana in Japanese are omitted or misspelled (pp. 73-75).

(5) is one of their patient's transcriptions.

(5) <u>Patient's output:</u>	花	開
<u>Correct form:</u>	花が	開く
<u>Transliteration:</u>	hana	hira
<u>Translation:</u>	flower	opens (blooms)
<u>Mistakes:</u>	nominative marker <u>ga</u> omitted	<u>ku</u> , end of stem (<u>k</u>) and tense marker (<u>u</u>) omitted

The Kanji characters for hana "flower" and hira are correct, but the Kana symbols for ga (nominative marker) and ku are omitted. What is particularly interesting is that by omitting ku, the patient is omitting part of the stem of the verb. The stem "blooms" is hirak and the present tense marker is u; the k and u are written as one Kana letter, ku. This suggests that the correct generalization about the writing of Japanese speaking Broca's aphasics is not that they omit grammatical formatives, but that they omit Kana symbols, whether or not they stand for grammatical formatives.

This means that errors in speaking and writing in Japanese must be analyzed as different kinds of errors in the grammar. Most of the errors in (4) are errors in inflectional morphology: a stem is produced, but not correctly marked with nominal or verbal particles. But in (5), both inflectional and derivational errors are made: by omitting the Kana after hira, not even a complete stem is produced.

Turkish

Turkish, like Japanese, is an agglutinative language: grammatical categories and relations are represented by single morphemes which are added to the end of a word with word boundaries between the stem and each morpheme. A rule of vowel harmony applies between stem vowels and affix vowels. Underlying word order is SOV.

Peuser and Fittschen (1977) present a case of a monolingual Turkish speaking Broca's aphasic. The patient had no spontaneous speech except for the recurring utterance /o:gjen/, although he could repeat single words. Comprehension was much less impaired than production. For an analysis of the patient's syntax, the authors present a curriculum vita, a spontaneous text that the patient had written without a model to follow.

(6)

<u>Patient's output:</u>	10.2.1945	benim	dogum
<u>Correct form:</u>		benim	dogumum
<u>Translation:</u>	10.2.1945	birth	my
<u>Grammatical Categories:</u>		nominative singular	nominative singular
<u>Mistakes:</u>		none	possessive pronoun lacks first person agreement marker
<u>Patient's output:</u>	1955	ilk	okul
<u>Correct form :</u>		ilk	okul
<u>Translation:</u>	1955	primary	school
<u>Grammatical Categories:</u>		nominative singular	nominative singular
<u>Mistakes:</u>	Either a verb is omitted (in which case the locative marker on the date 'te is also missing) or the date should be 1955-1960.		
<u>Patient's output:</u>	1960-63	orta	okul
<u>Correct form:</u>		orta	okul
<u>Translation:</u>	1960-63	secondary	school
<u>Grammatical Categories:</u>		nominative singular	nominative singular
<u>Mistakes:</u>		none	none
<u>Patient's output:</u>	23.9.1966	asker	
<u>Correct form:</u>		'da asker	oldum
<u>Translation:</u>	on 23.9.1966	soldier	I became
<u>Grammatical Categories:</u>		nominative singular	
<u>Mistakes:</u>	Verb and locative marker on date are omitted. Indefinite article is not needed in a predicative construction.		
<u>Patient's output:</u>	23.9.1969	tezkere	
<u>Correct form:</u>		'da tezkere	aldim
<u>Translation</u>	on 23.9.1969	certificate of discharge	I got

Grammatical nominative
Categories: singular

Mistakes: Verb and locative postposition on date are missing. An article is not needed here.

Patient's output: 10.19.1969 memur oldum

Correct form: 'da memur oldur

Translation: on 10.19.1969 civil servant I became

Grammatical nominative past
Categories: singular

Mistakes: Postposition with date is omitted.

Patient's output: 18.5.1970 alman

Correct form: 'da almany geldim

Translation: on 18.5.1970 Germany I came to

Grammatical nominative
Categories: singular

Mistakes: Postposition with date is omitted. Final y on alman is omitted (alman/almany is like German/Germany in English).
Verb geldim "I came to" which would require a dative object is omitted.

Patient's output: Sivas toprak ve işkan müdür

Correct form: Sivas'te toprak ve işkan müdür ü idim

Translation: in Sivas earth and housing manager I was

Grammatical nominative nominative nominative
Categories: singular singular singular

Mistakes: Locative marker with city name and verb are missing. Toprak ve işkan müdür is a complex noun phrase and requires the particle ü at the end to mark it as such.

Patient's output: 10 parmak daktilo

Correct form: 10 parmak ile daktilo

Translation: with 10 fingers I could type

Grammatical nominative nominative
Categories: singular singular

Mistakes: Postposition after 10 parmak is omitted. Verb is omitted. It is not a mistake that parmak is singular instead of plural. Turkish does not mark redundant plurals in this context.

All nouns are in the nominative singular, which is unmarked in Turkish. (Particles are added to the nominative singular to form other cases.) All particles and postpositions are omitted. Only one verb is used in the entire text. Here, as in the Russian case study, the inflectional morphology is extremely impoverished. Unlike the Russian case, however, and like the Japanese case, certain obligatory endings are omitted. Therefore, this patient's linguistic deficit would have to be located in two components of the grammar: there is both an impoverished set of phrase structure rules in deep structure and there is a deficit in the inflectional morphology.

Zulu

Zulu is a Southeastern Bantu language of the Nguni language group of Southern Africa, with fixed SVO word order. Inflectional prefixes are used to represent grammatical categories and relations. There are no separate prepositions, postpositions, or articles. All nouns are composed of a stem and a class prefix. The class prefixes must be learned the same way that grammatical gender is learned: although there are some semantic regularities, much of it is arbitrary. The classes can be broken down roughly as follows:

- | | | | |
|-----|------|------|-----------------------------|
| (7) | (1) | um- | people |
| | (1a) | u- | kinship terms, proper names |
| | (2) | aba- | plural of (1) |
| | (2a) | oo- | plural of (1a) |
| | (3) | um- | trees, rivers, body parts |

(4)	imi-	plural of (3)
(5)	i-	some animals, inanimate objects
(6)	ama-	plural of (5) and some class (9), liquids, abstract nouns
(7)	isi-	languages, ordinal numbers, groves
(8)	izi-	plural of (7)
(9)	iN-	animals
(10)	iziN-	plural of (9) and (11)
(11)	u-	miscellaneous and elongated objects
(12)		missing in Zulu
(13)		missing in Zulu
(14)	u <u>bu</u> -	collective and abstract nouns
(15)	uku-	nominalized verbs (infinitives)

Certain stems will have more than one meaning, depending on the class prefix. The stem Zulu can take a class 7 prefix (isi.Zulu "language") or a class 5 prefix (i.Zulu "heaven" or "sky"). The same prefix must also be attached to every element into that enters an agreement relationship with the noun: possessive, demonstrative, and relative pronouns; adjectives; and verb, if the noun is the subject. Prefix agreement between object and verb also occurs under certain conditions, but it is usually optional, whereas prefix agreement between subject and verb is obligatory. This phenomenon has been called "alliterative concord" because the phonological rules that operate between prefix and stem often reduce the prefix on governed forms to a single V or C. The initial vowel on some prefixes is similar to a definite article in many respects. For instance, it will not appear on a predicate adjective.

Within a generative grammar, the noun class and concord system may be analyzed as follows: noun class information is part of the derivational morphology and is represented in the lexicon; concordial prefixes on governed forms are part of the inflectional morphology. Note that concordial prefixes on governed forms, but not prefixes on noun stems, depend on constituent structure: a verb or adjective will appear with a different prefix in a different structure.

Traill (1970) presents a case of a bilingual Broca's aphasic who speaks English and Ndebele (a dialect of Zulu). In single word responses to questions, all of his errors were errors in the noun class system.

(8)

<u>Patient's output:</u>	i.gwatsha	i.Zulu	um.gwatsha
<u>Correct form:</u>	u.nogwatsha	isi.Zulu	u.nogwatsha
<u>Translation:</u>	rabbit	Zulu language	rabbit
<u>Mistakes:</u>	wrong prefix	wrong prefix	wrong prefix

<u>Patient's output:</u>	n.kunzi	ma.thambo	ba.ntwana
<u>Correct form:</u>	in.kunzi	ama.thambo	aba.ntwana
<u>Translation:</u>	bull	bones	children
<u>Mistakes:</u>	missing initial V	missing initial V	missing initial V

<u>Patient's output:</u>	.ntwana	.komo	.godl
<u>Correct form:</u>	um.ntwana	in.komo	um.godl
<u>Translation:</u>	child	cow	hole
<u>Mistakes:</u>	no prefix	no prefix	no prefix

<u>Patient's output:</u>	.gwatsha	.bisi
<u>Correct form:</u>	u.nogwatsha	u.bisi
<u>Translation:</u>	rabbit	milk
<u>Mistakes:</u>	no prefix	no prefix

The patient makes four kinds of mistakes. One, he simply omits the prefix. (It should be noted that a stem by itself cannot be construed as a word in Zulu.) Two, he omits the initial vowel; possibly, this can be analyzed as a syntactic mistake, equivalent to omitting an article in English, since the initial vowel is not always obligatory. Three, when he attaches the wrong prefix to a stem (i.gwatsha and um.gwatsha), he chooses a prefix of a semantically related class. Four, he chooses a prefix-stem combination (i.Zulu) that is a Zulu word, but the stem with that prefix is not the correct response to the question asked.

(9) is a list of some sentences that the patient produced; Traill does not say whether these sentences are spontaneous utterances, responses on a test, or repetitions.

(9)

<u>Patient's output:</u>	i.hhashi	u.lele
<u>Correct form:</u>	i.hhashi	li.lele
<u>Translation:</u>	the horse	is lying down
<u>Mistakes:</u>		incorrect concordial prefix
<u>Patient's output:</u>	in.komo	baleka
<u>Correct form:</u>	in.komo	i.ya.baleka
<u>Translation:</u>	the cow	runs
<u>Mistakes:</u>		concordial prefix and tense marker on verb are missing
<u>Patient's output:</u>	i.Zulu	i.nzima
<u>Correct form:</u>	isi.Zulu	si.nzima
<u>Translation:</u>	the Zulu language is awe-inspiring	
<u>Mistakes:</u>	Both prefixes are incorrect, although the noun-prefix combination is a Zulu word. However, the concordial prefix on the verb is correct, given the prefix on the head noun.	
<u>Patient's output:</u>	ma.phoyisa	dinga
<u>Correct form:</u>	ama.phoyisa	a.dinga
<u>Translation:</u>	the policeman	is wandering (patrolling)
<u>Mistakes:</u>	prefix missing initial V	concordial prefix is omitted
<u>Patient's output:</u>	ntwana	i.nye
<u>Correct form:</u>	um.ntwana	mu.nye
<u>Translation:</u>	the child	is different
<u>Mistakes:</u>	prefix missing	incorrect concordial prefix

Traill points out that there is never a case of a correct concordial prefix when the prefix on the head noun is incorrect or absent. Given the small amount of data, however, this could be a coincidence. But there is a more interesting phenomenon in the data. In the sentence ntwana i.nye, there is a concordial prefix on a verb even though the prefix on the head noun is missing. What principles, if any, determine the choice of prefix here? Two initial generalizations can be made about the data: one, the choice between singular or plural prefixes is always correct; two, an incorrect prefix-noun form is either a different Zulu word or a prefix from a related semantic class. The patient makes mistakes in both derivational and inflectional morphology: however, it is not clear whether mistakes in one component lead to mistakes in the other. In fact, we do not know what relation, if any, the two components have to each other in his grammar. In normal Zulu, the choice of prefix in the derivational morphology will determine the choice of prefix in the inflectional morphology. For this speaker, however, the relationship between the two components could be the same as in normal Zulu, it could be reversed, there could be a different relationship, or there could be no relationship at all. Without more data, it is impossible to determine what principles, if any, determine the choice of prefixes on governed forms.

In comprehension tests, the patient was able to make use of the information given by concordial prefixes.

- (10) (i) Khomba eli.lele
 Point to the one lying down
Eli is a class 5 prefix and class 5 includes ducks.
- (ii) Khomba e.lele
 Point to the one lying down
E is a class 9 prefix and class 9 includes cows.

When given sentence (i), the patient pointed to a toy duck; when given sentence (ii), he pointed to a toy cow. Notice that this result conflicts with the results of experiments on comprehension of Broca's aphasics in English, in which it was found that they did not make use of purely syntactic cues. I think that the different results in English and Zulu are a consequence of the fact that the grammatical class information of Zulu is represented in both the derivational and the inflectional morphology. Since a Broca's aphasic has access to a (perhaps deficient) lexicon, the patient may be using lexical, rather than syntactic, information on this comprehension test.

FOOTNOTES (TO CHAPTER TWO)

1. In other descriptions of the speech of Russian or German speaking Broca's aphasics, it has been reported that verbs also are uninflected and appear only in infinitival form (Goldstein, 1948). In this case, one would have to postulate a deficit in the inflectional morphology as well.

CHAPTER THREE

The overwhelming generalization that emerges from these case studies is that the language output of a Broca's aphasic is remarkably similar across different languages. But the linguistic deficit, described in terms of the grammar of any of these languages, may be quite different. In all of these languages, Broca's aphasics do not use grammatical formatives of one sort or another. In different languages, however, these grammatical formatives may belong to different components of the grammar: in some cases, they are part of the inflection morphology; in some cases, they are part of the derivational morphology; in some cases, they are part of neither. The grammatical formatives that are omitted may be free morphemes; they may be inflections attached to a stem by word-internal phonological rules; or they may be particles placed after a stem and connected by a rule of vowel harmony. Some of these grammatical formatives are non-syllabic; others are syllabic and unstressed; still others are syllabic and stressed. The output that results from omitting them is sometimes a phonological word of the language (in the sense of Kean, 1978) and at other times only part of a word or part of a stem. In sum, to analyze these different case studies as deficits in the grammars of the various languages, one would be forced to postulate deficits in different components of the grammar in different languages

But surely this would be missing the generalization that the language of a Broca's aphasic is very much the same in different languages. Described in terms of the normal grammar of a language, the grammars of Broca's aphasics appear dissimilar in different languages because the normal grammars of these languages are dissimilar. Notice, however, that it seems quite possible that a single grammar could be constructed to represent the linguistic knowledge of all of these Broca's aphasics--if this grammar is not required to be equivalent to a normal grammar that is missing one or more components.

At this point, it is appropriate to examine more closely the hypothesis that both the syntactic deficit and the phonological deficit theories make; that the grammar of a Broca's aphasic is a proper subset of the grammar of a normal speaker. A grammar, let us remember, is a theory of an object, language. It is a theory of what an individual must know in order to speak and comprehend a language. We assume that this knowledge is represented in the brain. But no one claims that the components of a grammar are real objects in the brain in the same way that, say, the components of a computer are real objects in a computer. We do not know how this knowledge is represented in the brain. Therefore, it would be, in effect, a fantastic coincidence, if a lesion were to disrupt the language faculty of the brain in such a way that a component of our theory was damaged or destroyed. We know that lesions in different parts of the dominant hemisphere damage language in different ways, but this in no sense implies that these lesions damage a theory

of language in different components.

Barring evidence to the contrary, it is much more reasonable to construct a theory of an aphasic language in the same way that we construct a theory of a natural language: we look at the object and try to determine the principles that govern it.

This approach, as has been noted, makes the assumption that aphasic language is rule-governed. This, too, is an empirical hypothesis that may or may not be true. But the case studies presented above support this hypothesis. The language output of a Broca's aphasic is similar in different languages: a possible explanation for this is that the grammar of a Broca's aphasic is the same across languages (with a different lexicon, of course). The knowledge of this grammar, like the knowledge of the grammar of a natural language, is represented in the brain, but there is no reason to assume that it is represented in the language faculty of the brain. Instead, I would suggest that when the language faculty of the brain is injured, another part of the brain (the non-dominant hemisphere, perhaps), less well-equipped to handle language, takes over. The knowledge of the grammar of an aphasic language will be represented in this area of the brain. Thus, an aphasic has access to the knowledge of a grammar, but not to the knowledge of a natural language grammar. And, in fact, data from experiments on Broca's aphasics in English support the hypothesis that the language of a Broca's aphasic has properties unique to it and not

at all like English. Let us examine the results of two of these experiments.

Saffran et.al. (1980) studied word order in sentences produced by Broca's aphasics. In two of these experiments, six Broca's aphasics were given pictures depicting action relations ([NP[V[NP]]]) and locative relations ([NP[be[PP]]]) and cards on which were written the constituents of these sentences. The cards were divided NP-V-NP for the action relations and NP-beP-NP for the locative relations. The subjects were asked to arrange these cards so that they formed a left-to-right linear sequence appropriate to the picture. The experimenters found that word order was not determined by grammatical relations (subject/object) or by thematic relations (agent/patient). Instead, the subjects consistently placed an animate NP before an inanimate NP, if there was such a contrast. If both NP's were either animate or inanimate, word order was unpredictable.

The authors suggest that other factors may play a role in determining word order. When an inanimate NP was the source of an action, the subjects performed unexpectedly well on inanimate subject/inanimate object sequences and no better than chance on inanimate subject/animate object sequences. (If animacy/inanimacy was the only factor, reversal of object and subject on the latter sequence would be predicted.) The experimenters suggest that a Broca's aphasic puts a "salient" NP first in a sequence and that several factors cause an NP to be designated salient. If the

thematic relations of the sentence are agent/patient, an animate NP will be the only salient NP in the sequence and the order will be animate/inanimate. But if the thematic relations of the sentence are source/patient, both an inanimate source as subject and an animate patient as object will be salient. This will explain the results of their source/patient sentences: if the object is inanimate, there is only one salient NP and the correct word order will be produced. But a sentence with an inanimate source and an animate patient will have two salient NP's so that either NP can be put first. These results suggest that word order in the language of a Broca's aphasic is rule-governed, but not by the principles that govern word order in English.²

In recent years, there have been a number of experiments (Goodglass et.al. 1967; Goodglass, 1968; and others) concerning the effects of intonational cues on language production and comprehension in Broca's aphasics.³ Stress appears to play a role in the grammar of an English speaking Broca's aphasic, but not the same role that it plays in the grammar of a normal speaker of English. For example, Swinney et.al. (1980) studied the effect of stress on word-monitoring with open class words (nouns, verbs, adjectives) and closed class words (free morpheme grammatical formatives) in Broca's aphasics and normal speakers of English. The experimenters found that if the target word was unstressed, normal speakers respond with equal speed to an open or a closed class word. If the target word is stressed, response time decreases in general and normal speakers respond more quickly to a closed than to an open class word. The authors explain:

Normal listeners use stress as a major cue for establishing expectations about sentence recognition; they expect sentential stress to fall on...the open class materials in a language and they treat any stressed item as a potential carrier of important contentive material (p. 140).

Since a closed class word is normally unstressed, it is responded to more quickly than an open class word when stressed, because it is, in effect, doubly stressed. (The listener does not expect it to bear any stress at all.)

If the target word is unstressed, Broca's aphasics respond to open class words more quickly than to closed class words. If the target word is stressed, the response time of Broca's aphasics decreases equally for open and closed class words. These results suggest that stress is encoded differently in the grammar of a Broca's aphasic and the grammar of a normal speaker of English.

It would be interesting to study the effects of intonational cues in Broca's aphasics in various languages since there are different restrictions on and interpretations of stress in the grammars of different languages. In some languages, emphasis is indicated by focal stress (primary sentential stress). In some of these languages (English, for example), word order is fixed and almost any item (even an affix) may be focally stressed in any position. In other of these languages (Hungarian, for example), the sentential stress pattern is relatively fixed, but almost any word can be moved into a stressed position. In other languages (Japanese and Papago, for instance), word order, rather than stress, is used to indicate emphasis. These are

usually tonal languages. In still other languages (Warlpiri, for instance), neither stress nor word order is used to represent emphasis. Instead, an enclitic is attached to the end of a word to indicate emphasis. Since stress plays a different role in the grammars of different languages, it would be interesting to determine if it plays the same role in the grammars of Broca's aphasics of different languages. If this is indeed the case, it would constitute additional support for the hypothesis that the grammar of Broca's aphasic language is the same across languages and a different entity altogether from the normal grammars of these languages.

Given the case studies presented above and the results of experiments on English speaking Broca's aphasics, as a preliminary hypothesis, it seems quite plausible to suppose that the language of a Broca's aphasic is rule-governed. In this case, it should be possible to construct a grammar of it. Perhaps this grammar will be similar to the grammar of a natural language and perhaps not. What may be more interesting, in fact, are the differences between the grammar of an aphasic language and the grammar of a natural language.

Another question is that of the relationship between the grammars of different aphasic languages. It has been suggested (Chomsky, 1980) that grammars of different natural languages will be determined from a universal grammar by means of choices in one direction or another of a small, well-defined set of parameters. That is, if certain choices are made, the grammar will be a grammar of French; if other choices are made, it

will be a grammar of Italian or Japanese.

It may turn out that there is a universal grammar of some or all aphasic languages just as there is a universal grammar of natural languages. If this were true, then the grammar of the language of Broca's aphasia or the grammar of the language of Wernicke's aphasia might also be determined by certain choices within a set of yet-to-be-defined parameters. Whether such a universal grammar exists remains to be seen.

If it turns out that the grammar of a natural language and the grammar of aphasic language have little relationship to one another, this in no way diminishes the importance of research on aphasia. The study of aphasic language is conducted for the same reason that the study of natural language is: we want to learn what we can about brain functioning. To take an example from another area of research: it is by no means obvious that the sub-cortical vision of a cat is a proper subset of a cat's cortical vision. Still, much may be learned from studying sub-cortical vision in cats. Similarly, aphasic language may not be a proper subset of normal language. Nevertheless, much may be learned about brain functioning--though not necessarily about the language faculty--by studying aphasic language.

FOOTNOTES (TO CHAPTER THREE)

1. The fact that people may recover from Broca's aphasia raises the question of whether a natural language grammar or an aphasic language grammar represents the linguistic knowledge of a recovered aphasic. At least in most instances, it does not appear that the grammar of a "recovered" Broca's aphasic is very much like the grammar of a normal speaker, even though both individuals may produce and comprehend the same sentences. Consider Goldstein's (1948) description of such a patient.

Two years after beginning the training, during which time he did not have continual lessons but constantly and eagerly practiced and tried to train himself, he spoke a great deal in quite well-constructed sentences. His speech was only a little hesitant. As he said himself, he spoke with too much consciousness of each word, rather than mechanically. He had a hard time finding words. His difficulty was not so much with motor performance of the word as with combining words in a fluent sequence; consequently, pauses appeared in his speech, very often before a conjunction or an adverb. He frequently did not know which conjunction he should use in a sentence. He pondered, recited several ones to himself, and experimented with each one until he found the right word. He then immediately said it aloudAs he had further difficulty in declining nouns and conjugating verbs, he would always experiment with them.... The principle defect was the difficulty to speak automatically (p. 195).

2. It should be noted that a contrast in animacy may play a role in determining word order in a natural language. An example of this is Navajo, which has underlying SOV word order. Subject-object inversion is quite free and does not lead to ambiguity: when the order is SOV, the morpheme yi precedes the verb; when the order is OSV, the morpheme bi precedes the verb.

- (i) Ashkii atʔééd yiztsʔqs
 boy girl yi-kissed
 "the boy kissed the girl"
- (ii) Atʔééd ashkii biztsʔqs
 girl boy bi-kissed
 "the girl [let] the boy kiss [her]"

As can be seen, there is a slight difference in meaning. When the object precedes the subject, it is interpreted as having ceded control to the subject. In Navajo culture, there is a hierarchy on which humans (adults, then children), animals (large, then small), plants, inanimate objects, abstract entities are ranked in descending order. A lower-ranking NP cannot precede a higher-ranking NP in a sentence; this word order will be considered ungrammatical by a Navajo speaker. Surely this is a constraint on word order in Navajo, but it is not usually analyzed as a syntactic constraint. Rather, it is assumed that these sentences may be generated by the syntax, but will not be produced by Navajo speakers because they are uninterpretable. (A lower-ranking NP simply cannot cede control to a higher-ranking NP; it does not make sense in Navajo culture.) Thus, the animacy/inanimacy contrast in Navajo imposes an extra-linguistic constraint on word order, since it is not part of the grammar of Navajo. However, the animacy/inanimacy contrast in the language of Broca's aphasic may impose a linguistic constraint on word order if it turns out to be part of the grammar of Broca's aphasic language.

3. There are two kinds of intonational cues in speech, stress and tone, both of which may be assigned phonemically or phonetically. Stress refers to differences of intensity; tone refers to differences of pitch. A language may make use of one or both of these intonational cues to encode information. English uses stress, but not tone, as an intonational cue; stress on individual words is assigned by phonological rules and can be the only distinguishing feature of a minimal pair ("per^ˈmit" vs. "p^ˈermit"); sentential stress is used to indicate emphasis.

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