Notes on the discourse features of Persian-speaking Parkinsonian patients*

Arezoo Adibeik
Allameh Tabatabaee University, Tehran, Iran

Idiopathic Parkinson's disease is a common, age-related, progressive neurodegenerative disease whose cause is yet unknown. This disease has several impacts on speech, many of which have not received extensive study in Persian. The goal of this article is to investigate the discourse features of Persian-speaking Parkinsonian patients using three major tasks to evaluate the local coherence in their speech, with the hypothesis that Parkinsonian patients will have deficits in producing local coherence and in using the cohesive devices. The three tasks were administered to five non-demented patients with idiopathic Parkinson's and five healthy people as a control group. Based on the results, I conclude that Parkinsonian patients in the early-moderate stage are not significantly impaired in topic shifts, whereas patients in late-moderate and advanced stages seem to have a significant deficiency in this area.

1. Introduction

Language function involves the comprehension, formulation and transmission of ideas and feelings by the use of conventionalized verbal symbols, sounds and gestures and their sequential ordering according to accepted rules of grammar (Ropper and Brown 2005: 413). Therefore, speech and language functions are of fundamental human significance, both in social interaction and in private intellectual life. When they are disturbed as a consequence of brain disease, the resultant functional loss exceeds in many ways all others in gravity—even blindness, deafness and paralysis. This study investigates the pragmatic effects of one such brain disease: the degenerative disorder known as Parkinson's disease (PD).

1.1 General Properties of Parkinson's Disease

PD is an age-related progressive neurodegenerative condition that is associated with the depletion of dopamine-containing neurons in specific brain regions. Dopamine is one of the principal neurotransmitters in the brain.[1] Although no single causative factor has been identified, several mechanisms are thought to be involved in the etiology of idiopathic PD, ranging from mitochondrial

*The present article is taken from my MA thesis entitled "Language disorders in Persian-speaking Parkinsonian patients: Comprehension and production," prepared under the supervision of Dr. Mohammad Dabirmoghaddam at Allameh Tabatabaee University (ATU). The thesis was defended in November 2007. My sincerest acknowledgements go to my very dear father, without whose help and support this research would have been impossible. I am also indebted to my very dear friends and colleagues Dr. Behrooz Mahmoodi Bakhtiari and Ms. Arghavan Golbaz for their valuable help in conducting some of the studies described in this paper.

[1] A neurotransmitter is a substance that regulates synaptic transmission, or a nerve cell's propensity to fire (depolarize) over a given time window (Ingram 2007: 362).

© 2010 Arezoo Adibeik

defects to genetic factors (Blandini et al., 2000). According to Yahr (1982: 343), PD has been encountered in all races, in every region of the world. It is one of the leading causes of neurologic disability in individuals older than 60 years of age.

PD is characterized by variable degrees of Parkinsonism, defined as a paucity and slowness of movement, tremor at rest, rigidity, shuffling gait and flexed posture. There are certain differences between young-onset PD (onset between 21-39 years of age) and older-onset PD (onset after 40 years of age): in particular, young-onset PD progresses more slowly and less commonly involves dementia (Bhidayasiri, Waters and Giza, 2005: 223).

1.2 Cognitive and Linguistic Aspects of Parkinson's Disease

Although PD is best known as a movement disorder, about half of Parkinsonian patients also suffer from cognitive deficits similar to those exhibited by patients with lesions in the prefrontal cortex. Cognitive deterioration in PD typically includes a wide range of deficits (Savage 1997; Owen and Doyon 1999), which prominently include problems involving functions that are traditionally attributed to the frontal lobes. According to Katsarou et al. (2003), it is not yet clear whether specific language disturbances form part of the PD cognitive profile. Another study (Flowers, Robertson and Sheridan 1995) notes that a behavioural change often attributed to PD is a reduction in verbal fluency or the ability to generate words of a given category spontaneously over a short period of time. There is some dispute, however, as to whether the deficit is a genuine symptom of PD and whether it applies to all forms of word fluency or only to one kind of word-finding.

Several studies have demonstrated that non-demented PD patients have difficulty understanding sentences (Grossman et al. 1991; Lieberman et al. 1990). However, there has been considerable controversy concerning the basis for this impairment. On the one hand, several reports have emphasized the possibility that some aspect of grammatical processing is impaired in PD (Cohen et al. 1994; Lieberman et al. 1992; Natsopoulos et al. 1991, 1993; Ullman et al. 1997). PD patients were also found to be impaired in their performance on a sentence-picture matching task assessing a variety of grammatical forms (Lieberman et al. 1992). The findings of Grossman (1999) also suggest that the sentence comprehension deficit in PD is due in large part to limitations in the strategic distribution of cognitive resources such as selective attention that contribute to the processing of complex material.

Lieberman and his colleagues have argued that compromised basal ganglia functioning in PD interferes with motor functioning as well as comprehension since both are mediated by the same motor structures of the brain, according to the motor theory of speech perception (Liberman and Mattingly, 1985). An alternative approach has focused on the claim that sentence processing requires executive resources such as working memory, selective attention, inhibition, and planning to support sentence comprehension (Grossman et al., 2002: 604).

According to McNamara and Durso (2003), pragmatic communication skills are impaired in some PD patients, and this impairment may be related to frontal lobe dysfunction. However, this proposal is problematic, as the sensory area of the brain—namely, the temporal, parietal and occipital lobes—is also involved in cognition and recognition. As is well-known, the cognitive area is not centered in a particular portion of the brain. It is diffused.

1.3 Cohesion and Coherence in Discourse

The present study focuses on the discourse features of Persian-speaking patients with PD. Regarding the effects of PD on discourse, Ahlsen (2006: 103) states:

> "Right hemisphere damage (RHD) can result in a number of deficits which are highly relevant for the use of language in context. One of these deficits is the discourse deficit. RHD persons may have problems managing complex communication situations and the difficulties can affect practically all of the types of semantic-pragmatic phenomena."

It should be noted that problems such as understanding speaker intentions and communicative acts, especially indirect ones, may also occur. Attention and integration problems lead to lack of selective focus and integration of information. Alternative meanings, inferences and metaphors can cause problems. This shows up as difficulty understanding humour, irony, etc. Social communicative problems often result from these symptoms (Saldert 2006).

A handful of studies have addressed linguistic comprehension and production deficits in PD patients (Grossman 1999; Grossman et al. 2001; Breitenstein et al. 2001; Lee et al. 2001; Grossman et al. 2002; Gräber et al. 2002; Katsarou et al. 2003). However, few studies have mentioned and studied patients' use of cohesive elements and their abilities to make coherent sentences—that is, less is known about their discourse processing abilities. Discourse constitutes the highest and most complex level of linguistic representation and is the one which interfaces directly with non-linguistic or conceptual structure. It might be defined as a linguistic organization above the level of the sentence where sentences or their conceptual counterparts, propositions, come together to form what are commonly described as **texts** (Johnstone 2002). According to Renkema (2004: 103–104), the most salient phenomenon of discourse is the fact that sentences or utterances are linked together.

In order to capture this "connectedness" and "textuality", two concepts are used: **cohesion** and **coherence**. Cohesion refers to the connections that are manifested in the discourse itself, while coherence refers to the connections that can be made by the reader or listener based on knowledge outside the discourse. The concept of cohesion used by Halliday and Hasan (1976: 10) is set up to account for relations in discourse, but in a somewhat different way, without implication that there is some structural unit that is above the sentence—rather, the term "cohesion" simply refers to the range of possibilities that exist for linking something with what has gone before. Halliday and Hasan identify five types of cohesive devices: (1) reference, (2) ellipsis, (3) substitution, (4) conjunctions/discourse markers, and (5) lexical cohesion.

Chantraine, Joanette and Cardebat (1998: 162–273) have identified the following six classes of discourse: (1) narrative, (2) conversational, (3) descriptive, (4) argumentative, (5) expository, and (6) procedural. The three tasks in this study are based on narrative and conversational discourse. The first task, *spontaneous speech*, is based on conversational discourse, while the next two tasks, the *cookie theft task* and the *picture description task*, are based on narrative discourse.

A conversational discourse may be said to be coherent when we can identify relationships among the ideas arising from the discourse, giving us the feeling of experiencing something holistic. Conversely, the failure to find such relations leads us to feel that the discourse lacks coherence. Coherence, then, is a subjective state of mind that results from generating or evaluating ideas in relation to one another. According to Coats (1995: 41), spontaneous speech often appears to be incoherent, thus making the analysis of naturally-occurring conversation a challenge. However, the internal evidence of conversational texts shows that they are successful, inasmuch as the participants themselves give no indication that they are discontented with what has been achieved, and we must therefore treat such texts as coherent.

Coherence can be either **local**, in which cohesive ties are used, or **global**, which relates to the world knowledge of the reader or the listener. Both local and global coherence are important elements in a conversational context. However, because of time constraints, this study concentrates only on the local coherence of Persian-speaking Parkinsonian patients, setting aside global coherence. The main purpose of the present research is to gain a better insight of the discourse features of PD patients and determine whether they display any deficits with regard to coherence.

2. Methods

2.1 Subjects

Five non-demented patients with idiopathic PD were enrolled in this study. There were three men and two women, aged 40 to 76 years. The cardinal symptoms of the disease (i.e. rigidity, tremor, bradykinesia, bradyphrenia) were noted in these patients. The study also examined a control group of five healthy subjects matched to the PD patients on chronological age, sex and educational background. Table 1 shows the demographic and clinical data for the Parkinsonian patients and the matched control group.

TABLE 1: Demographic and clinical data for PD patients and the healthy control group.

Variable	Group		
	Moderate PD	**Advanced PD**	**Healthy Control**
Sample size (n)	3	2	5
Female/male	1/2	1/1	2/3
Age in years (mean)	61.66	61.5	61.2
Duration of disease (years, mean)	5.3	13.5	n/a
Age at disease onset (mean)	56.33	48	n/a

For the PD patients, the diagnosis of idiopathic PD without dementia was made by an experienced neurologist (Dr. B. Adibeik), who provided the MMSE (Mini-Mental-State Examination; Folstein, Folstein and Mc Hugh 1975) scores as well as the severity measures for each patient. All patients were tested during their optimally medicated ("on") state. As shown in Table 2, all but one patient scored at 24 or higher on the MMSE. The remaining patient (PS) was in the progressive stage and scored 20 on the MMSE. The mean score for the PD patients is 23.4.

TABLE 2: MMSE scores in PD patients.

PD Patients	MMSE Scores
MA	25
AN	24
FG	24
AM	24
PS	20

پژوهشگاه علوم انسانی و مطالعات فرهنگی
پرتال جامع علوم انسانی

The healthy control group was recruited by personal contact. None of the control subjects had a history of neurological or psychiatric disease or were taking medication affecting the central nervous system. The mean MMSE score for the control group was 28.4.

2.2 Tasks and Procedures

We administered three major tasks to evaluate local coherence as well as the subjects' ability to use cohesive devices: (1) a spontaneous speech task, (2) a "cookie theft" task, and (3) a picture

description task. The procedures were kept similar for all subjects. After they gave their consent to take part in this research, they were asked a standardized set of demographic questions (age, education, etc.). All participants were tested individually and the stimuli were presented on two separate large sheets of paper. Before starting the tests, the subjects were given an explanation of the tasks. I should note that two potential subjects had been eliminated earlier because of their lack of visual ability to distinguish the pictures.

Spontaneous Speech Task

All subjects were asked to answer some objective questions, such as their name, age, family, the duration of the disease (for patients), their spoken languages or dialects, and their educational background.

Cookie Theft Task

All subjects were shown the cookie theft card from the Boston Diagnostic Aphasia Examination (BDAE; Goodglass and Kaplan 1972) and were asked to tell a story about the card for approximately 90 seconds. The story was recorded. The picture, shown in Figure 1, illustrates an event taking place in a kitchen.

FIGURE 1: The cookie theft picture.

Picture Description Task

This task was taken from Bilingual Aphasia Test (BAT) introduced by Paradis (1987). The subjects were shown four illustrations, all of which were related to each other and on the whole described a story. We used this task in order to evaluate the subjects' abilities in comprehending and distinguishing the coherence of the pictures and to ascertain whether their use of cohesive elements gives a better description and tells a better story. The four illustrations are shown in Figure 2.

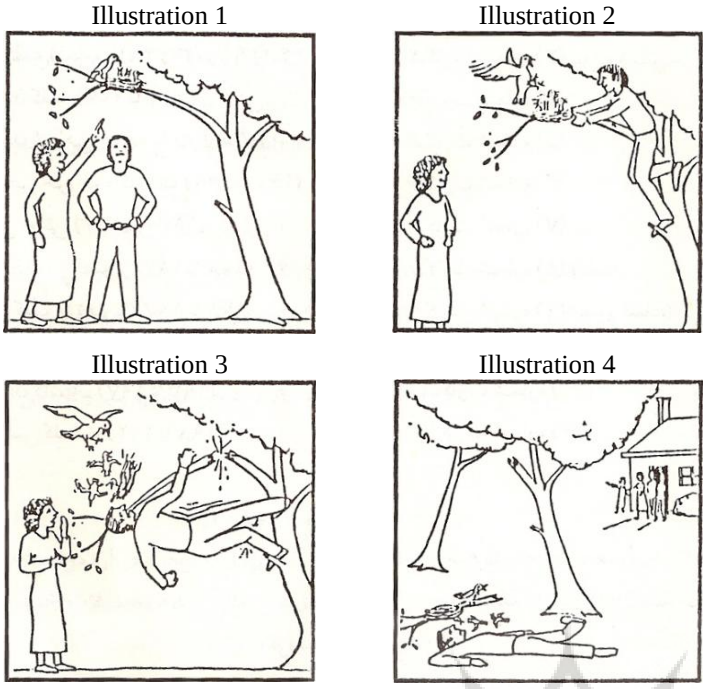

FIGURE 2: The picture description task.

3. Data Analysis

Recall from Section 1.3 above that Halliday and Hasan (1976) have identified five classes of cohesive devices. The number of such devices used by each subject was counted in each of the three tasks. In order to clarify the types of elements that were counted, the following examples illustrate each class of cohesive device. All relevant cohesive devices are bolded.

(1) REFERENCE

raft-am piš-e **doktor šahidi.** **ʔun** ham filmbardāri karde bud-Ø
go-1SG.PAST to-GEN **Dr. Shahidi** **(s)he-NOM** also film-taking do.PRF be.PAST-3SG

ye mariz-i mesl-e man-(r)o
one patient-INDEF like-GEN I-ACC

'I went to **Dr. Shahidi**. **He** had also taken a film from a patient like me.'

(2) ELLIPSIS

a. ʔahl-e kojā hast-in
from-GEN where be-PRES.2SG
EXAMINER: 'Where are you from?'

b. Sirjān
PATIENT: '**[I come from]** Sirjan!'

(3) SUBSTITUTION

qors o mosakken **o** **ʔin-(h)ā** ham ʔasar-i na-dāšt-Ø
tablet.DEF and/or painkiller.DEF and **this-PL** too effect-INDEF NEG-have.PAST-3SG
'(Neither) the tablets, (nor) the painkillers **and these things** had an effect on me.'

(4) CONJUNCTIONS/DISCOURSE MARKERS

ye mo?allem-e ?āmrikāyi dāšt-im **ke** māl-e sepāh-e dāneš
a/one teacher-GEN American have-PAST.1PL **who/that** belong-GEN corps-GEN literacy

bud-Ø … **be ?estelāh** … **ba?d** ?in(šaxs) sar-e sā?at **ke**
be-PAST.3SG **PREP.in term then** this (person) on-GEN time **that**

mi-šod-Ø dar-e kelās-(r)o mi-bast-Ø **va** man **hamiše**
PAST.CONT.3SG door-GEN class-ACC be-close-PAST.CONT.3SG **and** I **always**

dir mi-kard-am. **vali xob**, **be har hāl**, tamām-e talāš-am-(r)o
late ASP-do.PAST-1SG **but well**, **in-PREP any case** all-GEN effort-my-ACC

kard-am **o** dars xund-am **o** belaxare fāreqottahsil šod-am
do.PAST-1SG **and** study PAST.1SG **and** finally graduated be.PAST-1SG

'We had an American teacher **who** belonged to the…**so-called**…Literacy Corps. **Then** he used to close the door of the class on time **and** I was **always** late. **Well then**, **anyway**, I made all my efforts **and** studied **and** finally graduated.'

(5) LEXICAL COHESION

sāl-e 1381 ?amal kard-am, **?amal-e bāypas**
year-GEN 1381 to.operate do-PAST.1SG **operation-GEN bypass**
'I had an operation in 1381 [2002], **a bypass operation**.'

Table 3 shows the number of such devices used by each PD patient in the three tasks. The first patient (MA) was a 40 year-old female in the early-moderate stage of PD. She was a typical young-onset Parkinson's patient. She was a housewife with a high school diploma. The second patient (AN) was a 76-year-old male in the middle-moderate stage of PD. He was a retired teacher with a bachelor's degree. The third patient (FG) was a 69 year-old male in the late -moderate stage of PD. He was a retired officer with a bachelor's degree. The fourth patient (AM) was a 55-year-old male in the early-advanced stage of PD. He was an accountant with a high school diploma. Finally, the fifth patient (PS) was a 69 year-old female in the middle-advanced stage of the disease. She was a retired teacher with a master's degree.

TABLE 3: Cohesive ties used by PD patients.

Subject	**Number of cohesive ties used per task**			**Total Cohesive Ties Used**
	Spontaneous Speech	**Cookie Theft**	**Picture Description**	
MA	162	25	27	214
AN	28	15	21	64
FG	148	30	67	245
AM	107	24	20	151
PS	220	32	20	272
Mean – PD patients	133	25.2	31	189.2
Mean – control group	75	37.6	36.2	148.8

4. Results

4.1 Background Variables

Information on subjects' demographic data and patients' clinical data was provided in Section 2.1 above. Both the PD and control groups did not differ significantly with respect to age, the distribution of sex, and education. The advanced-PD patients had significantly longer disease duration than the moderate-PD patients.

4.2 Spontaneous Speech Task

In order to assess whether the PD patients were deficient in producing local coherence in spontaneous speech, we compared the number of cohesive ties and the frequency of local coherence used during this task with that of the control group. The patients showed some deficiency in producing local coherence. For example, when the examiner asked them about their age and educational background, three of the patients told her about their disease instead of answering the questions directly. However, after giving an account of their disease history, they went back to the original question. Interestingly, we noted that on average, the patients used more cohesive devices than the control group in the spontaneous speech task, which was quite remarkable. The number of cohesive ties used by each subject is shown graphically in Figure 3.

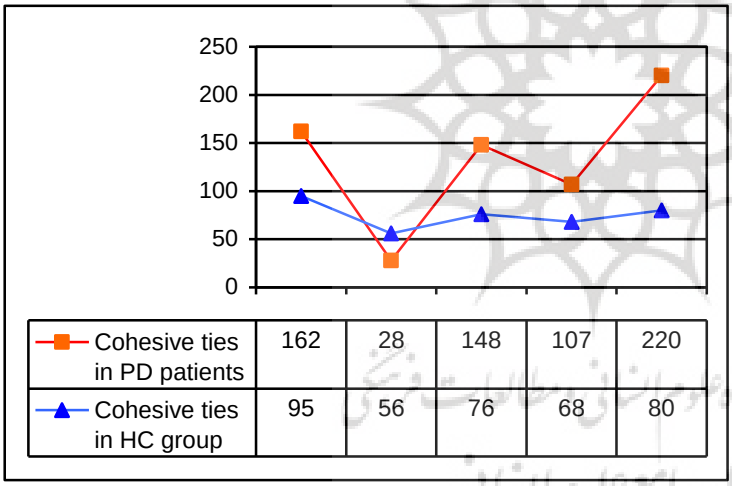

FIGURE 3: Cohesive elements used during the spontaneous speech task (HC = healthy control).

We also note that there appears to be some correlation between the use of cohesive elements in spontaneous speech and the educational background of the subject: the more educated the subject was, the more they tended to use cohesive devices.

4.3 Cookie Theft Task

The results of this task show that on average, the performance of PD patients differs from their HC counterparts: the PD patients used less cohesive ties than healthy controls. The PD patients showed some deficits in producing local coherence. This was mostly because of the patients' impaired cognition and lack of selective attention. The use of cohesive ties by each subject is illustrated in Figure 4.

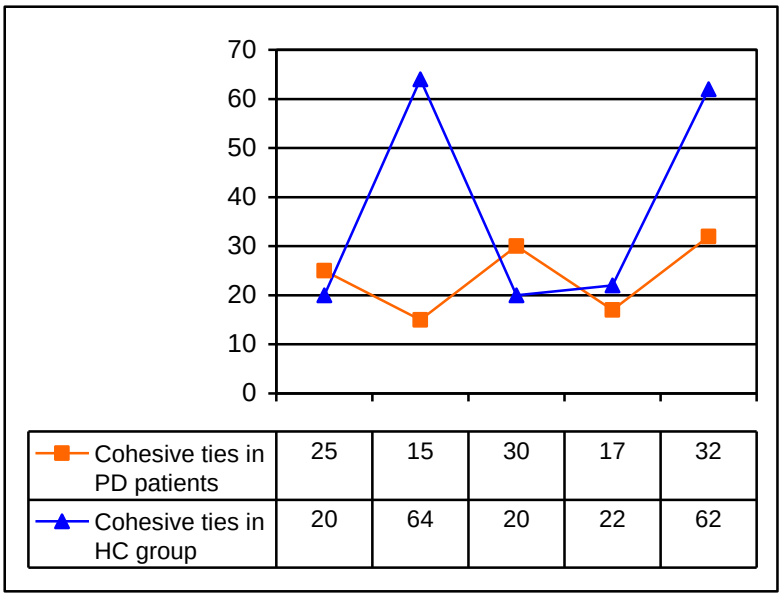

FIGURE 4: Cohesive elements used during the cookie theft task.

4.4 Picture Description Task

This task was used to assess the subjects' ability to distinguish and comprehend the coherence and cohesion in the sequence of pictures. Additional analyses were conducted to determine whether or not the use of cohesive ties by PD patients was less than the matched control group. In this task, the PD patients on average used fewer cohesive devices than the control group. The findings also imply that the PD patients' local coherence correlates with the stage of their disease, as the patients at more advanced stages showed greater deficiency. Figure 5 illustrates the number of cohesive elements used during the picture description task by all subjects.

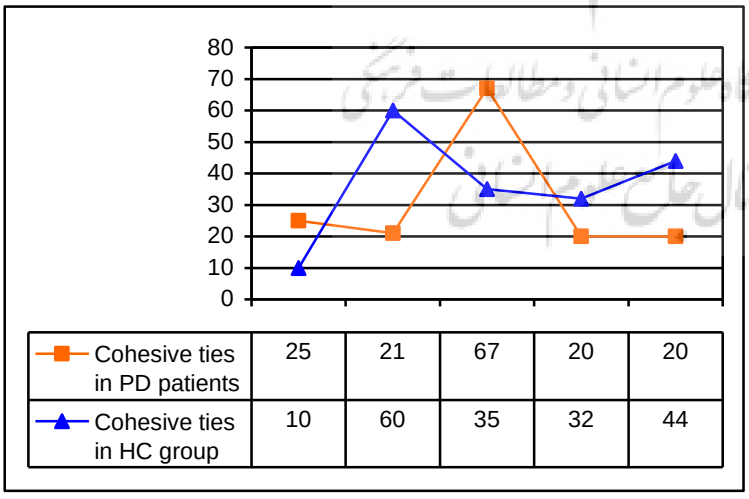

FIGURE 5: Cohesive elements used during the picture description task.

5. Discussion

The purpose of this study was to find out more about the discourse features of Parkinsonian spontaneous speech—in particular, whether the use of cohesive ties is impaired in PD patients, how such patients' use of cohesive ties differs from normal subjects, and how such deficits are related to the patients' clinical condition. As we have emphasized, there are various cognitive factors that affect the use of language in communication, including attention, memory, sensitivity to and production of emotional expression (e.g. by facial expression or prosody), and the abilities to grasp the situation as a whole, to selectively attend to what is important, and to adapt to changes.

As stated earlier, PD is a progressive neurodegenerative disease. It seems that the patients' right hemisphere is affected first, after which the disease may gradually affect the left hemisphere as well. In linguistic terms, the right hemisphere plays an important role in discourse processing, and automatic speech is also "relegated" to the right hemisphere.

Analysis of data from the PD and control groups revealed a striking difference between the numbers of cohesive devices they used during the 3 major tasks. The overall averages shown in Figure 6 illustrate the different performance of the PD group.

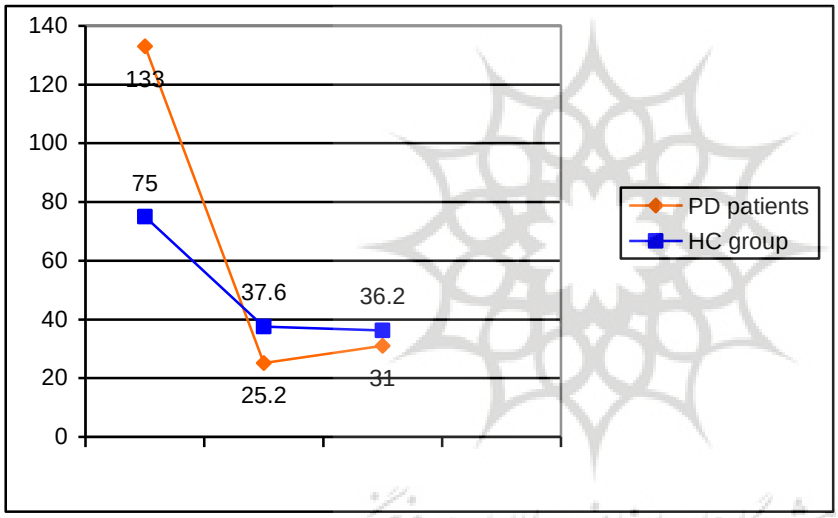

FIGURE 6: Mean scores for the use of cohesive devices in all tasks.

I should emphasize the limitations of this study both from a statistical viewpoint as well as the patients' status. However, these findings provide a starting point that can be built upon by future studies involving a larger sample of Parkinsonian patients.

6. Conclusion

As discourse features are much less studied than other linguistic aspects of PD, the present paper examined Parkinsonian patients' use of cohesive devices and local coherence in comparison with a matched control group. In general, we may conclude that neurolinguistic disorders are part of the Parkinsonian syndrome. Bear in mind that Parkinson's disease is considered by many to be a "frontal" disorder in which executive deficits occur. Our analysis also revealed that during the early and early-moderate stage, PD patients were not significantly impaired in the spontaneous speech task compared to the healthy controls, whereas patients in the late-moderate and advanced stages seemed to have a deficiency in this case. On the other hand, the patients' performance during the story

description and cookie theft tasks was somewhat similar to the healthy controls, although the patients used fewer cohesive ties than the control group. It is likely that the patients' cognitive abilities were mostly impaired due to their lack of selective attention. These results support the hypothesis that the degree of impairment of the local coherence of PD patients is related to the stage of their disease.

References

Ahlsen, E . 2006. *Introduction to Neurolinguistics*. Amsterdam/Philadelphia: Benjamins.

Bhidayasiri, R., M. F. Waters, and C. C. Giza. 2005. *Neurological Differential Diagnosis: A Prioritized Approach.* Oxford: Blackwell.

Blandini, F., G. Nappi, C. Tassorelli, and E. Martignioni. 2000. Functional changes of the basal ganglia circuitry in Parkinson's disease. *Progress in Neurobiology* 62, 63–88.

Breitenstein, C., D. Van Lancker, I. Daum, and C. H. Waters. 2001. Impaired perception of vocal emotions in Parkinson's disease: Influence of speech time processing and executive functioning. *Brain and Cognition* 45(2), 277–314.

Chantraine, Y., Y. Joanette, and D. Cardebat. 1998. Impairments of discourse-level representations and processes. In *Handbook of Neurolinguistics*, ed. by B. Stemmer and H. A. Whitaker, 260–273. San Diego: Academic Press.

Coats, J. 1995. The negotiation of coherence in face-to-face interaction: Some examples from the extreme bounds. In *Coherence in Spontaneous Text*, ed. by M. A. Gernsbacher and T. Givon. Amsterdam/Philadelphia: Benjamins.

Cohen, H., S. Bouchard, P. Scherzer, and H. Whitaker. 1994. Language and verbal reasoning in Parkinson's disease. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology* 7, 166–175.

Goodglass, H., and Kaplan, E. 1972. *Assessment of Aphasia and Related Disorders*. Philadelphia: Lea and Febinger.

Flowers, K. A., C. Robertson, and M. R. Sheridan. 1995. Some characteristics of word fluency in Parkinson's disease. *Journal of Neurolinguistics* 9(1), 33–46.

Folstein, M. F., S. E. Folstein, and P. R. McHugh. 1975. "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research* 12(3): 189–198.

Gräber, S., I. Hertrich, I. Daum, S. Spieker, and H. Ackermann. 2002. Speech perception deficits in Parkinson's disease: Underestimation of time intervals compromises identification of durational phonetic contrasts. *Brain and Language* 82(1), 65–74.

Grossman, M. 1999. Sentence processing in Parkinson's disease. *Brain and Cognition* 40(2), 387–413.

Grossman, M., S. Carvell, S. Gollomp, M. B. Stern, G. Vernon, and H. I. Hurtig. 1991. Sentence comprehension and praxis deficits in Parkinson's disease. *Neurology* 41, 1620–1626.

Grossman, A. B, B. Levin, H. Katzen, et al. 2001. Prospective study of lateralized tremor and its relationship to cognitive decline in Parkinson's disease. *Annals of Neurology* 50, S22.

Grossman, M., C. Lee, J. Morris, M. B. Stern, and H. I. Hurtig. 2002. Assessing resource demands during sentence processing in Parkinson's disease. *Brain and Language* 80(3), 603–616.

Halliday, M. A. K., and R. Hasan. 1976. *Cohesion in English*. New York: Longman.

Ingram, J. C. L. 2007. *Neurolinguistics: An Introduction to Spoken Language Processing and its Disorders.* Cambridge: Cambridge University Press.

Johnstone, B. 2002. *Discourse Analysis*. Oxford: Blackwell.

Katsarou, Z., S. Stavrakaki, A. Alexiadou, E. Anagnostopoulou, A. Kafantari, and S. Bostanjopoulou. 2003. Verbs with alternating transitivity in Parkinson's disease: Evidence from production and comprehension tasks. *Brain and Language* 87(1), 63–64.

Lee, C., M. Grossman, E. Zurif, P. Prather, J. Kalmanson, M. B. Stern, and H. I. Hurtig. 2001. Sentence comprehension and information processing in Parkinson's disease. *Brain and Language* 79(1), 13–14.

Liberman, A. M., and I. G. Mattingly. 1985. The motor theory of speech perception revised. *Cognition* 21, 1–36.

Lieberman, P., J. Friedman, and L. S. Feldman. 1990. Syntactic deficits in Parkinson's disease. *Journal of Nervous and Mental Disease* 178, 360–365.

Lieberman, P., E. Kako, J. Friedman, G. Tajchman, L. S. Feldman, and E. B. Jiminez. 1992. Speech production, syntax comprehension, and cognitive deficits in Parkinson's disease. *Brain and Language* 43, 169–189.

McNamara, P., and R. Durso. 2003. Pragmatic communication skills in patients with Parkinson's disease. *Brain and Language* 84(3), 414–423.

Natsopoulos, D., Z. Katsarou, S. Bostantzopoulos, G. Grouios, G. Mentenopoulos, and J. Logothetis. 1991. Strategies in comprehension of relative clauses in Parkinsonian patients. *Cortex* 27, 255–268.

Natsopoulos, D., G. Grouios, S. Bostantzopoulou, G. Mentenopoulos, Z. Katsarou and J. Logothetis. 1993. Algorithmic and heuristic strategies in comprehension of complement clauses by patients with Parkinson's disease. *Neuropsychologia* 31, 951–964.

Owen, A. M., and J. Doyon. 1999. The cognitive neuropsychology of Parkinson's disease: A functional neuroimaging perspective. In *Parkinson's Disease (Advances in Neurology)*, ed. by G. Stern, 49–56. Philadelphia: Lippincott-Raven.

Paradis, M. 1987. *The Assessment of Bilingual Aphasia*. Hillsdale, New Jersey: Lawrence Erlbaum.

Renkema, J. 2004. *Introduction to Discourse Studies.* Amsterdam/Philadelphia: Benjamins.

Ropper, A. H., and R. H.Brown. 2005. *Adams and Victor's Principles of Neurology*. 8th edition. New York: Mc Graw-Hill.

Saldert, C. 2006. *Inference and Conversational Interaction: Pragmatic Language Disturbances Related to Stroke*. Gothenburg Monographs in Linguistics, vol. 30. Gothenburg, Sweden: University of Gothenburg.

Savage, C. R. 1997. Neuropsychology of subcortical dementias. *Psychiatric Clinics of North America* 20(4), 911–931.

Ullman, M., S. Corkin, M. Coppola, G. Hickok, J. H. Growdon, W. Koroshetz, and S. Pinker. 1997. A neural dissociation within language: Evidence that the mental dictionary is part of declarative memory, and that grammatical rules are processed by the procedural system. *Journal of Cognitive Neuroscience* 9, 289–299.

Yahr, M. D. 1982. Parkinson's disease. In *Seminars in Neurology*, ed. by R. J. Joint, 343–350. New York: Thieme-Stratton.

پژوهشگاه علوم انسانی و مطالعات فرهنگی
پرتال جامع علوم انسانی