Narrative Discourse and Naming Performance in Epilepsy Patients

University of Groningen, 2014

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Acknowledgements

I would like to thank several people for their contribution to this project. First of all, I would like to thank Prof. Dr. Peter Mariën for the opportunity to test epilepsy patients in a hospital setting, thank you very much for your help and your hospitality. I am also grateful for the assistance given by Dr. Wim Tops, thank you for the constructive suggestions for the research and the help provided in organising the data collection. I would also like to thank René Herrera, thank you for the opportunity to take part in this project and to learn more about epilepsy. I would like to offer my special thanks to Prof. Dr. Roelien Bastiaanse, thank you for your guidance and encouragement in the research and writing process and for the advice and notes on the research and the thesis itself.

I would also like to thank my parents for their support and encouragement throughout my study.
Abstract
It has been stated that epilepsy patients can show alterations in their spontaneous speech. Several studies have focused on different forms of discourse production in epilepsy patients, but still there is not a clear view of the narrative production problems in epilepsy patients. The current study aimed to find differences between patients with temporal lobe epilepsy and healthy participants in narrative discourse production tasks, and also investigate the differences between patients and healthy participants on several naming tasks. The main hypothesis was that the temporal lobe epilepsy patients perform worse on a narrative discourse task than healthy participants. In the current study, the spontaneous speech of two epilepsy patients has been investigated, and compared to a group of neurologically intact individuals. With the use of the book Tuesday (Wiesner, 1991) participants had to tell a story that matched the book. The narratives that were created by the participants were then transcribed and analyzed. Apart from the narrative task, participants were also tested on an object naming task, and an action naming task. The narratives were scored based on content and on measures concerning the length of the narrative, the grammatical complexity, and lexical diversity. Results showed that the patients told fewer crucial story elements, and used fewer mental state expressions in their stories. Patients also tend to use fewer subordinate clauses, use more T-units to tell their story, use fewer words per T-unit to tell it, and have a greater lexical diversity in telling it. Both patients performed poorly on the action naming task, one of the patients also performed poorly on the object naming task.
Contents
Acknowledgements ........................................................................................................ 2
Abstract .......................................................................................................................... 3
Introduction ...................................................................................................................... 5
  Discourse and discourse analysis .............................................................................. 5
  Narrative discourse analysis ...................................................................................... 5
  Epilepsy and temporal lobe epilepsy ......................................................................... 6
  Language deficits in temporal lobe epilepsy ............................................................. 8
  Discourse deficits in temporal lobe epilepsy ............................................................. 10
  Current study ............................................................................................................. 12
Methods ......................................................................................................................... 13
  Participants ............................................................................................................... 13
  Materials ................................................................................................................... 14
  Analysis ..................................................................................................................... 15
Results ........................................................................................................................... 17
  Measures concerning grammar .............................................................................. 17
  Measures concerning lexicon ................................................................................... 19
  Measures concerning discourse .............................................................................. 22
Discussion ..................................................................................................................... 25
References ..................................................................................................................... 28
Introduction

Discourse and discourse analysis

As Van Dijk states in his book “The study of Discourse” (2010), there is no simple definition of the notion of discourse. Rather discourse can be divided in several different properties. But the one property of discourse that stands out, is still discourse as natural language use; “Its core property is undoubtedly the use of natural language as the unique humane ability to produce, and understand well-formed, meaningful and appropriate combinations of words, sentences or other units of rule-based language use” (van Dijk, 2010, p. 4). In linguistic studies, the study of discourse can add much relevant information, since not only isolated parts of language are studied, but also actual language use is included. Discourse can also be studied in several other disciplines such as: anthropology, sociology, psycholinguistics, sociolinguistics, cognitive and social psychology, and communication studies. In the current study, discourse will be discussed from a linguistic point of view.

Since there are several different properties of discourse, there are also different kinds of discourse analysis. For the current study, we will focus on clinical discourse analysis. By using clinical discourse analysis, the discourse of different kinds of patient groups can be studied, offering information about the discourse patterns used by a specific patient group. This information can be used to get a better understanding of various brain-behaviour relationships, and also bring new insights for diagnosis and treatment. In clinical discourse analysis, the language behaviour in clinical contexts is studied by looking at several areas of language behaviour, such as: syntax, vocabulary, phonology, conversation skills, and cohesion. By using clinical discourse analysis, discourse patterns of specific patient groups can be revealed which can lead to the development of models to describe the discourse patterns of a certain group. These models can be useful for researchers, healthcare workers, and family and friends of patients. (Asp & de Villiers, 2010)
**Narrative discourse analysis**

The one aspect narratives have in common is that “all narratives will depict a temporal transition from one state of affairs to another.” (Ochs, 2011, p. 68). Narratives can be used to depict events in the past, the present, and even in the future. Personal stories from patients can be referred to as “narratives of personal experience”. Narratives can provide much information concerning the productive language abilities of different patient groups. Research with the use of narratives is commonly used within various patient groups. For instance, narrative studies have been performed with children with specific language impairment, Down syndrome and Williams syndrome (Reilly et al., 2004), patients with closed head injury (Youse & Coelho, 2005), patients with aphasia (Andreetta, Cantagallo & Marini, 2012), and also in patients with epilepsy (Bell et al., 2003), (Field, Saling & Berkovic, 2000). Narrative discourse analysis can be useful to study spontaneous speech of patients. By using a certain framework to elicit narratives from participants, the given narratives can easily be analyzed, and compared between groups of participants. In the current study, the book “Tuesday” (Wiesner, 1991) has been used to elicit narratives from the participants. By using this book, participants are given a context to provide spontaneous speech.
Epilepsy and temporal lobe epilepsy

Epilepsy is a commonly occurring neurological disorder that affects an estimated 50 million people worldwide. In the Netherlands there are probably around 100,000 to 120,000 epilepsy patients. Every year an estimate of 6,000 new patients are diagnosed with epilepsy in the Netherlands (www.epilepsie.nl).

In the current study the definition of epilepsy and epileptic seizure proposed by the International League Against Epilepsy (ILAE), and the International Bureau for Epilepsy (IBE) is maintained. The definition of epilepsy is as follows: “Epilepsy is a disorder of the brain characterized by an enduring predisposition to generate epileptic seizures and by the neurobiological, cognitive, psychological and social consequences of this condition. The definition of epilepsy requires the occurrence of at least one epileptic seizure.” (Fisher et al., 2005, p. 471) The definition of epileptic seizure is as follows: “An epileptic seizure is a transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain.”(Fisher et al., 2005, p. 471)

In this study, we will focus specifically on temporal lobe epilepsy (TLE), since this is the most common form of focal epilepsy (Bell, Lin, Seidenberg & Hermann, 2011). In TLE, seizures arise from one, or both of the temporal lobes. There are two main types of TLE that are described by the ILAE (Engel, 2001). These are medial temporal lobe epilepsy (MTLE), and lateral temporal lobe epilepsy (LTLE) (Alarcón & Valentín, 2012). In reality it can be difficult to distinguish medial temporal lobe epilepsy from lateral temporal lobe epilepsy, as seizures can spread rapidly. Patients with temporal lobe epilepsy often suffer from seizures that occur in clusters within 1-2 weeks, with no seizures in between. TLE patients often display a regular pattern of seizures over years. This makes TLE patients good candidates for trials performed to study new medication. In temporal lobe epilepsy, cognition can be mildly impaired, but a more prominent issue is the memory deficits within this patient group.

A clear difference is stated between epileptic seizures and other kinds of seizures. In order for a seizure to be related to epilepsy, it means that there should be repeated seizures that cannot be related to an immediately treatable cause (Engel, 2001). The ultimate goal of epilepsy treatment is seizure control since this is an important aspect in the quality of life of an epilepsy patient. Different kinds of treatment are available for epilepsy patients. Several kinds of medication are available to help control the seizures within patients. However, seizures cannot be controlled by medication for every patient, and there are considerable side effects. Next to medication, there is also a special diet that has been designed to reduce seizures. However, it is difficult to maintain the diet for a longer period of time. 15% to 20% of patients have refractory epilepsy, which means that three or more drugs have been tried, but did not show effect of seizure control. These patients are candidates for alternative methods, such as a vagus nerve stimulator or resective surgery (Kohrman, 2007).

It is well established that there is a link between epilepsy and various cognitive disorders. Cognitive deficits that can be found in epilepsy patients include several abilities, such as: language, attention, higher-level problem solving skills, and memory impairment. In
TLE, particularly memory impairment is problematic. (Bell, Lin, Seidenberg & Hermann, 2011).

In a study performed by Giovagnoli, Mascheroni & Avanzini (1997) 100 patients with epilepsy and 57 healthy participants have been investigated with the use of self rating scales. Participants had to fill out a questionnaire on memory efficiency, the State Trait Anxiety Inventory, and the self-rating Depression Scale. Results showed that the mean score for the questionnaire on memory efficiency of the patients was significantly lower than the mean score of the healthy participants. For the questionnaires of anxiety and depression, the patient scores were significantly higher than the scores of the healthy participants. In sum, this study shows that patients with epilepsy report greater memory difficulties than healthy participants. It also shows that psychological factors are correlated with the memory difficulties.

In relation to mental well-being, it has been shown that there is a link between the diagnosis of epilepsy and personality disorder traits (Swinkels, Duijsens & Spinhoven, 2003). By using a questionnaire on personality traits, 203 patients with epilepsy and 332 control subjects were investigated on personality disorder traits. Compared with the control group, the epilepsy patients showed a higher score for personality disorder traits.
Language deficits in temporal lobe epilepsy

Several studies have shown that diverse language functions can be impaired in patients with TLE. In a study that included 23 TLE patients, several language functions were examined. (Bartha, Benke, Bauer & Trinka, 2005). The neurolinguistic findings were diverse. Among the language difficulties patients showed were: word finding deficits, errors in language comprehension, and naming deficits. Not all participating patients had language deficits. This study showed that patients with language deficits were significantly older at the time of testing than the patients without language deficits. Several other studies also reported a naming deficit in epilepsy patients.

In a study performed by Bell et al. (2001), TLE patients were tested for object naming and for semantic knowledge. TLE patients performed significantly worse on the object naming task. For the semantic knowledge task, participants were asked to give a definition of several objects. The results showed that patients with TLE produced significantly less specific physical, and associative information in comparison to the healthy participants. The data suggested that for TLE patients, performance on the object naming task could be predicted by the performance on the semantic knowledge task.

With the use of fMRI, several studies have been able to confirm that TLE patients can demonstrate reorganisation of several language functions (Powell et al., 2007) (Thivard et al., 2005). In a study performed by Thivard et al. (2005) 18 left temporal lobe epilepsy patients, 18 right temporal lobe epilepsy patients, and 17 healthy participants were studied with the use of fMRI during performance of three language-related tasks. Results showed that during story listening, and a repetition task, in left temporal lobe epilepsy patients the activation was significantly more right-sided in the temporal lobes than the healthy participants, and the right temporal lobe epilepsy patients. In this study 19% of the temporal lobe epilepsy patients displayed atypical language representation, including five left temporal lobe epilepsy patients, and two right temporal lobe epilepsy patients. This reorganization may be due to a compensatory mechanism since neuropsychological performances of patients with atypical language patterns were better than those of patients with typical patterns.

Powell et al. (2007) studied the reorganisation of language functions with the use of fMRI and by imaging white matter connections with the use of MR tractography. In their study, 14 unilateral temporal lobe epilepsy patients participated, as well as 10 healthy participants. Results showed that healthy participants, and the right temporal lobe epilepsy patients had a left-lateralised pattern of the performed language-related activations, and the associated structural connections. Left temporal lobe epilepsy patients showed a more symmetrical pattern for the language-related activations. These patients also displayed reduced left hemisphere, and increased right hemisphere structural connections.
Discourse deficits in temporal lobe epilepsy

In an attempt to study linguistic abnormalities in spontaneous speech of several groups of epilepsy patients, Hoeppner et al. (1997) found four patients in a group of 29 who showed verbose behaviour. These four patients all had left TLE. Verbose behaviour is showed by patients when in comparison with healthy participants, patients tend to create longer stories and in the process of telling it, use a more than average amount of nonessential speech, and ad irrelevant details. However, not all of the participating patients with left TLE showed verbose behaviour. Stories were elicited by using the “cookie thief card” from the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1983). The four patients who showed verbose behaviour produced more dysfluencies, more topical shifts, and talked about trivial details such as the clothing of the depicted persons. The tested patients who showed verbose behaviour tended to be older than the patients with TLE who did not show verbose behaviour. It is stated that verbosity might be related to either seizures or underlying neurological disease (Hoepner et. al., 1997).

Field, Saling & Berkovic (2000) investigated discourse production in 16 patients with left temporal lobe epilepsy and compared these data with data from 17 healthy participants. In this study, discourse production was elicited using the “Cowboy Story”, an eight-frame cartoon. The participants were asked to tell the story in as much detail as possible three times in a row. There were three variables that were analyzed: (1) speaking time, (2) word count, and (3) fluency. Confrontation naming was also tested, by using the Boston Naming Test (BNT) and the Controlled Oral Word Association Test (COWAT). Results of this study showed that the TLE group performed poorer on confrontation naming than the controls. The analysis of word count per cycle showed a significant group by cycle interaction. With the discourse task, the healthy participants showed a tendency to tell the story in fewer words over the three cycles. However, the temporal lobe epilepsy patients used an increasing number of words over the three cycles. The analysis of speaking time also revealed a group by cycle interaction. The authors suggest that this result is due to decreasing speaking time within the group of healthy participants, while patients tended to increase their speaking time over cycles. No significant results were found on the variable fluency.

Discourse production was also investigated by Bell et al. (2003). In this study different methods were applied to elicit various kinds of discourse. For the narrative discourse task, the participants were presented a cartoon consisting of a series of six black-and-white drawings. For a procedural discourse task, participants were asked to describe step-by-step how they go grocery shopping. Time limits were not used during these tasks. The analysis of the transcripts consisted of six different variables, namely: (1) total time, (2) total words, (3) speech rate, (4) non-communication index, (5) core story components, and (6) total words to clause index. Results showed no significant differences between patients and controls on the procedural discourse task. However, on the narrative discourse task, the patients and the controls showed significant differences on three of the six narrative discourse variables. The patients’ scores were worse than controls on number of core story components produced.
and rate of speaking. The patients also produced more non-communicative language. Overall number of impaired discourse scores correlated with the working memory index of patients.

In another study, narrative discourse performance was investigated in TLE patients (Herrera, 2013). This study focussed specifically on narrative discourse production by using a 19-frame, wordless picture book. Participants were asked to look at the book and then tell the examiner the story. Five different variables were used in this study, namely: (1) sentence length, (2) sentence complexity, (3) cohesion, (4) organization, and (5) conciseness. The results of this study showed no significant differences between the patient group and the healthy group. However, it is stated that examination of the individual transcripts show qualitative differences between the patient group and the group of healthy participants.

In a study performed by Strekas et al. (2013), a group of 25 children with epilepsy were examined with the use of standardized IQ, language tests, and narrative production. The group of epileptic children was divided into one group with recent onset of seizures and another group of children with more chronic seizure activity. The narratives were collected with the use of the storybook “Frog, where are you?” (Mayer, 1969). The narratives were rated by a group of 45 adult listeners. Each adult listener had to rate nine of the narratives blindly and score them based on: (1) overall quality, (2) use of grammar, (3) vocabulary, (4) fluency, (5) story structure, (6) colour/interest, and (7) prosody. The children with chronic seizure activity performed significantly poorer on the narrative task than their typically developing peers in four areas: overall quality, vocabulary, story structure, and grammar. However, it is stated that the children with chronic seizure activity produced more utterances when producing a narrative. Listener ratings did not significantly differ when seizures were of recent onset.
Current study

Several studies have shown that there are differences in narrative discourse production of TLE patients in comparison to healthy participants. Further research is necessary to create a clear view of narrative production problems in TLE patients, since so far studies have not been able to create a concise view of the narrative discourse problems within this patient group. The current study aims to find differences between TLE patients and healthy participants in narrative discourse production tasks, and also investigate the differences between patients and healthy participants in different naming tasks. The main hypothesis is that TLE patients will perform worse in a narrative discourse task than healthy participants.
Methods

The main goal of the study is to compare the behaviour of TLE patients and healthy participants on several narrative discourse tasks and naming tasks.

Participants

For the current study two epilepsy patients that had been diagnosed by a neurologist working in a hospital setting, have been selected. The following inclusion criteria have been applied for the epilepsy patients: (1) epilepsy diagnosed with the use of electroencephalographic recordings or magnetic resonance imaging, (2) at time of testing an age of 18 years or older, (3) at least 6 years of formal education, and (4) being right-handed. The following exclusion criteria have been used: (1) comorbidity with other neurologic or psychiatric disorders confirmed by the patients’ treating neurologist, (2) serious cognitive or language impairments, and (3) pharmacological treatment with Topiramate1.

In addition to the two epilepsy patients, five healthy participants have been investigated to form a representative norm group. The inclusion criteria that have been applied to the healthy participants are: (1) No history of diagnosed neurologic or psychiatric disorders, (2) at time of testing an age between 18 and 65 years old, (3) being right-handed, (4) at least six years of formal education, and (5) no history of language disorders. Since there was an age difference between the participating epilepsy patients, the control group consists of two individuals matched to patient RC, and three individuals matched to patient FS. An overview of the epilepsy patients is presented in table 1. An overview of the healthy participants is presented in table 2.

Table 1. An overview of the participating epilepsy patients.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Gender</th>
<th>Profession</th>
<th>Age at time of testing</th>
<th>Seizure Onset Time</th>
<th>Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC</td>
<td>Female</td>
<td>Unemployed</td>
<td>62</td>
<td>58</td>
<td>Fenobarbital</td>
</tr>
<tr>
<td>FS</td>
<td>Female</td>
<td>Website editor/student</td>
<td>24</td>
<td>2</td>
<td>Depakine Chrono</td>
</tr>
</tbody>
</table>

Table 2. An overview of the participating healthy participants.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Profession</th>
<th>Age at time of testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>TD</td>
<td>Male</td>
<td>Student</td>
<td>21</td>
</tr>
<tr>
<td>IV</td>
<td>Female</td>
<td>Student</td>
<td>21</td>
</tr>
<tr>
<td>LS</td>
<td>Male</td>
<td>Student</td>
<td>20</td>
</tr>
<tr>
<td>EK</td>
<td>Female</td>
<td>Retired elementary school teacher</td>
<td>64</td>
</tr>
<tr>
<td>GK</td>
<td>Male</td>
<td>Funeral director</td>
<td>59</td>
</tr>
</tbody>
</table>

1 Research has shown that the anti-epileptic drug Topiramate can have a negative effect on patients’ language abilities and cognition. (Lee, Jung, Suh, Kwon & Park, 2006)
Materials

The materials that have been used for the current study can be divided into two different groups: 1) naming tasks, and 2) narrative discourse tasks.

For the naming of actions, the naming of actions part of the Dutch Verb and Action Test (VAT) has been used. This action naming test has been developed as a part of the Werkwoorden en Zinnen Test (WEZT) (The Verb and Sentence Test (VAST), Bastiaanse, Edwards, Maas & Rispens, 2003). This test has been developed to investigate the specific problems of patients with aphasia in producing and comprehending verbs and sentences. The naming task is controlled for effects of instrumentality, transitivity, and frequency. With the use of an iPad, participants were shown several pictures of actions they had to describe in one word by using a verb. Instructions were as follows: “You will see a picture of someone performing an action. Can you describe in one word what this person is doing? It concerns a verb.” Two examples were available for the purpose of practicing. The examples were: drummen (drumming) and schaken (playing chess). After naming the examples, participants heard the correct response. When the examples were clear to the participant, the actual test was started. If the participant had difficulty understanding the test, the two practice examples could be rehearsed again. During the test no other information has been given. The test consists of fifty items.

To test the ability of the participants to name objects, a comparable object naming task has been used. With the use of an iPad, participants were shown several pictures of objects which they would have to describe in one word. Instructions were as follows: “You will see a picture of an object or an animal. Can you name this picture in one word?” The items boom (tree) and puzzel (puzzle) were being used as examples. After naming the examples, participants heard the correct response. When the examples were clear for the participants, the actual test could be started, if not, the practice items could be rehearsed again. During the test no other information has been provided. The test consists of fifty items and is balanced with the action naming test.

For the narrative discourse production, the book Tuesday (Wiesner, 1991) has been used to elicit a narrative. This book has been used to elicit narratives in previous research in children with autism spectrum disorders (Suh et al., 2014). The book consists of several pages with pictures. The following instructions have been given to the participants: “I am going to show you a book. It is called Tuesday. It contains a lot of pictures, but not a lot of words. The book describes a certain story. The story commences as follows: it was Tuesday night around eight o’clock. Can you tell the rest of the story by using the book and the pictures in the book?”
Analysis

For the discourse analysis of narratives, all participants’ discourse production was audiotaped for further transcription and analysis. Narratives have been divided into T-units (Hunt, 1970). A T-unit consists of a main clause which can have one or more subordinate clauses. Six measures have been obtained to perform a discourse analysis. The first two measures that are being applied within this study are originally described by Youse & Coelho (2005).

1) **Number of words per T-unit.** This measure can be calculated by dividing the total number of words by the number of T-units used in the story. This measure can be considered as a measure of sentence length.

2) **Number of subordinate sentences per T-unit.** This measure can be calculated by dividing the total number of sub-ordinate clauses in each story by the total number of T-units. The frequency in which participants use sub-ordinate clauses can be considered a measure of the complexity of sentence-level grammar.

3) **Type/token ratio.** The type/token ratio is a measure that can be considered as a measure of lexical diversity. In the current study the type/token ratio has been calculated by looking at the first uttered 100 words and counting the number of different words that have been used in this fragment. By dividing this number by 100, the type/token ratio can be calculated.

4) **Story elements.** A list of core story elements has been made by looking at the stories produced by the healthy participants. If the majority of the healthy participants used a certain aspect within their story, it is listed as a basic element. By calculating the percentage of essential story elements patients use in their story, the quality of the content of the stories can be examined. An overview of the core story elements is given in table 3.

5) **Mental state expressions.** The number of mental state expressions participants used in telling the story has been counted. An overview of the mental state expressions which can be used in telling the story, is displayed in table 4.
For the qualitative analysis of the stories, a list of key elements of the story have been set up to analyse the content of each participant’s story. Based on the stories provided by the healthy participants, a list has been made, representing the essential features that the story should contain. This list is presented in table 3.

**Table 3.** An overview of the essential story elements per page.

<table>
<thead>
<tr>
<th>Pages</th>
<th>Story elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>1. Turtle sits on log/turtle looks around</td>
</tr>
</tbody>
</table>
| 3-4   | 2. Turtle sees frogs/turtle is scared (an element about turtle)  
3. Frogs are flying on lily pads (an element about the frogs) |
| 5-6   | 4. Frogs are flying on lily pads/frogs are having fun  
5. Birds are frightened by frogs |
| 7-8   | 6. Frogs are flying/travelling (towards houses/suburb) |
| 9-10  | 7. Man eats a sandwich  
8. Man sees frogs |
| 11-12 | 9. Frogs fly into laundry |
| 13-14 | 10. Frogs create capes from laundry  
11. Frogs fly into house through an open window  
12. Frogs fly into house through a chimney |
| 15-16 | 13. Old lady is sleeping in chair  
14. Frogs are watching television |
| 17-18 | 15. Frog flies around/takes a walk  
16. Frog encounters dog/dog chases frog |
| 19-20 | 17. Frogs chase the dog/frogs fly along with dog |
| 21-22 | 18. Frogs sit in trees/frogs are falling down/frogs sit on roof |
| 23-24 | 19. Frogs fall down/frogs can’t fly anymore  
20. Frogs are going back in water |
| 25-26 | 21. Detective investigates leaves/tries to figure out what has happened |
| 27-28 | 22. There is a farm with a shadow on it |
| 29-30 | 23. Pigs are flying through the air |

**Table 4.** An overview of the mental state expressions that can be described within the story.

<table>
<thead>
<tr>
<th>Pages</th>
<th>Mental state expressions in story</th>
</tr>
</thead>
</table>
| 3-4   | 1. Fish are scared  
2. Turtle is scared |
| 5-6   | 3. Frogs are having fun  
4. Birds are scared of frogs |
| 7-8   | 5. Frogs enjoy flying |
| 9-10  | 6. Man is scared of frogs/man is surprised by frogs |
| 11-12 | 7. Frogs are having fun/Frogs are frightened by laundry |
| 15-16 | 8. Frogs enjoy watching television  
9. Cat is scared |
| 17-18 | 10. Frog is scared of dog |
| 19-20 | 11. Dog is scared of frogs |
| 23-24 | 12. Frogs feel sad/mad/bored/glad they’re home |
| 25-26 | 13. People feel confused |
Results

The results are displayed in tables 5 till 10. Since the participating groups are relatively small, no statistical tests have been performed on the data. To compare patients with the healthy participants, the patients’ scores are compared with the scores of the matched healthy participants, by looking at the range of the healthy participants. The main goal of the current study was to compare the linguistic behaviour of TLE patients and healthy participants on several narrative discourse tasks and naming tasks. The results show several interesting differences between the epilepsy patients and the healthy participants.

Measures concerning grammar

In table 5, the results for the measures concerning grammar are displayed for the younger patient and the matching healthy participants. In table 6, the results for the measures concerning grammar are displayed for the older patient and the matching healthy participants.

Table 5. Results for the younger patient and matching healthy participants for the measures concerning grammar (number of T-units, words per T-unit, number of subordinate clauses per T-unit)

<table>
<thead>
<tr>
<th>Participant</th>
<th>Number of T-units</th>
<th>Words per T-unit</th>
<th>Number of subordinate clauses per T-unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>29</td>
<td>10.76</td>
<td>0.45</td>
</tr>
<tr>
<td>LS</td>
<td>28</td>
<td>16.64</td>
<td>0.68</td>
</tr>
<tr>
<td>TD</td>
<td>20</td>
<td>20.1</td>
<td>0.95</td>
</tr>
<tr>
<td>FS (patient 1)</td>
<td>37</td>
<td>10.54</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Table 6. Results for the older patient and matching healthy participants for the measures concerning grammar (number of T-units, words per T-unit, number of subordinate clauses per T-unit)

<table>
<thead>
<tr>
<th>Participant</th>
<th>Number of T-units</th>
<th>Words per T-unit</th>
<th>Number of subordinate clauses per T-unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GK</td>
<td>23</td>
<td>13.39</td>
<td>0.57</td>
</tr>
<tr>
<td>EK</td>
<td>55</td>
<td>12.33</td>
<td>0.45</td>
</tr>
<tr>
<td>RC (patient 2)</td>
<td>111</td>
<td>8.50</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Length of the story told by the participants was measured in amount of T-units. Patient 1 used 37 T-units to tell the story, while the matching healthy participants used between 20 to 29 T-units to tell their stories. This suggests that patient 1 needed more T-units than the healthy participants to tell the story. Patient 2 used 111 T-units to tell the story. The number of T-units used by the matching healthy participants was however much smaller and ranged from 23 to 55 T-units. It can be noted that the range within the older controls was bigger than within the younger controls. Figure 1 contains a graph showing the number of T-units used by patients and by the healthy participants.
Figure 1. Graph showing the number of T-units used by the older patient compared with the matching healthy individuals, and the younger patient compared with the matching healthy individuals.

The number of words per T-unit has been calculated. This measure can be considered a measure of sentence length. For this measure patient 1 also scored below the range of the matching healthy participants. Patient 1 scored 10.54, while healthy participants ranged between 10.76 and 20.1. This shows that patient 1 used less words per T-unit than the matching healthy participants. This measure was also calculated for patient 2 and matching healthy participants. Patient 2 used an average 8.5 words per T-unit while the matching healthy participants ranged between 12.33 and 13.39. This shows that patient 2 also used fewer words per T-units than the healthy participants. Figure 2 contains a graph showing the number of words per T-unit used by patients, and by the healthy participants.

Figure 2. Graph showing the number of words per T-unit used by the older patient compared with the matching healthy participants and the younger patient compared with the matching healthy participants.
To measure the frequency in which participants used subordinate clauses, the number of subordinate clauses per T-unit has been calculated. This measure can be considered a measure of complexity of sentence-level grammar. Patient 1 had a low score in number of subordinate clauses per T-unit. However, with a score of 0.46, it ranged between the healthy participants’ scores, which ranged from 0.45 till 0.95. Patient 2 showed an extremely low number of subordinate clauses per T-units, which means patient 2 mostly uttered simple sentences with one main clause. Patient 2 scored 0.11, while the healthy participants ranged from 0.45 to 0.57. Figure 3 contains a graph showing the number of subordinate clauses per T-units used by patients and by the healthy participants.

**Figure 3.** Graph showing the number of subordinate clauses per T-unit used by the older patient compared with the matching healthy participants and the younger patient compared with the matching healthy participants.
Measures concerning lexicon

In table 7, the results for the measures concerning lexicon are displayed for the younger patient and the matching healthy participants. In table 8, the results for the measures concerning lexicon are displayed for the older patient and the matching healthy participants.

Table 7. Results for the younger patient and matching healthy participants for the measures concerning the lexicon (Object naming task, Action naming task and Type-Token Ratio)

<table>
<thead>
<tr>
<th>Participant</th>
<th>Object Naming</th>
<th>Action Naming</th>
<th>Type-Token Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>98</td>
<td>96</td>
<td>0.59</td>
</tr>
<tr>
<td>LS</td>
<td>100</td>
<td>98</td>
<td>0.53</td>
</tr>
<tr>
<td>TD</td>
<td>98</td>
<td>98</td>
<td>0.49</td>
</tr>
<tr>
<td>FS (patient 1)</td>
<td>100</td>
<td>92</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Table 8. Results for older patient and matching healthy participants for the measures concerning the lexicon (Object naming task, Action naming task and Type-Token Ratio)

<table>
<thead>
<tr>
<th>Participant</th>
<th>Object Naming</th>
<th>Action Naming</th>
<th>Type-Token Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>GK</td>
<td>100</td>
<td>100</td>
<td>0.58</td>
</tr>
<tr>
<td>EK</td>
<td>96</td>
<td>96</td>
<td>0.5</td>
</tr>
<tr>
<td>RC (patient 2)</td>
<td>78</td>
<td>70</td>
<td>0.66</td>
</tr>
</tbody>
</table>

Two different naming tasks have been used in this study. The naming task for actions showed a difference between the older patient and the matching healthy participants. While the healthy participants performed on 96 and 100 percent, epilepsy patient 2 was able to name only 70 percent correct in this task. This is below the scores of the healthy participants. The younger patient also showed a lower score than the matching healthy participants. While patient 1 scored 92 percent correct, the matching healthy participants scored between 96 and 98 percent correct on this task. The difference is smaller, but patient 1 still performed below the scores of all matching healthy participants.

For the object naming task, the differences were smaller between patients and healthy participants, but still there was a notable difference in scores for the older patient. Patient 2 is able to name 78 percent correct in this task, while healthy participants are able to score between 96 and 100 percent correct. For the object naming task, patient 1 scores 100 percent correct, which suggests that patient 1 has more difficulty in naming actions rather than objects. Figure 4 contains a graph showing the results of the object and actions naming tasks for patients and the healthy participants.
As a measure of lexical diversity, the type/token ratio has been calculated. Patient 1 has a TTR of 0.6 while matching healthy participants range from 0.49 to 0.59. Patient 2 has a TTR of 0.66 while matching healthy participants range from 0.5 to 0.58. This means that both patients have a higher TTR than their matching healthy participants. Figure 5 contains a graph that displays the Type-Token Ratio’s of the patients and the healthy participants.

**Figure 4.** Graph showing the results for object and action naming for the patient compared with healthy participants and the younger patient compared with healthy participants.

**Figure 5.** Graph showing the Type-Token Ratio for the older patient compared with healthy participants and the younger patient compared with healthy participants.
Measures concerning discourse

In table 9, the results for the measures concerning discourse are displayed for the younger patient and the matching healthy participants. In table 10, the results for the measures concerning discourse are displayed for the older patient and the matching healthy participants.

Table 9. Results for the younger patient and matching healthy participants for the measures concerning discourse (percentages of crucial story elements and number of mental state expressions).

<table>
<thead>
<tr>
<th>Participant</th>
<th>Percentages of crucial story elements</th>
<th>Number of mental state expressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>95.6</td>
<td>3</td>
</tr>
<tr>
<td>LS</td>
<td>100</td>
<td>7</td>
</tr>
<tr>
<td>TD</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>FS (patient 1)</td>
<td>82.6</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 10. Results for the older patient and matching healthy participants for the measures concerning discourse (percentages of crucial story elements and number of mental state expressions).

<table>
<thead>
<tr>
<th>Participant</th>
<th>Percentages of crucial story elements</th>
<th>Number of mental state expressions</th>
</tr>
</thead>
<tbody>
<tr>
<td>GK</td>
<td>82.6</td>
<td>4</td>
</tr>
<tr>
<td>EK</td>
<td>95.6</td>
<td>8</td>
</tr>
<tr>
<td>RC (patient 2)</td>
<td>43.5</td>
<td>2</td>
</tr>
</tbody>
</table>

To examine the content of the told stories, the stories of the participants were analyzed and scored for the amount of crucial story elements they contained. Patient 1 scored 82.6 percent of the crucial story elements while the matching healthy participants scored between 95.6 and 100 percent. Patient 2 scored 43.5 percent of the crucial story elements correctly, while matching healthy participants scored between 82.6 and 95.6 percent. Figure 6 contains a graph that displays the percentages of crucial story elements that were told by the patients and the healthy participants.
Figure 6. Graph showing the percentages of crucial story elements told by the older patient compared with healthy participants and the younger patient compared with healthy participants.

The number of mental expressions that participants have used while telling their stories have been counted. Patient 1 has used 2 mental state expressions, while the matching healthy participants have a range of 3 till 7 mental state expressions. Patient 2 has used 2 mental state expressions, while the matching healthy participants have a range of 4 till 8 mental state expressions. Figure 7 contains a graph that displays the number of mental state expressions that have been used by the patients and the healthy participants.

Figure 7. Graph showing the number of mental state expressions used by the older patient compared with healthy participants and the younger patient compared with healthy participants.
In sum, patients tended to use fewer crucial story elements and mental state expressions in their stories. The patients also tended to use more T-units to tell their stories, but they used fewer words per T-unit to tell it. They also tended to use a smaller number of subordinate clauses per T-unit, which can be seen as a measure of sentence level complexity. This implicates that the sentence level complexity is less developed in the patient group. Word finding was also impaired in both patients, especially in finding verbs. Both patients scored beneath the range of the healthy participants on action naming. While patient 1 scored 100 percent correct on the object naming task, patient 2 was also impaired in object naming with a score of 78 percent.
Discussion

The results that have been found in the current study, can be related to the results of previous research. Field, Saling & Berkovich (2000) also studied narrative performance of TLE patients by using an eight-frame cartoon. In this study, confrontation naming was also tested. Results of this study showed that patients performed significantly worse on confrontation naming tasks. This is comparable to the results found in the current study. Both patients performed below the range of the healthy participants for the naming of verbs. However, only one of the patients performed below the range of the healthy participants for the naming of objects. Since the patient group of the current study was relatively small, it is not possible to draw a conclusion from this finding. Both patients however, performed worse on the naming of verbs than the naming of objects. In the study of Field, Saling & Berkovich, results also showed that patients used more words to tell their stories, in comparison to this study, patients used more T-units in the current study to tell their stories.

In their study Hoeppner et al. (1979) found four patients to display verbose behaviour. In this study also a narrative production task was used. Participants were found to focus more on details than on the main subject. The current study seems to provide results in concordance with the findings of Hoeppner et al. (1979). Patients also tended to use “verbose” behaviour while telling their stories. Patients left out a great percentage of crucial story elements and used a great amount of T-units to tell their story. Especially patient 2 tended to focus on the details of the pictures of the book, including many descriptions of the pictures and making references to her own personal life during the story.

In a study by Bell et al. (2003), discourse production was also investigated in temporal lobe epilepsy patients. The patients’ scores were worse than healthy participants on number of core story components produced and rate of speaking. These findings correspond with the findings of the current study. Both patients that were tested in the current study, described fewer of the essential story elements than the matching healthy participants. Rate of speaking was not investigated in this study. It can be stated that the hospitalized patient who was participating, used the most time of all the participants to tell the story. Perhaps this is a factor which can be taken into account for future research.

There are several limitations to the current study which can be discussed. Since the current patient group was relatively small, it was impossible to perform a statistical analysis. For a more representative patient group, it is suggested for follow-up research to form a patient group of at least ten epilepsy patients. Matched to this patient group, a group of ten healthy participants can be recruited to form a representative norm group. Age is also a matter that can be addressed in following research. In the current study two individual patients have been matched to separate groups of healthy participants to reassure that results would not show effects of age. For following research it is recommended that the patient group, as well as the group of healthy participants, will contain participants between
Healthy participants can be matched in age to one of the patients to create a patient group and a group of healthy participants which is equally spread in age.

The methods that have been used in the current study can also be considered in some aspects. For the narrative production, the book Tuesday (Wiesner, 1991) has been chosen to elicit a narrative from the participants. Tuesday offers the participants the opportunity to describe many picture elements as well as telling much about the story in the form of performed actions. Participants can also include mental state expressions concerning the characters, and the book also provides the researcher information concerning the ability of the participant to form a logical story. The introduction of the book to the participants that has been used, can perhaps be adjusted. For the current study the following set of instructions has been given to the participants: “I am going to show you a book. It is called Tuesday. It contains a lot of pictures, but not a lot of words. The book describes a certain story. The story commences as follows: it was Tuesday night around eight ‘o clock. Can you tell the rest of the story by using the book and the pictures in the book?” The used introduction states what is expected from the participants. However, it was sometimes unclear for the participants what exactly was asked of them, and especially participating patients asked for repeated instructions. To make it clearer for the participants what is expected from them, it is an option for future research to provide participants with an example. A possible instruction which includes an example which can be given is as follows: “I am going to show you a book. It is called Tuesday. It contains a lot of pictures, but not a lot of words. The book describes a certain story. The story commences as follows: it was Tuesday night around eight ‘o clock. The sun was going down, when turtle decided to go for an evening walk. Can you tell the rest of the story by using the book and the pictures in the book?” By using this example, the participant receives a clearer view of what is being expected of him/her. This example contains a description of one of the pictures and it also describes a certain kind of action. This way, participants receive an example of a description and an action, so participants will not be biased to include mostly descriptions or actions. While it is arguable that providing participants with an example creates more clarity for the participants, it can also be said that this example can trigger participants to copy the example in their stories. However, it is likely that patients with difficulties in describing actions and forming a story will still show difficulties in creating their stories.

The selection of epilepsy patients has proven to be difficult during the current study. Originally there were three patients selected to provide data for this study. Two of these patients were tested in a hospital setting, while one of the patients was being tested at home. One of the tested patients in a hospital setting, however, recently developed epilepsy after a stroke. This means that any effects that would have been found in the data that this patient provided for the study, could either be due to her stroke or to her epilepsy. Since this separation was impossible, this patient was excluded from the current study. The other patient which was being tested in a hospital setting had a higher age than the original age range. Since the original age range was 18-50 and patient 2 was 62, the age range was changed to include her data in the study. Patient 2 also suffered from a depression, for
which she was being treated. This means that patient 2 was not a perfect candidate, although she fulfilled the other criteria for inclusion. Her data were however included to include the data of one more epilepsy patient. Therefore, it is necessary to stress the fact that patient 2 cannot be seen as a perfect candidate for the study. Because of the age difference and also the difference in age of onset time, patient 1 and patient 2 were individually matched to healthy participants. Patient 1 had a more mild version of epilepsy. Patient 1 had in total suffered two epileptic seizures. At the time of testing, patient 2 was functioning so well that soon her medication would be stopped. The original selection criteria for patients were originally more strict. However, looking at the current study it can be discussed if it is truly feasible to select a representative patient group which fulfils all the criteria.

Another point concerning the selection of the participants for the current study is the nationality of the participants. Patient 2 and the other patient who was tested in a hospital setting were both of Belgian nationalities, while patient 1 and the matched healthy participants were all of Dutch nationality. Since in Belgium a certain dialect of Dutch is being used, it is possible to compare the data of Dutch participants with data of Belgian participants. However, it can also be imaginable that small linguistic differences between both groups can exist due to the difference in nationality. For the naming tasks, Belgian participants sometimes had slightly altered responses. To check if the responses were the same in meaning, a Belgian expert was consulted to compare the answers from the Belgian participant to the Dutch participants. For future research it is recommended to form both groups of participants from persons with the same nationality to make sure that no effect of nationality can be found in the results.

For future research it can also be recommended to create a clearer view of the patients intellectual and psychiatric background. Since research has shown that epilepsy patients are likely to show more personality disorder traits (Swinkels, Duijzens & Spinhoven, 2003), this is something that should be accounted for in epilepsy research. The correlation between the functioning of patients in a psychiatric and intellectual aspect combined with language is a subject that could be explored further.
References


