Thesis: Left Hemisphere Brain Damage and Its Effects on Language

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Introduction

"When we study human language, we are approaching what some might call the 'human essence' the distinctive qualities of mind that are, so far as we know, unique to man." [Noam Chomsky, Language and Mind]

As this quote says, language is the most important aspect of human life. Without it, we would not be able to communicate with one another to talk or express ideas. Human language is our highest cognitive function.

From past research, we now know that language is lateralized. Lateralization is used to refer to any cognitive functions that are primarily localized to one side of the brain or the other. It has been documented and proven that the two halves of the brain are anatomically and functionally asymmetric. It has been found that in most people, language functions are localized in the left hemisphere. Researchers have shown that there is a difference in neurological development in the two halves of the brain. Lateralization is complete by puberty. It has been postulated that for around 95% of right handed adults, it is the left hemisphere that is dominant for language. For left handed adults, 70% are left hemisphere dominant for language, while the rest are right hemisphere dominant. It has also been postulated that even though the left hemisphere is more specialized in the grammatical and semantic aspects of language, the right hemisphere does have some linguistic capabilities (Foss and Hakes, 360).

Artificial language, natural language, and indeed all human and animal communication have in common three features: form, content, and use. Form refers to the system of signals: the dictionary of sounds and words or gestures, the combination of sounds or gestures, and the syntax used to convey messages. Content refers to the message of the communication, the ideas that are coded by the language. In human conversation, the content is what a person says and what others understand that person to say. Use refers to how people or animals use the message or respond to it in different contexts. Use, therefore, includes nonlinguistic as well as linguistic aspects of communication (Kandell and Schwartz, 689).

Each feature of language seems to involve a different aspect and perhaps even a different level of neural organization. Thus, language form depends on the neuronal machinery for generating motor behavior-for vocalization and for gesture-as well as on the neural representation of grammatical speech. Content involves a different and higher neural representation, that of images, ideas, concepts, and the neural translation of these ideas into the units of form-into gestures or vocalization. Usage involves still more complex neural representations, those of individual identity and of a perception of social context. Form, content and use are affected and result in different ways. Form is affected by lesions of the cerebral cortex which results in Broca's aphasia (Broca's will be discussed in detail later). Content is disturbed

in Wernicke's aphasia and in conduction aphasia. Use is affected in the aprosodias (again they will be discussed later) (Kandell and Schwartz, 689).

Human languages are creative, structured, meaningful, and interpersonal. The creative aspect of language is obvious. We do not learn a language simply by memorizing a large number of stock sentences. Instead, we create original sentences with every new thought we speak. As listeners, we readily interpret the sentences spoken by others. Language is structured by a set of rules. We construct sentences grammatically even though we may not apply the rules consciously. We speak ungrammatically only infrequently. Language is also meaningful and representational. The purpose of structure in language is to permit ideas to be represented and expressed clearly. Words and their arrangement into sentences are a means, and often the only easy means, for communicating ideas. The main purpose of grammar is to allow different meanings to emerge from the various relationships of words in a sentence. We use language in an interpersonal way, its purpose is to allow one human being, or one human brain, to interact with another. Speech sounds that are used for speech perception are called phonemes, which are perceptual units from which speech sequences are composed. Two levels of structure of language can usually be distinguished: 1) the combination of phonemes to form syllables and words, and 2) the combination of words to form phrases and sentences (Kandell and Schwartz, 689-90).

The question of how and where language emerged has been an ongoing debate for years. Recent research has shed some light on this question. As stated before, in most individuals, the left hemisphere is dominant for language. In modern man, the cortical speech area of the temporal lobe of the right planum temporale is larger in the left hemisphere than in the right hemisphere. These asymmetries have also been found in Neanderthal man (who lived 30-50,000 years ago) and in Peking man (who lived 300-500,000 years ago) (Kandell and Schwartz, 691). Whether these anatomical and functional asymmetries originally evolved for language, for other forms of communication, or for an entirely different function, is still not known. Now the view is that language may have risen in between these two times, about 100,000 years ago, and it only rose once. Therefore, from this assumption, and the location of the fossils found, all human languages must have arised from a single language first spoken in the eastern part of Africa.

The second question that researchers have been trying to answer is: Did human language emerge from ape communication? There have been two theories that have been at the forefront of this issue. The first theory is referred to as a gestural theory. It proposes that language evolved from a system of gestures that emerged when certain apes assumed an erect posture, freeing their hands for social communication. Now that they were erect, their hands were free to do other things, therefore they began to use gestures as a form of communication (Kandell and Schwartz, 691).

The second theory is referred to as a vocal theory. It states that language came from the evolution of different calls. It states that there was a change in the structure of the mouth, jaw and vocal tract that allowed them to produce different sounds. This theory explains why all human languages have so many features in common. Some researchers believe that language is a result of both early gestures and vocalizations (Kandell, and Schwartz, 691).

All of the research presented thus far was of great use to many historians, linguists, and sociologists. Pyscholinguists were now interested in finding out whether language is innate or learned. From studying language, we know that language acquisition is a learning process. We also know that there is a "critical period" for the learning of a language. If an individual is not exposed or introduced to a language before the end of the critical period, then the individual will never speak, read, or write at his or her intended level. But, there are other aspects which do make it obvious that the source of language is not solely the due to the environment, or input. First, most people whether left or right handed are left-hemisphere dominant. This may be due to certain factors before birth that insure that the left hemisphere is dominant. Second, some features on the left side of the brain are larger than those on the right side of the brain (i.e. the planum temporale- the specialized area of the temporal lobe that is committed to speech and includes Wernicke's

area), and these differences are noted at birth. Third, newborns recognize the difference in single speech sounds categorically (e.g. the difference between /p/ and /b/. Lastly, the language acquisition steps of all children throughout the world are the same. All of these reasons show that parts of language are partly innate. There is a theory that suggests that language is determined by the structure of the human brain and follows from its development. Therefore, the human brain is prepared for the control of speech by its developmental program. On the other hand, the particular languages spoken and the dialect and accents in that language are determined by the social environment. Therefore, language arises from a combination of innate (or genetic) and environmental factors (Kandell and Schwartz, 691-2).

The aphasias are acquired disturbances of language that result from insult (Vascular damage, trauma, or tumor) to specific regions of the brain, almost invariably to specific regions of the cerebral cortex. Aphasia is not uniform from individual to individual. Different legions in different parts of the cerebral cortex disturb particular aspects of language. It is a disturbance of language capacity, involving comprehension, production, or both, that is not attributable to a speech impediment. Aphasia affects other cognitive and intellectual skills to some degree. Aphasia occurs most frequently after strokes. 40% of major vascular disorders in the cerebral hemispheres produce language disorders. Other common etiologies

of aphasia include trauma, brain tumors, and degenerative processes, such as Alzheimer's Disease. Regardless of what type of brain damage is the result of these situations, it can never be completely reversible.

The neurobiological understanding of language is very rudimentary. The most important neuroanatomical model for the neurological basis of language is that by Wernicke and Geschwind (See Figure 1.). It tries to account for the various aspects of speech related disorders and illustrate for each of them the importance of anatomical localization.

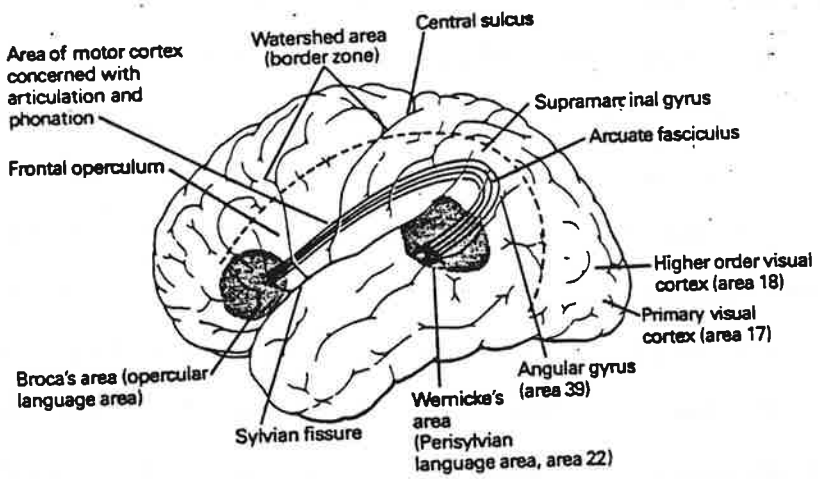

Figure 1. Wernicke and Geshwind's neuroanatomical model of language. Language areas of the brain shown. (Kandell and Schwartz, 693).

There are many different types of aphasia. Wernicke's aphasia is characterized by a deficit in comprehension of language. Wernicke's area is in the temporal lobe in the auditory cortex adjacent to the auditory cortex. The lesion usually involves the left posterior and superior portions of the temporal lobe (See Figure 1). Though comprehension is severely impaired, verbal output is fluent. It is normal in rate, rhythm, and melody, but patients use the wrong combination of words. Also, some patients tend to add additional syllables to words and additional words to phrases. These neologistic or paraphasic distortions most frequently involve key lexical items, such as nouns, verbs, adjectives, and adverbs. People with Wernicke's are not aware of the the errors they are making in their speech. Patients with this type of aphasia also have severe reading and writing disabilities. Even though other neurological signs may be absent, occasionally a right visual field defect is encountered. Using the neurological model, we can reason why these symptoms are present. Visual images or words reaching the visual or auditory cortex fail to activate Wernicke's area and thus fail to activate the remainder of the language system. A spoken word may not be processed perceptually and may not be understood. Consequently, the word may not be comprehended (Kandell and Schwartz, 694).

Broca's area is located at the posterior part of the third frontal gyrus, immediately in front of the motor area controlling the vocal tract. Broca's aphasia involves damage to the motor

association cortex in the frontal lobe and usually includes the posterior portion of the third frontal gyrus that forms part of the frontal operculum (See Figure 1). Comprehension is usually preserved, but language output is impaired and nonfluent. This can range from almost complete muteness to a slowed, deliberate speech that uses simple grammatical structures. Patients use only key words. Broca's speech is composed chiefly of nouns, adjectives, and main verbs with relatively few pronouns, articles, prepositions, auxiliary verbs, and conjunctions. The so-called "function words" are missing. Broca's aphasics usually express nouns only in the singular, verbs in the infinitive or participle, and they often eliminate articles and adverbs, and sometimes even adjectives (Berndt, 227). There is also a breakdown in the construction and coordination of constituent phrases. Unlike Wernicke's aphasics, Broca's aphasics are aware of their errors. Although language production is severely compromised, comprehension of spoken and written language is usually preserved, because the posterior language regions of Wernicke's area are sill intact. Broca's aphasics have problems reading aloud and their writing skills are a bit abnormal.

Other physical symptoms include an occasional right hemiparesis and homonymous hemianospia (loss of vision). Also, since Broca's area is in the region which controls the muscles of the face, tongue, jaw and throat, it has been hypothesized that the disruption of speech associated with it is due to partial

paralysis of the muscles required for articulation. However, it has been shown in other instances that these muscles which were non-functional in speech were functional in other activities. We can again use the neurological model to see what processes are occurring in this situation. A patient with this type of lesion has relatively normal comprehension of both written and spoken language, but speech and verbal communication are abnormal because the muscular articulation pattern for sound and for the grammatical structure of language are never passed on to the motor cortex. (Kandell and Schwartz, 695).

As you can see, a lesion in either Wernicke's or Broca's area lead to partial destruction of speech, but the way in which speech is affected is different. A lesion in Broca's area disturbs the the production of speech but has a much smaller effect on comprehension. Damage to Wernicke's area, on the other hand, disrupts the use of words in language.

In conduction aphasia, there are lesions in the arcuate fasciculus which interconnects Wernicke's and Broca's areas. Due to the lesions in this area, Broca's area, though intact, cannot receive input from Wernicke's area. Communication is fluent, but patients have paraphasic intervals. Their ability to repeat, naming, read aloud, and write are also greatly affected. Some individuals have apraxia for limb and facial movements. The

neurological model shows us that a lesion in the arcuate fasciculus disconnects Wernicke's area from Broca's, and as a result, verbal communication is now disordered because the visual or auditory pattern is not conveyed to the part of the brain involved with language production (Kandell and Schwartz, 695).

Anomic aphasia usually results from lesions in the posterior aspect of the left inferior temporal lobe, near the temporal-occipital border (See Figure 1). Patient's speech is fluent, but there is a disturbance in finding words. This is also known as the "tip of the tongue syndrome". Some aphasics substitute the word they are looking for with another that does not have the same meaning but is associated with it (i.e. table for chair). Other aphasics will talk in circles until the word is found or suggested.

Lesions which cover the entire perisylvian region result in global aphasia. These lesions compromise both Wernicke's and Broca's areas and the arcuate fasciculus. People with global aphasia are unable to speak, comprehend language, read, write, repeat or name. This type of aphasia is extremely devastating (Kandell and Schwartz, 695).

In transcortical aphasia, the ability to repeat spoken language is preserved. The lesion involved is found outside the perisylvian language centers. The symptoms usually result from

damage to the brain at the junctions of the vascular territories of the middle, anterior, and posterior cerebral arteries (Kandell and Schwartz, 695). There are three types of transcortical aphasia: motor, sensory, and mixed. In transcortical motor aphasia, the individual's speech is non-fluent, and he or she only release a few syllables at a time. Despite this, they are able to repeat words and phrases surprisingly well. Their comprehension and reading levels are also normal. Their writing may be slightly impaired. The lesion causing this is usually found anterior to Broca's area in the frontal lobe. Transcortical sensory aphasia is caused by a lesion in the parietal-temporal-occipital junction. The patient's speech is fluent, but their comprehension is defective. The individuals are unable to read or write, and they have difficulty in finding words. Nevertheless, they are able to repeat spoken language. Lastly, mixed transcortical aphasia is very rare. Patients here are unable to speak unless they are spoken to. Even so, their responses are very easy and simple; sometimes they even become echolalic. Besides this, they are not competent in any other language function (Kandell and Schwartz, 695-6).

There are two other types of language disorders that should also be addressed. Prosody deals with the musical intonation of speech. When there is a disturbance in this component of language, it is referred as aprosodia. Unlike aphasia, this problem arises in the right hemisphere of the brain. Apraxia is a

disorder in the understanding of complex motor commands and the execution of certain learned movements. The actual problem is in the cognitive component of learned movements. Aphasia should not be confused with dysarthria and dysphonia. Dysarthria and dysphonia result from weakness or non-coordination of the muscles controlling the vocal apparatus. Dysarthria is a disturbance in articulation, whereas dysphonia is a disturbance in vocalization. Both are disorders of the mechanical process of speech. They do not necessarily affect language comprehension or expression. In some cases, patients are able retain their language capacity despite their speech impediment (Kandell and Schwartz, 693).

Aphasia, its causes, and its effects is a large area of study today, since there are thousands of cases reported each year. The research performed has not only given us insight about aphasia, but about language, the brain and how it functions. Further research needs to be carried out, so perhaps new theories can be formed to help improve our neurological models. Also, by learning about the brain, we may be able to "tap" into how it controls the rest of the body, furthering our knowledge about the human body as a whole.

Works Cited

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PART TWO: CURRENT DEBATES ON AGRAMMATISM

In this section I will be discussing aphasia in linguistic terms. The first part will consist of a summary of the deficits found in both Broca's and Wernicke's aphasic speech. The second part will consist of a summary of the recent work done by some of linguistics' most prominent researchers.

As was discussed in the Introduction of this paper, aphasia is a term that is used to describe the many problems of language deficits that arise from multi-forms of brain damage. The two main forms of aphasia are Broca's and Wernicke's which are caused by lesions or destruction in their respective parts of the brain (For review, please see the appropriate sections in the Introduction).

In Broca's aphasia, speech seems to come with great difficulty and is very slow, and articulation is impaired. However, Broca's aphasia involves more than articulatory defects. In addition to awkward articulation and impaired prosody, symptoms include a reduction in available vocabulary, a restriction of grammar to the simplest forms, and a disturbance of writing ability that is most often as impaired as speech. In Broca's speech, we usually only find "broken" sentences made up of nouns, adjectives, and main verbs. Broca's aphasics' speech is characterized by a lack of pronouns, articles, prepositions, auxiliary verbs, and conjunctions. In the worst case, a Broca's aphasic can only utter single nouns with long pauses in between

each. It has been proven by many researchers that Broca's aphasics produce a significantly decreased number of grammatical "function words" overall and an increased proportion of nouns and adjectives relative to function words (Berndt, 227).

In Wernicke's aphasia, speech is phonetically and even grammatically normal, but it is semantically deviant. In Wernicke's aphasia speech, words are often strung together with considerable facility and with the proper intonations, so that the utterance has the recognizable structure of a sentence. The words chosen though, are inappropriate, and sometimes include nonsensical syllables of words (Wang, 77). Aphasics of this type also have great difficulty comprehending speech. Reading and writing are comparably impaired.

Despite that they are both known as types of aphasia, Broca's and Wernicke's aphasia are quite different. Broca's defect lies in the production of sentences, whereas Wernicke's defect lies in the use of words in sentences.

Now let's turn our focus on Broca's aphasia. Many researchers have done experiments to find out exactly what is happening to speech and language in a Broca's aphasic using a more linguistic rather than a neurological approach. The first of these people is M.L. Kean. Most people have viewed this type of aphasia in terms of a syntactic deficit. Kean argues that Broca's

aphasia lacks grammatical systematicity and that the only coherent interpretation of it can be found in phonological structure (10). Kean wanted first to establish qualitative differences in linguistic deficits associated with lesions in various areas of the brain and to second focus on Broca's aphasic's speech and look at it with respect to linguistic theory (10). Her hypothesis states that Broca's aphasia can only be accounted for in terms of the interaction between an impaired phonological capacity and otherwise intact linguistic capacities (10).

Her argument for this fact lies in the omission pattern found in Broca's aphasic's speech that she states can be given a "uniform account as the phonological simplification of a sentence into the minimal string of 'phonological words' within the sentence" (10). Looking at linguistic processing then, Kean states that the capacity to construe items as phonological words is part of normal functioning. She argues that "by assuming all aspects of the language faculty to be intact, except for the phonological, we can predict that there will a systematic variation in the likelihood of omission of function words and grammatical morphemes which parallels the variation in the way these elements are treated within the normal language processing system" (10).

Kean states that part of the function of the phonological component of grammar is 1) to specify the segmental sound shape of

individual words (i.e. distinguishing "pun" from "fun", and 2) to specify the stress and intonation patterns of words in a sentence and of sentences as a whole (15). If Broca's aphasia truly has a phonological deficit, then we would have to find problems in both of these areas. Blumstein et al has provided data which shows that the articulation of Broca's aphasics in fact deviates from the norm, thereby providing evidence for Kean's hypothesis (Kean, 16).

Kean found that many of the morphological omissions of Broca's aphasics are conditioned by the sonorance hierarchy. She found that consonantal morphemes are least likely deleted after vowels and most likely deleted after fricatives and stops. Also, the likelihood of their deletion when preceded by liquids is greater then when preceded by vowels but less likely when preceded by consonants. Post-vocalic morphemes are more likely to be retained than post-consonantal (17).

One of Kean's objectives was to establish that there is a phonological difference between words that have word-boundary affixes and words which have non-word-boundary affixes. A morpheme is defined as the most elemental unit of grammatical form. For example, the word "boyish" contains two morphemes, "boy" and "-ish". A bound morpheme is a morpheme which cannot occur unattached. Examples of bound morphemes are prefixes and suffixes such as "-able" and "un-"; these are not words on their \

own and would not make sense if they occurred alone. A free morpheme is one that can occur by itself such as "man", or "prove". Kean found that the affixes which Broca's aphasics most likely omit are those which are phonologically word-boundary morphemes (i.e. 's or is). Non-word boundary morphemes were not typically omitted (i.e. sub-, re-, per-, ob-) (21).

From this observation, Kean decided that there must be a difference between word and non-word boundary affixes. She found that the difference lied in stress. Word boundary affixes were found not to affect the stress pattern of a word, whereas non-word boundary affixes were found to affect the stress pattern of a word (22). She also found that the affixation of the plural, possessive, or verbal markers to a word never affects the placement of stress, and nor does the cliticization of "is" (22). In the speech of Broca's aphasics, the stress pattern of words is normally retained therefore Kean came to the conclusion that Broca's aphasics have a tendency to omit those affixes which do not play a role in the assignment of phonological stress to words (22). Kean formulates a new "rule" governing a Broca's aphasic's speech: 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 his language (25). Because most function words do not affect the stress pattern of any sentence, it would make sense that most function words would be altered or omitted all together, and we do see this in aphasic speech. This

statement also correctly predicts that Broca's aphasics do not speak in jargon. Lastly, Kean says that the dysprody found in Broca's aphasic's speech is not inherently deviant but rather arises as a consequence of the interaction of normal intact components of the linguistic system with the impaired phonological component (40).

Kean's interpretation relies exclusively on universal aspects of word level phonological structure, segments, boundaries, and phonological words (41). All of theses are the properties which define the domain of phonology. Agrammatism can be accounted for on the basis of the sound structure which exists between words and between a word and its affixes. From the data on speech errors presented in her work, she predicted that the inflectional affixes and function words (words that are never epoxied) will be more deletable than derivational affixes and that among the derivational affixes which are integrated to the base word form a lexical item (Kean, 32). It was her hypothesis that "Broca's aphasics have a normal linguistic capacity in all domains except for the phonological and that the central realization of this deficit is in the minimization of the phonological structure of a sentence (32).

In conclusion, from Kean's research we have learned that she believes that the deficit in language found in Broca's aphasia is due to a phonological abnormality. According to Kean, despite

this problem, Broca's aphasics have normal linguistic capabilities in all other domains.

Kean's phonological account for agrammatism has not convinced all researchers. The major conflict lies in the statement by Kean which states that she claims that agrammatism can be accounted for on the sole basis of the sound structure which exists between words and between a word and its affixes (Kean, 40). In my opinion, since the Broca's aphasic's speech is not only affected in spontaneous speech, but also in writing, reading out loud and silently, comprehension, and in many other ways, it is hard for me to believe from reading several different views on the subject, that all of these deficits are caused by one and only one defective factor. Kean states that "all aspects for the language faculty are intact save for the phonological" (10). The fact that this may mean that the lesion found in Broca's aphasics only affects the phonological aspect of language, is also difficult to be proven, since this area is quite large, and it is probable that it is more specialized for additional capabilities. There have been many other hypotheses with supportive data that have been proposed. Goodglass and Berko have put forth a morphological basis for agrammatism (1960), and Goodglass has also put forth a syntactic theory for this deficit (1973) (Kean, 13). These present only two different views. There are hundreds of different ways to look at the abnormal speech of a Broca's aphasic. As stated before we will look further into two more accounts.

Lewis Shapiro and Beth Levine are a another group of researchers who have done work with Broca's aphasics. It is known that verbs have been implicated in the apparent syntactic deficits underlying some aphasic syndromes (Shapiro, Levine , 22). Broca's aphasia patients have trouble producing verbs: more verbs are omitted than nouns during speech. In a study done by Shapiro and Levine, their main focus was to examine verb processing during on-line sentence comprehension in aphasia. They did so by looking at three different groups of people, and determining whether or not they were sensitive to the argument structure arrangements of verbs. The three groups used were agrammatic Broca's aphasics, fluent aphasics, and normals for a control.

Shapiro and Levine state that there is evidence that the reason behind Broca aphasic's agrammatism in speech and comprehension can be explained by the part of the grammatical system that assigns thematic roles of a verb's argument structures (i.e. agent, theme, goal) to noun phrases (22). When agrammatics try to comprehend complex sentences, they assign inappropriate thematic roles. Therefore, Shapiro and Levine believe that the mapping of thematic roles onto noun phrases is the problem, and that the problem may also involve a deficit in lexical access (22).

Shapiro and Levine's study asks two very important questions: 1) whether Broca's aphasics are normally sensitive to a verb's

predicate-argument structure, therefore also to its thematic roles and 2) whether the mental device that activates the verb and its argument structures operates in a normally fast-acting and automatic fashion during sentence comprehension (23).

Shapiro and Levine deal with two different aspects of how verbs are represented in the lexicon. The first is strict subcategorization which characterizes the syntactic form of the phrases or clauses a verb selects, regardless of semantic content. The second is predicate-argument structure which is relevant to both the syntax and the semantics: to syntax by characterizing the argument-taking properties of verbs, and to semantics-by forming a first-order approximation of a semantic description of a sentence (Shapiro and Levine, 24).

In their first experiment, they used four different syntactic verb types in the test sentences - pure transitives [PT] (e.g. throw), obligatory three-place verbs [OV] (e.g. put), non-alternating datives [NAD] (e.g. donate), and alternating datives [AD] (e.g. give). Pure transitives allow only an NP and a simple two-place argument structure of the form (x,y). Obligatory three-place verbs also allow a single subcategorization, and NP PP, and a single argument structure possibility of the form (x,y,z). Nonalternating datives allow two possible strict subcategorizations, and NP and an NP PP, and two argument structure arrangements such as (x,y) and (x,y,z). Lastly,

alternating datives allow three possible strict subcategorizations, and NP, NP PP, and an NP NP. They also allow two possible argument structures such as (x,y) and (x,y,z) (Shapiro and Levine, 30). [For further explanations of these verbs see page 30]. By manipulating the verb at different points in the sentence, or in other words, by placing a visual display of a letter string (which did not continue the sentence in any way and which was not related to the sentence) either in the immediate vicinity of the verb or four syllables past the verb, Shapiro and Levine "sought to explore whether the cost associated with activating all of a verb's argument structure possibilities in the immediate vicinity of the verb would dissipate as the sentence unfolded over time" (31). For example, the patient would be given the following sentence (from Shapiro and Levine, page 33):

{The old man exhibited ^ the new suit on ^ the rack.}

The sign "^" represents when the visual display which would be shown (each different sentence was done separately.) From measuring the reaction times of the subject to both sentences, they then wanted to see if there were any notable or significant differences. The results were as follows: in normals, using verbs, PT and OV yielded faster reaction times (RT) than NAD and AD. There were no differences when the sentence was manipulated downstream. The same results were found in Broca's aphasics. In fluent aphasics, only manipulating the preposition yielded

results. In this case, PT had a slower RT than OV, and OV had a faster RT then NAD (36).

Experiment two examined two other verb types, but this time the relevant differences were semantic: two complement verbs (2CV) and four complement verbs (4CV). 2CVs allow two different possible argument structure arrangements. 4CVs allow four different arrangements and thus are more complex in terms of argument structure than 2CVs (Shapiro and Levine, 36). [Again, for further explanation see page 36]. They used the same technique as in Experiment 1. The results were as follows: In normals and Broca's aphasics, the only effects were found with the verb. The 2CV had faster RT than 4CV, and with the preposition, there were no differences. In fluent aphasics, no differences were found in either the verb or preposition (38).

For normals in experiment 1, it was found that the verbs which had the fastest RT were those which allowed only one argument structure possibility. The dative verbs had slower RT and allowed two argument structure possibilities. In experiment 2, the 2CV had faster RT than 4CV. For these results, it would seem necessary that all of the relevant thematic possibilities be momentarily available to the device that activates the verb. This is presumably why verbs allowing more argument structures yield longer RT than those with fewer arrangements (Shapiro and Levine, 39). Shapiro and Levine hypothesize about why argument structure

possibilities are activated at cost in the vicinity of the verb. They state that it is possible that the lexicon is organized primarily by representations referring to argument structure, and that argument structure holds a certain representational privilege over strict subcategorization information (39). They also speak of the downstream effect. They suggest that it may have to do with the possibility that it is simply the time course itself that determines the dissipation of the cost associated with activating a verb and its multiple argument structures. It may also have to do with the structure of the sentence itself because by the time the preposition is reached, the thematic roles have already been assigned by the verb. They acknowledge that there are problems with this second possibility that need to be worked on (39-40).

Since agrammatic aphasics had the same results as normals, it looks like access to the lexicon and to a verb's thematic information is normal for these patients. It is the assignment of thematic roles to a sentence's noun phrases that appears to contribute to these subjects' inability to comprehend certain sentence structures (40). Shapiro and Levine state that it may be that when more complex sentence structures are presented, where mapping of a verb's thematic roles onto noun phrases are less transparent, activation of a verb's argument structures may no longer appear normal (41). The data found here suggest that the general

lexical access deficit they show for polysemous nouns and lexical items divorced from sentences may not be extended to include the real time processing of verbs and their arguments. Shapiro and Levine are continuing their work in this area (41).

From the data on fluent aphasics, it appears that these subjects are not normally sensitive to the argument structure representations of verbs. Their problem may have more to do with semantics. Since their results are different than those of the Broca's aphasics, then it would seem that these two groups have different processing antecedents to their comprehension deficits (Shapiro and Levine, 41).

There have been many criticisms of Shapiro and Levine's experiments. The two most prominent are that 1) the fluent aphasics were a large group of a heterogeneous nature, thereby producing "noisy data", and 2) some people claim that some of the verbs used were not "pure", meaning that they could be put in more than one category (Shapiro and Levine, 41-2).

Lastly Shapiro and Levine try to explain why the normal sentence processing system appears to be sensitive to the argument structure representations of verbs and not to strict categorization. They state that it may be that argument structure is the principle by which the lexicon is organized. From other studies there has been evidence that shows that lexical entries

are best organized by argument structure. Strict subcategorization does not appear to have either the same representational or processing status as does argument structure so far as lexical organization and processing is concerned (43-4).

In conclusion, Shapiro and Levine have found four important facts: 1) argument structure represented with verbs in the lexicon affects processing of sentences in normals (noting that if this is how the lexicon is organized, then this would not be surprising), 2) all argument structures represented with verbs are momentarily activated near verbs during sentence comprehension, but over time, this activation disappears, due to the time elapsed, 3) for agrammatic Broca's aphasics the device that activates the verb and its structural properties operate normally. The general problem with verbs of complex sentences has to do with postactivation processing, and 4) fluents are not sensitive to argument structure represented with verbs and therefore may have a semantic-like sentence processing deficit (Shapiro and Levine, 44-5).

The last group of researchers I will discuss is Schwartz, Linebarger and Saffran. In their work, these researchers attempt to articulate a syntactic deficit theory of agrammatism (SDTA) in three different versions (Schwartz et al, 83). Aphasics have been shown to be insensitive to the syntactic structure of sentences: They have difficulties in conjugating and declining various parts of speech, and have tendencies to confuse transitivity and

intransitivity, the passive voice, and the future tense, and they also have difficulty in selecting articles and prepositions correctly marked for number and case (Schwartz et al, 87). There have been researchers who have developed nonsyntactic explanations, such as Solomon. Despite that his theory accounts for the difficulty in comprehending long and complex sentences, it does not account for the poor performance of aphasics on tasks devised to test grammatical knowledge.

As stated above, Schwartz et al have three different versions of the SDTA which differ in the type of syntactic component they attribute to the intact language processing system. The first version is called the claim of computational coherence. This states that "there exits a component of the language processor that functions to build representations of the syntactic structure of sentences." (Schwartz et al, 90). The second version is called the competence claim. This states that within the syntactic component, the patient's knowledge of the syntactic rules is expressed in the form of a data base rather than a set of procedures (Schwartz et al, 91).

The third version is called the transparency claim. This says that the role of the data base is that the syntactic description of sentences is done by the direct application of those rules and statements that constitute the data base. It also says that the mechanism behind the application of these rules are

indifferent (Schwartz et al, 91). The three versions share a commitment to a component of the language system dedicated to performing syntactic analysis of sentences heard and spoken, and a commitment to a principled account of agrammatism. However, they differ in their characterization of the syntactic component, and in particular the way in which syntactic knowledge and syntactic processes interact (Schwartz et al, 98).

For theorists who adopt version 3 of the SDTA, one possible hypothesis is known as the closed-class hypothesis. It consists of five important features which are as follows. 1) open and closed class vocabulary are represented and searched differently in the mental lexicon and in the course of sentence planning. 2) The paucity of closed class items (functors and inflexional affixes) in agrammatism is explained as a restriction on the production system in its access to this vocabulary type. 3) Closed class elements appear to be recognized by special operations whose characteristics are that they manifest neither word-frequency sensitivity, nor left to right scanning bias, both of which operate strongly in the perception of open-class items. 4) Agrammatic aphasics display the word frequency and left to right scan effects of both open and closed class vocabulary. 5) Agrammatic aphasics' problem is in the restriction on the operation of the special access routines to closed-class vocabulary (Schwartz et al, 96-7). The main focus of the hypothesis is that in agrammatism, the closed-class-dependent

structure-building operations are not carried out. The comprehension deficits of these patients are attributed to an inadequate parse of the input sentence, brought about by a failure to recognize, classify, or exploit the elements of the closed-class vocabulary (Schwartz et al, 98).

From the evidence from aphasic dissociations of agrammatic aphasics, Schwartz et al have made some assumptions. They think that it is plausible to think of the language processor as performing specifically syntactic operations and that in the course of parsing the syntactic component will minimally construct a hierarchial tree structure containing gaps. Also they believe that the syntactic component must encode in some fashion certain well-formedness constraints on syntactic structures (Schwartz et al, 111).

Schwartz et al also performed a grammaticality judgment study. Here they sought to determine whether agrammatic aphasics were capable of sentence processing consistent with an intact syntactic component. They also sought to see if four aphasics were capable of detecting violations in syntactic structure. They asked the subjects to judge a battery of sentences which contained ten different "conditions", such as: strict subcategorization (e.g. *He came my house or He came to my house), particle movement (e.g. *She went the stairs or She went up the stairs), tag questions (e.g. *He fell down, didn't it? or He fell down, didn't

he?), reflexives (e.g. *I helped themselves. or, I helped myself.) [* means that the sentence is ungrammatical], and etc. on the basis of their grammaticality or "correctness". They examined the pattern of results for what they reveal about the subjects' ability to recover and syntactically evaluate phrase structure, structures with gaps, and verb morphology by categorizing the the subject's responses as "hits" ore "false alarms" and analyzing them statistically (Schwartz et al, 111 and 114).

The overall level of accuracy for each of these tests were very high. The results from the phrase structure test imply that the patients are able to recover the hierarchical phrase structure of the test sentences and that they are sensitive to the well-formedness constraints on phrase structure in whatever form these constraints are represented.

Also, they are able to analyze phrase structure as well. The results from the 'gaps exam' show that aphasics are able to infer gaps and to evaluate the well-formedness of the structures containing the gaps. The subject-auxiliary inversion test provides evidence for great sensitivity to well-formedness constraints on these structures, as well as ability to "undo" the rule of subject-auxilary inversion, that is, to recognize the fronted auxiliary as the first element of the auxiliary string. Schwartz' et al conclusion based on the grammaticality study is that agrammatic aphasics are indeed capable of exploiting the

closed-class vocabulary for the syntactic analysis of the sentences that they hear, that is, they reject the closed-class hypothesis as wrong (Schwartz et al, 116).

So, what does this mean for the SDTA? The central theme of the SDTA was that agrammatic language takes the form it does because of an underlying inability to construct syntactic representations. From the data that is presented in their paper, we see that agrammatic aphasics are capable of performing the requisite syntactic analysis, therefore it is incorrect to characterize the state of their language processing system as (Language System minus Syntactic Component) on any version of a syntactic component yet articulated. Schwartz et al therefore view the data as evidence that falsify the SDTA. They have proposed that the problem these patients have may be a failure to assign thematic roles based on the well formed products of a syntactic analysis (Schwartz et al, 120-1).

So, in this section I have presented three groups of researchers and their work on agrammatism. Kean tries to convince us that the basis of agrammatism is a phonological deficit. Shapiro and Levine attack agrammatism via a verb processing or syntactic method, but end up focusing on semantics. Lastly, Schwartz et al find that it may be due to a semantic problem. Though they all have approached the problem in different manners and from different points of view, in some cases, there is a

certain amount of overlap (we can find syntactic traces in each group's presentations). This overlap only proves to us that much more work is needed to be done in order to find the mechanism behind agrammatism. It is only through further research that this can be accomplished.

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PART THREE:

PERSONAL RESEARCH AND EXPERIMENTS AND THEIR IMPLICATIONS

My past research on and knowledge of agrammatism had instilled in me a great interest in working with some aphasics. I became especially fascinated by a little girl named Alison, who was nine when I first met her. She is the sister of a friend of mine and during visits I spent much of my time with her. Alison was adopted as an infant and her biological mother had rubella while carrying her. Alison was born a "blue-baby", in other words, the walls in her heart were not formed, therefore her oxygenated blood was mixing with deoxygenated blood. Therefore, she had to undergo open heart surgery when she was an infant. Today, Alison is brain-damaged. Her parents do not know why; it may be due to her mother's illness or perhaps from unknown complications during surgery.

I noticed many differences in Alison which set her apart from other "normal" children. Alison found it hard to express herself. She never spoke in full sentences. Often, she used just nouns and unconjugated verbs with many pauses in between. She also stuttered a great deal. Her reading and writing were also below the average level for her age group. I also met Alison's friends, many of whom were just like her. This showed me that Alison was not an exception, that she was not alone, and that there were plenty others like her - adults even!

When I took an introductory course in Linguistics here at Swarthmore, we covered psycholinguistics, focusing on aphasia, and

I thought to myself that I may be able to connect Alison's and other's deficits to aphasia. I hoped to find such an answer since none of us, including her parents, knew anything about her condition: how it happened, whether it was permanent or short term, or if she would ever improve.

My curiosity got the better of me. I thought that I might be able to do my own experiments on children like Alison and normal children to find out what was the basis for this difference. What did the "normal" children have that Alison did not? Therefore, my work has led me here, searching for some answers.

I performed some of my own experiments on Alison, Lori (who both are brain damaged) and Julie (for a control - she is "normal"). In the first experiment, my aim was to find out what was the understanding level of Alison and Lori, and whether or not it was affected by differences in stimuli. I read to them three books - Ira Says Goodbye, When I Was Nine, and The Snake That Couldn't Slither. I also attempted to have them listen to a recording of Jacob Two Two Meets The Hooded Fang and watch the film version of Pinnochio. Lastly I had them read a book that required their input. The second experiment was a taping of spontaneous conversation between Alison and Lori while they were coloring, so I could perhaps find some differences in their language and see whether I could compare my findings to the current literature. The third and last experiment consisted of

providing two picture books to both Alison and Julie, and having them tell me the story. From this I hoped to see the differences between a normal and brain damaged eleven year old, not only in language but in perception as well.

In the first experiment, I learned much about the children's comprehension abilities. Each of these books had a mean sentence length of six to eight words. First, I found that the girls have extremely short attention spans. They only paid attention when I went sentence by sentence and frequently asked them questions. Their correct responses showed me that they did comprehend what was going on in the story. The only concern I had was that they were merely repeating the question to me, so I changed the phrasing of the question and they still answered correctly. They disliked The Snake That Couldn't Slither the most. Perhaps their dislike was due to the fact that they could not relate to the plot (which dealt with an overgrown snake) whereas the other books had children going through everyday problems and events. The recording of a book showed me that they were not able to follow reading aloud when it occurred at a fairly normal to fast pace. There were no pictures to help them secure what was going on, so they may also have felt lost. Lastly the books which integrated their activities in the story yielded the best results. They were stories that forced the girls to pick a word or picture which was appropriate to complete a test sentence from a group of pictures and words. They were entirely capable of doing this and were even

able to do it on a higher level, with a more difficult book. They may have been most successful at this because it allowed them to read and to be read to at their own pace, and it involved them in the story, which had the dual function of learning and also keeping their attention.

In sum, there are three important issues that arose from my earlier research: 1) I found that one's reading level does not have to be necessarily equal to their vocabulary level, and vice versa. From observing the children's use of language and their ability to understand spoken language, I learned that it is possible to have a large vocabulary, but at the same time have a difficulty in comprehending when those words are strung together. 2) I learned that it is not true that if one can not speak well, then one can not comprehend or read well, and 3) It seems as though these girls and perhaps other aphasics will best respond to stimuli that can somehow be related to themselves in some way.

Next, I would like to focus attention on the results found from the transcription of the spontaneous conversation between Alison and Lori. Two major trends were found in the transcription. First, I noted that Alison usually leaves out pronoun subjects followed by auxiliary verbs such as "Do you" or "I Can't" and "I don't". Alison also tends to interchange the subjects <u>me</u> and <u>I</u> freely (i.e. "<u>Me</u> have homework.", instead of '<u>I</u> have homework.'). Lori tends to leave out "the" and "-ed" endings

(i.e. "Mommy drop me off here.", instead of 'Mommy dropp**ed** me off here'). She also tended to interchange I and you freely Both girls tend to leave out the auxiliary verb "is" (i.e. "Lori Busy?"). These trends are expected since the 'telegraphic speech' of aphasics has been fully substantiated in the literature (See Part I of this paper). There were also sentences produced by Alison which were syntactically incorrect. For example, Alison asked me, "Pick Keri over later?" The correct sentence would have been: [Are you going to **pick Keri** up and bring her **over later**?]. So, looking back at Alison's question, we can see that perhaps she only uses the most pertinent information. She is talking to me so she leaves out the parts [are you going to...]. It is obvious that I would be bringing Keri back so she leaves out [...and bring her]. I think Alison's difficulty in producing complete sentences concerns the pronouns and the verb. I am not sure if she thinks that the relations of the pronouns to their subjects is obvious therefore are ignored or that she is unable to assign the proper role of the pronoun to the subject. We learned in Part I of this paper and in Shapiro and Levine's work which was discussed in Part II of this paper, that verbs are more frequently deleted than some nouns in agrammatic speech. Another reason for Alison's deletions of verbs may be that she only uses the important "action" verbs (pick up, bring over) to get her point across. These verbs are verb particle verbs seemed to have been fused together in this sentence.

Another type of sentence that Alison would frequently produce consists of incorrect negatives. For example, she would say, "No back to school Tuesday." Leaving the word order the same, she could have said, "I don't have to go back...". But, as you can see, this phrase contains [I don't have...] which stated before, she normally drops with the attached phrase.

In the third and last study, both Alison and Julie were given two picture books: Good Dog Carl and One Frog Too Many. Both of these books did not contain words. The task given to each girl was to tell the story. Since Alison is aphasic and Julie normal, I expected to be able to compare and contrast different aspects of their speech, interpretations, and other cognitive abilities. The third and last experiment also provided some insight on the problem. From this, there were eight major points found: 1)Continuity- Alison took each individual picture as a single unit. She did not connect any of the pictures together (i.e. she never used the words "and then", "next", etc.). Julie (the normal girl) clearly saw a beginning, middle, and end. She frequently flipped back the pages to make sure that she was correct in what happened, and then she finished her sentences after she turned the page which shows that she notices that the story is made up of continuous events. When she reached the final page she even said, "...and that's the end". 2)Descriptions- Alison only identified the characters and the motions or actions that they were engaged in. (i.e. "baby riding dog...dog and baby on the bed) This is

Julie's description of the same picture: "the baby stands up and stands on the dog's back, and gets a ride into the lady's bed and they're both playing on the bed". Notice how Julie's story is not simply a rendition of movements; she also includes the details and the circumstances of the actions which are needed to make a story complete. 3)Relations-As stated above, Alison does not relate any of the actions to the whole story. For example, in one picture the dog is looking out the window at an old woman. Alison just says "dog lookee outside" while Julie completes the action. She states,"the dog looks out the window **at the lady** who is going out." (It is known, I should point out, that many Broca's aphasics delete prepositions, and this does offer an alternative explanation of Alison's abbreviated speech). At the end of the story where the dog gets away with everything, Julie picks up this conceptual link and says,"..and the dog tried to look innocent." Julie also uses the words "again" and "same" which show that she is referring to another picture, showing some type of connection between them. Alison just said that the "...dog lay down". The difference here may be due to different cognitive level differences. 5) Use of language- Alison never used pronouns while Julie was able to use "it", "she", and "he". Also, Alison would question herself many times. She would say something and then say, "right?". Again, this is not abnormal for a Broca's aphasic. It has been shown before that Alison rarely uses pronouns. 6)Vocabulary- Two instances were very interesting here. First, there was a picture where there was an aquarium, but Alison

did not know the word for it, so after a pause she finally said,"pond". In another instance she did not know the word "blowdryer", but she said "blowing". This shows that even though she does not know the word, she did indeed know the function and its elements and provided another word with those same qualities. I think this has to do with overextensions or overgeneralizations. Overextensions of terms involves the application of a word to an object that may no truly belong to the class of objects that form the referent class for speakers. The basis for overextensions usually has been found to be perceptual, that is an object receives a label because it looks like, sounds like, moves like, or feels like, the "true" referent. Occasionally the extension can be identified as having a functional basis (Nelson, 54). 7) Logic- It seemed as though Alison sometimes did not think about the logic behind her statements. In one picture, the dog's eyes were closed, the baby was on his back, and she said that the dog was sleeping. She did not think that it was unlikely; that a dog would be sleeping standing up with a baby on his back. I noticed that Julie also did this, but the difference was that Julie corrected herself, showing that she was thinking about what she said and did not let the first thought into her head be final. 8) Reality interference- Alison sometimes substituted her own dog's name (Mugsy) for the dog in the story. This was never found with Julie: she kept to the story only.

The trends just discussed were also found in the study involving the other book. In addition, I saw two new things. First, in one picture the frog was getting his leg bit. Alison then says,"he bleeding". This may mean that she realizes the consequence of what is happening. Second, I saw that despite the fact that Alison had no problem describing actions, she had problems identifying emotions. I am not sure why, because she knows what sad, happy, and angry are. Perhaps this is so because it may be harder for her to notice these emotions in faces than feeling them herself.

All of this research and experimentation has led me to formulating my own ideas and hypotheses about agrammatism. My first hypothesis deals with the matter of conjoined sentences versus embedded sentences. Look at the following sentences:

(1a) The man crossed the street and the dog followed the man.

(1b) The man that was followed by the dog crossed the street.

(2a) The man was carrying a baby and the man was wearing a blue shirt.

(2b) The man carrying a baby was wearing a blue shirt.

I believe that an agrammatic would have less trouble understanding 1a and 2a rather than 1b and 2b. 1a and 2a contain two non-complex sentences joined by the obvious conjoiner "and". Looking at 1b and 2b, these sentences contain embedded clauses, which confuse the aphasic. He or she is unable to properly relate or

connect these phrases (which may be sentential or other) to its correct subject or phrasal node. Therefore the core of this hypothesis is:

{Increasing syntactic complexity will consistently decrease comprehension.}

The second idea I have about agrammatic speech is that I think that these people also may have problems with reflexives. In the sentence:

(3) John's father loves him.

the whole noun phrase 'John's father' is the theme of <u>love</u> and <u>him</u> is the patient of <u>love</u>. In general, I think that thematic roles are difficult for Broca's aphasics, or persons with agrammatism, and that adding reflexives to these sentences increases the level of difficulty for them. In these cases I believe that aphasics will have trouble discerning the patient, theme and sometimes agent roles. Perhaps the aphasics lack the ability to link the subject noun phrase to the theme of the sentence. One can actually find out the answer to this by showing aphasics this statement and asking them questions such as:

(4a) Who does John love?
(4b) Who does John's father love?
(4c) Does John love his father?
(4d) Who loves John?

and many others and see what the answers are. According to my hypothesis, the aphasic will incorrectly answer some or all of these questions.

I noticed that some sentences (with thematic roles) are semantically reversible. When two noun phrases are, for example, both animate or both inanimate, the sentence is typically reversible. I predict that this will also cause a failure of comprehension in the case of the agrammatic. Here are some examples:

(5a) The boy drinks water. [animate-inanimate]--non-reversible
(5b) The girl jumps rope. [animate-inanimate]--non reversible
(6a) The bear eats the tiger [animate-animate]--reversible
(6b) The pole dents the car [inanimate-inanimate]--reversible

In summary then, I believe that an aphasic will have more trouble comprehending 6a and 6b rather than 5a and 5b, because those sentences in 6a and 6b are semantically reversible, and will cause the aphasic to confuse their thematic roles.

My fourth hypothesis turns our attention to verbs. In my experience, I have seen in agrammatic speech that for the most part verbs are only found in the present tense. Seeing that aphasics do sometimes use the plural form of words, it is unlikely that the lack of past and future tense markers is a result of a phonological deficit. Perhaps, a better explanation of the

'present - tense only' phenomenon is that aphasics' linguistic (or semantic) capacities only allow them to speak in the present tense. Also, the lesion present may only allow the patient to speak of things tangible to them, therefore leaving the future and the past with out speech. I am not sure how much work has been done in this area, but perhaps there is way to teach certain patients the ability to talk about things not presently perceived, either relearning it or even learning it for the first time.

Next, I would like to discuss open class words and closed class words. Closed class words are more frequently deleted than open class words. This may have to do with that in language learning, the closed class component is "laid down later after the open class", and perhaps in a different developmental pattern (Gleitman, 170). If this is true, then it makes sense that the closed class would be deleted first since it is placed in the lexicon last, then the closed class could be easier to remove. (In other words, the last on it is the first to go). Gleitman further states that since the closed class is not an independent component as the open class is, it is therefore a dependent one and can not stand alone, so an aphasic would "delete" the dependent variable and would need to keep the more important independent one (170).

Lastly, I would like to talk about aphasia on a larger scale. Going back to the work of Piaget and Chomsky, they both believe in

the varied stages of development, especially language development. It is well known that children incorrectly formulate sentences (i.e. verb tenses, word order, etc.). Then, from listening and observing the people in their surroundings they memorize words and their meanings and the rules about how they are used; therefore speaking correctly, but sometimes making mistakes with over and undergeneralizations. In the next stage they stop memorizing and work it out on their own, sometimes making other errors, but ultimately correcting themselves. I can only speculate that on a larger scale, the lesions that are apparent in agrammatic aphasics force them to return the first stage (as in stroke patients who once were able to talk without errors but presently can not) or never allow them to go beyond it (as in patients with brain damage from birth). Therefore, in these cases, the patients are only using their knowledge up to stage one. In children who suffer from brain damage from birth, it has been noted that their learning is not extremely slow, but occurs at a fairly normal pace, until some level is achieved, and unfortunately this occurs at a point very early in life (Gleitman, 174).

I do not believe that you can pin the cause or basis of agrammatism on one single component of language such as syntax, semantics, phonology, and etc. I believe that it is a combination of all of the components whose deficits interact with one another. What future research will bring to this field is a more in - depth view of how each of these aspects is affected and how they

combine themselves to produce this case of agrammatism in so many people.

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PART FOUR: FINAL THOUGHTS AND CONCLUSIONS

In this paper I have discussed all types of aphasia from a linguistic and biological view, the controversy surrounding causes and problems of agrammatism, and finally, my own views and suggestions about this topic. Aphasia is a serious and complicated subject. I believe that agrammatism is not a product of a single deficit. I think that it is caused by an assembly of affected parts including: the phonetic, semantic, syntactic, psychological, and other linguistic facets.

The brain damage that results in aphasia is not reversible. However, due to the research and medical breakthroughs that have been accomplished, some people do in fact recover from aphasia. The therapy that is available is grueling and very difficult and sometimes does not totally "cure" the patient. Treatments that are offered to aphasics are dependent on how severely the patient is affected. In the worst cases, all language capabilities have to be re-learned, including reading, writing, and spelling. One can understand the difficulty for the aphasic in learning language again, beginning with the alphabet, especially in an older patient. Speech pathologists can spend endless hours working with an aphasic each day, sometimes with little improvement. Another reason why therapy is grueling is because not all patients suffer from the same afflictions so therapy is usually "personalized" to each patient. This means even more time and effort need to be devoted to the task. In the less severe cases, some speech impediments can be worked through in a smaller amount of time. A

last reason why therapy is difficult is due to the effort put in by the patient. Many older patients do not want to "start over" or are already depressed because of their state. This, as in any illness, can have a tremendous effect on the outcome of therapy.

An important factor in chances for recovery is how the brain damage occurred. It has been said that if brain damage occurs by a slow deterioration rather than in a short and forceful way, the patient will not suffer the same consequences, since the brain has the time to become sensitized to the stimulus, or in other words, the brain becomes accustomed to the stimulus, whereas given a sudden blow, the brain is shocked suddenly.

Another factor that must be taken into consideration when dealing with aphasics is the age of the patient when the "shock" that caused the aphasia occurred. If the damage occurs early in life, then language is barely affected. The patients seem to "pick up right where they left off" when they stabilize. It has been hypothesized that this period lasts up to four years of age (Foss, Hakes, 359).

Between the ages of four and puberty, the chances of recovery from damage to the language centers of the brain are good, but not as good as before four. It seems as though there is a loss of language in this case, but language can be reacquired. After

puberty, it is very difficult to regain the linguistic fluidity and overall language ability one had before. After the age of four, the left hemisphere has begun to assume its dominance for language, and the two hemispheres develop differently. Therefore when damage has been done to the left hemisphere later in life, then the right hemisphere may compensate for the other to some extent but from its own point development.

Only more work, research, and experiments will allow us to gain insight into the exact mechanism behind agrammatism and aphasia. From this, we can also improve our methods of treatment as well as embark on new techniques. Hopefully the necessary funding will be provided for these projects which will in the next decade or possibly sooner show us to the correct solution of this fascinating and ever changing issue -**AGRAMMATISM.**

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