As we have discussed earlier, there are two basic and established assumptions behind all neuropsychological and neurolinguistic investigations -- Fractionation Assumption, according to which brain damage damages a system in a predictable manner, basically in the way it is organized, and Transparency Assumption, according to which one can hypothesize about the underlying process by observing an individual’s performance. Here the question of the approach that should be adopted for case studies becomes relevant. This study relies on the single-case method. Primarily, in cases of aphasia, it is assumed that the subjects have normal cognitive capacities, including normal language abilities. Ideally the subject should be selectively impaired for linguistic abilities only while the rest of the cognition is intact. Such cases save an investigator of the complexities of the other interacting factors but unfortunately brain damage usually affects more than one function.

3.1 Multiple Single Case Studies

The method used and implemented in the present study is single case study. Both the Fractionation Assumption and Transparency Condition are established basic principles and assumptions underlying all the neuropsychological and neurolinguistic investigations. So the human brain damage does not affect the system grossly but damages it in a predictable manner in the way system is organized and an individual’s performance is transparent, therefore one can hypothesize about the underlying process from the observations of the individual. But this hypothesis is not suited to developmental disorders as it is possible that in such cases, the brain may congenitally be deficient in the
way of organization, unlike a normal brain. Neither the anatomical impairments nor the cognitive-linguistic impairments were same for the cases under consideration; hence no group study was justified in such cases. Single-case study approach also satisfies the sufficiency condition [for more arguments and discussion, see section 2.3].

3.2 Method of Dissociations

Principles underlying single case approach will be fractionation assumption, dissociation and double dissociation. Since mental processes were not directly observable and their existence and function must be inferred from the task performances of the patients. The goal of cognitive psychology and cognitive neuropsychology is to identify, enumerate and characterize the fundamental processes underlying human behaviour. Therefore dissociation and double dissociation were useful tools in such research, if not the magical, for determining the existence of the mental processes – a criterion for localizing mental function in the human brain. The process of single dissociation [‘presence of a symptom A and the absence of a symptom B’] and double dissociation [‘presence of a symptom A and absence of a symptom B & presence of a symptom B and absence of a symptom A’] were of great importance in adopting the single-case methodology [see 2.4 for the details]. This way psychological distinction or independence of the cognitive system was derived. The presence of the single dissociation strongly suggested and that of the double dissociation confirmed the psychological distinction of a cognitive structure.

3.3 About the Place of Work

The place of work was Govind Ballabh Pant Hospital, New Delhi. Patients of aphasia, my subjects, were made available by the Outpatient Department (OPD) of the Department of Neurology in the hospital. The meetings with the relevant patients and the data elicitation were done in the Neurobehaviour Clinic & Neurolinguistics Laboratory, G. B. Pant Hospital, New Delhi, India.
3.4 Criteria for the Selection of Cases

There were two types of criteria for the selection of the cases for the present study.

3.4.1 Inclusion Criteria

1. Patients could be of both sexes with left hemispheric cerebral infarcts caused by cerebro-vascular disease resulting in aphasia.

2. Stable aphasics with onset of aphasia at least eight weeks prior to clinical assessment and testing.

3. Patients must be with a minimum level of auditory comprehension to follow the performance tasks given by the investigator.

4. The literacy level of the patient must be at least 10 + 2.

3.4.2 Exclusion Criteria

1. There was an exclusion of patients with neurological diseases other than cerebro-vascular disease, such as tumors, degenerative diseases (e.g. Alzheimer's disease and Pick's disease), neoplastic diseases and other infectious diseases.

2. Patients, in addition to aphasic deficits, with other cognitive deficits were excluded.

3. Severe aphasics, whose language was heavily impaired, were also excluded in the present study, for there was no scope of adequate language testing.

4. Unstable aphasics with onset of aphasia of less than eight weeks at the time of clinical assessment and testing.
3.5 Points considered during data elicitation

Proper care was taken during the data elicitation as there were external factors which controlled the nature of the data significantly. Test anxiety was alleviated and minimized and it was insured that the elicitation process took place in a conducive environment.

For creating a conducive environment for successful communication it was kept in mind that one had to

a) Treat the aphasic patient as a respected adult,

b) Keep the distractions [e.g. background noise or the presence of the other persons in the elicitation room] to a minimum,

c) Appreciate and seek humor to lighten the communication interaction,

d) Give one's undivided and individual attention,

e) Ignore poor articulation,

f) Remember that successful communication is the goal regardless of the quality of the response and

g) Not let the conversation with the patient turn into a therapy-like session by correcting or requesting repetitions unnecessarily.

To increase the subject’s auditory comprehension, the investigator took following precautionary measures and –

a) Always maintained eye-contact with the patient while speaking,

b) Spoke slowly and clearly and with natural intonation and loudness while making most of the facial expressions,

c) Repeated and rephrased as needed,
d) Asked simple questions and supplemented one’s speech with natural gestures and pointing,
e) Gave one direction at a time and simplified long and complex directions and
f) Changed topics slowly, with warning.

To understand the patient better the investigator –

a) Was always an attentive and an active listener,
b) Was patient and allowed the patient to complete his or her statements,
c) Did not routinely anticipate and fill in the end of the statements but was sensitive to the abilities and desires of the patient and let them finish themselves and
d) Gave the patient enough time to respond in addition to other basic needs for an investigating interaction.

After selecting the subject, a clinical diagnosis of aphasia was made using Benson (1979)’s bedside clinical approach.

3.6 Aims and Objectives

The study of the impaired language data is important for two basic goals – firstly, for understanding the nature of the pathology and secondly, for learning the normal cognitive linguistic processes. Although the concerns for these two goals and their perspectives will be overlapping but it was necessary to understand the difference of their need.
3.6.1 Area of Investigation

The area of investigation was morphology, inflectional morphology in particular, so the errors were checked for their morphological nature. However, the present work limited its scope to the mental representation of inflectional morphology at morphological (lexical) level and at post-lexical level but the nature of syntactic processing, e.g. agreement, is not within the scope of inquiry of this work. Since inflectional morphology was being studied, the representation and processing of number, gender, person, tense and aspect inflectional markers was the focus. The debate between autonomous morpheme representation and full word listing hypotheses was also looked into as a consequence. Also the results were compared with the competing morphological models in current linguistic theory.

3.6.2 Two-step Data Elicitation

Data elicitation was carried out using a two-step approach.

First, all subjects were subjected to a series of task comprising of repetition, reading aloud the written/printed text, copying the written/printed text and writing to dictation. The stimulus set consisted of a series of 35 sentences and 48 single words. Task performance was recorded and the data analyzed to comprehend – the specific linguistic deficit and the modality in which it occurred. It was done to determine the presence of the morphological deficit. In step 2, an extended battery of tests\(^1\) was given to each individual patient to – deepen the inquiry and to obtain a larger sample of task performance responses to examine the nature of the morphological deficits and, the morphological representation and processing.

The subjects were put to further extended data elicitation tests for the purpose of the linguistic investigations, particularly for the morphological representations. Depending on the performance of the subjects in the initial testing the investigator changed nature of

\(^1\) For details on extended tests, refer ahead to section 3.7.
the extended data elicitation tests for the concerned subject. Subjects unable to comprehend the sentences were not administered the tests based on sentences. Within the subjects with the comprehension of sentences there was a gradation as there were subjects who could carry out commands which consisted of more than one adjunct and then there were subjects who couldn’t carry out them consisting of any adjunct. Depending on the ability of the subjects in this regard the data elicitation tests changed its nature in its extended version, meant for the main body of the work. As in the case of modalities the subjects incapable of repetition were not asked to repeat for the extended tests. Accordingly, in the data elicitation tests in the extended version, sentences were complex in terms of number or the presence/absence of adjuncts. Sentences of transformation like passives and interrogative sentences were avoided. Thus the extended data elicitation differed from patient to patient and therefore the tests varied accordingly.

3.7 The Extended Linguistic Tests

The extended tests used in the elicitation of the main body of the data consisted of words and simple sentences. While selecting the words for the present purpose, words belonging to any particular register, i.e. register of any profession, were not considered. Subjects selected for extended data elicitation belonged to technical professions, except one who was a housewife but otherwise an Economics graduate. Registers in Hindi are otherwise also rare because most of the times, the medium of instruction is English, especially in families where the average education is more than ‘10+2’. Just to avoid the conflict very

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2 Any element of structure of a clause or a sentence which is not part of the its nucleus or core. In the sentence, /tebal par rnk=ti hu-I krtab-o xdi-j-q-e/, /tebal par rnk=ti hu-I/ is adjunct. Adverbials (of time and place) and adpositional phrases are generally considered adjuncts in a language. In the case of adpositional phrases it is the subcategorization frame or the argument structure of a verb which decides if the adpositional phrase in question is adjunct.

3 In few cases passives are the normal preferences and those were included in the questionnaire.

4 Register is a set of words characteristic of a particular area or field of activity.

5 Nowadays some organizations show keenness for use of Hindi as part of their language policy but even then English counterparts are always preferred by the concerned users, e.g. between ‘interest’ and /byaj/, ‘interest’ is preferred. But nonetheless the issue is debatable. To avoid this conflict over language preference, all registers of professions were excluded in the questionnaire.
common words like /kʰata/ ‘account’, and /sar-i/ ‘table’ were avoided, although these are high frequency words.

3.7.1 Description

Words in the questionnaire belonged to two grammatical classes, namely noun class and adjective class. There were derived varieties of nouns and adjectives also to check the nature of nature of inflectional and derivational processing components. Then these words, i.e., inflected and derived nouns and adjectives, included all the possible inflected forms for number and gender. Oblique plural forms were avoided in words unit.

3.7.2 Distribution in words

3.7.2.1 Inflected Words

In this category of words there were nouns and adjectives. Nouns were of all morphologically related forms – Plural and singular forms; masculine and feminine forms. Then the adjectives or the modifiers were also of inflected types for different number and gender. There were masculine singular and plural forms and then feminine forms which is not marked for plural number overtly.

The total number of inflected words was 729. Within this category of inflected words, there were 537 nouns and 192 adjectives. The detailed break-up of the inflected nouns and adjectives is specified in the appendix.

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Although normally adjectives are governed by the nouns they qualify and therefore they must accompany the nouns which send them to the attributive position but here in this study, especially in the cases with single word output, only the adjectives were the inputs to the complete NP.
3.7.2.2 Derived words

There were derived words in the list also. These consisted of both nouns and adjectives. Noun derived from nouns and adjectives and then adjectives derived from verbs and nouns. Then all morphologically related forms were also listed – the inflected forms for singular and plural number and masculine and feminine gender. In the category of adjectives there were words which did not have any other forms inflected with number or gender.

The total number of derived words was 283. Within the category of derived words, there were 201 nouns and 82 adjectives. The detailed break-up of the derived nouns and adjectives is specified in the appendix.

3.7.3 Distribution in sentences

The sentences, which included all the basic types, e.g. having transitive and intransitive verbs, (except the interrogatives and topicalised sentences that involve transformation processes), were simple. Sentences also were with all post-positions with the nouns inflected for different gender and number. The sentences were in basic word order of Hindi. In case of a post-positional phrase (PpP) present in the sentence some phrases preceded the subject especially when the subject is inanimate as the position of PpP after the subject makes the effects of certain segments of the sentences highlighted and marked. The modalities used were – reading aloud; writing to dictation; copying the written or printed texts; and repetition.

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7 These types of sentences are used to study syntax and the interface between syntax and morphology which is not the purpose of the present research.
8 In /pani gə qc mə h-ə/ S-PpP-V and /gə qc mə pani h-ə/ PpP-S-V– the former is marked and the latter is unmarked, where the inanimate subject is topicalised. Human subjects are always topicalised in sentences for unmarked effects.
Within sentences there were words belonging to the word classes of nouns, adjectives, verbs, adverbs and post-positions. Nouns were of different types in the sentences. They were pronouns, subject-nouns, object-nouns, subject-nouns oblique and object-noun oblique depending on its structure and position in the sentences. Similarly adjectives were also of different types depending on the structure and the source of their structure. They were pronominal adjectives inflected both for singular and plural numbers and also for masculine and feminine gender. Then there were normal adjectives with inflected varieties for singular and plural number and masculine and feminine gender. In this word category, there were ordinals, cardinals and indeclinables also.

There were adverbs, or modifiers of verbs, in the sentences also but these were very few in number. Then there were verbs in the sentences. Verbs were both of main or content type and auxiliary or copula type. Then there were verbs of V2 type which co-occur with the main verb\(^9\) and contribute to the meaning of the main verb. Their literal meaning in isolation is not applicable to the semantics of the main verb when they are used as V2. As V2 they have their own semantics. There were post-positions also in the sentences.

Then the verbs present in the sentences were also inflected for different markers. Verbs in Hindi sentences are with tense and aspect markers and in addition tense and aspect marker carry the singular or plural number marker and masculine or feminine gender marker.

Tenses were of all the types, possible in Hindi – present, past and future, whereas the aspects were also of all types – indefinite, perfective and progressive or continuous.

The sentences were of Indicative, Declarative (in all the tenses - present, past and future), Imperative and Subjunctive types.

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\(^9\) They are part of explicator compound verbs. V2 is the explicator part of the compound verb.
The total number of sentences was 287. There were 406 nouns, 78 adjectives, 14 adverbs, 337 verbs and 116 post-positions. The finer and detailed break-up of the set of the sentences is specified in the appendix.

3.8 Analyzing Procedures

The errors were tabulated and analyzed. Any systematic error pattern could lead to the understanding of the organizational design of language in the brain. Therefore the systematic patterns of errors were found with the help of the tabulated errors, and then they were discussed in details. The study of morphological patterns helped in validating the hypothesis regarding dissociations [i.e. of inflectional morphology and derivational morphology, and double dissociations of the cognitive functions [See section 2.4]. Therefore, the procedure of the research was inductive, as the nature of the data was not predictable.