
Variation in Grammatical Complexity Across Three Types of Discourse

Variations de la complexité grammaticale dans trois formes de discours

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Abstract

This study investigated variations in grammatical competence in three types of discourse: picture description, procedural discourse, and story retelling. Twenty-two patients with aphasia (5 Broca's, 7 conduction, and 10 anomic) and 10 persons with normal speech served as participants. Three grammatical measures were considered: words per T-unit, clauses per T-unit, and percentage of dependent clauses. For all three measures, the picture description task elicited the most complex grammatical usage. The story retelling task consistently ranked the lowest in grammatical complexity and was significantly lower than the picture description task in all three measures. It may be inferred from these trends that patients with aphasia and those with normal speech both use discourse that is grammatically more complex in tasks with less structure or constraint.

Abstré

L'étude portait sur la variation de la compétence grammaticale dans trois formes de discours : la description d'une illustration, l'explication d'une procédure et la narration d'une histoire. Vingt-deux sujets atteints d'aphasie (5 d'aphasie de Broca, 7 d'aphasie de conduction et 10 d'aphasie amnésique) et 10 personnes ayant une élocution normale ont participé à l'étude. Trois mesures grammaticales ont été envisagées : le nombre de mots par unité de temps, le nombre de phrases par unité de temps et la proportion de relatives. Dans les trois cas, c'est la description de l'illustration qui a suscité l'usage le plus complexe de la grammaire. La narration de l'histoire s'est toujours classée au dernier rang pour ce qui est de la complexité grammaticale et donne des résultats significativement plus faibles que la description de l'illustration, pour les trois mesures. On en déduit que les personnes atteintes d'aphasie et les témoins se servent d'un langage grammaticalement plus complexe dans les tâches moins structurées ou comprenant moins de contraintes.

Because connected speech is frequently impaired in patients with aphasia, consideration of their spoken discourse is a critical issue. Discourse analysis attempts to discover the systematic properties and sequential organization of utterances. Since discourse is defined according to its communicative function, a variety of discourse genres can be used to formulate a message (Ulatowska & Chapman, 1989). Previous research has focused on four types of discourse (Ulatowska & Bond, 1983): conversational discourse, expository discourse (centres on a particular topic), procedural discourse (tells how something is done), and narrative discourse (description of an event or episode). It is recognized that the unique structure of each type places different linguistic and cognitive demands on the communicator (Ulatowska & Chapman, 1989).

Early discourse studies involving speakers with aphasia found a relative preservation of discourse structure in participants with moderate impairments (Ulatowska, Doyel, Freedman-Stern, Macaluso Haynes, & North, 1983; Ulatowska, Freedman-Stern, Doyel, Macaluso Haynes, & North, 1983). Despite marked deficits at the sentence level (e.g., reduced amount and grammaticality of linguistic structures), speakers with aphasia manifested a relative preservation of discourse structure. This preservation of information structure did not extend to more severely-involved patients. In a study of five individuals with aphasia characterized by severely reduced, fragmentary verbal expression, discourse was characterized by an absence of essential elements and inappropriate sequencing of narrative events (Bond, Ulatowska, Macaluso Haynes, & May, 1983).

More recent studies have examined specific linguistic alterations under varying task situations. Lemme, Hedberg, and Bottenberg (1984) examined productivity and narrative level in ten adults with mild to moderate aphasic impairments. Narratives were constructed under three conditions: a) speaking about a set of toy dolls, b) describing a Norman Rockwell print, and c) describing sequence pictures. Productivity was measured by the number of words and number of T-units. To measure narrative level, Applebee's (1978) analysis was employed. Each story was assigned a narrative level ranging from one to six, with higher numeric values reflecting an enhanced ability to integrate story elements. For example, the first level (termed heaps) consisted of characters and actions that were mentioned but not linked together. In the highest level (termed narratives), the main character developed over the course of the story. The investigators found that verbal productivity (measured by number of words and number of T-units) and narrative level were highest for the most structured situation (sequence picture) and lowest for the least structured (toy dolls). Similar results were obtained by Bottenberg, Lemme, and Hedberg (1987) when comparing narratives elicited with the Cookie Theft picture from the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass & Kaplan, 1983) and sequence pictures. In twelve participants with mild to moderate aphasic impairments, sequence pictures tended to elicit longer language samples with higher levels of narrative organization. Control groups were not included in the design of the Lemme et al. (1984) and Bottenberg et al. (1987) studies.

In a study of 21 persons from 60 to 85 years of age with normal speech, Shadden, Burnette, Eikenberry, and DiBrezza (1991) reported findings differing from those of the previous studies (Lemme et al., 1984; Bottenberg et al., 1987). They assessed grammatic and discourse variables in four types of tasks: Cookie Theft picture description (Goodglass & Kaplan, 1983), procedural discourse, story-retelling, and sequence pictures. For the key grammatic measures, including clauses per T-unit and proportion of subordinate clauses, procedural discourse tasks were found to be the most complex, followed by the Cookie Theft picture description, and, finally, the sequence picture task. Performance on the story retelling tended to be inconsistent. The finding of increased complexity in procedural rather than narrative discourse (e.g., sequence pictures) contrasts with Lemme et al. (1984) and Bottenberg et al. (1987). Shadden et al. (1991) noted that the reduced structure and constraint in the procedural discourse task may serve to enhance grammatic complexity. The authors suggested that allowing the participants to relate from their own experiences in a less structured manner (e.g., procedural discourse) resulted in improved performance.

In summary, there are discrepancies in previous studies regarding the effect of discourse type on grammatic complexity of discourse. Lemme et al. (1984) and Bottenberg et al. (1987) found longer and more complex utterances in the more structured discourse situation (e.g., sequence pictures), while Shadden et al. (1991) discovered greater complexity in a less structured task (e.g., procedural discourse). Evidently, participants with aphasia (Lemme et al., 1984; Bottenberg et al., 1987) displayed a different pattern of performance as compared to those with normal speech (Shadden et al., 1991). The purpose of the current study is to provide further clarification regarding this issue. Specifically, the study examines variations in grammatic performance across three types of discourse: picture description, procedural discourse, and story-retelling tasks. This investigation focuses primarily on grammatic measures since they provide useful indices of language quantity and language complexity. Consistent with past research, the current study predicts that grammatic differences will be found among discourse types. Specific trends are also expected to depend on presence and type of aphasia. Specific aphasic subgroups are examined in this study since systematic differences in grammatic and lexical usage (Goodglass & Kaplan, 1983; Benson, 1979) are expected to influence discourse production. Ulatowska and Chapman (1989) note that certain lexical and sentential level skills are required for discourse production. These include the effective use of verbs to form clauses, the ability to sequence or order information logically, and other underlying skills. Various aphasic subgroups, particularly persons with fluent and nonfluent aphasia, might be expected to show substantial differences on these abilities. For example, Ulatowska, Doyel et al. (1983) found that persons with anterior and posterior aphasia demonstrated differences in grammatic measures during a procedural discourse task; those with anterior aphasia produced fewer correct T-units and total clauses than those with posterior aphasia.

Method

Participants

Twenty-two adults with aphasia were included as participants in this investigation: 5 Broca's, 7 conduction, and 10 anomic. Syndrome of aphasia was determined by using the guidelines provided by Goodglass and Kaplan (1983). These specific syndromes were chosen for inclusion because they are all characterized by good auditory comprehension and thus, the participants with aphasia were capable of understanding instructions and performing the experimental tasks. Only persons with mild to moderate aphasic impairments, good auditory comprehension, and the ability to produce real words in a meaningful context were

Grammatical complexity and discourse type

included in the study. To assess comprehension, the Complex Ideational Materials subtest of the BDAE (Goodglass & Kaplan, 1983) was used. All participants with aphasia included in this study (Broca's, conduction, anomic) were required to demonstrate scores above the 50th percentile on this subtest. Participants with aphasia were medically stable at the time of testing; each had sustained a single, left hemisphere cerebrovascular accident resulting in aphasia.

Ten normal controls also participated. Between-group one-way analyses of variance were performed to determine the differences, if any, between aphasia groups and normal participants as a function of age and years of education. No significant group differences were observed for age [$F(3,28) = 1.04, p > .05$] or for years of education [$F(3,28) = 2.46, p > .05$]. All participants were right-handed, native speakers of English. Data from these same participants were reported in a previous study (Williams, Li, Della Volpe, & Ritterman, 1994). That study focused on topic and listener familiarity, whereas the current study concerns type of discourse. Tables 1 and 2 present participant characteristics.

Table 1. Characteristics of Participants with Aphasia

Participants	Age	Gender	Education (Years)	Months post onset	Type of Aphasia
# 1	75	M	12	6	Broca's
# 2	59	M	10	134	Broca's
# 3	63	M	11	9	Broca's
# 4	53	M	17	71	Broca's
# 5	68	M	14	3	Broca's
# 6	69	F	14	24	Conduction
# 7	67	M	12	48	Conduction
# 8	64	M	12	13	Conduction
# 9	75	M	12	18	Conduction
#10	70	M	12	13	Conduction
#11	67	M	16	50	Conduction
#12	75	F	11	4	Conduction
#13	67	M	12	39	Anomic
#14	49	M	14	18	Anomic
#15	69	M	11	10	Anomic
#16	71	M	11	104	Anomic
#17	52	M	18	32	Anomic
#18	68	F	16	4	Anomic
#19	60	M	9	75	Anomic
#20	79	F	16	9	Anomic
#21	73	F	18	21	Anomic
#22	49	F	12	8	Anomic

Mean = 65.50

13.18 32.41

Table 2. Characteristics of Participants with Normal Speech

Participant	Age	Gender	Education (Years)
# 1	76	F	16
# 2	71	M	14
# 3	81	M	16
# 4	75	M	12
# 5	70	M	14
# 6	73	M	17
# 7	69	M	19
# 8	68	M	19
#10	56	F	16

Mean = 68.80

Procedure

Type of Aphasia

At the onset of the testing session, tasks designed to determine the syndrome of aphasia were administered to participants with aphasia only. Type of aphasia was determined by the investigator after assessing three clinical parameters, auditory comprehension, spontaneous speech production, and repetition of phrases. The specific methodology for assessment has been used in a number of previous studies (Li & Canter, 1983; Li & Williams, 1990; Williams & Canter, 1982).

With regard to spontaneous speech, fluency is one major characteristic distinguishing between anterior (Broca's) and posterior (conduction, anomic) aphasia. Criteria for classification were the six features of speech production used in the BDAE rating scale (Goodglass & Kaplan, 1983). The ratings were applied to 10-minute samples of spontaneous speech.

To differentiate participants with conduction aphasia from those with anomia, the Repeating Phrases subtest of the BDAE (Goodglass & Kaplan, 1983) was administered. Participants classified with conduction aphasia showed repetition skills below their spontaneous speech skills, while those classified with anomia displayed good repetition skills.

Discourse Tasks

Each of the three types of discourse examined in this study has a unique grammar and unique characteristics (Ulatowska & Bond, 1983). Picture description focuses on a particular topic. Procedural discourse consists of steps that are conceptually or chronologically linked. Narrative discourse is a description of a happening related as a sequence of events.

To assess picture description, the Cookie Theft picture from the BDAE (Goodglass & Kaplan, 1983) was used. The participant was asked to describe the Cookie Theft picture as completely as possible. Procedural discourse skills were evaluated using two tasks: going to the market and going out to dinner. Participants were instructed by the listener to "tell me in four to five steps how you would . . . (perform the particular task)." A number of examples were then provided prior to the actual experimental items. Two story-retelling tasks were presented to determine narrative skills. Each story consisted of five sentences, with word frequency, grammatical complexity, and sentence length balanced across stories. The two stories (A Doctor's Visit and A Shower) are presented in the Appendix. The participant was instructed to listen to the story and "tell it back to me exactly as I have read it." The examiner read the story and the participant immediately retold it. Two sample stories were provided as practice items, ensuring that participants understood the nature of the task before administration of the experimental items.

Scoring

Testing sessions were tape-recorded using a Marantz portable cassette recorder (Model PDM 201). The sessions were recorded in their entirety to allow for subsequent transcription. Participants' verbalizations were scored from written transcriptions of the tape-recorded testing sessions. There were five discourse samples to analyse for each participant (Cookie Theft picture and two each of the procedural and story-retelling samples).

Prior to linguistic scoring, transcribed discourse was segmented into T-units, defined as one independent clause plus the dependent modifiers of that clause (Hunt, 1965). Only utterances pertaining to the specified topic were scored.

Linguistic scoring involved four types of measures. Three measures (number of words per T-unit, number of clauses per T-unit, and percentage of dependent clauses) represented the grammatical complexity of participant utterances and discourse. The final measure, percentage of content words, was an indication of the amount of information conveyed. A description of each measure follows:

1. Number of words per T-unit measured the length of the T-unit.
2. Number of clauses per T-unit represented the number of grammatical constructs per T-unit.
3. Percentage of dependent clauses measured the complexity of grammatical constructs.

4. Percentage of content words assessed effectiveness in communicating information. Content words were separated from function words (grammatical particles), which related to grammatical competence.

For each Cookie Theft sample, these four linguistic measures were computed. For the two procedural discourse tasks, the four linguistic measures were computed separately for each task and then averaged across tasks. The story-retelling means were computed in a similar manner to procedural discourse.

Reliability

To assess reliability, 25% of the speech samples were re-scored by an independent aphasiologist. Inter-judge reliability for each of the four dependent measures was as follows: number of words per T-unit (92%), number of clauses per T-unit (97%), percentage of dependent clauses (95%), and percentage of content words (93%).

Results

Data were subjected to a multivariate mixed-design analysis of variance (ANOVA). The analysis contained one within-group variable (discourse type) with three levels (picture description, procedural discourse, story retelling), one between-group variable (participant category) with four levels (Broca's aphasia, conduction aphasia, anomia, normal speaker), and four dependent measures (the linguistic measures described above).

The analysis revealed significant main effects for both variables: discourse type [$F(8, 21) = 14.55, p < .001$] and participant category [$F(12, 66) = 2.24, p < .05$]. There was no significant interaction between the discourse and participant category variables ($p > .05$). With respect to the discourse type variable all four dependent measures were statistically significant: (a) number of words per T-unit [$F(2, 27) = 13.94, p < .0001$], (b) number of clauses per T-unit [$F(2, 27) = 4.45, p < .05$], (c) percentage of dependent clauses [$F(2, 27) = 4.84, p < .05$], (d) percentage of content words [$F(2, 27) = 76.59, p < .0001$]. The means and standard deviations for these dependent measures are presented in Table 3.

Scheffé (1959) a posteriori analyses revealed the following patterns. Significantly more words per T-unit were produced in the picture description task than both the procedural and story retelling tasks ($p < .01$). Significantly more clauses per T-unit were produced in the picture description as compared with the story retelling task ($p < .05$). Both picture description and procedural discourse elicited

Table 3. Means and standard deviations for four dependent measures within three discourse tasks

	Picture Description		Procedural Discourse		Story Retelling	
	Mean	SD	Mean	SD	Mean	SD
Words/T-Unit	8.66	2.37	6.85	2.92	6.40	1.18
Clauses/T-Unit	1.55	.44	1.48	.53	1.34	.21
Percent/Dependent Clauses	14.18	2.24	14.78	1.77	8.70	1.49
Percent/Content Words	42.90	4.61	41.16	5.80	51.76	6.68

significantly more dependent clauses than story retelling ($p < .01$). These results suggest that less structured tasks, such as a picture description, elicit higher levels of grammatical complexity. For the final measure, percentage of content words, a different pattern emerged. Significantly more content words were produced during the *story retelling* situation than both the procedural discourse and picture description tasks ($p < .01$).

Within the participant category, one dependent measure (dependent clauses) was found to be significant ($p < .05$). Means and standard deviations for each dependant measure by participant category are presented in Table 4.

Scheffé (1959) a posteriori testing revealed that both participants with normal speech and conduction aphasia produced a significantly greater percentage of dependent clauses than those with Broca's aphasia ($p < .05$). Apparently, the percentage of dependent clauses was more salient than the other dependent measures in differentiating between participants with fluent and nonfluent aphasia.

Discussion

The results of the current study provide further evidence that the unique structure of each discourse type places different linguistic demands on the speaker (Ulatowska & Chapman, 1989). When three types of discourse were compared, consistent differences in grammatical measures emerged. For the three grammatical measures (words per T-unit, clauses per T-unit, and dependent clauses), the picture description task elicited the most complex grammatical usage

in speakers. The story retelling task consistently ranked the lowest in grammatical complexity and was significantly lower than the picture description task in all three measures. The procedural discourse task tended to occupy an intermediate position between the other two tasks.

The findings of the current study are consistent with the observation of Shadden et al. (1991) that task constraint appears to reduce grammatical complexity. In Shadden et al. (1991), procedural discourse ranked highest in grammatical measures, followed by the picture description and then by the sequence picture task. In comparison to other tasks, the sequence picture task is regarded as a highly constrained and structured situation (Hedberg & Stoel-Gammon, 1986; Ulatowska & Chapman, 1989). In the present study, a story retell rather than a picture sequence task was used. However, the retelling procedure is also highly constrained (Liles, 1993). Consistent with the findings of Shadden et al. (1991), the story retell task ranked lowest in grammatical measures and differed significantly from the picture description task.

There are several possible explanations why increased constraint appears to create limitations for the speaker. Hedberg and Stoel-Gammon (1986) link the notion of structure or constraint to the class of stimuli used. They assert that the amount of structure inherent within the stimuli has a major impact on the organization of story construction. For example, stimuli such as toys or objects provide little inherent structure to the speaker. On the other hand, a related sequence of pictures involves a high degree of structure. A picture with characters and a physical setting provides a medium degree of structure (Hedberg & Stoel-Gammon, 1986).

Table 4. Means and standard deviations for four dependent variables within four participant categories

	% Dependent Clause		Words/T-unit		Clauses/T-unit		% Content Words	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Normal Speech	16.24	2.09	8.45	.58	1.66	.09	46.21	1.49
Conduction Aphasia	15.23	2.63	7.70	.46	1.52	.10	41.15	1.12
Anomic Aphasia	10.58	1.61	6.22	.26	1.29	.04	46.48	1.24
Broca's Aphasia	5.33	1.70	6.62	.48	1.28	.08	46.74	2.06

Liles (1993) elaborated on how the amount of external structure affects task performance. The discussion compared two major types of stimuli used to generate narratives: generation procedures (i.e., reports on personal experience, requests to tell a story about a picture) and retelling procedures (i.e., story productions after movie viewings, narrating a previously heard story). Liles (1993) noted that generation procedures apparently encourage a greater range of linguistic variation and content, as compared to retelling procedures. In large part, this is due to the nature of the stimuli. During generation, the speaker has reduced reliance on external stimuli and is consequently forced to rely more heavily on internal narrative organization. This apparently enhances verbal range and complexity. Along similar lines, Shadden et al. (1991) noted that the presence of an auditory linguistic model during their story retelling task markedly reduced self-generation, and thereby decreased verbal complexity.

Apparently, the speaker who is minimally directed by context, relies more heavily on internalized narrative organization. To examine these internal operations, it is useful to define the role of linguistic schema or "frames." A frame is an inferential body of knowledge, based on the speaker's pragmatic experience and linguistic rule system. During discourse production, a particular "frame" is elicited in conjunction with each new stimulus or topic (Minsky, 1977). The structure of the task can significantly influence the way frames are accessed. In the less constrained task, frames are not directed by external stimuli. This affords the speaker greater freedom in accessing the number, type and sequence of frames (Minsky, 1977; Tannen, 1979). We posit that these increased options allow the speaker to be more creative and elaborate in structuring grammatic usage, thereby increasing grammatic complexity.

This explanation can be applied to the specific tasks in the current study. In the picture description task, speakers can choose from a wide array of visual stimuli to structure their linguistic frames. In the process of relating various aspects of the picture into a cohesive description, a high level of grammatic complexity tends to be achieved. In the procedural discourse task, fewer possible frames are available since the topic is specified and speakers provide "four to five steps" in sequence. A corresponding decline in grammatic usage occurs. Finally, in story retell, linguistic frames are rigidly constrained; speakers must adhere to the previously presented auditory model. In this situation, grammatic complexity falls to the lowest level. It should be noted that our story-retell task was limited to brief, five-sentence, single episodes. In a longer and more complex narrative, different verbal complexity patterns may emerge.

The tendency to provide grammatically complex discourse in less-constrained tasks applied to both normal

speakers and those with aphasia. As previously observed, the only significant difference noted in the participant category variable pertained to dependent clauses. As one would expect, participants with Broca's aphasia produced fewer dependent clauses than either those with conduction aphasia or normal speakers.

With reference to previous research, results of the current study are consistent with those of the recent work of Shadden et al. (1991) as opposed to those of the earlier studies by Lemme et al. (1984) and Bottenberg, et al. (1987). These earlier studies found productivity and narrative level higher for more structured situations. One reason for the discrepant findings may relate to the relatively small number of participants utilized in earlier studies. The study by Lemme et al. (1984) involved ten participants and Bottenberg et al.'s (1987) study involved twelve participants. The current study and that of Shadden et al. (1991) was characterized by larger and perhaps more representative groups of participants.

With regards to the percentage of content words produced, story retelling elicited a significantly higher percentage of content words than the other two discourse tasks. This finding suggests that the grammatically simpler discourse in story retelling is accompanied by higher information content. It is likely that the participant utilizes lexical rather than grammatic means to convey the informational load of this narrative task.

In summary, the principal findings in this study indicate that variations in type of discourse elicit systematic changes in speakers' grammatic usage. Decreased constraint apparently allows both persons with aphasic and normal speech to use a higher level of complexity. It is probable that speakers rely more on internalized schema and organization, when they are minimally directed by external stimuli. These results suggest that linguistic constraint should be taken into account during diagnostic and therapy activities, when determining the complexity level of various types of discourse.

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Appendix

Stories Used in the Story Retell Task

A Doctor's Visit

Tom, my six-year old, had a sore throat and fever. I took him to the doctor's office. We spoke to the receptionist, signed in, and sat in the waiting room. The doctor examined Tom. Tom was diagnosed with strep throat.

A Shower

Mary decided to take a hot shower. She went into the bathroom. She stepped into the shower, reached for the soap, and turned on the hot water. The water was icy cold. Her hot water heater was broken.