Chapter 1

Introduction

1.1. Topic of this study

...yeah, aphasia, yeah, in the beginning I didn’t know it and then I knew it later on, yeah, so I, I, I had err yeah, my wife knew it, but yeah, I had I think: ‘What’s happening now?’, that was nothing, I know, I do not even know what it was, I didn’t know anything about it, how is that? Well, yeah, after about four months I knew it officially, how it was then. I said: ‘well yeah, that will be fine.’. I kno- I kno- I I did not even know of these of these of these words, which I had here, did I also not even know, how it err how it went. I think, well yeah, will be o.k., but yeah, so later on I started talking more and than it err came to my err head that err well yeah, you never know, now you will get better than it was...

This is a fragment of the spontaneous speech of an aphasic patient, who participated in the present study. He was asked to talk about his speech problems. As may be clear from the fragment, this patient has severe word
finding problems, both nouns and verbs are difficult to retrieve. Often, he is searching for words and, in comparison to a non-language-disturbed control, he produces less nouns. With respect to verbs, it seems that he produces a reasonable number, but these are often the same (e.g. *to know*). This lack of variability in the production of verbs is also a sign of word finding problems.

Word finding problems are common to all types of aphasia. Diagnosis of these disturbances is mostly not concerned with the retrieval of verbs. The Dutch assessment test batteries (SAN-test, Deelman, Koning-Haanstra, Liebrand and Van der Burg, 1981; AAT, Graetz, De Bleser and Willmes, 1992; PALPA, Bastiaanse, Bosje and Visch-Brink, 1995) do not contain subtests for action naming, and the same holds for most of the English diagnostic tests (e.g. PALPA, Kay, Lesser and Coltheart, 1992). As far as is known, only the BDAE (Goodglass and Kaplan, 1983) includes an action naming test.

However, this does not mean that verbs are not problematic to retrieve and therefore do not deserve attention in an assessment test. On the contrary, in the last two decades it has been empirically shown that verb retrieval can be disturbed specifically as compared to noun retrieval in aphasics (e.g. Miceli, Silveri, Villa and Caramazza, 1984; Williams and Canter, 1987; Miceli, Silveri, Nocenti and Caramazza, 1988; Zingeser and Berndt, 1990). From these studies it is nevertheless unclear whether these specific problems have to be assumed for all aphasics.

The aim of this thesis is to investigate the problems Dutch aphasic patients encounter in the processing of verbs at the word and at the sentence level. For comparison, noun retrieval at the word level will be examined as well. The results will show whether patients have specific problems with verbs as compared to nouns at the word level and what role sentence context plays on verb retrieval.

As stated above, former studies on verb retrieval showed that verbs might be more difficult to retrieve by aphasics than nouns. However, it has also been shown that this only holds for some aphasics, whereas others perform better in verb retrieval than noun retrieval. Overall, a rather confounding
variation in results has been reported in the different studies which have been conducted. This fact would appear to make one more assessment of verb and noun retrieval problems of little importance. Nevertheless, in this thesis some linguistic factors which may affect verb retrieval will be considered, whose effects might explain the variation in the results of former studies. These used uncontrolled groups of verbs, whereas in the present study it is planned to investigate several types of verbs. These types were selected by focusing on different aspects of verb retrieval, i.e. syntax (transitivity), conceptual structure (instrumentality) and phonology (name relation with a noun).

The overall question of this study will be: Are verbs more difficult to retrieve than nouns in Dutch aphasics and which linguistic factors influence verb retrieval in isolation and sentence context?

The next section of this chapter will give an overview of the way verbs are processed in normal language production. The other sections concern aphasia. In section 1.3., a description is given of the different types of aphasia that are considered in this thesis. The results of previous studies into the problems of verb processing in aphasics will be presented in the sections 1.4. to 1.6. and in the last section the research questions which have guided the present study will be stated.

1.2. Verb processing

In this section an overview of the verb processing procedures which are supposed to characterize normal language production will be given. This overview is specifically presented to demonstrate which factors play a role in verb retrieval. Therefore, only a few theoretical frameworks will be considered. As has been shown by Best (1996), theories on normal lexical processing are not suitable to be used unequivocally to explain aphasics’ data (see also Laine and Martin, 1996). Hence, the following description, based on the sentence production model of Levelt (1989), the spreading activation theory of Dell (1986), the Government and Binding Theory of
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Chomsky (1981) and theories on lexical conceptual structure (e.g. Jackendoff, 1990; Rappaport and Levin, 1988), is not meant to cover the performance of aphasics in verb retrieval, but to show all aspects of verbs that play a role in verb processing. Furthermore, it is not the only way in which verb processing may be described, but it suffices to demonstrate the different stages in verb retrieval and the role of different sorts of lexical information stored with the verb.

1.2.1. Lexical retrieval of verbs

Let us assume that someone wants to express the action *to give*, for example, to say the sentence *the boy gives the girl a book*. The first stage in verb production is to activate a mental representation or the concept of the verb.

According to Levelt (1989), the mental representation of the verb *to give* can be assumed as the following representation:

$$\text{(1) \ EVENT[CAUSE(X,EVENT[(GO_{poss}(Y,PATH[(FROM/TO (X,Z))]))]))]}$$

The conceptual representation of the verb *to give* contains, for example, the information that there is an event in which one person (X) causes the action by means of which an object (Y) that is possessed by this person (X) comes into the possession of another person (Z). A more elaborated description of the lexical-conceptual structure of the verb will be presented in 1.2.3.

Word-information is stored in the lexicon. According to Levelt, the lexicon is divided into two components, one for lemmas and one for forms. In the first component, the meaning and the syntactic and semantic information of a word are stored; the second component contains the phonological form.

The conceptual information of the verb *to give* activates the lemma of this verb in the lexicon. The different syntactic and semantic elements of the
lemma will be outlined, following Chomsky’s Government and Binding (Chomsky, 1981) and Principles and Parameters (1986) framework. The lemma of the verb to give consists of the following elements:

(2)  
give  
* syntactic category: V  
* syntactic complements (subcategorisation): [NP NP] or [NP PP]  
* argument structure: (x,y,z)  
* thematic structure: (agent, theme, recipient)

The lemma contains word-class information. In this case, the syntactic category verb (V) is indicated. The syntactic complements represent the subcategorisation frame of the verb. The subcategorisation frame specifies the syntactic environment into which a verb can be placed. The verb to give has two possible complement structures. One, [NP NP], is necessary in order to produce sentences like (3):

(3) The boy gives the girl (NP) the book (NP)

In this case, apart from the subject, an indirect object and a direct object are produced. Instead of the production of an indirect object, an oblique complement can be produced by using a prepositional phrase (PP). This accounts for sentences like (4)

(4) The boy gives the book (NP) to the girl (PP)

Subcategorisation is used as well-formedness information. Sentences must satisfy the Projection Principle (Chomsky, 1981):

1 According to Levelt (1989), thematic structure is a conceptual notion. In his model, the thematic structure is therefore not a part of the lemma. Within Chomsky’s Government and Binding (Chomsky, 1981) framework, it is assumed that the thematic properties are part of a lexical entry (but see section 1.2.3.). The thematic structure is seen as a semantic notion. Furthermore, in contrast to Levelt (1989), in the present study the argument structure is seen as a syntactic notion, following again Chomsky’s Government and Binding theory.
(5) Projection Principle: Representations at each syntactic level are projected from the lexicon, in that they observe the subcategorisation properties of lexical items.

This means that sentences must satisfy the complement structure of a verb. Therefore, a sentence like (6) is ungrammatical, because one complement is missing.

(6) *The boy gives the girl

The argument structure representation is also used as syntactic well-formedness information. The verb to give has three arguments which are represented as variables (x, y, z). Argument structure is concerned with the number of participants expressed by the conceptual representation. The verb to give requires three participants, a giver, a receiver and a given object, as is represented in (7):

(7) [The boy x] [gives [the girl y] [the book z]]

The arguments that fall within the domain of the verb (y,z) are internal arguments, whereas (x), falling outside this domain is an external argument. Verbs requiring three arguments are called three-place verbs. Apart from these one-place (e.g. to skate), two-place (e.g. to grind), and four-place verbs (e.g. to exchange) exist. All arguments must be specified in a sentence in order to make it well-formed, following the Projection Principle. The example in (6) is not well-formed because both a complement and an argument position are unspecified.

The argument structure of a verb interacts with the specification of its thematic or theta-roles, the thematic structure. The verb to give has three thematic roles, the agent (the one who performs the action of giving), the theme (the object that is given), and the recipient (the one who receives the object that has been given). During sentence construction thematic roles are assigned to the arguments of the verb.
According to Levelt (1989), the phonological form that belongs to the lemma is retrieved from the second component of the lexicon, the component in which the word-form-lexemes are stored. The lexemes consist of information on the phonology and morphology of a word. With respect to phonology, for example, the number of syllables of a word, the prosody and the segmentation are stored. For the verb to give (Dutch: geven), the phonological form is /gjɛn/ (Dutch: /χɛvɔn/).

The morphological information is activated at the form level. This means that the verb inflections, like stem+s: gives (Dutch: stem+t: geef/), and stem+en: given (Dutch: ge-stem+d/t/en: gegeven), are also stored at this level.

According to Schreuder, Jarvella, Job and Sandström (1989), whether or not storage of verb inflections is separate is language dependent. They found that verb forms in Dutch are stored separately, whereas in Italian they share one lexical entry and inflection is adjusted by morphological rules.

1.2.2. Spreading activation

How does lexical retrieval of a verb take place? One of the theories of lexical activation is the spreading activation theory (Dell, 1986, 1989; Stemberger, 1985). This theory is based on speech errors of normal speakers. According to this theory, a concept not only activates the target word but also related words. This means for the verb to give that, at the lemma level, semantically related lemmas like to receive, to donate, to borrow and to sell, get coactivated. When the activation of the target lemma reaches its threshold the phonological word form becomes addressed. The target lemma deactivates while related lemmas stay active. The

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2 See Levelt (1989) for the description of some alternative theories on lexical retrieval.

3 For reasons of comparability, in this description Levelt's (1989) terms lemma and form are used. Dell (1986), however, distinguishes four so-called strata: semantic stratum, syntactic stratum, morphological stratum and phonological stratum. These strata consist of nodes that can be activated and when active, they spread their activation to other connected nodes. The nodes at the syntactic stratum are comparable to the lemmas; the nodes at the morphological and phonological level are comparable to forms.
deactivation is necessary in order to prevent this lemma from activating a form again when the next word in a sentence has to be produced.

At the form level, forms that are phonologically related to the target become coactivated. This means that not only the form *to give* will be activated, but also *to live*, *to gild* and *gift*.

The process of spreading activation at the lemma and the form level is depicted in figure 1.1. With respect to the form level the picture in figure 1.1. is highly simplified. At the form level different processing levels should be distinguished with respect to distinctive features, phonemes, and syllable components.

Many different forms will be activated to varying degrees because they share some phonological information. They can, for instance, have the same syllable structure or they can share phonemes. With respect to the syllable structure of the verb *to give*, for example, *gift* shares the onset and *live* the rhyme.

![Diagram](image)

Figure 1.1.: An example of spreading activation at the lemma and the form level for the verb *to give*
The spreading of activation is not only downwards, but also upwards. This is necessary in order to maintain the high speed of the speech process. Processing is not sequential but parallel, and there is always activity at different levels during speech production. This means that a phonological form becomes available in different stages.

1.2.3. Verb retrieval in sentence construction

In the last two sections the description of verb retrieval focused on verb retrieval in isolation. In daily life, however, we do not use verbs in isolation, rather we speak in sentences. This means that we should make use of the information that is stored with a verb in the lexicon. Below, the process of sentence production will be described based on Levelt’s (1989) sentence production model, but again using linguistic theories to explain the semantic and syntactic processes that take place during sentence production. Levelt’s model is represented in figure 1.2.

![Figure 1.2.: Levelt’s Blueprint of the speaker (Levelt, 1989: 9)](image-url)
The conceptualizer generates the preverbal message. This message consists of conceptual information representing the intention of the speaker. The preverbal message comes into the Formulator, which is a component with a binary function. The grammatical encoder processes the lemma information from the lexicon and adjusts the grammatical relations reflecting the conceptual relations in the message. The output of the grammatical encoder is the surface structure. It is used by the phonological encoder to produce a phonetic plan. The phonological encoder is fed by form information in the lexicon, and also produces the procedures for generating the prosody of an utterance. In the articulator, the phonetic plan is converted into neuromuscular instructions to put the articulation organs into action. The movements of these articulation organs yield overt speech, which is then monitored, along with internal speech, by the speech comprehension system.

In sentence construction, a preverbal message of the sentence that has to be produced is activated. For the sentence the boy gives the girl a book, this can be depicted as follows:

\[
(8) \quad \text{EVENT[CAUSE(X(boy)),EVENT[(GO}_{\text{pos}}(Y(\text{book}),\text{PATH}[(\text{FROM/T}\text{O} (X(\text{boy}),Z(\text{girl}))))])])}
\]

Rappaport and Levin (1988) and Jackendoff (1990) have elaborated on the lexical-semantic structure of the verb. Their theories are based on the strong correlation that exists between a verb’s semantic and syntactic properties. According to these theories a verb’s syntactic argument structure is predictable from this semantic representation. Rappaport and Levin (1988)\(^4\) assume two levels of lexical representation, one that is syntactically relevant, the Predicate-Argument Structure (PAS), and one that is semantically relevant, the Lexical Conceptual Structure (LCS). The PAS is viewed as a projection of the LCS. The latter structure

\[\text{\textsuperscript{4} See also Rappaport, Levin and Laughren (1993), Levin and Rappaport Hovav (1995).}\]
provides the meaning of the verb by decomposition of a predicate, as shown in (9) for the verb to put:

(9) \[ \text{put} \ [x \text{ cause } [y \text{ come to be at } z]] \]

This structure represents the event that \( y \) was not in the position \( z \), but \( x \) causes it to come into this position, as is phrased in (10):

(10) John puts the book on the table

The arguments of the PAS are linked with the different substructures of the LCS. Linking rules identify the participants in terms of variables that occur in the substructures of the LCS. The PAS mediates between the lexical conceptual representation and the syntactic structure. Rappaport and Levin do not focus on this syntactic structure.

One might ask whether subcategorisation information is needed to be expressed as part of the verbs’ lemma, when the syntactic structure is predictable from the semantic structure. Jackendoff (1990) argues that there are arguments to include subcategorisation as part of lemma of a verb. One of these arguments concerns the semantically unpredictable restrictions of the syntactic category of a complement. Jackendoff presents the following examples (Jackendoff 1990: 257):

(11) a. Harry became/went/got crazy
    b. Harry became/’went/’got a raving maniac
    c. Harry ??became/went/’got out of his mind

All three verbs may have an adverbial complement, however become is subcategorised for an NP as well, go allows a PP complement, whereas get allows neither. These restrictions are syntactic and have to be specified by the subcategorisation frame of the verbs.
Concentrating on the syntactic structure, when the lemma is activated, the verb-argument structure becomes available and the thematic or theta-roles have to be assigned to the arguments in the sentence. Within the Government and Binding framework, this assignment is based on the Theta Theory. This theory states that theta-roles are assigned to arguments by a theta-assigner (i.e. lexical categories like verbs, prepositions, nouns and adjectives). This assignment is constrained by the Projection Principle (see 5) and the Theta Criterion (Chomsky 1981):

(12) Theta Criterion: each argument bears one and only one theta-role, and each theta-role is assigned to one and only one argument

This means that the thematic roles, specified by the lemma, will be assigned to the arguments in a one-to-one fashion. The verb *give* will assign the role of agent to *the boy*, the one who performs the action, the role of theme to *the book*, the object that is given and the role of recipient to *the girl*, the person who is receiving the theme, as is shown in (13):

(13) GIVE (boy<sub>agent</sub>, book<sub>theme</sub>, girl<sub>recipient</sub>)

According to Grimshaw (1990), argument structures are constructed in accordance with a thematic hierarchy. The argument structure expresses prominence relations determined by the thematic information of the verb. Grimshaw suggests the following hierarchy:

(14) (Agent(Experiencer(Goal/Source/Location(Theme))))

The Agent is always the most prominent argument, as shown in (15) for the verb *to kiss*:

(15) kiss (x (y))

Agent Theme
The most prominent argument, in this example the Agent, is mapped onto the subject. If there is no Agent, as in Experiencer verbs like to fear, the Experiencer will be the most prominent argument, as is shown in (16):

(16) fear (x (y))
    Experiencer Theme

Based on Grimshaws’ theory, the concept of external argument may be defined as the argument that is the most prominent. According to Grimshaw, theta-role assignment takes place from the least to the most prominent argument. From this assumption, it follows that the external argument will be the last one to be theta-marked. Since prominence is specified in the argument structure, the reference to theta-role labels is no longer necessary. Grimshaw states that this means that thematic roles do not project into the grammatical representation, but that they are just tools to describe lexico-syntactic problems. A similar view is held by Rappaport and Levin (1988), who argue that predicate decomposition at the lexical conceptual level makes the properties of the predicate argument structure predictable from the meaning of the verb, making theta-role labels superfluous.

Levelt (1989) assumes that the mapping of the thematic roles onto the syntactic complements take place as part of the single process of grammatical encoding. Bastiaanse (1993), however, distinguishes two processes. Firstly, a semantic encoder retrieves the lemma from the lexicon and assigns the thematic roles to the arguments. Secondly, a syntactic encoder creates the syntactic structure and maps the syntactic complements onto the thematic roles. Bastiaanse bases this distinction on aphasic data, describing patients who have selective problems with semantic or syntactic encoding.

The inflection gets specified during grammatical encoding. The third person singular present tense form of the verb to give has to be retrieved
from the form lexicon. The input that has to be phonologically encoded looks as follows:

(17) \[ \text{BOY}_{\text{agent, subject}} \text{ GIVE}_{\text{verb, 3rd person sing.; present tense}} \text{ GIRL}_{\text{recipient, indirect object}} \text{ BOOK}_{\text{theme, direct object}} \]

The lemmas represented in this structure activate the corresponding forms in the lexicon. The verb form is specified as \emph{third person singular present tense} and therefore the form gives (Dutch: \textit{geeft}) will be retrieved.

The phonological encoder builds, based on the form information, a phonetic or articulatory plan for each single lemma and for the complete utterance. The articulator executes the phonetic plan and the sentence is pronounced.

1.3. Typology in aphasia

Aphasia can be defined as a deficit in production and comprehension of spoken and written language, caused by a unilateral localised brain lesion in subjects who had a normal language development (Prins and Bastiaanse, 1997).\textsuperscript{5} In most of the cases (about 85%) it is caused by a stroke, a cerebrovascular accident (CVA). A CVA occurs if the blood flow to parts of the brain is interrupted by thrombosis, an embolism, or a haemorrhage. Other causes of aphasia are (open or closed) head injury, a tumour or an infectious disease, like encephalitis.

In the literature, different aphasic syndromes are usually distinguished. The type of aphasia is closely related to lesion site. Broca’s aphasia, Wernicke’s aphasia and anomia are the most common types of aphasia described in the literature.

\textsuperscript{5} Prins and Bastiaanse (1997) give a comprehensive introduction into aphasiology in Dutch
1.3.1. Broca's aphasia

Broca’s aphasia or agrammatism is characterized by a deficit in sentence production and comprehension. In spontaneous speech, patients speak non-fluently and produce so-called telegraphic speech: mainly content words are used and function words (prepositions, articles and auxiliaries) are omitted or substituted. Inflections or other grammatical morphemes are substituted or omitted as well. Agrammatic patients are patients for whom sentence production is characterized by these symptoms.

Broca’s aphasics often suffer from articulatory disorders. Word comprehension in Broca’s aphasics is relatively well preserved, but it is shown that these patients have problems with syntactic sentence comprehension (e.g. Caramazza and Zurif, 1976; Grodzinsky, 1990; 1995). Oral reading, writing and repetition are often as severely disturbed as speech.

A part of the spontaneous speech of a Broca’s aphasic who participated in the present study is given in (18). This patient is asked to talk about his speech problems and his work.6

(18) Ik wil graag eerst van u weten hoe het komt dat u niet goed kunt praten jajaja kunt u me dat vertellen? nou, eigenlijk eh ja eh zenuw, ernstig, ja goed, zenuwinfarct en hoe lang is dat geleden? nou, och gut eh viert ja, weet niet nee? nee vorig jaar? ja, ja hoor, ja hoor en hebt u toen in het ziekenhuis gelegen? ja, ziekenhuis eh weg, ja...hê....weg nee, lukt het niet? ja, hopeloos En begrijpt u mensen wel goed? oh ja wel, ja dat gaat goed ja maar het praten zelf.. ik klem, bl- blokkeert, ja, gek hè ja. Iets heel anders, wat voor werk hebt u gedaan conciërge u was conciërge ja Kunt u me daar iets over vertellen? Wat moest u doen? nou, eigenlijk, ja, eigenlijk wel ja, wat deed u zoal overdag? koffie, koffie en eh leuk, leuk en wat voor school was dat? eh, nee of was het geen school nee, eh technisch, technisch, nee

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6 In these examples, the sentences that were produced by the author are printed in italics.
To begin with, I would like you to tell me how your speech problems started? yeah, yeah, yeah Could you please tell me that? well, actually err yeah err nerve, badly, yeah well, nerve-infarction And this happened how long ago? well, oh gosh, err fourt- yeah, don’t know no? no last year? yeah, yeah sure, yeah sure and did you stay in the hospital then? yeah, hospital err gone, yeah...gosh....gone no, you don’t get it? yeah, hopeless And do you understand people? oh yeah sure, yeah that’s going fine yeah but talking.. I trap, bl- blocks, yeah, strange, isn’t it? yeah. Something completely different, what kind of job did you do? janitor You were a janitor yeah Can you tell me something about it? What did you have to do? well, actually yeah, actually yeah yeah, what did you usually have to do coffee, coffee and err oh nice, nice and what kind of school was it? err no It wasn’t a school? no technical, technical, no

1.3.2. Wernicke’s aphasia

Wernicke’s aphasics speak fluently and well-articulated, but their speech is often incomprehensible. This is because they produce many word and phoneme substitutions (paraphasias) and/or neologisms. Semantic paraphasias occur when a patient substitutes a word with a semantically related word (e.g. table -> chair), whereas phonemic paraphasias arise when one or more phonemes are substituted (e.g. plane -> plate). Neologisms are substitutions of a word by a non-word for which it is unclear what the target word should be.

Wernicke’s aphasics mix up or narrow syntactic structures in sentence production (paragrammatism). Comprehension in Wernicke’s aphasics is severely disturbed, both at the word and sentence level. Writing and repetition are also severely disturbed. Oral reading may be spared.

An example of the spontaneous speech of a Wernicke’s aphasic who participated in the present study is given in (19).

(19) Kunt u me eerst nog eens vertellen wat er precies met u gebeurd is? hoe mij {gebeurd} ik ben eh goed gegaan altijd geweest en toen eh we
Can you begin by telling me again what exactly happened to you? how me [havvened] I have been err going well always been and then err we had nice, were bought buildings, here where we always went and we went this way together with each other always, because I was there alone and this woman was also alone but she stood on the sixth floor and I stood on the fourth and then we went each other, but then has fallen and then I haven’t got anything, fallen of course and then they took us that building here, yeah, where then we- not well with us and then we were sitting err with each other sitting err I have to wait and to be put down and look yeah how I was and all these things

1.3.3. Anomia

Anomics speak fluently, are well-articulated and comprehensible, using sentences which are, in the main, grammatically well-formed. Their main problems are word finding difficulties. In severe cases, these word finding problems can lead to empty speech, which is characterized by a lack of explicit information. Comprehension and repetition are relatively spared in these patients, whilst reading and writing deficits may occur in varying severity.

In (20) an example of the spontaneous speech of an anomic, who participated in the present study, is given.
How did your speech problems start? when I err didn’t get well, they have hel- err helped me, the the doctor in the hospital and err when I recovered, then I started with err difference of speech. That was also after my err my-err err surgery started yeah, so you had other problems first.. I had absolutely no speech problems, never not but why did you have to stay in the hospital then? Why did you have surgery? because I here had (plural) a err bleeding in my brain which had erupted and err that I had. Before I had indeed that was surely five or six weeks before, I had a surgery down here, from this way to this way (shows a scar on his head) and then here such a thing, yeah that also has a name, so they also did that to me, but that was before

1.3.4. Other types of aphasia

In addition to these types of aphasia, in the overview of the results of previous studies of verb processing (sections 1.4 to 1.6), conduction aphasia and global aphasia will be mentioned. Conduction aphasics have significant problems in repetition. In spontaneous speech they speak fluently with phonemic paraphasias and they use syntactically well-formed sentences. Comprehension in these aphasics is relatively well-preserved. In
global aphasics, all language modalities (oral expression, comprehension, reading and writing) are severely disturbed.

1.3.5. Fluency

Fluency is also used to distinguish aphasic subgroups. Two categories of patients are distinguished: fluent and non-fluent patients. According to Poeck (1989), a distinction based on fluency is too broad, because it considers, for example, patients with a severe comprehension disorder (Wernicke’s aphasics), and patients with relatively spared comprehension (anomics), together in one group. Poeck argues that in group studies the fluency-nonfluency dimension is not suitable and for case studies it is dispensable.

1.4. Verb processing in aphasia

From the overview in section 1.2., it is clear that verb processing is a very complex process. This overview only covered verb production. Levelt (1989) only specified the sentence production process. Bastiaanse (1993) also described the different stages in word and sentence comprehension. Her description is based on aphasic data. Comparable stages are found in production and comprehension. This means that in comparison to phonological, syntactic and semantic encoding for production, also phonological, syntactic and semantic decoding are assumed for sentence comprehension. These stages will not be discussed here, because the overview was mainly given to show what factors may play a role in verb processing and these factors (i.e. the semantics, the syntax and the phonology of the verb) are comparable for verb production and comprehension.

The verb plays an important role in sentence processing and hence it might be expected that the study of verb processing in aphasia has attracted a large number of aphasia researchers. This is, however, not the case. It is
only during the last fifteen years that the verb has received more attention. Earlier, the production or comprehension of verbs was not studied as a specific topic and with respect to verb production in spontaneous speech, it was only mentioned that Broca’s aphasics omit verbs. In this section, the results of studies of verb processing, which have been performed during the last two decades will be described.

1.4.1. Verb production: action naming versus object naming

Studies of the production of lexical verbs are often restricted to action naming compared to object naming for different types of aphasia. In action naming, a patient is asked to say which action is performed in a picture. This elicits the production of a verb. In object naming, the production of a noun is elicited.

The reported results on action and object naming are somewhat contradictory. Some studies mention that agrammatics name objects better than actions, whereas anomics or Wernicke’s aphasics show the opposite pattern (e.g. Miceli et al., 1984, 1988; Zingeser and Berndt, 1990; Bates, Chen, Tzeng, Li and Opie, 1991; Chen and Bates, 1998). Others found no differences between agrammatics and anomics in action naming, but report that both patient groups’ performance was better in object than in action naming (e.g. Williams and Canter, 1987; Kohn, Lorch and Pearson, 1989). Basso, Razzano, Faglioni and Zanobio (1990) found no significant differences between action and object naming, neither for agrammatics nor for anomics.

Some clear cut verb-noun dissociations have been shown in single cases: selective disorders for both noun retrieval (e.g. Zingeser and Berndt, 1988; Damasio and Tranel, 1993; Daniele, Giustolisi, Silveri, Colosimo and Gainotti, 1994; Miozzo, Soardi and Cappa, 1994; Breen and Warrington, 1994; De Renzi and Di Pellegrino, 1995) and verb retrieval (e.g. McCarthy and Warrington, 1985; Caramazza and Hillis, 1991; Damasio and Tranel, 1993; Daniele et al., 1994; Ardilla and Rosselli, 1994; Kremin, 1994; Mitchum and Berndt, 1994; Orpwood and Warrington, 1995; Manning and
Selective disorders for verbs were mentioned both in fluent and in nonfluent aphasics, selective disorders for nouns only in fluent aphasics. All the nonfluent aphasics, except the one described by Orpwood and Warrington (1995), suffered from aphasia associated with a degenerative disease (either a dementia or primary progressive aphasia). In fluent patients, the selective disorders for both nouns and verbs appeared after both degenerative diseases and strokes.

In two recent papers, Berndt, Haendiges, Mitchum and Sandson (1997) and Berndt, Mitchum, Haendiges and Sandson (1997) present multiple case studies, for which fluent and nonfluent aphasics were assessed by several tests for verb and noun retrieval at the word and sentence level. Although some of the Broca’s and Wernicke’s patients show a more or less consistent selective deficit for verbs and some of the anomics for nouns, most of the data reflects the pattern that is seen throughout the literature: a rather confounding variation in verb and noun retrieval.

1.4.2. Verb production in spontaneous speech

Little attention has been paid to verb production in spontaneous speech. Most spontaneous speech studies focus on agrammatic patients, demonstrating their problems in producing auxiliaries and lexical verbs and their use of less complex verb constructions (e.g. Lapointe, 1985; Saffran, Berndt and Schwartz, 1989; Goodglass, Christiansen and Gallagher, 1993).8

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7 Apart from specific problems with verbs as compared to nouns in oral expression and in comprehension, specific problems with verbs have been described in aphasics in reading or writing as well (Baxter and Warrington, 1985; Caramazza and Hillis, 1991; Baynes and Iven, 1991).

8 There are also studies discussing problems with verb inflection in Broca’s aphasics or agrammatics (e.g. Miceli, Mazzucchi, Menn and Goodglass, 1983; Nespoulous, Dordain, Perron, Ska, Bub, Caplan, Mehler and Lecours, 1988; Miceli and Caramazza, 1988; Caramazza and Hillis, 1989; Miceli, Silveri, Romani, and Caramazza, 1989; Saffran et al., 1989; Menn and Obler, 1990; MacWhinney and Osmán-Sági, 1991; Bastiaanse, Jonkers and Ruhland, 1991, Jarema and Kehayia, 1992; Jonkers, 1993; Bastiaanse, 1995).
Only a few studies are concerned with verb production in the spontaneous speech of fluent aphasics. Vermeulen and Bastiaanse (1984) found a low type-token ratio for the variable *content words*, including verbs in a group of Dutch anomics. This means that the variety of the produced verbs is low. A low type-token ratio reflects word-finding problems (Vermeulen, Bastiaanse and Van Wageningen, 1989).

Furthermore, Vermeulen and Bastiaanse (1984) found that anomics produce significantly more auxiliaries than normal controls. Comparable results were found by Jonkers (1993) and Bastiaanse, Jonkers, and Moltmaker-Osinga (1996). They showed that Dutch anomics produced fewer verbs, but more auxiliaries and copulas in spontaneous speech than a control group of normal speakers. The type-token ratio for lexical verbs was significantly lower for the anomics than for the normal controls. Bastiaanse, Edwards and Kiss (1996) showed the same results in a cross-linguistic study for Dutch, English and Hungarian fluent aphasics.

1.4.3. Verb comprehension

The number of studies considering verb comprehension is low. Comprehension of verbs, in comparison to nouns, at the word level has been described to be problematic for individual patients, agrammatics as well as anomics (e.g. McCarthy and Warrington, 1985; Miceli et al., 1988). Bates et al. (1991), however, did not find differences in performance between the comprehension of nouns and verbs for both Broca’s aphasics and Wernicke’s aphasics. This shows that, similar to production, no consistent results have been reported for verb comprehension.

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9 In some studies the inflection pattern in the spontaneous speech of fluent aphasics is described (e.g. Tsvetkova and Glozman, 1975; MacWhinney and Osmán-Sági, 1991; Jonkers, 1993).
1.4.4. Conclusion

From this overview of the literature on verb processing, the conclusion on the distinction between verb and noun production and comprehension can be described as follows: verbs may or may not be more difficult to retrieve than nouns for aphasics, and there may or may not be a qualitative difference between the performance of agrammatics and anomics. Furthermore, both individual fluent aphasics and individual nonfluent aphasics have been described with a specific deficit for verbs and some individual fluent aphasics with a specific deficit for nouns.

1.5. Possible factors influencing verb processing

The overview of the literature presented above showed a rather confounding variation in the reported results. Bastiaanse (1991), however, suggested that the different outcomes of group studies of action and object naming may have been caused by the type of verb which was elicited. In particular, during the last few years some studies have been performed which considered the effect of verb type on verb processing. In this section an overview of these studies will be given.

1.5.1. The effect of verb type: comprehension

One of the first aphasiologists who pointed to the effect of verb type on comprehension was the famous A.R. Luria. He mentioned that some types of verbs were difficult to comprehend for aphasics. Luria (1966) reported that verbs expressing actions that are transacted from one entity to another (e.g. to take from someone) were problematic for patients with parieto-occipital lesions. According to Luria, logico-grammatical operations were disturbed in these patients and in order to comprehend these verbs such an operation has to be interpreted.
In the thirty years that passed since, more reports on the influence of verb type on comprehension in aphasics have been made. Jones (1984), for example, demonstrated that for agrammatic aphasics directional motion verbs were more difficult to comprehend in sentence context than nondirectional motion verbs.

Directional motion verbs are verbs expressing an action that is performed between two entities that have a specific spatial or directional relationship to each other. In order to know the meaning of, for example, the verb *push*, it is important to be aware of the location of the pusher and the pushee. If one has to make a distinction between pictures depicting sentences like *the boy pushes the girl* and *the boy pulls the girl* this information is necessary.

According to Jones, agrammatics have problems with these kinds of verbs, because their semantic structure has an implicit predicate, expressing the directional relation between the entities:

(21) \( \text{push} \quad \text{EVENT} \ (\text{CAUSE}(X(\text{boy}))(\text{MOTION}(Y(\text{girl})))) \ [x \ \text{behind} \ y] \)

(22) \( \text{pull} \quad \text{EVENT} \ (\text{CAUSE}(X(\text{boy}))(\text{MOTION}(Y(\text{girl})))) \ [x \ \text{ahead of} \ y] \)

Referring to the theory of Rappaport and Levin (1988) on Lexical Conceptual Structures, this implicit predicate may be seen as a subpredicate of the LCS.

For *push* and *pull*, this subpredicate expresses if the entity performing the action is in front of or behind the one who undergoes the action. The occurrence of such a subpredicate makes these verbs more difficult to process, especially when a choice has to be made based on this information in a word-to-picture-matching task. This is the case if the target verb is *to push* and the distractor *to pull*.

Byng (1988) and Black, Nickels and Byng (1991) investigated the influence of thematic information in sentence comprehension. From their studies, it follows that Broca’s aphasics may have problems with the assignment of thematic roles that are specified by the verb. This does not mean that these patients have problems in accessing the meaning of the verb. Sentences in which thematic information does not play a role are better comprehended.
In particular, reverse-role verbs are problematic. These verbs have two arguments that could, in principle, both receive the role of agent. In sentences like the nun splashes the queen (Black et al. 1991) both nun and queen are a possible agent. Difficulties with thematic role assignment lead to errors in sentence-to-picture-matching tasks, in cases where patients have to choose between a picture in which, for example, the splashing is performed by the nun and a picture in which the queen is the one who is splashing.

Recently, Breedin and Martin (1996) showed that verb type may influence verb comprehension. They reported the effect of the use of reverse-role verbs (e.g. to buy and to sell), related function verbs (e.g. to cut, to sew, and to knit), and opposite meaning verbs (e.g. to cry and to laugh) in a word-to-picture-matching task. This study only took the performance of three nonfluent and one fluent patient into account. Therefore no group effects for the influence of verb type were reported.

Two of the nonfluent patients had specific problems with reverse-role verbs. They scored low when they had to choose between, for example, a picture in which a girl was selling something to someone and a picture of a girl who bought something from someone. This indicates that these patients have problems in assigning thematic roles.

The third nonfluent patient also had problems with these verbs, but he also scored low on verbs that were semantically related to reverse-role verbs (e.g. to trade). This means that he had difficulties in word-to-picture-matching if he had to choose between verb pairs like to sell and to trade. These verbs do not differ with respect to the reversibility of the semantic roles. Accordingly, this patient does not have specific problems with the assignment of thematic roles. It was concluded that he had difficulties with semantically complex verbs, having multiple subpredicates and arguments.

The fluent patient had low scores for different types of verbs. It was assumed that he had a deficit in the representation of the meaning of verbs.
1.5.2. The effect of verb type: production

There are several factors that might influence the retrieval of verbs in production. Bastiaanse (1991) performed an explorative study into the retrieval of instrumental verbs in isolation and sentence context in two Broca’s aphasics and two anomics. Although she took noninstrumental and instrumental verbs into account, she focused on the latter group. Table 1.1. shows the results of the individual patients.

<table>
<thead>
<tr>
<th></th>
<th>action naming</th>
<th>sentence construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-I (n=9)</td>
<td>+I-N (n=6)</td>
</tr>
<tr>
<td>Broca 1</td>
<td>0.44</td>
<td>0.50</td>
</tr>
<tr>
<td>Broca 2</td>
<td>0.66</td>
<td>0.83</td>
</tr>
<tr>
<td>anomic 1</td>
<td>0.56</td>
<td>0.67</td>
</tr>
<tr>
<td>anomic 2</td>
<td>0.44</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Table 1.1.: Proportions of correct answers for the three types of verbs in action naming and sentence construction by the patients described by Bastiaanse (1991). (-I: noninstrumental, +I-N: non-name-related instrumental, +I+N: name-related instrumental)

The results in this study showed that within the class of instrumental verbs, name relation with a noun influenced verb retrieval both positively and negatively. The verb to brush is name-related to the instrument brush, whereas to cook is not name-related to the instrument pan. From the results it was also clear that the effect of name-relation was not comparable at the word and sentence level. Three of the four patients performed better on the name-related instrumental verbs in sentence context than in isolation, whereas for the non-name-related instrumental verbs the opposite holds.
According to Bastiaanse, in activating an instrumental verb, (name-related) instruments get co-activated (cf. the spreading activation theory, described in 1.2.2.). This co-activation could facilitate or disturb the activation of the verb.

No apparent group patterns could be found but only two patients of each type were tested. What is clear from this study, however, is the influence of name-relation on verb retrieval. Furthermore, the results revealed different effects of this factor for verb retrieval in word and sentence context. This study was the pilot for the present one.

As with verb comprehension, Breedin and Martin (1996) showed that the type of verb played a role in verb production in the same patients previously described in section 1.5.1. The verbs Breedin and Martin used in the verb comprehension test were also used in two tests studying verb production in isolation and sentence context. In particular, reverse-role verbs were difficult to produce for the two nonfluent patients who had also problems with these verbs in comprehension. This means that they suffered from a general deficit in the assignment of thematic roles concerning both production and comprehension. The third nonfluent patient, who had difficulties with semantically complex verbs in comprehension, performed poorly on all types of verbs in verb production at the word and sentence level. The same holds for the fluent patient, who was described by Breedin and Martin.

Thompson, Shapiro, Schneider and Tait (1994) found in an analysis of conversational speech samples, that agrammatics showed a preference for one- and two-place verbs with respect to argument structure requirements, whereas three-place and complement verbs rarely occurred. The first two types of verbs were used more frequently than by normal controls, whereas the second two types were used less often. If three place or complement verbs were used, the agrammatics did not make use of the full range of argument structures: they used these verbs in their simplest form, with fewer arguments or without sentential complements.
Thompson, Lange, Schneider and Shapiro (1997) further investigated verb and verb argument production in agrammatics. They showed that the argument structure of a verb did not influence the retrieval of verbs in a naming task in these patients. Sentence construction, however, was influenced by the number of arguments a verb requires. Agrammatics preferred the least complex verbs, namely verbs requiring one argument, like *to ski*. Furthermore, the number of possible argument structure arrangements played a role.

Two-place verbs, in which both arguments are obligatory, have only one argument structure. This is the case for *to kiss*, as is clear from the examples (23) and (24).

(23) The man kisses the woman
(24) The man kisses

These verbs are called *obligatory two-place verbs*. There are, however, also verbs in which one of the arguments is not obligatory realized, the so-called *optional two-place verbs*. For these verbs the absence of the internal argument does not make the sentence ungrammatical as is shown in the examples (25) and (26).

(25) The man drinks a beer
(26) The man drinks

These *optional two-place verbs* are supposed to have two argument structure arrangements, one with and one without the internal argument realized in the syntax.

Thompson et al. found that sentences with verbs with only one argument structure were more often correctly produced than sentences with optional verbs with more possible argument structures.

Thompson et al. also took the influence of the type of the thematic role of the argument into account at the sentence level. They found the following order of difficulty: sentences with only an Agent or an Experiencer role were produced correctly significantly more often than sentences with a
Theme/Patient role, which in turn were better preserved than sentences with a Goal/Location role. This order connects with the prominence hierarchy in thematic roles suggested by Grimshaw (1990).

Kiss (in press) took the effect of the argument structure on verb retrieval in sentence context of two Hungarian agrammatics into account. In her study, she used a picture description task in which the production of verbs was evoked that varied in argument or thematic structure complexity. Simple one-place verbs like *ásít* (to yawn) were the easiest verbs to access. Verbs with a complex verb-argument or thematic structure were more difficult to retrieve. This means that two-place verbs led to more problems than one-place verbs. However, within the group of two-place verbs, differences concerned with the thematic structure of the verbs also occurred. Two-place verbs with a locative complement, for example (27), were more difficult than reversible two-place verbs, as in (28) (examples taken from Kiss, in press).

(27) A férfi átmegy az úttesten
    the man across-go-3sg the road-on
    the man is crossing the road

(28) A férfi megvigasztalja a lányt.
    the man-nom. prefix-comfort-3sg.def. the girl-acc
    the man comforts the girl

The thematic role of agent is mapped onto the subject and the role of theme onto the object in (28). This is easier for the agrammatic patients than the assignment of the thematic role of agent to the subject and the thematic role of Location to a locative argument, as in (27).

Not only the argument and the thematic structure of a verb played a role in its accessibility. Kiss found an effect of morphological complexity on verb retrieval as well. A one-place verb, that contains a reflexive, like
*vakarózik* (to scratch oneself) was more problematic to access than a morphologically simple one-place verb.

1.5.3. Conclusion

The lexical entries of verbs contain different sorts of information, such as information about meaning, syntactic subcategorisation, verb morphology, argument structure, thematic properties and name relation. From the overview in this section, it is clear that this information plays an important role with respect to verb retrieval in verb comprehension, on naming tests and in sentence construction. Altogether, these studies show that meaning (Jones, 1984; Breedin and Martin, 1996), verb morphology (Kiss, in press), the verb-argument structure (Thompson et al., 1994; Thompson et al., 1997; Kiss, in press), thematic information (Byng, 1988; Black et al., 1991; Breedin and Martin, 1996; Thompson et al., 1997, Kiss, in press), and phonological form (Bastaanse, 1991) influence verb processing in aphasics.

1.6. Explanations for problems in verb processing in aphasics

The explanations that are described for problems in verb processing in aphasics are unequivocal, as far as the overall studies of verb and noun retrieval are concerned. According to some authors, problems with the retrieval of verbs are caused by a disturbance in, or in the access to, a subcomponent of the form lexicon in which verbs are stored (Miceli et al., 1984, 1988; Williams and Canter, 1987).

Miceli et al. (1984) state that the agrammatic’s difficulties with verbs occur because these patients have problems in retrieving the correct lexical form of the verb from the lexicon. They assume that verb and nouns are stored separately in different subcomponents of the form lexicon. The access to
the separate subcomponent of the lexicon for verbs is disturbed.\footnote{Bates et al. (1991b) commented on this theory of Miceli et al. (1984), that it does not suit to explain the data found for Chinese Broca’s aphasics. In Chinese, there are compound words consisting of a verb and a noun part. Chinese Broca’s aphasics have specific problems with the verb part in naming these compounds, whereas Wernicke’s aphasics have more problems with the noun part of the compound. According to Bates et al., this shows that also at a sublexical level problems with verbs can occur in Broca’s aphasics, making explanations concerning the lexical level difficult to hold.

The article of Bates et al. (1991b) is, however, criticized by Zhou, Ostrin and Tyler (1993). They indicate that the status of the compound words that were used by Bates et al. (1991b) is dubious. In some cases, the targets that were used by Bates et al. are not compounds but composed constituents. In these cases, the lexical representation of these ‘compounds’ is different (see Bates, Chen, Li, Opie and Tzeng (1993) for a reaction, see also Chen and Bates (1998)).} Comparable explanations for verb-noun dissociations have been given by Caramazza and Hillis (1991) and Manning and Warrington (1996). Based on the results of their study to comprehension, Miceli et al. (1988) also concluded that there has to be a separate in- and output to the subcomponents for nouns and verbs in the lexicon because verb retrieval can be selectively disturbed in production and comprehension in agrammatics.

Zingeser and Berndt (1990) claimed that verb retrieval problems in agrammatics are caused by their syntactic deficit. Zingeser and Berndt argued that in an action naming test, all information belonging to the verb has to be retrieved, including syntactic information. In comparison to nouns, verbs carry more syntactic information, making them much harder to retrieve from the lexicon for patients with a syntactic deficit, like the agrammatic patients.

Damasio and Tranel (1993), Daniele et al. (1994), Miozzo et al. (1994) and Gainotti, Silveri, Daniele and Giustolisi (1995) tried to connect the verb retrieval problems of nonfluent aphasics and the noun retrieval problems of fluent aphasics with the localisation of their lesion. According to their theory, the conceptual representation of actions is stored in, or near, the motor cortex in the frontal part of the brain because the execution of actions is controlled in this part of the brain. Agrammatics are supposed to
have lesions in this brain region and therefore they have problems with verbs.
The representation of objects is stored in the sensoric association layers of the cortex (in the posterior regions of the brain). Anomics and Wernicke’s aphasics often have lesions in this part of the brain, leading to problems in noun retrieval.

The explanations that are proposed for specific problems with verbs or nouns in different types of aphasia differ from those that are presented in the studies of verb processing in which the effect of verb type is taken into account. In these studies, the problems with aspects of verbs are mostly carried back to the more general deficit Broca’s aphasics and anomics suffer from.

There has been a debate on the underlying disorder of agrammatic production in which explanations with respect to a syntactic or a morphological deficit or to a limitation in processing capacity have been presented. Miceli et al. (1983) described two case studies of agrammatic patients. One of these patients (omitting articles, prepositions and main verbs), was assumed to have a syntactic and a morphological disorder, the other (omitting articles and prepositions to a much larger extent and also omitting auxiliaries, but having fewer problems with main verbs), was supposed to suffer from merely a morphological deficit. This implies that both a syntactic and a morphological deficit can lead to agrammatic performance.

Nespoulous et al. (1988) described an agrammatic patient who was perfectly able to present grammaticality judgements and to perform sentence anagram tasks. Therefore they excluded a syntactic disturbance in this patient. They assumed that the patients’ processing capacity was reduced, but they did not indicate which processes were affected.

Kolk and co-workers state that the actual disturbance in agrammatics is a decay in the activation of the different elements of the sentence

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11 See Bastiaanse (1995), for a comprehensive discussion of these explanations.
representation (Kolk, Van Grunsven and Keyser, 1985; Kolk and Heeschen, 1990; Kolk and Heeschen, 1992). This is caused by a lesion in the cortical area that is used for sentence processing. Another part of the cortex takes over, but because that part is less capable for this function, this causes a delay. An agrammatic patient may, however, adapt to the delay by using telegraphic speech for which less (syntactic) information has to be processed. If patients do not adapt, they are going to speak paragrammatically.

Bastiaanse (1995) assumed a syntactic deficit, or, in terms of Levelt (1989), an impairment in grammatical encoding, for the agrammatic patient she described. This patient was able to produce both telegraphic and non-telegraphic speech within one session in which spontaneous speech was recorded. Bastiaanse supposed that the conceptualizer of her patient was able to adapt to the disturbance in grammatical encoding. This assumption brings Bastiaanse’s explanation in correspondence with the other mentioned explanations. The fact that the patient could adapt to her syntactic problems connects with Kolks’ theory. The reduced processing capacity account of Nespoulous et al. (1988) should relate to a disturbance in grammatical encoding and a morphological and a syntactic disorder (Miceli et al., 1983) would not have to be different deficits, but the occurrence of the different patterns could be a matter of strategy.

Here, it is assumed that Broca’s aphasics or agrammatics suffer from a syntactic deficit. This deficit leads to problems in sentence comprehension (e.g. Zurif, Swinney, Prather, Solomon and Bushell, 1993; Grodzinsky, 1995; Swinney and Zurif, 1995) and production (e.g. Hagiwara, 1995; Friedmann and Grodzinsky, 1997; Bastiaanse and Van Zonneveld, in press; Bastiaanse and Jonkers, in press). With respect to production, a syntactic deficit may lead to the production of incomplete or ungrammatical sentences. Different aspects of syntactic processing may be impaired in Broca’s aphasics (see Bastiaanse and De Jong, 1996). First, the processing of the semantic and syntactic lemma information may be disturbed. When this happens, syntactic complements or arguments may be omitted, resulting in incomplete or short sentences. Also, mapping of thematic roles onto the
arguments or the syntactic complements may be problematic. Furthermore, Broca’s aphasics may have problems with syntactic movement, which may cause difficulties with verb inflection. Finally, it is possible that case marking, and the coding of morphological markers for tense and number will be disturbed, or that there will be no coding at all, leading to the substitution or omission of grammatical morphemes.

Considering verb retrieval, a syntactic disorder is mentioned as the cause for difficulties in verb processing as such. According to Bastiaanse (1991), Broca’s aphasics have problems in retrieving the verb lemmas from the lexicon because of an improperly working grammatical encoder. Next, a syntactic deficit has also been shown to lead to problems in activating and processing the verb argument structure and thematic information of a verb (e.g. Thompson et al., 1997; Kiss, in press).

Anomics are assumed to suffer from a lexical retrieval deficit. They are considered to have problems in retrieving the complete phonological information of words (e.g. Kay and Ellis 1987; Ellis and Young, 1988). With respect to verb retrieval, it is supposed that they are able to activate the correct verb lemma, but that they are unable to retrieve the corresponding phonological form from the lexicon (see Bastiaanse, 1991; Jonkers, 1993) and therefore, name-relation may play a role in verb processing in anomics.

1.7. Research questions

Whilst verbs play an important role in sentence construction (see 1.2.) it remains clear that verb processing is problematic for at least some aphasics (section 1.4.). Undoubtedly, within the past fifteen years, verb processing has become a more serious object of research (section 1.4. - 1.6.). However, there are still some major questions which remain unanswered. These will be presented and described below. Answering these questions is the goal of the present study.
1.7.1. Do verb-noun dissociations in aphasia exist?

From studies like those of Miceli et al. (1984, 1988), Williams and Canter (1987) and Zingeser and Berndt (1990), it may be concluded that verbs or nouns can be selectively disturbed in aphasics. Williams and Canter supposed that this held for all aphasics, whereas Miceli et al. (1984, 1988) and Zingeser and Berndt (1990) assumed that Broca’s aphasics have specific problems with verbs and anomics with nouns. Basso et al. (1990), however, reported no differences between the performances for verbs and nouns in all aphasics. These difference results do not provide many reasons for doing another comparable assessment of verb and noun retrieval. However, as will be further outlined in section 1.7.2. in the present study, the effect of verb type on verb retrieval will be considered. The type of verb was ignored in the former studies to verb and noun retrieval.

The first step, however, in the present study is to discover whether verbs are specifically difficult as compared to nouns. In other words it will be investigated whether there exists a verb-noun dissociation in a group of Dutch aphasics and if this is the case, whether it is a double dissociation. The latter would mean that some aphasics have more problems with verbs than nouns, whereas others show the opposite pattern. In order to account for an effect of aphasia type, the results of Broca’s aphasics, anomics and Wernicke’s aphasics are compared. These three types of aphasia have been chosen because their performance is described most often in the literature with respect to verb processing.

Action and object naming were tested in these patients. Due to reports that verb comprehension may be problematic for some aphasics (e.g. Miceli et al., 1988), this was also examined.

According to Caplan (1996), it may be assumed that many disorders found with word production in sentences are related to disturbances of the processing of these words in isolation. However, in sentence production additional problems may occur, for example, with the construction of a syntactic structure and the insertion of lexical items into sentences.
Therefore, in order to account for a possible effect of sentence context on verb retrieval, next to action naming verb retrieval in sentence construction was studied. For comprehension, verb comprehension was not only investigated at the word level, but also in sentences. The results will be presented in chapter 3.

1.7.2. What is the influence of the type of verb on verb retrieval?

Chapter 3 will give the overall scores on verb comprehension, action naming and sentence construction. It has been reported, however, that the use of different classes of verbs could effect the results in these tests (e.g. Bastiaanse, 1991; Thompson et al., 1997). Therefore, after the overall scores have been presented, the effect of verb type on these scores will be analyzed.

Three variables were taken into account, transitivity, name-relation with a noun and instrumentality. These three variables concern a syntactic factor (transitivity), a phonological factor (name-relation with a noun) and a conceptual factor (instrumentality).

As previously stated in section 1.6., Broca’s aphasics suffer from a syntactic deficit in language production, whereas in anomics lexical retrieval is disturbed (i.e. the retrieval of phonological forms from the lexicon). Therefore, it may be presumed that the performance of the Broca’s aphasics in verb production is influenced by transitivity and that verb retrieval in the anomics is affected by name-relation with a noun. The effect of transitivity will be discussed in chapter 4. The role of name-relation with a noun and the influence of instrumentality will be considered in chapter 5. This will be done, in response to Bastiaanse (1991) discovering an effect of name-relation within the group of instrumental verbs. Therefore, it will be considered if instrumentality itself has an effect on verb retrieval, before the effect of name-relation with a noun will be regarded.

The effect of verb type on verb comprehension and production will be considered in groups of Broca’s aphasics, anomics, and Wernicke’s
aphasics. In the present study, group data will be the starting point. Group data is helpful in finding tendencies and making generalisations. When effects for groups are found, the results will be more powerful than when these effects are found within one patient. However, to account for the performance of some individual patients differing widely from the group performance, the data of these patients, which, based on a descriptive statistical analysis, are outliers or extremes with respect to the effect of verb type, will be removed from the groups.

1.7.3. What do the results reveal on the storage of verbs?

The final chapter (chapter 6) of this thesis will give an overview of the results as described in chapter 3 to 5. These outcomes will be compared with the results of former studies of verb processing in aphasia. A discussion will follow to ascertain precisely how the present study contributes to the knowledge on verb processing in aphasia and on the way verbs are stored in the lexicon. With respect to the latter, some theories on the storage of verbs that were based on aphasic data have already been discussed in section 1.6.

Miceli et al. (1984), for example, claimed that verbs and nouns are stored in a subcomponent of the form lexicon and that the access to these subcomponents can be disturbed. In addition, Miceli et al. (1988), argued that separate subcomponents for verbs and nouns have to be assumed with respect to production and comprehension. It has also been suggested that the representations of verbs are stored in the brain near the motor cortex, making them difficult to retrieve for Broca’s aphasics who suffer from a frontal lesion (cf. Daniele et al., 1994). According to this theory, objects are stored in the posterior part of the brain, which makes them difficult to retrieve for anomics, suffering from posterior lesions. The data of the present study can consider the feasibility of these two theories. In addition to the contribution of the results of the present study to the discussion on verb processing in aphasics, it will be considered how the results contribute to some theories on non language-disturbed verb processing.