Chapter 5
Discussion

The present study aims to explore the cognitive mechanisms that underlie lexical processing. Further, it aims to know whether a speaker’s active lexicon is dealt with largely by mechanisms of storage and retrieval of whole-word forms, or whether there are also mechanisms of morphological composition that are invoked during normal processing. It also aims to explore the nature of these cognitive mechanisms or morphological compositions. These constitute some very central and important issues in neurolinguistic studies and in the following sections, through the discussions on the analysed data for each case, the arguments progress to the central issues in the area. This constitutes the principal focus of the current chapter. In the following section we have taken the impairment – patterns of the cases into consideration and discussed their significance in the context of neurolinguistic findings.

5.1 Case 1: R.K.

5.1.1 Dissociations

The data obtained in Case 1, R.K., led to the following inferences:
1. Dissociation between two levels of production and comprehension –

   a) Dissociation between lexical production and post-lexical or syntactic production on repetition and reading aloud tasks. Similar findings were also reported by Jarema & Kehayia (1992), Luzzatti & Blesser (1996) and Badecker (1997).
b) Dissociation between lexical comprehension and post-lexical or syntactic comprehension on reading aloud tasks. Similar findings were also reported by Pierce (1982 & 1983).

2. A dissociation between spared auditory (phonological) comprehension and impaired written/reading (orthographic) comprehension at post-lexical or syntactic level. This finding has not been reported in the available literature.

3. Dissociation between spared plurality markers on adjectives with 0% error rate and impaired plurality markers on nouns with 73.09% error rate at lexical level output. This dissociation has also not been reported before in the literature.

4. Dissociation between impaired /-e/ (e.g. /hir-e/) and /-ā/ (e.g. /patt-ī-y-ā/) plurality markers with 86.32% error rate, and relatively spared /-ē/ (e.g. /kawī-ta-ē/) plurality marker with 48.1% error rate for the nominal categories and this spared marker is phonologically atypical in Hindi. Such a highly fine grained dissociation, such as within plurality markers, has never been reported before in neurolinguistic literature.

5. Further dissociation was found between feminine nouns which take /-ē/ as plurality marker. Among the different groups of feminine nouns it was seen that the group of feminine nouns which was not able to access plurality, with 90.75% error rate, was the group of nouns with consonant and /-u/ as their last segment. Other group with /-a/ as their last segment was able to access plurality with relatively spared ability with 8.1% error rate, therefore the dissociation within /-ē/ plurality marker was found. Dissociation within the same plurality morpheme, again a very fine grained dissociation has not been reported before.

6. Dissociation between spared feminine gender marker access for the nouns and impaired feminine gender marker access for the adjectives. This was again dissociation within a particular gender marker, never reported earlier by researchers.
7. Double dissociation between the categories of the nouns and the adjectives in terms of the access to the plurality and the feminine gender marker (e.g. /acch-i/ was converted to /acch-a/). Miceli et al (1984) reported double dissociation between nouns and verbs and here double dissociation between adjectives and nouns is being reported for the first time.

5.1.2 Implications

Here lexical production was impaired at the inflectional level. This patient had hardly any sentence level production and her speech was limited to single words. RK could comprehend simple sentences but there was no syntactic output. Dissociation was observed at the syntactic level between input phonology and input orthography whereas at the lexical level there was no such dissociation, i.e. both input orthography and input phonology were preserved. Dissociation of input orthography and input phonology was reported by Caramazza & Miceli (1990), but the present study provides the evidence for the dissociation within input orthography for the lexical and post-lexical outputs.

Fig. 5.1: Dissociation within Input Orthography in Case 1: R.K.
Here there were no impairments in plurality on adjectives (with 0% error rate) in contrast to the 73.09% error rate in the plurality for nouns\(^1\). Further there is dissociation within the plurality marker on nouns. Then there was feminine gender marker impairment on the adjectives with 90.06% error rate, while in contrast the nouns had preserved feminine gender marker with 0% error rate (e.g. /laɾk-ɾ-y-ə/ was converted to /laɾk-ɾi/). The double dissociation between the nouns and the adjectives was observed. Miceli et al. (1984) also reported double dissociation between production of nouns and verbs -- as the agrammatic patients were impaired in the production of verbs and relatively intact in the production of nouns and then the anomic patients exhibited impairments on nouns while the verbal category was intact.

*Couldn’t be tested in the absence of sentence-level output and written sentence comprehension.

\[^1\text{Ranjan (1998) and Nehru & Ranjan (1999a) also reported cases of Wernicke’s and Broca’s aphasia with dissociation between number and gender inflectional morphology.}\]

Fig. 5.2: Schematic presentation of plurality impairments on nouns in Case 1: R.K.
There is selective impairment in plurality markers on nouns. This is strong evidence for selective and separate processing of plurality markers for nouns and adjectives. Again within the nouns there is highly selective intactness of the plurality marker /-e/ which is suffixed to feminine nouns only. This again is a strong evidence for selective processing of /-e/ plurality marker. Further investigations into this spared plurality marker /-e/ revealed a finer dissociation which places claims for selective processing of /-a/ ending feminine nouns (which were the only preserved category of feminine nouns with 8.1% error rate). Generally in Hindi language the feminine marker on nouns has been universally accepted as /-i/ (e.g. /lark-i/) and the masculine marker as /-a/ (e.g. /lark-a/), therefore the category of feminine nouns under discussion in this patient, are exceptionally marked for gender – which makes it, as a category, prone to the effect of any impairment in language. This is the reason this category of nouns was selectively spared so the selective processing for this /-a/ ending feminine nouns (e.g. /mal-a/).

Fig. 5.3: Schematic presentation Gender Impairment in Nouns and Adjectives in Case 1: R.K.
Other feminine nouns within the /-e/ plurality marker, i.e. consonant and /-u/ ending, were relatively impaired. The selective processing of /-a/ ending nouns was found\(^1\). The selective impairment of feminine gender inflectional marker on adjectives provides claims for the selective and separate processing of the feminine gender marker against the masculine gender inflectional marker.

![Fig. 5.4: Double Dissociation of nouns and adjectives (& of number and gender also) in Case 1: R.K.](image)

There was a double dissociation between adjectives and nouns as nouns could process feminine gender markers without impairment but plurality markers with impairment and adjectives couldn't process feminine gender markers but process plurality markers. Therefore this claims for separate and selective processing of nouns and adjectives. Even

\(^2\) The data was not statistically relevant as the number of stimuli were only 4 although there were 100% impairment on these nouns.

\(^3\) Ranjan, (1998) reported a similar selective processing in S.G. for /-a/ ending feminine nouns with 0% error rate, while /-a/ ending masculine nouns were severely impaired with 92% error rate, i.e. plurality /-e/. He also reported, in addition, a very selective processing of the plurality marker /-a/ with error rate of 94.6% while other plural inflections /-e/ & /-e/ were relatively spared with error rate 11.5% on an average.
the number and gender inflectional markers are autonomously represented\(^4\) as there was a clear cut double dissociation between them.

\(^4\) Ranjan (1998); Ranjan et al (1998a); Nehru & Ranjan (1999a) also reported dissociations between number and gender inflectional morphology.

Fig. 5.5: Directionality and hierarchy of the number and gender inflectional morphemes: Evidences from Case 1: R.K.
Present language breakdown data support the hierarchy in the access and thereby support a directionality constraint in the word-formation strategy. Singh & Agnihotri (1997) do not consider the directionality constraint as valid in the word formation strategy. For them, all words are equally accessible to the speaker. They uphold the 'bi-directionality' in word formation strategy. They supported this hypothesis with evidence from language acquisition and diachronic linguistics. In the present study, the response to masculine plural or singular noun (e.g. /lərk-e/ or /lərk-a/), was never a feminine noun (e.g. /lərk-ı-y-ā/ or /lərk-i/) and vice-versa, which suggests that gender is more internal to the noun than number. Process in the impaired access may start with deletion of number and then if there is no attested form of word without number, overt or non-overt, it will try the next option available to the speaker as R.K. converted /əcc^b-i/ to /əcc^b-a/ where the nature of number marker could not be ascertained in the former word. The option left for her was to select from the same plane. Therefore it is obvious that the gender inflectional marker is more internal than the number inflectional marker for nouns. This supports Ranjan (1998), which provided the same hierarchical structure for noun's access to number and gender inflectional morphology. Nehru & Garg (1997) also reported along the same lines and showed that in the morphological impairments, number inflection is more impaired than gender inflection.

5.2 Case 2: OPS

5.2.1 Dissociations

Based on the analysis of the impaired data following inferences were made –

1. There is dissociation between spared input orthographic lexicon and impaired phonological lexicon as OPS could read and copy the printed or written texts without impairment but couldn’t repeat verbally or write to dictation. This dissociation was in accordance with the architecture of mental lexicon as discussed by Caramazza and his colleagues before [Caramazza & Miceli (1990)].
2. At the lexical level there was dissociation between there was no error in the category of nouns and whereas the impairment was present in the category of adjectives with error rate of 8.85% which was not significant at all, at the outset. But a further closer examination into the impairments in the category of the adjectives revealed that the group of adjectives getting most affected (e.g. /ləmb-i/) in the access was the one which could be converted onto nouns by the process of substitution of the inflectional morphemes by the derivational morpheme /-ai/ (e.g. /ləmb-ai/ with the help of the derivational morpheme /-ai/). Therefore, the dissociation between the two categories of adjectives – nominalisable adjectives, which can take derivational morpheme to get nominalised & non-nominalisable adjectives. This was a case of dissociation within the category of adjectives and this has never been reported before in neurolinguistic literature.

3. On repetition tasks on adjectives, OPS substituted the inflectional affix, i.e. feminine gender in most of the cases, i.e. 13 out of 17; with derivational affixes which nominalises the bases. Out of all errors, 76.47% errors belonged to the group of adjectives which take /-ai/ suffix to nominalize (e.g. /ləmb-i/ can be nominalised as /ləmb-ai/), 17.6% belonged to the adjectives which take /-apən/ to get nominalize (e.g. /apən-i/) and 5.8% take /-apa/ for the nominalization (e.g. /bʊf-apə/). If the impairments would be compared with respect to the number of stimuli then the error rates would be 92.8%, 11% & 50% for the adjectives groups which take nominalising affix /-ai/,-apən/ & /-apa/ respectively. The clear-cut dissociation could be observed within the adjective groups (based on the,derivational morpheme which nominalises the adjectives) – adjectives which could be nominalised by the derivational morpheme /-ai/ (92.8% impairment) and those which could be nominalised by the rest of the derivational morphemes, /-apən/ & /-apa/ (14.3% impairment). Inside data on a particular lexical category a very fine grained dissociation was presented – dissociation within derivational morphology (of adjectives) and this has never been reported in aphasic literature before.

4. After observing the above dissociation, i.e. as stated in 3., and approaching this with different perspective a parallel dissociation could be stated - between the feminine-
marked adjectives and the masculine-marked adjectives, e.g. /əcc^h-i/ was converted to /əcc^h-ai/ whereas /əcc^h-a/ was preserved, (both of the categories from which nouns could be derived by substitution, i.e. deletion of the gender and number inflectional marker and the addition of the derivational morpheme), as could be seen clearly that relatively more feminine-marked adjectives are impaired than are the masculine ones.

5. At the syntactic level the impairments on the word classes of nouns and adjectives were with 5.66% and 6.41% error rates respectively, as OPS substituted semantically in these categories of words (e.g. the response /g^hɔr/ was for the stimulus /k₄₉r-a/ and /s₄ndɔr/ was for /sœp^h₁d/). So the dissociation between the two levels of productions – namely, lexical and post-lexical level – was very much apparent in terms of word class access. This dissociation has been reported by a number of groups of researchers before.

6. The impairment within the verbal inflectional morphology of aspect marker, was observed. Relatively indefinite aspect was more impaired than other aspects, therefore the dissociation between impaired indefinite aspect with 44.39% error rate and spared progressive and perfective aspects with 0% and 5.97% error rates respectively, could be stated. Dissociation within the aspect verbal inflectional morphology was presented which has not been reported earlier. OPS converted ‘jate’ to ‘ja rha’ and ‘gaya’ to ‘a raha’ in his post-lexical output tasks.

7. Within the indefinite aspect marking it could be clearly seen that verbs in present tense were more prone to impairment than those in past and future tenses, i.e. 80.35% error rate in present indefinite sentences as opposed to impairment as opposed to 3.33% & 0% error rates in past and future indefinite respectively. Thus dissociation within the indefinite aspect marker was observed as the same aspect marker /-t/ was impaired for present tense sentences and was spared relatively (e.g. 3.3% error rate) in past tense sentences – so the tense acted as the context in access to the indefinite aspect marker in the present case.
5.2.2 Implications

In this case, there was also dissociation between spared input orthography and impaired input phonology which has also been reported by Caramazza & Miceli (1990) who also provided evidences for the autonomy of output phonology and output orthography, suggesting architecture of the mental lexicon. Dissociation between the spared word class of nouns and impaired word class of the adjectives was found then the dissociation within the category of adjectives was also observed. Dissociations within the adjectives argue that highly selective process is involved in the convergence of feminine nouns into abstract nouns (e.g. /əc^h^-i/ to /əc^h^-ai/) which themselves form a sub-category of the noun word-class.

![Diagram of Impairments on Adjectives in Case 2: OPS](image-url)

**Fig. 5.6: Schematic Pattern of Impairments on Adjectives in Case 2: OPS**
Overall this evidence strongly suggest a highly selective process involved in the conversion of gender inflectional morphology to abstract nouns (e.g. conversion of /ləmb-i/ into /ləmb-ai/- as selective (feminine) gender marker (e.g. /-i/) was deleted and substituted by again a highly selective derivational morpheme (e.g. /-ai/). In addition, this is a highly selective deletion & adjunction, i.e. substitution, of an inflectional morpheme by a selective derivational morpheme, which strongly supports in favour of considering independent inflectional and derivational morphology as existing on the same plane of linguistic organization, specifically the organization of morphology as a whole.

The selective processing of the nominalisable (e.g. /ləmb-a/) and non-nominalisable (e.g. /bʊg-a/) adjectives was also supported. Within the nominalisable adjectives, the separate processing for the different derivational morpheme was also provided evidences. On a separate plane as depicted in the schematic presentation above, the dissociation between the impaired feminine (e.g. /ləmb-i/) and spared masculine (e.g. /ləmb-a/) nominalisable adjectives proves the selective processing for the separate gender inflectional marker for adjectives.

At the sentence-level utterance, these word classes were preserved therefore inflectional deficits which were present on word classes in lexical output were absent in post-lexical output. Thus lexical and post-lexical outputs were in dissociation regarding the impairment in the adjectives. Luzzatti & Bleser (1996) also presented this dissociation through the cases of agrammatism who displayed preserved number and gender inflections and derivational suffixes but a severe disturbance in inflectional morphology of lexical compounds, which requires syntactic analysis at the word level.

Within the verbal complex of inflections, tense inflection was intact but the aspect inflection was impaired. Dissociation between tense and aspect inflectional marker and further, that within the aspect inflectional marker were observed – as only indefinite aspect was impaired against the relative sparing of progressive and perfective aspect inflections.
After closely analyzing the verbal inflections in impairment it was found that tense inflections are intact but very specifically and selectively in present tense the indefinite aspect was impaired. Indefinite aspect marker in present tense was impaired with 80.35% error rate, while in past and future tense, that was relatively spared with 3.33% and 0% error rates respectively (e.g. /jata hae/ was converted to /ja rəh-a hæ/). Therefore present tense was in dissociation with other tenses. This claims for a separate processing of present tense, or more specifically selective tense-specific aspect processing. Also, within aspect inflectional category dissociation places evidence for a selective processing of the
indefinite aspect marker. Also, tense inflectional morphology in the sentences was preserved in the present case and therefore the impaired status of aspect marker places evidence for dissociation the two verbal inflection morphology, i.e. aspect and tense, and thereby for autonomous processing of these markers in the organizational structure.

The above schema of hierarchy of access to the tense and aspect inflection was evolved from the pattern of the impairments on verbal inflections, i.e. tense and aspect inflections.
& number and gender inflections on tense and aspect (and person only overt on tense, e.g. 1st person information in tense inflection /h-ū/ but not in the verbal or aspect inflectional complex /jat-a/). Indefinite aspect inflection was impaired selectively while the tense inflection was preserved at the same time. Therefore the verb selects tense before the aspect as there is no impairment such that aspect is preserved and the tense is impaired. Therefore the hypothesis would be that if the tense will get impaired then the aspect marker will obviously be impaired as placed lower in hierarchy after tense. In Hindi both tense and aspect are marked for agreement with the noun phrase in the sentence – either with the subject or with the object. Oblique case blocks this agreement, i.e. the agreement between the noun phrase and the verb phrase. Tense and aspect are marked for number, gender and person which are borrowed from the noun phrase to maintain the agreement. In this case tense-internal and aspect-internal inflections, i.e. number, gender and person inflections, were preserved, as the nouns and adjectives were also not impaired for number and gender inflectional markers. This again provides strong evidence of selective processing of inflectional morphemes on aspect as they are spared even when the aspect itself was impaired. Although Friedmann and Grodzinsky (1997) also presented a case of agrammatic production which showed dissociation within verbal inflectional morphology, and they observed a selective deficit of tense inflection, use of copula and embedded structures while the agreement inflections were relatively intact. Whereas in present case, i.e. Case 2, the dissociation is within the aspect inflectional morphology which is a highly selective deficit and it has not been reported previously. Ranjan (1998) made a strong claim for an autonomous and very selective processing of number inflection on tense as every inflection on the verb was preserved except the plurality on present and past tense inflection in indefinite and progressive aspect. OPS was impaired in single word processing tasks and in the sentence processing tasks, the selective impairment was on grammatical morpheme. This goes as against the claim made by Garrett (1982) that morphological paraphasias (e.g. errors in agreement) can result from deficits to sentence processing mechanisms while single word processing remains unimpaired. Nehru et al (1999c) also demonstrated a case for autonomous morpheme representation in which the Broca’s aphasic selectively deleted the present tense marker

\[^{5}\text{From subject noun phrase only.}\]
on singular nouns. Therefore in the present case, the patterns of impairments suggest strongly that morphological impairments are not due to the deficits in sentence processing, as the agreements of number and gender inflectional morphology of subject or object NPs to verbal inflections were maintained. Ranjan (1998) also provided further supporting evidence in favour of this.

5.3 Case 3: DKJ

While the category of nouns was intact that of adjectives was affected in repetition modality. DKJ tended to substitute the masculine plural marker with masculine singular marker, i.e. converting /lamb-e/ into /lamb-a/ i.e. substituting the /-e/ (masculine plural marker) with /-a (masculine singular marker). In other words he first stripped off the masculine plural inflection and then added the masculine singular inflection. In repetition tasks at the lexical level, the only other error-type was the loss of feminine gender inflection in the adjective word class, and then substitution by the masculine singular marker (e.g. ‘chot-i/ was converted to /chot-a/). There were no errors on the masculine-marked adjectives in terms of gender inflection, as their gender was maintained even when the number was impaired.

5.3.1 Dissociations

Analysis of the impaired entities on repetition tasks revealed the following inferences –

1. Dissociation between nominal category and that of adjectives as the nominal category was spared with 0% impairment while the adjectives were impaired with 45.43% error rate, i.e. 104 adjectives are impaired out of a total 192 adjectives. The number and gender inflection on adjectives were impaired while nouns were intact along these inflections, as DKJ converted /nat-e/ to /nat-a/ and /chot-u/ to /chot-a/.

\footnotetext{Number could not be ascertained in the absence of overt marking for plural, only other way to test the plurals in feminine in the absence of the overt marker is through the sentences and at the syntactic level there was no error in gender marking at all.}
2. The types of impairment in the category of adjectives were distributed to the inflections – number inflection, i.e. masculine plurality morpheme /-e/ was substituted by the masculine singular morpheme ‘-a’ (e.g. /nat-e/ to /nat-a/), & gender inflection, i.e. the feminine gender morpheme /-i/ was substituted by masculine gender marker ‘-a’ (e.g. ‘cʰotʃi’ to ‘cʰota’).

(a) First there was dissociation between impaired number inflection and spared gender inflection on masculine-marked adjectives.
(b) Secondly, there was dissociation between impaired gender marker and preserved number marker on feminine-marked adjectives.

5.3.2 Implications

Based on the dissociations as stated above in 2(a) and 2(b) an inference could be brought about – there is a double dissociation between number and gender inflection in the category of adjectives. This is a dissociation specific to a lexical category (of adjectives) and has never been reported earlier in neurolinguistic literature. Earlier in a research by Miceli et al 2002, it was reported anatomically that gender inflectional morphology is an independent processing component.

\(^7\) Stands for both the singular number marker and the masculine gender like ‘-i’ which stands for both feminine gender and singular number.
Here as obvious from the Fig. 3.1, there is a dissociation between nouns and adjectives (like in Case 2: OPS where also nouns were spared), which claims for a selective processing of the two word classes. On the other hand, Ranjan (1998) demonstrated a dissociation between spared adjectives and impaired nouns. Within the adjective class, both masculine and feminine genders were impaired differently. The findings hold a claim for a double dissociation between number and gender, and also a double dissociation between masculine and feminine marked adjectives. Therefore the feminine and masculine marked adjectives have a selective processing as in the previous case, i.e. OPS. The presence of double dissociation between gender and number inflectional marker claims for separate processing mechanism for both the inflections. The above cases place evidences for the dissociation between inflectional and derivational morphology, also reported previously by Miceli & Caramazza (1988); Ranjan (1998); Nehru & Ranjan (1999 a&b). About the directionality and the hierarchy of the inflectional markers on adjectives, at least this does not go against the hierarchy as shown in Fig. 1.5. In case of the impaired feminine marker on adjectives there was an absence of overt marking for singular/plural number. Therefore, we can't say for sure if there is
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preservation of number marker on adjectives marked with feminine gender. To validate or refute the hierarchy of access to the inflections, we need a case that has impairments on feminine-marked adjectives in sentence-level output as in the sentences only the number impairment on feminine-marked adjectives could be checked by looking at the agreement inflectional markers.

5.4 Agrammatism and autonomous morpheme representation

'Separate representation of feminine nouns based on the last phone as its segment, i.e. /-a/ ending feminine nouns were spared in Case 1: R.K'.

'Feminine and masculine - marked adjectives are autonomously represented'.

The above lines might look like an inference drawn from the data analysis and consequently it might be argued that it is neither full word listing nor a complete autonomous morpheme representation and that both words and morphemes are represented in the mental lexicon. But this does not hold true in the present cases. Here the debate on the nature of agrammatism should be presented as to what other researchers have found.

There has been a debate on agrammatism regarding the nature of deficits as traditionally it is a loss of inflection and function word while paragrammatism is the substitution of those. In case of Hindi there is always overt or non-overt marking on the words for different inflectional marker. So it is always a case of substitution of inflectional suffixes. Therefore the agrammatism in the context of Hindi will have different dimension covering both the deletion and then addition of affixes. Both Wernicke’s aphasics and Broca’s aphasics seemed to be significantly impaired in the production of inflectional morphology [Bates et al (1987)]. Also, there is no significant difference in the absolute level of performance of Broca’s aphasics and Wernicke’s aphasics [Haarmann & Kolk (1992)]. As Broca’s aphasics weren’t more likely to omit than substitute inflections and function words whereas Wernicke’s aphasics also substituted inflections, in addition to
words. Also, Grodzinsky (1990) noted that in some languages it is not phonologically possible to omit inflections. So the agrammatic errors were always substitutions. Inflectional substitution were witnessed in Hebrew [Grodzinsky (1984)], in Italian [Micieli et al (1983); Miceli & Caramazza (1988); and Bates et al (1987)], in French [Jarema and Kehayia (1992)], in German [Janssen & Penke (2002); Bates et al (1987)], in Greek [Kehayia (1990); Kehayia et al (1990)] and in Hindi [Ranjan (1998); Nehru & Ranjan (1998a&b); also in the present thesis]. Unlike the claims made by Goodglass et al (1993) these inflectional errors are independent of comprehension, the Broca’s and Wernicke’s aphasics displayed a remarkable difficulty in the auditory comprehension regarding sentence processing, e.g. complex sentences.

In the context of Hindi the substitution is the only possible morphological process in the inflectional and derivational\(^8\) morphology. In the light of the above arguments the inferences in the beginning of the section could be examined again and then the hypothesis about the autonomous status of morpheme is strengthened further. Since it is not possible to find words in Hindi, which are capable of being inflected, having no inflection attached to them, the cases of agrammatic prediction are always that of substitution rather than omission. In case of overt marking for both the genders in words /laṛk-a/ and /laṛk-i/, there is no overt existing form with zero gender inflection. This agrammatism / paragrammatism distinction doesn’t work well for Hindi, as agrammatism is a syndrome traditionally defined as ‘the loss of inflections and function words’ therefore this needs to be reexamined in the light of the aphasic cases from richly inflected languages like Hindi, Italian, Greek and German.

Further the morphological paraphasias could be stated to provide strong evidences for another existing hypothesis in the field of neurolinguistics. Numerous studies in aphasiology have supported the autonomous morpheme representation - more recently in 1990s by researchers like Badecker & Caramazza (1998), Penke et al (1999) and

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\(^8\) The impairments may show the deletion of derivational morpheme as in Case 1: R.K. but that derivational marker is replaced by inflectional morphemes, e.g. /buṭ-apa/ was impaired to /buṭ-a/ where /-apa/ derivational morpheme was deleted and replaced by /-a/ which is a masculine gender and singular number inflection in adjectives.
Waksler (1999), Ranjan (1998); Nehru & Ranjan (1999 a&b); Badecker & Caramazza (1998) while arguing for the morphological substitutions as not a mere product of lexical paraphasias quote their own study [Badecker & Caramazza (1991)] of a case S.J.D., an English speaking patient who exhibited morphologically illegal forms, e.g. /poor-less/ in response to /poor-est/ in a sentence. They argued that if all morphological errors were simply a case of whole-word mis-selection then one would expect all substitution errors to be grammatically well-formed. Therefore the morphological errors and the whole-word substitutions could not be treated as one. It will be very simplistic and straightforward to say that morphological errors were due to a true deficit of lexical morphology, i.e. lexical paraphasia. Ranjan (1998); Nehru & Ranjan (1999 a&b) also provided evidences for autonomous morpheme representation of different plurality markers and gender markers through dissociations within number and gender inflectional morphology. A very consistent error pattern in one category of affixed words against a very consistent sparing of other categories of affixed words speaks very strongly of morphological paraphasias as not merely lexical paraphasias, i.e. substitutions or mis-selection of another related word. If there is lexical paraphasia in one category of nouns – other categories should also be affected along the same line. If the nouns are spared completely against impaired category of adjectives – this would result in stating the autonomous status for the word classes of nouns and adjectives. But then, if somebody substitutes affixes and thereby substituting the word-class of adjectives by that of nouns, that too, in a particular group of adjectives, i.e. which have overt feminine marking, then, this certainly is not a case of mere mis-selection of a morphologically related word or lexical paraphasia as the patient is selecting nouns instead of the adjectives very consistently, but rather this is an evidence for autonomous morpheme representation of the feminine gender marker for adjectival category.

RK, i.e. Case 1, consistently converted plurals to singualrs in nouns while adjectives were spared. If this is also a case of lexical paraphasia, then in this case RK would have selected other morphologically legal words instead of just selecting the singular form of the stimuli. But the error patterns were highly selective and methodic, i.e. conversion of

\[9\] He tried to show the dual nature of the morphological representation using the naturally occurring language data – through code switching, novel forms and speech errors.

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plural to singular nouns. The inference is quite obvious that she did not substitute gender. Morphologically related forms within the same word-class include words with both gender inflections (wherever applicable, e.g. /\textipa{\textit{virdya-l\textbar{y}}} won't have a morphologically related feminine gender form). Going by the theory of lexical morphology, she never substituted /l\textipa{\textit{drk-i/}} with /l\textipa{\textit{drk-a/}}, /l\textipa{\textit{drk-i-y-\textbar{a}/}} with /l\textipa{\textit{drk-a/}} or /l\textipa{\textit{drk-e/}} but the very consistent substitutions were – /l\textipa{\textit{drk-e/}} with /l\textipa{\textit{drk-a/}} and /l\textipa{\textit{drk-i-y-\textbar{a}/}} with /l\textipa{\textit{drk-i/}}, which strongly suggest an autonomous component for plurality in this case, denying the morphological paraphasias as mere lexical errors. Otherwise in the R.K.'s output it is not possible to witness only singular forms in response to plural nouns throughout the data.

Further in Case 3 DKJ, the errors were selectively in adjectives, not in nouns at the lexical level (and even these errors were completely absent in sentence production tasks). So this can not be a mere coincidence that there was not a single error on adjectives in sentences. There must be a division between the two levels of processing, i.e. single-word and sentence\textsuperscript{10}. Then again within the word class of adjectives, DKJ's morphological paraphasias were characteristic in certain ways –

1) Plural number impairments were only on masculine-marked adjectives &
2) Gender impairments were only on feminine-marked adjectives.

He always selected /a\textipa{\textit{cch-b-a/}} for /a\textipa{\textit{cch-b-i/}} and /a\textipa{\textit{cch-b-a/}} for /a\textipa{\textit{cch-b-e/}} despite the forms like /a\textipa{\textit{cch-b-i/}}, /a\textipa{\textit{cch-b-e/}}, /a\textipa{\textit{cch-b-a/}} being available to him for substitution for all the adjective stimuli and these features were consistent in all the errors made on adjectives. /a\textipa{\textit{cch-b-a/}} (masculine singular form) was maintained and was never substituted.

In Case 2, i.e. OPS, the errors were selectively on adjectives while nouns were completely spared. Again this error pattern was very consistent with Case 3 (DKJ) where also adjectives were the only affected word class while the nominal category was totally spared. The adjectives were converted into nouns. This was the type of error on

\textsuperscript{10} The errors included change in word order and ellipsis of phrasal structures like subject and object NP, adverbial phrase, adjective phrase etc.
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adjectives. What is important here is that OPS selected nouns, i.e. abstract nouns, for as morphological paraphasias, whenever he couldn’t access the stimulus.

The morphologically related forms within the same word class could be
1) For /cʰot-i/ – /cʰot-a/ and /cʰot-e/
2) For /mo-t-a/ – /mo-t-i/ and /mo-t-e/

But these were never selected by OPS as his responses. Instead he opted for nouns like “motapa”. Now if this is also a kind of lexical error, then it would be making a statement to dissolve the word-class boundaries, i.e. there is nothing like independent components of nouns and adjectives in the lexicon. But that is not true as obvious from the analysis of the impaired data in OPS and DKJ. Then another argument from lexical morphology could be that OPS tended to select the word from different word-class as the impaired response, even when other forms were available to him within the same word-class. Why did he selectively choose the derived nouns? What then, should be the implication? It would be that for /accʰ-i/ (a feminine adjective), there was no access to its masculine counterpart in singular or in plural, i.e. /accʰ-a/ & /accʰ-e/, whereas the masculine singular (with 11% error rate impairment) and masculine plural adjectives are accessible to OPS when they themselves were the stimuli. So there was a selective impairment of the pathways to “masculine gender forms of adjectives” when the stimulus was feminine adjective. The non-selection of “moṭi”, or /moṭ-e/ in response to /moṭ-a/ – has a different and significant argument for the dynamics of the relationship between morphological substitutions and lexical paraphasias. The word which was available to OPS for adjective /moṭ-a/ was a noun /moṭ-apa/. It could be argued similarly in this case that the selective and consistent blockage of access to the other forms of the same word class like /moṭ-i/ or /moṭ-e/ places an evidence that /-a/ suffix is acting autonomously as it was replaced by a nominalising suffix as part of a consistent pattern.
Lexical approach to these errors will be that OPS switched to nouns for substitutions. But the question arises – why were other related forms from the same word class not picked up? Again, why the selection from the same word class was blocked in a consistent pattern, i.e. without any single exception? The explanation seems to be that selective access to nouns was due to the decomposition of masculine & feminine gender and singular number inflection from adjectives and then addition of the derivational morpheme to form the (abstract) nouns. What could be the process – instead of stating a flat reason of “whole-word substitution, the plausible explanation seems to be that – there are roots, inflections and derivational morphemes. Instead of saying that other morphologically related adjectives were not accessed, in a consistent way – it would result in saying that the route to feminine and plural forms was blocked for masculine singular adjectives and, the route to masculine forms was blocked for feminine-marked adjectives, so those routes are selectively impaired following the lexical morphology approach. Then there is something like masculine and feminine gender inflection and plural inflection acting independently in the processing of the adjectives. This will be equal to saying that these inflections are separately placed in the lexicon.
Then explaining the change of word-class it could be argued that since no other attested forms were available, the roots were approached and, instead of selecting illegal suffixes for plurality/masculinity, i.e. like /moṭː-x-y-ā/ & /acch-ē/, selected a legal derivational morpheme and came out as a perfect attested form. Fig. 4.1 explains the structure of the processing of the adjectives, in the present context, i.e. for cases 2 & 3 (OPS & DKJ).

When there are such selective impairment and intactness, the brain can't be so simplistic and straightforward in the processing of language. It just can't go about selecting a word from all the words available to the speaker. There are roots and inflectional and derivational morphemes too, which decide the nature of the output. Therefore these
morphological paraphasias are the result of compositional errors and not of whole-word lexical substitutions or lexical mis-selection as also argued and supported by Badecker & Caramazza (1991) who quoted a case of morphologically illegal form /poor-less/ as a response to /poor-est/, which will always be a case of mis-selection of an inflectional suffix. Normal lexical output system has to include procedures for composing morphologically complex words from their morphological constituents. Otherwise in whole-word substitution, if it is to select a word from the set of all words (includes all inflected and derived words), it will either be chaos or costly in terms of time for the processing of language of the brain. Therefore it has to be methodical in the way language processes in the brain – then only there will be economy of derivation and processing – which is necessary as our brain is much faster than we can imagine.

5.5 The nature of Morphology

Morphological impairments are not syntactically driven impairments. It is evident from the data of the Cases 2 & 3. Whatever the impairments are in the morphology of subject or object NPs, i.e. number and gender markers, or in the morphology of the verb, i.e. in aspect and tense markers, the final agreement is always maintained without any exception. For example, in Case 2\textsuperscript{11}, OPS changes the aspect or tense marker in the verbal inflectional morphology, but always maintains the agreement (e.g. /jat-e hā/ and /ho go-yi hā/ are converted to /ja rōh-e hā/ and /ho go-yi/ respectively). This hints at the separation of morphological component from syntactic one as the process of morphological composition becomes impaired and only then syntactic parsing takes place, so that the agreement on the verb is coordinated with that of the NP in the sentence. Compositional errors in morphology are distinct and these exist distinctly from the level of sentence processing. This split of morphology and syntax is also evident in DKJ\textsuperscript{12}, i.e. Case 3, in his response, where deletions of whole NP (e.g. subject NP or

\textsuperscript{11} For the morpheme-to-morpheme translation of the sentences in Case 2, look in the section 4.2.3.2
\textsuperscript{12} For the morpheme-to-morpheme translation of the sentences in Case 3, look in the section 4.3.3.2.
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pronominal NP /us-ne/) or adjective phrase (e.g. /me-r-e/), or postpositional phrase, PpP, (e.g. /kamr-e mee/) take place. This does not interrupt the agreement of the sentence in terms of morphological composition and therefore this deletion proves the syntactic parsing as a separate process. To the stimulus /mer-e jut-e puran-e hae/, he responded with /jut-e puran-e hae/. Then for the stimulus /us-ne mujhe d'okha d'-y-a hae/, his response was /mujhe d'okha d'-y-a hae/ and for /kamr-e mee andher-a hae/ the response was /andher-a hae/. It is evident that DKJ doesn't break the phrases, rather the ellipsis of the whole phrase takes place in him, i.e. the PpP /kamr-e mee/, the AdjP /me-r-e/ or the pronominal NP /us-ne/, and this could be argued for the autonomous nature of morphology as the denial of the access to the word /kamr-e/ or /us-/) might have prohibited DKJ in taking the post-position /mee/ or nominative marker /ne/ and as a result, this meant loss of whole phrases and there were no morphological leftovers like /us-/, /kamr-e/, 'mee' or /ne/ in his sentences. The denial of the access to either the post-position or the NP results into the blockage to the other phrasal component and the sentence is maintained in terms of the agreement. Then there are cases of changes in word order, where DKJ moves the object NP (e.g. /hana/ and /hara/) to the beginning of the sentence with maintained agreement. The stimulus was /rakh-oe ne hana k'ha-y-a hae/ and his response was /hana rakh-oe ne k'ha-y-a hae/ and for /rakh-r-y-a har ja-t-i hae/ his response was /har rakh-r-y-a ja-t-i hae/. So, the movement of object NP to subject position doesn't result in any confusion over the roles of NPs, i.e. nominative or accusative, in his sentences. This is suggestive of the fact that word order is distinctly processed in a component other than morphology.

In all the above examples, i.e. errors in tense/aspect markers, deletion of NP, PpP or AdjP and change of word-order, agreement was maintained. Whenever or wherever the
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impairments took place, this did not affect the agreement of the sentence. So this suggests strongly that morphological process is separate from the agreement maintenance.

5.5.1 The nature of morphological processing

Let us look at some other responses of DKJ, Case 3, at the post lexical level. In response to /wəh pɛɾ ke upəɾ hæ/ he provided with /pɛɾ ke upəɾ hæ/ and for the stimulus /ap-se mɪl-kəɾ mʊjʰe kʰusʰi hu-i/ his response was /ap-se mɪl-kəɾ kʰusʰi hu-i/.

In the above examples, following observations could be made –

1. There is deletion of the NP (in nominative or accusative role).
2. There is maintenance of agreement in the sentences.
3. Even when the NP is deleted in the sentence, the semantic sense of the deleted NP remains in the sentence. The place of NP-trace can be argued to be posited in the sentences, the position of the NP-trace might be the position of the NP in the stimulus but since the word-order has changed in DKJ’s utterances the NP-trace could be placed /pɛɾ ke upəɾ/ and /hæ/ for the first sentence and in the beginning of the sentence, i.e. before /ap-se/ for the second sentence. This can’t be denied as NP-traces are not overt. The change of order has already taken place and this is evident from his responses which do not involve ellipsis.

The positing of NP-traces in the sentences of DKJ tells us something more about the morphological component. Even after the morphological composition and insertion has taken place, the sense of slot does not vanish with the impaired utterance. The impairment in the level of morphology does not delete the syntactic roles of the NPs in the sentences. The presence of the NP-trace tries to maintain the semantics of the sentence with less information in the sentence. Therefore the syntactic planning for the
slots of different phrasal components might have taken place earlier than the morphological insertion. After the morphological composition and insertion has taken place, then the agreement features of the subject NP are copied on to the tense node and thus agreement insertion is closer to the attested speech or phonological component. This can be said about the post-lexical utterances.

The data suggests the separation and hierarchy in the different levels of language processing (see fig. 5.11). Syntactic planning for slots must be done in the beginning, and then only the morphological insertion takes place. Finally the maintenance of agreements takes place.

![Fig. 5.11: Morphological Insertion](image)

This supports the strong lexicalist hypothesis, a derivative of the lexicalist hypothesis, that posits the existence of an autonomous morphological component consisting of a set of listed items and a set of word-formation rules and principles and that both inflectional and derivational operations take place in this component. The findings agree to the lexicalist hypothesis (Chomsky 1970; Anderson 1988) in the fact that principles that regulate the internal structure of the words are different from those that govern syntactic structure/domain. This explanation is also in agreement with the theoretical model of morphology suggested by Distributed Morphology (DM) of Halle & Marantz (1993, 1994) as they also consider the morphological structure (MS) as a distinct level of language processing and maintain that this morphological insertion takes place after syntax. But the point of disagreement with them is that in DM, every morpheme is a morpho-syntactic representation. The present study demonstrates the existence of
morphological processing without syntactic planning for slots in case of production at the lexical level.

The findings in the sections 5.1.2 and 5.2.2 tell us that number, gender and derivational morpheme are dissociable units of meaning, i.e. morphemes. These outcomes are at the lexical level of production in case 1 and 2. This dissociability of the different units of meaning can not be ignored. Later if we examine the post-lexical production of case 2, the agreement is also a dissociable unit; as even after the substitution of aspect, the agreement morpheme attached to it is maintained and we can posit that within a word the addition of units of meaning, i.e. morphemes, follows a hierarchy or a sequence. The fact that there are dissociable units in both the lexical and the post-lexical production, the autonomous nature of those units can not be denied.

This means that morphological markers, at least in Hindi, are represented in dissociable forms at the lexical level. The same can be stated of the highly inflected languages. Further there is no obvious reason why the same generalizations can not be extended to the less inflected languages. In fact, evidence already exists that this generalization is scientifically valid in the case of English, as documented in previous studies (e.g. Nehru et al 1999 b & c). Now it can not be argued that morphemes that are represented at the lexical level as dissociable autonomous entities will be represented in a series of non-dissociable full words at the post-lexical level. The scientific and empirical evidence that has been brought out in this study strongly argues in favour of dissociable morpheme representation at the lexical level. We, therefore, can not let the hypothesis stand that at the post-lexical level, these dissociable autonomous entities will disappear from the human mind leaving the mental lexicon altogether as a hypothetical residence of non-dissociable non-autonomous full words. This would deny the existence of the morpheme altogether. It can't be that morphemes are represented in dissociable forms at the lexical level, but not so at the post-lexical level. The hard scientific evidence brought out in this study demolishes the hypothetical claims that deny autonomous morpheme representation.
It is obvious that the above discussion refutes both the Full listing Hypothesis (Butterworth 1983, Tyler & Wessels 1983) and mixed or dual processing hypothesis (Patterson 1982, Tyler et al 1990, Wurm 1997, Vannest & Boland 1999) while supporting Taft & Forster (1975) and Taft (1979 a & b, 1988, 1992) that not words but morphemes are represented in the mental lexicon.

The present study places evidence against Beard (1966, 1991), where he has, in his lexeme-morpheme based morphology, denied the existence of affixes saying that these are the by-products of morphophonological rules, i.e. word-formation rules. The findings in the present study agree to Lieber's lexicalist morphology in the existence of lexemes and affixes and that these combine to create words. The results of the present study does not support the Network Model of Bybee (1985, 1988) as she also posits the existence of words in the lexicon, and says that they relate to each other via identical and similar phonological and semantic features. Although the semantic organization has not been dealt with in this study but the semantic substitutions or paraphasias found in Case 1 & 2 suggest that the words semantically related are placed together (e.g. /cadar/ for /kap-e/) but the words did not relate to each other phonologically. At times, semantically related words, belonging to two different lexical categories, were also found in substitution (e.g. /dost/ (n.) for /apn-i/ (adj.))

Also, Word-Network Model by Singh & Agnihotri (1997) is denied as a plausible model of morphology (in Hindi) by the present study, as they support the existence of words and word-parts as the basic units of analysis and for them, word-parts which do not have any lexical status outside the word-formation rules in the lexicon, may or may not correspond to morpheme. They do not consider the notions of root, lexeme and morpheme altogether which is strongly controverted and denied by the present study. Furthermore, one of their proposals that if one form is available to a speaker, he or she will know all the other related forms, including the forms which change shape due to adjunction of word-parts, is in strong contrast with the findings of this study. The

13 For the morpheme-to-morpheme translation of these words in Case 1, look in the section 4.1.3.
14 In this work, they have presented a case study of Hindi morphology.
proposal that all the words are connected to each other via specific WFRs, which carry word parts as operational agents, is also not a viable and economical option for a speaker.

The evidence in the present study thus conclusively demonstrates that morphological representation in the mental lexicon involves autonomous morpheme representation rather than full word listing. The findings support those theoretical formulations of morphological representation that conceptualize autonomous morpheme representation. The full word listing hypothesis is not supported.