1.1 Introduction

The purpose of this study is to examine the use of case marking in the speech production of Wernicke’s and Broca’s (also called agrammatic) patients. Russian was chosen as a morphologically rich language with overt case marked on the noun phrases (DPs). According to Tsvetkova and Glozman (1975), Wernicke’s patients have difficulties with nouns, especially with omission and superfluity of objects, and with verb omission. In Broca’s aphasia, speech production is characterised by the omission and substitution of grammatical morphemes. Not all grammatical morphemes are equally impaired however. It has been shown with Russian Broca’s patients (Ruigendijk 2002) that the omission of a case-assigning category, for example, a verb, leads to incorrect case marking on the object DP, and sometimes also the subject DP. However, when the case-assigner is present, nominative case and accusative case are relatively unimpaired. Dative and instrumental case, on the other hand, are significantly more impaired, even when a case-assigner is present. The deficit is functionally localised at the level of structural encoding (following Bastiaanse, 2003) resulting in difficulties with the processing of lexical (lemma) information. The present study seeks to confirm the previous findings and find out whether a similar dichotomy can be found in a Russian Wernicke’s patient, KI, namely whether linguistic constraints on grammatical morphemes account for errors in Wernicke’s speech production.

The first section gives a general overview of Russian grammar and focuses on the use of case and determiners under the constraints of Government and Binding theory. The second section gives a psycholinguistic theory of case using Levelts model (1989). Subsequent sections look at the Broca’s and Wernicke’s aphasia and the implications of cross-linguistic studies in morphological production in language impairments. The current study, its methods, results and conclusion are then presented, and the results are discussed in light of the findings.
1.2 Theoretical Linguistic Background from a Russian Perspective

Case is a syntactic notion which specifies, among other things, the role the noun plays in a sentence. For example, in the sentence “The mother washes the girl,” the mother is the subject and the girl the object. Since in English overt case marking has all but died out, these roles are no longer visibly present. Russian, however, is a morphologically rich language, and the roles of subject, мама (mother), and object, девочка (girl), are realised overtly on the noun by nominative and accusative case marking respectively: Мама (NOM) моет девочку (ACC). It is essential to the understanding of a sentence that the correct case be used for each DP.

There are interesting implications for this. For example, a reversible sentence cannot be created in Russian in the same way as in a non-case marked language, since in Russian overt case marking generally leaves no room for doubt as to ‘who does what to whom’. In English and Russian, therefore, two different types of case are manifested: abstract and morphological. Abstract case is manifested on the noun phrase (NP) in every language, as stated in case theory by Chomsky’s Case Filter, i.e. every phonetically realised NP must have case (Chomsky, 1981a, 49). English has abstract case. Russian, not only has abstract case, but also morphological case. In other words, in Russian and other Slavic languages, case is overtly marked as bound morphemes (suffixes) on nouns, as seen above (девочка (ACC)).

NPs in Russian are known as Determiner Phrases (DPs) (although there are some instances where this is disputed (see Franks 1995, 376:2 on numeral phrases). Previously in Government and Binding Theory (Chomsky, 1970, in Haegeman, 1994), Noun Phrase structure assumed the noun to be the head of the NP, with the specifier position for hosting determiners such as the/a in English and der/die/das in German. Abney (1987) introduced a new structure for the NP, known as the DP-hypothesis, whereby the category of articles is the most important element in a noun phrase. Thus, the determiner is the maximal projection of the DP and takes the NP as its complement. This analysis is also be used for Russian NPs.
In Russian, case marking is obligatory. If no case marking were used, the noun stem would become a non-word; for example the nominative ending –а in вилка (fork), cannot be removed: *вилк. There are six different cases: nominative, genitive, dative, accusative, instrumental and prepositional. Case is marked on adjectives, pronouns, numerals and participles as well as nouns. This study focuses on case marking in nouns only. Russian is not only marked for case, but also for gender and number. There are three genders: masculine, feminine and neuter. Gender is marked on singular nouns and on verbs in the past tense.

Case marking in Russian is subdivided into three declension classes (see table below). Nouns decline according to one of these classes. Most masculine and neuter nouns belong to the first declension, feminine nouns belong to the second declension, apart from those ending in a soft sign (–ъ), which belong to the third declension (Wade, 1992). Masculine singular nouns are also marked for animacy in the accusative case. In the nominative and accusative case, certain declensions are neutralized. This mainly occurs in masculine inanimate nouns ending in a consonant, and in feminine nouns ending in a soft sign. For example, the masculine inanimate noun стол (table) contains a null-morpheme and may represent either nominative or accusative case.

Table 1. Summary of all declension patterns in simplified form. NOM=Nominative; ACC = Accusative; GEN=Genitive; DAT=Dative; INS=Instrumental; PREP= Prepositional

<table>
<thead>
<tr>
<th></th>
<th>Singular</th>
<th></th>
<th></th>
<th>Plural</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>NOM</td>
<td>Маскул.</td>
<td>Жен.</td>
<td>Фем.</td>
<td>Маскул.</td>
<td>Жен.</td>
<td>Фем.</td>
</tr>
<tr>
<td>NOM</td>
<td>consonant</td>
<td>-о</td>
<td>-а/-я</td>
<td>-ъ</td>
<td>-ы/-и</td>
<td>-а/-я</td>
</tr>
<tr>
<td>NOM</td>
<td>-й</td>
<td>-е</td>
<td>-ёнь</td>
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<tr>
<td>NOM</td>
<td>-ь</td>
<td>-ё</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACC</td>
<td>Inanimate</td>
<td>=NOM</td>
<td>=NOM</td>
<td>-у/-ю</td>
<td>-ъ</td>
<td>=NOM</td>
</tr>
<tr>
<td>ACC</td>
<td>Animate</td>
<td>=GEN</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>GEN</td>
<td>-а/-я</td>
<td>-ый/-и</td>
<td>-и</td>
<td>-ов/-ев/-ей</td>
<td>-и</td>
<td></td>
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<tr>
<td>DAT</td>
<td>-у/-ю</td>
<td>-е</td>
<td>-и</td>
<td></td>
<td>-ам/-ям</td>
<td></td>
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<tr>
<td>INS</td>
<td>-ом/-ем/ём</td>
<td>ой/-о</td>
<td>-ю</td>
<td></td>
<td>-ами/-ям</td>
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<tr>
<td>PREP</td>
<td>-е</td>
<td></td>
<td>-и</td>
<td></td>
<td>-ах/-як</td>
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</tbody>
</table>
Word order in Russian is relatively free, although basic word order follows subject, verb, object (SVO). Since there are no definite/indefinite articles in Russian, the distinction between specific and non-specific nouns is made by context. Ellipsis is also a feature of Russian, particularly in conversational speech. Since gender and number are already marked on the verb, DPs are commonly omitted. This is perfectly grammatical, such as in the following sentence where ‘I’ is omitted:

(a) Каждый день езжу куда-нибудь.
Every day go.PRES.SING\(^1\) somewhere.

Everyday I go somewhere.

This type of ellipsis is only used in context. For example, in the past tense, verb endings only distinguish between single and plural. A DP would be necessary here to further clarify precisely who the verb refers to:

(b) Нервничал очень?
Worry.PAST.MASC.SING\(^2\) very?

Were you/was he/ was I very worried?

(Interviewer talking to KI)

The following study focuses on case, therefore number and gender will not be analysed. The experimental task will look at the nominative, accusative, dative and instrumental. The genitive and prepositional are not examined. Genitive case is rather more complex and the prepositional requires a preposition rather than a verb for case assignment. All the target items are in the singular.

1.3 Levelt’s Model of Sentence Production from a Russian Perspective

Every DP not only requires case, but also requires a source for case. To understand how case is assigned in Russian, it is helpful to consider Levelt’s model of sentence production (1989, 1999). This model describes how lexical encoding and the retrieval of this information is used for case assignment and DP production in normal adult

\(^1\) PRES.SING is the present tense singular
\(^2\) PAST.MASC.SING is the past tense, masculine singular
speakers. In this model, three processing levels use specific knowledge stores: the initial concept is fed through to the lexicon where grammatical and phonological encoding takes place to form a phonetic plan, and finally to the motor commands required for articulation of the utterance (see diagram below).

The model distinguishes two types of lexical representations: the ‘lemma,’ which is an abstract representation that encodes meaning and grammatical information, and the subsequently activated ‘lexeme’, which is phonologically encoded and represents the underlying word form. Although case assignment is made by the verb, case itself is a property of the DP (Franks 1995) and is required before the lexeme is created. In Russian, for example, before the noun ‘cat’ is uttered, the concept is formed and the noun lemma is then specified for meaning (semantic information) and encoded for category (noun) and case (e.g. nominative case). At the Phonological Encoding level, the underlying word form of cat in Russian (/ko∫kɑ/) is represented; finally the word is articulated ([ko∫kɑ]) (See, however Caramazza et al, 2001 for a cross linguistic investigation into the order of retrieval information in determiner production.)

Figure 2 Simplified version of Levelt’s model for Russian

Finally, let’s take the following sentence and see how the verb is encoded for semantic and syntactic information:
Костищина бьет мужчину.

Woman.NOM hits.3PERS.PRES3 man.ACC

The woman hits the man

The lemma of a verb holds semantic information about the meaning of the verb and its thematic roles and also syntactic information e.g. the number of arguments the verb can take and what case the verb will assign. The verb ‘to hit’ takes two arguments, an agent and a patient. The verb then assigns nominative case to the subject DP Женщина and accusative case to the object DP мужчину.

1.4 Theta Roles and Case

Thematic roles are a semantic feature, but are closely related to the realisation of case on DPs. Franks (1995) model of case proposes a system of co-indexation of the verb and DP, where case assignment is a consequence of theta-role assignment.

The ordering of thematic roles in a sentence is licensed by the verb and is known as argument structure. For example, in the sentence “The boy hits the girl” the verb ‘hit’ licenses the role of Agent to ‘boy’ and Patient to ‘girl’. Thematic roles such as Agent, Patient, Beneficiary etc. are directly represented on the DP as part of a syntactic node; thus Agent is related to the nominative, Patient to accusative and Beneficiary to dative. DPs in the instrumental case are an exception and do not depend on theta-role assignment (see below). This meshing of syntactic and semantic information is pertinent to our discussion of case assignment in Broca’s and Wernicke’s speech production, since it has been argued that a pattern of impairment DPs in Broca’s aphasia is related to the juxtaposition of case assignment types in Russian (Ruigendijk, 2002). In Russian, case can be assigned in a number of ways: structurally, lexically, or inherently. In GB theory, nominative, accusative⁴ and instrumental⁵ cases are assigned structurally. Here I assume dative case to be assigned lexically (following Ruigendijk 2002, although see Franks 1995).

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3 3PERS.PRES is the 3rd person, present tense
4 Other NP’s such as in time and distance phrases such as vsyu noč (all night) and tseluyu nedelyu (the whole week), and in intransitive verbs such as spat’ (to sleep) are not covered in this paper, however these non-arguments can also be assigned accusative case as well as lexical assignment of the accusative by a preposition.
5 Ruigendijk initially considers a structural account for the instrumental, but opts for an inherent approach following Babyonyshev to account for her aphasic data.
The following section gives an overview of the types of case assignment in Russian.

1.4.1 Structural Case

Structural case assignment is made solely by virtue of the syntactic position of the DP in the sentence (Franks 1995). In GB theory, the subject NP is base-generated in VP and moved to AgrS. The finite verb moves out of VP to AgrS where it assigns nominative case to the DP in the specifier of AgrS (see figure on nominative case assignment). The following sentence is used as a guideline:

Женщина бьет мужчину.
Woman.NOM hit.3PERS.PRES man.ACC
The woman hits the man.

Figure 3a: Simplified syntactic tree: Nominative case assignment
Accusative case is assigned to the object DP in the specifier position of AgrO by the transitive verb which has moved to AgrO (see figure on accusative case assignment):

Figure 2b: Simplified syntactic tree: Accusative case assignment

The instrumental case is assigned structurally by virtue of its syntactic position to sisters of VP as adjuncts. No other case is permitted on adjuncts here and wide range of semantic interpretations are employed, e.g. function: писать карандашом (to write with a pencil), кормить кашей; movements of the body: мигать глазами (to blink one’s eyes); the time of day: ранним утром (in the morning); route: идти лесом (to walk through the forest). Such DPs are optional and cannot take arguments, hence they do not depend on theta-role assignment.

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6 Some verbs also assumed to specify the instrumental case inherently. Inherent case is specified in the lexicon of the verb; for example управлять (to manage) assigns both theta role and case to the DP (see Franks 1995) even when passivised. Such verbs are not discussed here.
1.4.2. Lexical case

Lexical case is also known as quirky case. Unlike structural case assignment, the dative case is assigned lexically by the verb to object DPs in a sentence. Here the dative case is assumed to be specified in the lexical entry of the verb and overrides structural case assignment i.e. the default accusative case is not assigned. It is argued (Fowler, 1987b in Franks 1995) that they can be considered as indirect objects rather than direct arguments of the verb due to their inability to passivise. There are a number of verbs in Russian which assign the dative case, including verbs of assistance or hindrance, e.g. помочь (to help), мешать (to hinder) and verbs denoting attitude, e.g. угрожать (to threaten), верить (to believe). For example, the noun мужчина (man.NOM) acquires the dative case ending —е to become мужчине (man.DAT) when it follows the verb помочь (to help):

Женщина помагает мужчине.
Woman.NOM help.3PERS.SING man.DAT
The woman helps the man.

Figure 4 Lexical case assignment

2.0 Speech Production in Aphasia

2.1 Speech production in Broca’s Aphasia

In broad terms, there is a dichotomy between the two most commonly known subtypes in aphasia: Broca’s aphasia, and Wernicke’s aphasia. Broca’s aphasic patients are known as ‘agrammatic’ in their speech production; Wernicke’s aphasia is also known as fluent aphasia. One of the characteristics of aphasia is the seeming dissociation in the sparing and impairment of word classes. Speech production in Wernicke’s aphasia is associated with the sparing of function words e.g. determiners, prepositions, pronouns and auxiliaries but a deficit in content words i.e. verbs, nouns, adjectives. Broca’s aphasia shows the opposite pattern. The present study examines these two complementary language deficits in terms of morpho-syntactic properties in speech production.
Broca’s aphasia is associated with the left inferior frontal gyrus and was named after Paul Broca (1824-1880). The main symptom recognised as typical of Broca’s aphasia is agrammatic speech, i.e. slow, effortful speech in a ‘telegraphic style’ and reduction of grammatical complexity. Comprehension is relatively preserved. The omission and substitution of bound and free morphemes and inflected forms is a feature of speech production. Utterances are generally short and often incomplete.

Various accounts have attempted to pinpoint the underlying deficit in Broca’s aphasia. Jakobson (1953) ascribed the style of speech to a disturbance of word order and the disappearance of “words endowed with purely grammatical functions” i.e. conjunctions, prepositions, pronouns and determiners. Kean (1977) claimed that impaired speech production can be explained by a phonological deficit in agrammatic vocabulary. Some have posited a morphologically motivated account (Bates and Wulfeck, 1989), while others have attributed a syntactic deficit (Caplan (1983), Friedmann and Grodzinsky 1997, Hagiwara, 1995, Bastiaanse et al (in press), Ruigendijk (2002)).

The present study ascribes a syntactic deficit at the grammatical encoding level. The reason for this assumption is explained as follows. Broca’s patients show a preference for non-inflected verbs rather than finite verbs which are more complex since they require tense and agreement (Bastiaanse, R. & Edwards, S (2004). It has also been shown that Dutch Broca’s patients have problems with verb movement, in particular of finite verbs (Bastiaanse and Van Zonneveld, 1998). They produce finite verbs in the base generated position (i.e. in the embedded clause) significantly better than finite verbs that have been moved to the second position (i.e. in the matrix clause) Bastiaanse et al (2002). This suggests impairment at a syntactic level. However, this discrepancy between clauses is not present in Russian (Avrutin & Bastiaanse in preparation) and English (Thompson and Bastiaanse in preparation), so the problem involves more than just verb movement. According to Kim and Thompson, (2002), Broca’s patients have more problems producing verbs with a greater number of arguments. Despite good verb comprehension, verbs with three arguments were harder to produce than those with two arguments, which in turn were harder than one argument verbs. This points the level of impairment to lexical-syntactic access to the grammatical encoder.
This however is not the full story. As mentioned above, impairments vary among word classes. Lexical aspects are relatively spared. For example, in German, Dutch and Italian Broca’s patients, it has been shown that lexical aspects such as gender are usually unimpaired (Luzzatti and De Bleser, 1996; Bastiaanse et al, 2003). On the other hand, a lack of function words in speech production is characteristic of speech production in Broca’s aphasia. More specifically, the omission and substitution of grammatical morphemes has been observed. Morphological accounts (e.g. Bates et al 1991) describe global vulnerability to closed class items which varies from language to language. Linguistic information is differentially impaired or spared according to an item’s information value (cue validity) and the amount/type of processing required (cue cost). However, this does not explain the global sparing of gender across languages compared to the differential impairment of case (Bastiaanse et al, 2003), nor the verb inflection pattern seen in Dutch Broca’s patients (Bastiaanse and Van Zonneveld, 1998). The omission and substitution of morphemes can be better described as a syntactic deficit at the level of grammatical encoding which then leads to a diminished processing capacity for complex information. Other theoretical accounts have explained the deficit in functional morphemes in terms of an impairment that affects only certain parts of the syntactic tree (e.g. Friedmann and Grodzinsky 1997, Hagiwara, 1995). However, the present study is interested in one particular area of morpho-syntax: morphological case-marking.

Speech production in Broca’s aphasia is often characterised by the omission and substitution of the determiner (Ruigendijk et al., 1999; Ruigendijk, 2002). In morphologically impoverished languages such as English the determiner ‘the’ is often omitted. In morphologically rich languages such as Russian or Turkish where no determiners are used, one case may be substituted for another. For example, the nominative case may be used in place of the accusative case. Caplan (1983) argues that since thematic roles are assigned to NPs by virtue of their position in the sentence, English Broca’s patients do not map word order onto thematic information; Saffran et al (1980) claim that Broca’s patients do not retain notions like subject and object. Later studies have shown that the relation between noun and verb (from Bastiaanse et al, in press, and Ruigendijk & Bastiaanse, 2002) is an important one for case assignment and that case assignment in Broca’s speech production is affected by
impaired processing of the lemma information of the verb. Ruigendijk et al (1999) demonstrated how once verbs are left uninflected, case is not assigned to the subject. In German and Dutch spontaneous speech in Broca’s aphasia, case is more likely to be omitted than substituted. When a case-assigner is present, case is assigned correctly, but when a case-assigner is not present, the default nominative is used. In experimental tasks where the case-assigner is given, subject nouns are correctly case marked (Ruigendijk and Bastiaanse, 2002), but objects are more problematic. The focus of the present study is to examine the use of case marking in Russian since overt case marking on the noun plays such an important role in constructing a sentence.

### 2.1.1 Speech production in Broca’s aphasia in Russian

A number of studies have looked at the use of speech production in Russian aphasic subjects. Luria (1973) described patients who have good understanding of the meaning of individual words but “they cannot grasp the meaning of the construction as a whole” [p153]. According to him, they reject the “logical-grammatical relationships” which are expressed in Russian by case marking, such that a construction in the genitive e.g. brat ottsa (the father’s brother) becomes indistinguishable in meaning from otets brata (the brother’s father). In a later study by Akhutina (1991, cited in Ruigendijk, 2002) it was observed that in early stages of recovery patients can only distinguish between nominative and accusative case. Other cases were recovered much later. A more recent study (Ruigendijk, 2002) looks specifically at the use of morpho-syntactic abilities in Russian Broca’s patients and concludes that the omission of a case-assigning category e.g. a verb, leads to incorrect case marking on the object DP, and sometimes also the subject DP. However, when the case-assigner is present a pattern emerges whereby nominative case and accusative case are relatively unimpaired, but the dative and instrumental case are significantly more impaired. The question now arises as to how Wernicke’s patients deal with case marking on DPs and whether a similar pattern is exhibited.

### 2.2 Speech production in Wernicke’s Aphasia

The counterpart to Broca’s aphasia is known variously as paragrammatism, fluent aphasia, jargon aphasia or sensory aphasia. This disorder is most commonly
associated with Wernicke’s aphasia localised by Carl Wernicke’s (1848-1904) and is functionally linked to the left superior temporal gyrus. Fluent aphasia is also a feature of severe anoma and conduction aphasia. For continuity’s sake, I will use the term Wernicke’s aphasia here.

Speech production in Wernicke’s aphasic patients is quite the opposite to the agrammatic speech of Broca’s aphasia. Speech production is fluent, but empty in content and with word finding problems and frequent circumlocutions. Comprehension is problematic. Syntactic abilities are considered to be relatively intact and sentences are longer and more syntactically complex than those found in speech production in Broca’s patients. Wernicke’s patients produce paraphasias, both semantic (i.e. semantically related word substitutions) and phonological (i.e. substitutions, omissions or transpositions of one phoneme for another).

An example of spontaneous speech by KI, a Russian with Wernicke’s aphasia who is tested in this study is given below:

P: Мне надо снять еще вот это… А где вот это –то
I still need to take off this thing… And where is that thing

I: Очки
Glasses

P: Конечно…. Я уже снял, все сделал… стра..стра..странные теперь сиденья бывают, бывают и женщины
Of course… I already took off, I did it all.. (on seeing the observer) Strange.. strange seats exist, also women exist

…

P: Вот она, главное я хотел сказать ей… Потом..сейчас не будем.. потому что я же сиденья не работал дома. Два дня не работал дома. Потому что бабушка ушла на фиг
There it is, the main thing I wanted to say to her… Then. Now we won’t. 
Because I already seat didn’t work at home. I didn’t work at home for two 
days. Because granny left damn it

... 
I: А что с бабушкой случилось?
So what happened to granny?

P: Она меня не сделалась сюда, бабушка … и ушла гулять…

She didn’t put me here, granny… And she went out for a walk.

In listening to Russian Wernicke’s7 patients, Luria (1973) described the speech production as follows: “the intonation and melodic aspect of their speech as a rule remains intact”[p139], but in its severe form speech may be described as a ‘word salad’ where: “the nominatives (the substantives) are almost completely absent, and all that are left are either interjections or habitual expressions such as: “let me see…how does it…confound it all…I know but I can’t…”[p139].

2.2.1 Syntactic comparison of Wernicke’s and Broca’s aphasia

There is a plethora of studies examining sentence production in Broca’s aphasia. However, in Wernicke’s aphasia relatively few exist, and studies investigating syntactic deficits produced in Wernicke’s aphasia are particularly scarce. Wernicke’s aphasia is considered to be primarily a lexical impairment, and a strictly lexical view of Wernicke’s aphasia (e.g. Butterworth 1979) is classically supported in literature although these studies concern predominantly morphologically impoverished languages such as English (but see Kean, 2003). A different story has been posited in studies of morphologically rich languages. Wernicke’s patients do produce paragrammatic speech, which, similar to Broca’s patients, is more apparent in experimental tasks than in spontaneous speech (e.g. Heeschen, 1985), Bates et al 1991; Kolk, van Grunsven & Keyser, (1985) and they make both gender and case substitution errors with determiners (Bayer, De Bleser and Dronsek, 1987).

7 Luria’s terminology is somewhat different. His classification system of aphasia (1964, 1966, 1970, 1973) is used throughout Russia and contains a total of six different aphasia types, each correlated with a specific area of the brain. For consistency, I use the equivalent Wernickes /Broca’s terms throughout this paper.
There has been some discussion over the uniformity of paragrammatic speech in Wernicke’s and Broca’s aphasia. Bates et al (1991) claim that fluent and non-fluent aphasic speech contains similar morpheme substitution error rates in a morphologically rich language such as German. On the other hand, in a Cantonese study (Law, S-P., Cheng, M-Y., 2002), Wernicke’s aphasics performed better than Broca’s aphasics on all categories of grammatical morphemes. The authors suggest that the distinction between Cantonese fluent and non-fluent groups is quantitative rather than qualitative. However, Heeschen (1985) described the incorporation of syntactic illformedness and morphological errors in early views of Wernicke’s aphasia in a form which is dissimilar to that seen in Broca’s aphasia. Further studies have found that Wernicke’s and Broca’s patients perform differently in their production of function words, verbs, pronouns, referential elements and case. In Dutch spontaneous speech (Kolk and Heeschen, 1992), it was found that Broca’s patients omit function words while Wernicke’s patients both substitute and omit function words. Broca’s patients also have a tendency to omit the main verb of the sentence, whereas Wernicke’s do this relatively infrequently.

In a study of speech production in Russian Broca’s and Wernicke’s aphasia, Tsvetkova & Glozman (1975) used three tasks; patients were asked to describe the history of their illness, a story about the North and a story using a well-known painting as a prompt. At word level, both groups erred in their use of case on nouns, but in number, Broca’s patients were more likely to err on nouns and adjectives whereas Wernicke’s patients found pronouns problematic. At sentence level, Wernicke’s patients either overused or omitted object nouns, while Broca’s patients tended to omit both subject and object nouns. Tsvetkova & Glozman conclude that grammatical word forms are impaired to varying degrees in both forms of aphasia although they do not decide whether the underlying deficit is due to incomplete retrieval of the lexicon information on the verb, or rather due to an inability to use this information in syntactic impairment.

In the production of pronouns in spontaneous speech it has also been found that Wernicke’s patients produce higher proportion of pronouns than normal (Bates and Wulfeck, 1989). Further research by Ruigendijk & Avrutin (2003) suggests that
Broca’s patients are selectively impaired in their interpretation of pronouns, whereas Wernicke’s patients have a more general problem interpreting referential elements. They conclude that while Wernicke’s patients suffer from a lexical deficit that causes the interpretation errors, Broca’s patients err due to syntactic limitations.

In the use of case, Bates and Wulfeck (1989) suggest a pattern can be seen in case substitution errors by fluent and non-fluent aphasics. In a sentence production task Broca’s and Wernicke’s patients both make case substitution errors, but Broca’s patients tend to overuse default nominative whereas Wernicke’s patients are less consistent and are more likely to substitute any case. In a single case study by Ruigendijk (2002), a German Wernicke’s patient made no case errors in spontaneous speech, but showed comparable errors to those made by Broca’s patients in the experimental task and overgeneralisation of one case, the accusative.

The present study is based on an experiment by Ruigendijk (2002) which examines the use of case marking in Russian Broca’s patients. Ruigendijk tested 7 Russian and 10 German Broca’s patients and found that the omission of a case-assigning category, for example, a verb, leads to incorrect case marking on the object DP, and sometimes also the subject DP. However, when the case-assigner is present, nominative case and accusative case are relatively unimpaired. Dative and instrumental case, on the other hand, are significantly more impaired, even when a case-assigner is present. Ruigendijk assumes that this pattern can be accounted for in terms of structural and lexical assignment by the verb: nominative and accusative case are said to be \textit{structurally assigned} at S-structure level by the verb, whereas dative and instrumental case are \textit{lexically assigned} at D-structure level by the verb. The suggestion is that Broca’s aphasic patients can assign case and produce the correct case morphology when case is structurally assigned but cannot when case is lexically assigned. The deficit is functionally localised at the level of structural encoding (following Bastiaanse, 2001, in press) resulting in difficulties with the processing of lexical (lemma) information. The present study seeks to confirm the previous findings regarding the Broca’s patients and also to find out whether a similar dichotomy can be found in a Russian Wernicke’s patient, KI. Will linguistic constraints on grammatical morphemes account for errors in Wernicke’s speech production?
Since little research has drawn on case-marking abilities of both Broca’s and Wernicke’s patients in speech production, the aim of this present study is to clarify some of the issues presented above. Since omission and substitution effects are strongly correlated with the morphological features of a language, Russian will be used to explore the extent to which omissions and/or substitutions of case show patterns of generalisation in Wernicke’s and Broca’s aphasia. A spontaneous speech task is used to study the overall production of case and use of case-assigners. The results are compared alongside an experimental task in which the nominative, accusative, dative and instrumental cases are examined.

3.0 The study

3.1 Aim

This study seeks to find out whether the production of morphological case marking is related to the presence or absence of a case-assigning category, and if so whether a pattern of impairment can be seen in individual patients. The aim is twofold. First of all to replicate and reinforce the Russian results of the Broca’s patients in Ruigendijk’s study (2002); namely that

a) in Russian speech production in Broca’s aphasia, the production of correctly case-marked DPs is related to the realization of a case-assigning category, such as the finite verb in AgrS, the transitive verb in AgrO or a preposition.

b) in the absence of a case-assigning category, the default nominative case is overused.

c) in the presence of a case-assigning category, the nominative and accusative are the least impaired cases; the instrumental case is more impaired than nominative and accusative; the dative case is more impaired than the other cases.
The second aim of the study is to investigate the use of case in Wernicke’s aphasic speech. Based on previous studies regarding fluent aphasic speech production, it is expected that Wernicke’s speech production will also exhibit agrammatic features, thus above hypotheses relating to Broca’s speech production will also be tested on Wernicke’s speech production. Finally, given the differences in speech production between Broca’s and Wernicke’s aphasia, the use of case marking is also expected to vary. Thus, the following hypotheses will attempt to address this possible outcome:

- **d) The production of DP’s in Wernicke’s speech production differs qualitatively compared to Broca’s speech production.**

### 3.2 Method

#### 3.2.1 Participants

Three patients with Broca’s aphasia and one patient with Wernicke’s aphasia participated in the study. All were male and residents of St. Petersburg, Russia. None of the patients had other impairments. The test was conducted in St. Petersburg at two polyclinics specialising in aphasia. One Broca’s patient and one Wernicke’s patient were tested by a Russian aphasiologist under the supervision of a clinical linguist (myself). The other two Broca’s patients were tested by a clinical linguist and supervised by a Russian aphasiologist. Both these last two patients gave absolute assurance that they could understand me, since although I speak fluent Russian, it is not my native language. The data were compared against the same results from 10 non-brain damaged Russian speakers taken from Ruigendijk’s data.

#### 3.2.2 Broca's patients

KO, TSV and TI were all classified as having Broca’s aphasia and their speech was likewise typically agrammatic in style. All were right-handed and were aphasic as the result of a stroke in the left hemisphere. The mean age of the three Broca’s patients was 55 years old and time post onset was 2 years 6 months, 5 months, and 2 years 1
month respectively. Reading and comprehension in each patient was good and each was able to produce the written words from the test material. All three patients had completed higher education. Prior to their strokes, KO, TSV and TI had followed professions as infrastructure administrator, mathematician and power line engineer respectively.

3.2.3 Wernicke's patient - KI

KI is a 64 year old man who suffered a CVA in what was termed the middle artery 5.5 months previous to testing. He had no hemiplegia at time of testing. Although the patient report states that his CVA is located in the right hemisphere and he is reported to be right handed, according to his performance and medical record his diagnosis is that of a Wernicke’s patient. This was confirmed by the Luria test materials and can also be seen by the strongly typically Wernicke-like tendencies in his spontaneous speech.

KI’s spontaneous speech is fluent with normal intonation but often void of content and he has word finding problems:

KI: Мне надо снять еще вот это… А где вот это –то
    I still need to take off this thing… And where is that thing

I: Очки
Glasses

....

I: В больнице?
At the hospital?
KI: Два раза я все это… Лариса конечно… не Лариса конечно.. мама моя
    Twice I all that… Larissa of course… not Larissa of course.. my mother
I: Не переживайте. Может водички дать попить?
    Don’t worry. Would you like a bit of water to drink?
KI: Ещё не хватало!

No way!

(I = interviewer)

Sometimes phonological errors are also produced, often as a result of his anomia: ‘Тал тал – галстук’ (‘tal tal – galstuk tie). Different forms of phonological errors are made; real word substitutions, for example, noun for a verb; пакет пакет (packet) instead of капать капет’ (to drip); non-word substitutions машин машик maschik – target: мужчина muschine (man.DAT), and stress transpositions [do’rogu] – target: [daro’gu] (the way.ACC).

Very rarely, agreement and number errors are made, for example, KI refers to one woman in the room as женщины women in the plural, and uses a masculine form when talking to a woman when the feminine form would be the appropriate ending; понил? Did you understand.MASC.SING? (to a female aphasiologist).

In comprehension, KI reading skills are intact; he was able to read and comprehend the text as well as produce the written words orally.

KI was a former chauffeur and had completed standard elementary school education. He has no visual or auditory impairments other than the fact that he wears glasses to read. He had a strong interest in memorabilia and would often give stories and bring along old photographs or letters during sessions for us to see.

<table>
<thead>
<tr>
<th>PATIENT NO.</th>
<th>NAME</th>
<th>M/F</th>
<th>AGE</th>
<th>HANDEDNESS</th>
<th>TIME ONSET (MONTHS)</th>
<th>ETIOLOGY</th>
<th>WESTERN CLASSIFICATION</th>
<th>LURIA CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KI</td>
<td>M</td>
<td>64</td>
<td>Right?</td>
<td>18</td>
<td>CVA R-Hemi Wernicke’s</td>
<td>Sensory</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>TSV</td>
<td>M</td>
<td>66</td>
<td>Right</td>
<td>5</td>
<td>CVA L-Hemi Broca’s</td>
<td>Motor</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>TI</td>
<td>M</td>
<td>56</td>
<td>Right</td>
<td>25</td>
<td>CVA L-Hemi Broca’s</td>
<td>Motor</td>
<td></td>
</tr>
</tbody>
</table>

* According to the classification proposed by A.R. Luria there are six types of aphasia, which differ in respect to the localization of impairment in the brain: afferent motor aphasia, efferent motor aphasia, acoustic-gnostic aphasia, acoustic-mnestic aphasia and semantic aphasia. For simplicity’s sake, I have used here the terms motor aphasia and sensory aphasia which are analogous to the Western equivalents of Broca’s aphasia and Wernicke’s aphasia respectively.
Table 2 Patient Data

3.2.4 Materials

Two tasks were chosen: a free speech task and a DP insertion task. These are explained in more detail below. The tasks are similar to those of an earlier study Ruigendijk (2002) which were designed for Russian speaking patients with Broca’s aphasia. For the present study, two of the tasks from Ruigendijk (2002) were chosen which could also be used to test Wernicke’s patients for case marking abilities.

Task 1 Free Speech Task
The participant engaged in general discussion with the interviewer along the lines of history of their illness, activities over the weekend or family. This was done to elicit free speech data which could be analysed for frequency and type of use of DPs. These data were then compared to the experimental task.

Task 2 DP insertion task
This task consists of 89 items, each item consisting of a picture with an incomplete sentence. For example a picture of a man saving a woman, with the sentence underneath “…is saving the woman.”:

![Image of a man saving a woman]
Figure 5 Example item in DP insertion task “… rescues the woman”

The participant was asked to look at the picture and then read the sentence below it out loud and fill in the missing DP, using the picture as a cue. The target DPs required either nominative, accusative, dative, or instrumental case. Items used either single or double object sentences. The case-assigning verb was always given in the sentence, so that the task could test for the ability to assign case when the case-assigning category is present.

Examples of sentences in each of the six conditions:

*Single object*

1. Nominative: e.g. “the man”
   
   ... The man.NOM greets the woman

2. Accusative: e.g. “the man”
   
   The woman pushes...the man.ACC

3. Dative: e.g. “the man”
   
   The woman phones...the man.DAT

4. Instrumental: e.g. “the bottle”
   
   The woman threatens the man...with the bottle.INS

*Double object*

5. Accusative: e.g. “the man(DAT), the book(ACC)”
   
   The woman shows the man…the book.ACC

6. Dative: e.g. “the man(DAT), the hammer(ACC)”
   
   The woman gives…the man.DAT…the hammer

The different conditions allow for a number of comparisons to be made. In the single object sentences, nominative versus accusative versus dative versus instrumental case assignment can be analysed. Subject versus object case assignment can be compared in the nominative versus accusative and dative single object sentences. Finally, double versus single object sentences can be compared for sentence complexity effects.
There were no time restraints made during the test, although if the participant was struggling for a long time with a response the interviewer decided when it was appropriate to move on to the next item. Alternatively, in the case of word finding problems the beginning of the word was said as a prompt by the interviewer, or if necessary, a ‘primer’ was given. For example, the sentence “The woman carries the …(man)” may be primed by “Here is a man, here is a woman”. In the case of reading problems with specific words, the participant repeated the word read out by the interviewer. On one or two occasions where the Wernicke’s patient was not able to provide a response, the interviewer tried to elicit a response by giving a multiple choice list of the target DP in four cases.

The test was carried out over one or two sessions according to how much the participant and/or interviewer felt he could cope with.

3.2.5 Scoring

The scoring system follows as closely as possibly to that of Ruigendijk (2002) so that comparisons could be made with her data.

Free Speech

All the DPs produced during the free speech task were counted and analysed to see if a case-assigning category (e.g. a verb, preposition or quantifier) was present and whether the DP was correctly case marked (see below for examples). This was to find out whether the aphasic subjects could correctly case mark DPs once they had produced the case-assigning category. Personal pronouns are also counted as DPs.

An utterance with both a case-assigning category and correct case morphology on the DP can be seen in the following example:

a) Correct case marker with case-assigning category:

Девочка моет собаку.

The girl.NOM washes the dog.ACC

If a case-assigning category was present, a DP may be produced in the incorrect case. In this example, the nominative case is produced instead of the genitive:
b) Incorrect case marker with case-assigning category:

Три инсульт

Three *stroke.NOM.SING

Should be:

three strokes. GEN.SING

(KO: Broca’s )

If a case-assigning category was not present, the correct case marking may still be
given on the DP:

c) Correct case marker with no case-assigning category

Два раза я все это… Лариса конечно… не Лариса конечно.. мама моя

Dva rasa ya vsyo eto…Larissa kanyeshna…nye Larissa kanyeshna..mama maya

Two times I all that…Larissa.NOM of course…not Larissa.NOM of course…my

mother

Twice I all that… Larissa of course… not Larissa of course.. my mother

(KI: Wernickes)

DP-insertion task

Sometimes the participants gave more than one response to an item. In these cases the
response which best matched the picture was analysed. Responses which were not the
target response were also accepted as correct if they were other grammatically and
semantically feasible variants such as synonyms.

3.2.6 Statistical Analysis

Because there are relatively few aphasic participants in this study, non-parametric
tests are used to compare across and within groups. The Mann-Whitney-U test is used
to compare the aphasic against the normal data, and Wilcoxon signed rank or
Friedmann’s test is used to compare within group scores. This also follows the
methodology in Ruigendijk’s study and should allow for easy comparison with her
data.
3.3 Results

3.3.0 Free Speech

The participants engaged in general discussion with the interviewer along the lines of history of their illness, activities over the weekend or family. The interviewer stopped the discussion when she saw appropriate. The discussions with the Broca’s patients were fairly short and sentences produced were often on word level. The volume of speech produced by the Wernicke’s patient was greater and he was willing to talk at great length on a topic.

The frequency and type of use of DPs was analysed, namely whether the DPs was produced with or without a case-assigner such as a verb or preposition, and if case-assigner was produced, whether the case corresponded correctly with the case-assigner. When a case-assigner was absent, the number of DPs in the default nominative case was analysed in comparison to other cases produced.

3.3.1 Broca’s

The results of the three Broca’s patients in the free speech data are given below:

<table>
<thead>
<tr>
<th>BROCA’S</th>
<th>Case-assigner present</th>
<th>Case-assigner absent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Case</td>
<td>Incorrect Case</td>
</tr>
<tr>
<td>TSV: Number DPs</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>TI: Number DPs</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>KO: Number DPs</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Mean</td>
<td>5.00</td>
<td>0.33</td>
</tr>
<tr>
<td>SD</td>
<td>3.00</td>
<td>0.58</td>
</tr>
</tbody>
</table>

Table 3 TSV, TI and KO Broca’s : Free Speech

A total of 26 DPs were produced in the three Broca’s patients. The majority of DPs (62.5%) were produced with a case-assigner. There was only one instance of an
incorrect case produced with a case-assigner. Case was thus correctly assigned 96% of the time when a case-assigner was present. The default nominative was used without a case-assigner 38% of the time. Overall the nominative case was produced more frequently than the other cases – 69% of all DPs produced in the free speech data were in the nominative case:

**Individual scores**

The breakdown of the individual scores for the case produced with each DP are given below:

<table>
<thead>
<tr>
<th>TOTAL DPs</th>
<th>NOM</th>
<th>GEN</th>
<th>DAT</th>
<th>ACC</th>
<th>INS</th>
<th>PREP</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSV</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>TI</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>KO</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total DPs per case</td>
<td>18</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 4 TSV, TI and KO Broca’s: Total number of each case marker produced (including those without case-assigners)

**TSV**

TSV produced a total of 14 DPs, and used every case at least once apart from the instrumental. More DPs were produced with case markers than without. When no case-assigner was present, TSV used the default nominative case every time.

**KO**

KO’s speech was quite severely impaired, with many utterances at word level. He produced only nominative cases in his free speech, with equal numbers of DPs with case-assigner as without case-assigner. No personal pronouns were produced. One error in case was made where genitive should have been used instead of nominative. This was where the number three requires the genitive case: Три инсульт (NOM) *Three stroke* (NOM) was produced instead of Три инсульта *Three strokes* (GEN).
Few DPs were elicited from TI’s spontaneous speech data; those produced had case-assigners present, except for one occasion where a DP in default nominative was used alone. This is an elliptical utterance and is perfectly grammatical:

I: А что тогда случилось?
And what happened then?

P: Инсульт
Stroke(NOM)

(P = patient, I = interviewer)

Compiled scores

The data from the three Broca’s patients were added to the free speech data of seven more Broca’s patients taken by Ruigendijk (2002) (see appendix for table).

Free Speech: Brocas

![Bar chart showing the number of DPs produced for each case assignment]

Figure 6 Results of Broca’s patients in the free speech task

A total of 198 DPs were produced by the 10 Broca’s patients, and all the DPs were produced with case morphology. Of these, 87 DPs (43.9%) were elicited in the context of a case-assigning category, e.g. a verb or preposition. When no case-assigning category was present, the majority (82.6%) of DPs produced were in the nominative case.
Error Analysis
In the free speech samples, out of all the DPs which were produced with a case-assigning category, only two DPs had incorrect case marking. Where a case-assigning category was not present, other cases were used 17.4% of the time. Most of these could be analysed as elliptical utterances (see Ruigendijk, 2000 for more detail).

3.3.2 Wernicke's
In the free speech task, KI produced a total of 37 DPs. 33 DPs (89%) had a case-assigner present. One sentence contained all 4 DPs produced without a case-assigner. All 4 DPs without a case-assigner were in the nominative case. When a case-assigner was present, case was assigned correctly 100% of the time.

Free Speech: WERNICKES (KI)

![Graph showing the distribution of correct and incorrect case assignments with and without case assigners.]

Of the 37 DPs elicited, 70.3% were in the nominative case:

Table 5 Free Speech – Wernicke; Total cases produced

<table>
<thead>
<tr>
<th>KI</th>
<th>NOM</th>
<th>GEN</th>
<th>DAT</th>
<th>ACC</th>
<th>INS</th>
<th>PREP</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPs</td>
<td>26</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>37</td>
</tr>
</tbody>
</table>

Other case marking was mostly generated by set expressions: слава Богу(DAT) *thank God*; ради Бога(GEN) “be my guest” (in the context used, lit: for the sake of God); минуточку(ACC) *wait a minute.*
**Error Analysis**

There are no examples in KI’s free speech sample of incorrect case marking. One DP (сиденье seat) was frequently used as a filler in KI’s speech and did not always hold the properties of a DP. For example, in one utterance, this word was superfluous to the number of arguments required for the verb:

я же сиденье не работал дома

I.NOM [EMPH] seat.NOM [NEG] work.PAST.SING.MASC at.home

*But I seat didn’t work at home.*

This was not included in the DP analysis.

**3.4 DP insertion task**

In this task the participant was required to fill in the noun with the correct case marking, given an incomplete sentence. The given sentence included a case-assigning category such as a verb or preposition.

In the case of the Broca’s patients, the test was completed in one session in around 45 minutes, and most reported that it was an easy task to do. The Wernicke’s patient, KI, required two sessions to complete the task. This was due to a general slower and more hesitant response, especially with certain cases (instrumental, accusative), and much greater verbal output, i.e. comments on how the pictures looked with (e.g. a man hitting a woman with a bottle was a favourite!) and occasional interruptions between items to tell a story.

**3.4.1 Broca’s**

**3.4.1.1 Individual scores**

The results of the DP insertion task for the three Broca’s patients are summarised below:
<table>
<thead>
<tr>
<th>BROCA’S</th>
<th>Single Object Sentences</th>
<th>Double Object Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>% correct</td>
<td>NOM</td>
<td>ACC</td>
</tr>
<tr>
<td>TSV</td>
<td>100</td>
<td>90</td>
</tr>
<tr>
<td>TI</td>
<td>100</td>
<td>95</td>
</tr>
<tr>
<td>KO</td>
<td>100</td>
<td>85</td>
</tr>
<tr>
<td>Mean</td>
<td>100</td>
<td>90.0</td>
</tr>
<tr>
<td>SD</td>
<td>0.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Table 6 Individual percentage scores of correct DPs in DP insertion task, mean and standard deviation (SD) of TSV, TI and KO. NOM = nominative, ACC = accusative, DAT = dative, INS = instrumental

The three Broca’s patients made no omissions, only substitutions for case.

**Single-object sentences**

Overall performance on the insertion of the nominative case was at ceiling level. The insertion of correct DPs in the single object accusative case sentences was slightly less (90%). The performance in instrumental case (85%) and the single object dative case (76.19) were weaker.

**Comparison of the double-object versus single object sentences**

The percentage of correct DP insertions in the accusative single object sentences (90%) was similar to that of the accusative double object sentences (93.3). Performance in the dative was the poorest in both single object (76.19) and double object (63.33) sentences. The drop in performance in the dative case was largely due to a specific impairment in the dative for one of the patients (KO) (see below).

**TSV**

TSV performed at ceiling on the nominative items and the accusative and dative double object DPs. The single object accusative and dative cases and the instrumental case incurred some errors, but overall the cases were inserted correctly into the sentence almost every time.
TI
TI showed no impairment on the nominative and made only a few errors throughout the DP insertion task. These were fairly evenly distributed across the remaining accusative, dative and instrumental cases. The greatest number of errors were made in accusative double object sentences (80% correct).

KO
The dative case is most heavily impaired (30% correct overall), with no correct insertions of the dative in the double object sentences. The insertion of instrumental (70%) and accusative cases (85%) is less problematic. When the incorrect case was chosen, KO chose the default nominative every time as a substitute.

3.4.1.2 Compiled scores
The results from the three Broca’s patients were merged with the seven patients from Ruigendijk’s data. Statistical analysis was carried out to see if there were any trends in the overall performance of DP insertion in Russian Broca’s patients. The combined data is given in the table below:

<table>
<thead>
<tr>
<th>% correct</th>
<th>Single Object Sentences</th>
<th>Double Object Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOM</td>
<td>ACC</td>
</tr>
<tr>
<td>Broca’s</td>
<td>89.00</td>
<td>82.00</td>
</tr>
<tr>
<td>SD</td>
<td>19.26</td>
<td>13.17</td>
</tr>
<tr>
<td>Controls</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>SD</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 7 DP insertion task. Mean % correct scores for all 10 Broca’s patients and 10 non-brain damaged controls. SD = Standard Deviation. NOM=nominative, ACC=accusative, DAT=dative, INS=instrumental.

The overall performance of the Broca’s patients was significantly worse than that of the non brain-damaged control subjects (MWU: z= -6.371, p=0.00).
**Single Object Sentences**

The Broca’s patients scored significantly lower than the non-brain damaged speakers on all single object sentences testing production of nominative, accusative and dative, as well as instrumental sentences (nominative, MWU: $z=-2.163$, $p<0.05$; accusative MWU: $z=-4.049$, $p<0.001$; dative, MWU: $z=-2.513$, $p<0.05$; instrumental, MWU: $z=-3.253$, $p<0.01$).

Within the Broca’s group, there was no significant difference between the production of nominative and accusative DPs (Wilcoxon: $z=-1.791$, $p=0.073$), or between dative and accusative DPs (Wilcoxon: $z=-1.480$, $p=0.139$). However, dative DPs were significantly more impaired than nominative DPs (Wilcoxon: $z=-2.552$, $p<0.05$).

**Double Object Sentence**

In the double object sentences the Broca’s patients performed significantly worse than the non brain-damaged speakers (accusative MWU: $z=-2.164$, $p>0.05$; dative, MWU: $z=-2.954$, $p<0.01$).

**Single Object versus Double Object Sentences**

When comparing production of DPs by the Broca’s patients in single object sentences against double object sentences, the insertion of the accusative in single object sentences was significantly worse than insertion of the accusative in double object sentences (Wilcoxon: $z=-2.059$, $p<0.05$). There was, however, no significant difference in the insertion of dative DPs in single and double object sentences (Wilcoxon: $z=-1.342$, $p=0.18$).

**Error Analysis**

In the DP insertion task the Broca’s patients made 196 errors in all. 164 of these errors were made by Ruigendijk’s Broca’s patients, of which 3% consisted of omission of the case-marking morpheme and 22% accounted for errors such as irrelevant/nil reactions and omission of the entire DP.

Of all errors made, most were in the ‘overuse’ of the nominative case i.e. the nominative case ending was used instead of the correct case (37%). Other substitution errors were made in the accusative (24%), dative (12%), genitive (6%) and instrumental (1%).
Some patients tended to overuse one particular case e.g. KO consistently used a nominative case ending instead of the required dative.

### 3.4.2 Wernicke’s

The results of the DP insertion task for the Wernicke’s patient, KI, are as follows:

<table>
<thead>
<tr>
<th>WERNICKE’S</th>
<th>Single Object Sentences</th>
<th>Double Object Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOM</td>
<td>ACC</td>
</tr>
<tr>
<td>% DPs correct</td>
<td>90.5</td>
<td>60.0</td>
</tr>
</tbody>
</table>

A clear pattern emerged in the use of case in DP insertion in KI. The pattern also carried across both single and double object sentences. The instrumental case was most impaired (15.8% correct), followed by the accusative (60% single object, 63.6% double object). Performance on the dative and nominative cases was much higher (nominative: 90.5%, dative single object: 85.7% dative double object: 90%).

**Error Analysis**

KI made both substitutions (26) and omissions (6) of DPs in the DP insertion task. The dative (12 substitutions) or the nominative case (10 substitutions) was most likely to be used instead of the target case. The accusative was rarely substituted (2) and the genitive and instrumental cases were never used.

### 3.5 Summary

The overall results from the free speech task show that both the Broca’s patients and the Wernicke’s patient could use case-assigners and assigned the correct case to the DPs when a case assigner is present. When a case-assigner was not present, the default nominative case was the preferred case. In the Wernicke’s patient, KI, the case-assigner was rarely absent.

The preference for the nominative case was not so clearly represented in the DP insertion task. A summary of the results for the DP insertion task are given below:
Although the nominative case was most likely to be ‘overused’ by the Broca’s patients when an error was made, the accusative was also substituted, and to a lesser extent, the other cases as well. Although there was some individual variation in the ability to correctly insert DPs, the general pattern showed that the instrumental and nominative DPs were the least problematic cases. The accusative case was produced correctly more often in single object than in double object sentences. The dative case was the hardest case to insert.

The Wernicke’s patient showed quite a different pattern. KI had no problems inserting the nominative and dative cases, but also tended to overuse these same cases in error. The accusative case was more problematic, but was only used twice in error. Performance was no different in single and double object sentences. The instrumental DPs were the hardest to insert into the sentences and the instrumental was never used in place of another case.

In both the Broca’s and Wernicke’s patients cases were substituted for rather than omitted.
4.0 Discussion

This study looked at the production of case marking in Russian Broca’s and Wernicke’s aphasia. Two tasks were used. A free speech task measured the overall ability to produce case in relation to the realisation of a case-assigning category. The experimental task investigated the possibility of a pattern of sparing and impairment of one case over another by testing the ability to insert the correctly case assigned DP into a given single or double object sentence requiring either the nominative, accusative, dative or instrumental case.

Firstly, the findings confirm that the morpho-syntactic abilities of both Broca’s and Wernicke’s aphasic patients are indeed impaired. The aphasic participants scored overall significantly lower than non-brain damaged controls in the DP insertion task. Secondly, the results demonstrate that in both groups case substitutions are made rather than case omissions. This is also reflected in previous studies using sentence production tasks to test morpho-syntactic abilities in aphasic patients (Bates and Wulfeck, 1989; Ruigendijk, 2002).

4.1 Production of case-assigning categories and overuse of the default nominative case

The results of the Broca’s patients confirm the first two hypotheses of the study, and echo the previous findings by Ruigendijk (2002), namely that in Russian speech production, the production of correctly case-marked DPs is related to the realisation of a case-assigning category and that in the absence of a case-assigning category, the default nominative case is overused. In the free speech task, Broca’s patients frequently produced utterances which included nouns but no verbs. Where a case-assigner was present, case was assigned 97.75% correctly, indicating that Broca’s patients can produce the correct case morphology if a case-assigning category such as a verb or preposition is given in the utterance. However, utterances were frequently produced without case-assigners, and in the majority of DPs produced (82.6%), the default nominative case was used. Other cases i.e. genitive, dative, accusative, instrumental and prepositional were rarely used when no case-assigner was present.
This poses the question as to why it is that the nominative case is preferred over the other cases? Perhaps Broca’s patients are trying to avoid producing case-assigning categories which they find more problematic, and this naturally produces nouns in the nominative case, which is, after all, the default case. In some patients, utterances produced were frequently at word level and can be taken as elliptical. For example, in the following dialogue the reply given by the Broca’s patient is perhaps more colloquial, but nonetheless perfectly grammatical:

I:  А что тогда случилось?  
And what happened then?  
P:  Инсульт  
Stroke,NOM  

(I = interviener, P = patient)

Since a DP in the nominative case can stand alone as a grammatical and comprehensible utterance and it requires no case-assigner to be understood, this tendency to use the nominative case may then be carried over to more syntactically complex utterances so that even when another case is required on a DP, the default nominative is still preferred. This also suggests that grammatical complexity plays a large role in sentence construction - a phenomenon which has been echoed in other studies (Kim and Thompson, 2002; Bastiaanse & Edwards, 2004). The DP insertion task shows that Broca’s patients are indeed able assign case correctly if necessary and to perform well the majority of the time. The lemma level information is intact, however, there is a syntactic problem at the level of grammatical encoding which may be related to complexity of the utterance. First of all, however, let us have a look at how the Wernicke’s patient, KI, performed in the free speech task.

KI consistently produced DPs with a case-assigner (89%), and assigned case correctly 100% of the time. So, unlike the Broca’s patients, case-assigners were not frequently omitted and neither was the default nominative was overused in the absence of a case-assigner. This is also in line with a German Wernicke’s patient tested by Ruijendijk (2002). It might therefore as first seem that KI has no morphosyntactic impairment with case. However, if we look qualitatively at the breakdown of DP’s, the result is
surprising. KI produces 26 DPs in the nominative case in comparison with none in the prepositional case and only one in each of the instrumental and genitive cases. Furthermore, other case marking was mostly generated by set expressions. This yields perhaps only anecdotal evidence of either preference for the nominative case or a relatively unimpaired nominative case in comparison with the other cases, since only a sample of speech was taken. However, further findings from the DP insertion task strengthen this view.

4.2 Other cases

The findings show that patients use different techniques when producing DPs in the two different tasks. In free speech, the patients rely heavily on the nominative case; however, the findings of the DP insertion task show differential performance in other cases as well. The third hypothesis of the study states the following:

**In the presence of a case-assigning category, the nominative and accusative are the least impaired cases; the instrumental case is more impaired than nominative and accusative; the dative case is more impaired than the other cases.**

The overall results from the 10 Broca’s patients support this hypothesis. The reason for the difference in results between tasks is likely to be due to the fact that in the DP insertion task, patients cannot rely on grammatical elliptical utterances in the nominative case and recognise that to produce a grammatically acceptable sentence, other cases than the nominative are required (see also Ruigendijk, 2002). Concerning the 10 Broca’s patients, there is one result from the DP insertion task that varies from the statistical analysis made in the original seven Broca’s patients from Ruigendijk’s study. The results including the three new patients show that inserting accusative DPs in sentences requiring two accusative DPs is significantly harder than insertion of the accusative in single object sentences. In the original study of the seven Broca’s patients, no statistical effect was seen in comparing single and double object sentences. This effect is due to scores at ceiling level in TSV and KO for double accusative sentences.
The difference in results emphasises the importance of analysing the impact of individual patterns of impairment. Previous studies have also observed this effect. For example, Ruigendijk (2002) reports two out of nine German Broca’s aphasics who over-generalised dative case for the accusative. The results of the present study also show individual patients may have a marked impairment in one case. For example, in the DP insertion task, one of the Broca’s patients, KO performed much lower in the dative case than in any of the other cases. Moreover, double object sentences in the dative case (0% correct) were more problematic than single object sentences in the dative case (43% correct). It seems that some patients exhibit an overuse of one particular case, while others manifest an impairment that runs along a continuum.

The above hypothesis does not hold for KI, the Wernicke’s patient. In KI the following pattern was observed:

**In the presence of a case-assigning category, the nominative and dative are the least impaired cases; the accusative case is more impaired than the nominative and dative; the instrumental case is more impaired than the other cases.**

KI exhibited what may be considered a specific impairment in particular cases. The results reveal a striking pattern of sparing and impairment. Similar to the Broca’s patients, the impairment is not manifested in spontaneous speech, but becomes apparent in the experimental task. KI overused the dative case in the DP insertion task - almost three quarters of errors are dative substitutions; the remaining are nominative substitutions. He had great problems inserting the instrumental case (15.8% correct), and to a lesser extent, the accusative case (62% correct).

One theory that may explain the pattern exhibited in KI is as follows. First of all, dative case is overused. In the semantic interpretation of a DP, the thematic role of Beneficiary is related to the dative case. Note that nominative case (related to Agent) is overused in the free speech task, and accounts for one third of substitutions in the DP error analysis in the DP insertion task. Let us assume that KI imposes a certain semantic pattern on the participants of an event. Thus, he uses the Agent-Beneficiary thematic relation for each event. This results in the dative case being produced
correctly, but when another case such as the accusative is required, he incorrectly chooses the dative case again, since this corresponds to his incorrect semantic pattern of an event.

Why then does KI perform so poorly on the instrumental case? The instrumental case is used on adjuncts, which are optional. It cannot take arguments and is therefore not dependent on theta-role assignment. Hence it does not fit in with the KI’s semantic pattern at all and he either gives null answers or substitutes other cases, mainly the default nominative case.

If this theory proves to be true, the imposition of a certain semantic pattern may occur in different forms. For example, in a case study by Ruigendijk (2002), a German Wernicke’s patient also showed an overgeneralisation of one case, the accusative. This is an effect which is also documented in Broca’s patients. Further studies of case-marking in Wernicke’s speech production are needed to see whether the pattern in KI can be generalised across Wernicke’s patients, or whether an impairment in morphological case-marking is exhibited in different forms in different patients. Likewise investigatory on-line and off-line tasks may help determine whether compensatory tactics are made during sentence processing whereby the production of one particular spared case or one particular semantic pattern is used to the detriment of a more impaired case or semantic pattern. Thus it may not be useful to only consider a patient as having an impairment in one case only if the case is not used. It is also possible that the overuse of a case may also constitute an impairment.

The final hypothesis is as follows:

The production of DP’s in Wernicke’s speech production differs qualitatively compared to Broca’s speech production

The findings do not conclusively prove that Wernicke’s and Broca’s patients qualitatively differ. However, it is likely that some patients exhibit an overuse of one particular case, while others manifest an impairment which runs along a continuum. Moreover, a combination of the two manifestations may be seen. Further studies are needed to ascertain whether the overuse of one particular case is a semantically
motivated impairment, while a general degradation of case along a continuum is
syntactically motivated.

**Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP</td>
<td>Determiner Phrase</td>
</tr>
<tr>
<td>NOM</td>
<td>Nominative case</td>
</tr>
<tr>
<td>ACC</td>
<td>Accusative case</td>
</tr>
<tr>
<td>DAT</td>
<td>Dative case</td>
</tr>
<tr>
<td>INS</td>
<td>Instrumental case</td>
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<td>Fem.</td>
<td>Feminine</td>
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<td>OZ</td>
<td>interviewer</td>
</tr>
<tr>
<td>I</td>
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</tr>
<tr>
<td>PRES</td>
<td>Present Tense</td>
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<tr>
<td>PAST</td>
<td>Past Tense</td>
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**Acknowledgements**

To all the patients and control subjects who were so willing to be tested, to Esther Ruigendijk for making her test available, and to Olga Zychkova for her invaluable help and advice. My thanks also to Roelien Bastiaanse for her unswerving patience and support and to Sergey Avrutin for his useful comments.

**References**


Franks, S. (1995) Parameters of Slavic Morphosyntax *Oxford University Press*


Ruijgendijk & Avrutin (2003) The comprehension of pronouns and reflexives in agrammatic and Wernicke’s aphasia *Brain and Language, in press*


# Appendix

## Free Speech Data

<table>
<thead>
<tr>
<th>BROCAS Case Assigner present</th>
<th></th>
<th></th>
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</thead>
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<td>Incorrect Case</td>
</tr>
<tr>
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<tr>
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<tr>
<td>SD</td>
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<td>0.58</td>
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Table 8 TSV, TI and KO Broca’s patients: Free Speech

<table>
<thead>
<tr>
<th>BROCAS Case Assigner present</th>
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<th></th>
</tr>
</thead>
<tbody>
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<td>0.38</td>
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Table 9 Ruigendijk’s 7 Broca’s patients: Free Speech

<table>
<thead>
<tr>
<th>KI (Graph) Case Assigner present</th>
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<tr>
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<td>Correct Case</td>
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</tr>
<tr>
<td>WERNICKES: KI</td>
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<td>0</td>
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</table>

Table 10 Wernicke’s patient KI: Free Speech
DP insertion task

<table>
<thead>
<tr>
<th>TOTALS (Graph)</th>
<th>Single Object Sentences</th>
<th>Double Object Sentences</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>NOM</td>
<td>ACC</td>
</tr>
<tr>
<td>mean</td>
<td>100.0</td>
<td>90.0</td>
</tr>
<tr>
<td>SD</td>
<td>0.0</td>
<td>5.0</td>
</tr>
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</table>

Table 11 TSV, TI and KO Broca’s: DP insertion task

<table>
<thead>
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<th>TOTALS</th>
<th>Single Object Sentences</th>
<th>Double Object Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>ACC</td>
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<tr>
<td>Mean</td>
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<td>78.6</td>
</tr>
<tr>
<td>SD</td>
<td>21.7</td>
<td>14.4</td>
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</table>

Table 12 Ruigendijk’s 7 Broca’s patients: DP insertion task

<table>
<thead>
<tr>
<th>TOTALS</th>
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<th>Double Object Sentences</th>
</tr>
</thead>
<tbody>
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<td>NOM</td>
<td>ACC</td>
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<tr>
<td>Mean</td>
<td>84.3</td>
<td>78.6</td>
</tr>
<tr>
<td>SD</td>
<td>21.7</td>
<td>14.4</td>
</tr>
</tbody>
</table>

Table 13 Total Broca’s patients: DP insertion task

<table>
<thead>
<tr>
<th>WERNICKE’S</th>
<th>Single Object Sentences</th>
<th>Double Object Sentences</th>
</tr>
</thead>
<tbody>
<tr>
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<td>ACC</td>
</tr>
<tr>
<td>% correct</td>
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<td>60.0</td>
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</table>

Table 14 Wernicke’s patients: DP insertion task
Summary

<table>
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<th>% correct</th>
<th>Single Object Sentences</th>
<th>Double Object Sentences</th>
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</thead>
<tbody>
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<td></td>
<td>NOM</td>
<td>ACC</td>
</tr>
<tr>
<td>Brocas</td>
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<td>82.00</td>
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<tr>
<td>Wernickes</td>
<td>90.5</td>
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<tr>
<td>Controls</td>
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<td>100</td>
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</table>

Table 15 TOTALS: DP insertion task

<table>
<thead>
<tr>
<th>Free Speech</th>
<th>Case Assigner present</th>
<th>Case Assigner absent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Case</td>
<td>Incorrect Case</td>
</tr>
<tr>
<td>BROCAS: TOTAL</td>
<td>87</td>
<td>2</td>
</tr>
<tr>
<td>WERNICKES: KI</td>
<td>33</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 16 TOTALS: Free Speech
Free Speech Samples

Broca's: TSV

I: Жена в больнице? Дома? На больничном?
Is your wife in hospital? Home? In a hospital ward?
P: Ну на больничном, в общем… сначала нет… потому что выходные как раз…
Well in the hospital ward, in general… at the beginning not… because the weekend just then
I: Так у нее давление или что?
So she has high blood pressure?
P: … ну давление у нее… давление в общем-то все время…
… well she has high blood pressure… high blood pressure generally all the time
I: Жена лежит, не встает?
Your wife is lying down, not standing?
P: Вот … два … три там… в общем-то… не ходела…
See… two… three there… in general… she doesn’t walk…
I: Так Вам надо ехать сейчас что ли?
So you need to go now do you?
P: … что-нибудь для… для нее это… сделайте чего-нибудь…
… Something for… for her it… do something…

Broca's: TI

I: Вы можете мне рассказывать, как это все случилось? Это давно уже было?
Could you tell me how it all happened? Was it already a long time ago?
P: Давно
A long time ago
I: Больше чем год назад?
More than a year ago?
P: Да
Yes
I: Может два года? Поменьше?
Two years perhaps? A bit less?
P: Побольше
A bit less

... 
I: А что тогда случилось?
And what happened at that time?
P: Инсульт
Stroke
I: Вы упали?
You fell?
P: Нет, не упал. На машине ехал.. в больницу…
No, I didn’t fall I was going by car.. To the hospital…

Broca's: KO
I: Как поступили? Что случилось?
How did you get it? What happened?
P: Не знаю… то есть… год..два, три.. эээ…э…
Don’t know… Let’s see… about two, three, year.. errr. rr…
I: Вы ложились в больницу?
You were lying in hospital?
P: Да
Yes
P: Три инсульт
Three stroke
I: Три инсульта? Три раза значит?
Three strokes? That means three times?
P: Да.да.да
Yes, yes, yes.
I: Ой, много!
Oh, a lot!
P: Да. Вот…
Yes. So…

…

I: Вы в офисе работали?
You worked in an office?
P: Да, да, да
Yes, yes, yes

I: Какая работа была?
What sort of work was it?
P: … торговля…
… Sales…

I: административная работа?
Administrative work?
P: Ад.. ад.. административная работа (-C+N)
Ad.. ad.. administrative work

Wernicke’s: Kl

P: Мне надо снять еще вот это… А где вот это –то
I still need to take off this thing… And where is that thing
I: Очки
Glasses

P: Конечно…. Я уже снял, все сделал… стра.. стра.. странные теперь сиденья бывают, бывают и женщины
Of course… I already took off, I did it all.. Stra.. stra.. strange seats exist, also women
I: Картины вы имеете в виду?
Do you mean the pictures?

P: Ну вот они здесь случайно
Well there they are all of a sudden
I: Ничего страшного, ничего
Nothing to worry about, it’s fine

P: Ты уж пойми только
You just got it

I: Да. Конечно
Yes. Of course

P: Вот она, главное я хотел сказать ей… Потом...сейчас не будем.. потому что я же сиденье не работал дома. Два дня не работал дом. Потому что бабушка ушла на фиг

There it is, the main thing I wanted to say to her… Then.. Now we won’t.. Because I already seat didn’t work at home. I didn’t work at home for two days. Because granny left damn it

I: Голова не болит у вас сейчас?

Is your head hurting now?

P: Плохо не понять… откуда отсюда.. бывает мы вместе работали..

нормально вроде…

Bad not to understand… Where from from here.. we would work together..

seems to be okay..

I: Вы тогда ходили к невропатологу

Then you went to the neurologist

P: Я просто… сейчас слава Богу.. нормально сделался

I just… now thank God.. I got myself sorted out

I: Ладно, ничего. Вы в выходные понервничали как я поняла

Okay, fine. During the weekend you got a bit worried I gather

P: Конечно

Of course

I: Ну как же, это же Вас беспокоит.

Come on now, it’s worrying you.

P: Мое.. как это сказать… работать…работает… нет работает…

минуточку… с тобой вместе работают… тогда лучше работать..

My.. how to say it… to work… works… not it works… one minute… we’ll do some work together… in that case it’s better to work..