

The Communicative Informativeness and Efficiency of Connected Discourse by Adults With Aphasia Under Structured and Conversational Sampling Conditions

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Measuring communicative informativeness under conversational discourse conditions is perhaps the most valid means of determining the interpersonal verbal communication abilities of adults with aphasia. Nevertheless, the data derived from such analyses are expensive to collect and subject to unknown sources of variability. In this study, samples of connected discourse were obtained from 20 subjects with aphasia under structured and conversational sampling conditions to determine the extent to which they were related on measures of communicative informativeness. Results revealed that subjects produced significantly greater percentages of informative words [i.e., correct information units (Nicholas & Brookshire, 1993)] under conversational discourse conditions, but that the percentage of correct information units produced during structured discourse tasks could be used to predict performance under conversational conditions with a high degree of accuracy.

Measuring communicative informativeness and efficiency under conversational discourse conditions is perhaps the most valid means of determining the interpersonal verbal communication abilities of adults with aphasia. Nevertheless, conversational discourse sampling can be problematic in that the procedure is often too expensive and logistically impractical to be employed in most clinical settings. Further, the very attributes that contribute to the ecological validity of the sampling method also contribute to its variability. That is, the language produced under such conditions may be affected by a number of factors specific to the sampling context,

including the manner in which conversations are elicited (Doyle, Thompson, Oleyar, Wambaugh, & Jackson, 1994; Wambaugh, Thompson, Doyle, Cammarata, 1991), the topics of conversation, and the familiarity of the sampling context (Glosser, Wiener, & Kaplan, 1988).

Elicitation procedures that require subjects to describe pictured events or to provide procedural information are more efficient methods of language sampling and have been studied rather extensively with respect to the effects of stimulus and task variables on connected discourse performance of subjects with aphasia (cf. Bottenberg & Lemme, 1991; Bottenberg, Lemme, & Hedberg, 1987; Brenneise-Sarshad, Brookshire, & Nicholas, 1991; Correia, Brookshire, & Nicholas, 1990; Easterbrook, Brown, & Perrera, 1982; Potechin, Nicholas, & Brookshire, 1987). While such structured elicitation procedures allow for greater control of potential sources of variability among subjects and across repeated measures, they differ from conversational sampling methods with respect to their functional purpose, contextual elements, and cognitive demands. Because the effects of these variables on communicative informativeness and efficiency are poorly understood, the relationship between aphasic speakers' performance under structured sampling conditions and their performance during conversational sampling conditions is presently unknown. Therefore, the purpose of this investigation was to compare the communicative informativeness and efficiency of aphasic adults' connected discourse across structured and conversational sampling conditions, and

to examine the strength of the relationship between their performances under these two conditions. Specifically, we compared the total words, number of correct information units, and percentage of correct information units (Nicholas & Brookshire, 1993), between the two conditions. In addition, we compared the percentage of accurate/complete main concepts obtained from structured discourse samples (Nicholas & Brookshire, 1995), to a measure developed specifically to capture the informativeness of discrete communicative attempts during conversational discourse. This measure, the percentage of informative minimal discourse units, is defined in Appendix A.

Method

Subjects

Twenty subjects with aphasia participated in the investigation. Fifteen were male and 5 were female. Subjects ranged from 40 to 79 years of age with a group mean of 62.8 years. All subjects were monolingual, native speakers of English who sustained a single, left-hemisphere stroke and were referred for speech and language evaluation. Each subject passed a pure-tone audiometric screening at 30 dB HL in the better ear. The subjects varied with respect to handedness, months postonset of CVA, estimated premorbid IQ (Wilson, Rosenbaum, & Brown, 1979), overall aphasia severity as measured by the Porch Index of Communicative Ability (PICA; Porch, 1981), and aphasia classification as measured by the Western

Aphasia Battery (WAB; Kertesz, 1982). Descriptive information for individual subjects is presented in Table 1.

Procedures

Structured Discourse. Structured discourse samples were elicited using the 10 stimuli described by Nicholas and Brookshire (1993). These items consist of four single pictures, two picture sequences, two requests for procedural information, and two requests for personal information. Stimuli were presented individually to each subject in random order. Subjects were instructed to describe what they saw happening in each picture, or to provide the requested procedural/personal information, which was printed on a 5 x 7 inch card and read aloud by the examiner. Subjects who did not respond to a particular stimulus, or stopped talking before producing 15 seconds of speech, were given a single prompt by the clinician to provide additional information.

Conversational Discourse. Conversational discourse samples were elicited in simulated natural environments located at

two separate research sites. These rooms were carpeted, contained comfortable furniture, draperies, wall hangings, a TV monitor/VCR unit, and unobtrusive audio- and video-recording equipment. Conversational discourse samples were elicited using topic-open and topic-constrained sampling procedures based on previous findings that these conditions significantly affected the proportionate distribution of assertions and requests for information in the conversations of normal adults (Doyle et al., 1994). That is, normal subjects asserted information frequently and requested information rarely under topic-constrained sampling conditions, whereas the reverse held true in topic-open sampling conditions. As such, we attempted to provide sampling contexts in which these two broad categories of communicative functions would occur in roughly proportionate distribution.

Both procedures employed familiar conversational partners identified by subjects for purposes of the investigation. The topic-open sampling method consisted of a 7-minute unconstrained conversation prior to which subjects and their respective partners were instructed that they could

discuss anything they chose. The topic-constrained sampling method immediately followed. In this condition, the subject and his or her conversational partner viewed a 4.5-minute prerecorded *ABC News American Agenda* segment and then discussed its content for 7 minutes. The specific segment used in this study was entitled "Boot Camps for Young Offenders" and was selected for its high interest level as determined by previous validation studies (Doyle et al., 1994).

The first 7 minutes of conversation obtained from each sampling method were combined for purposes of analysis, thus yielding one 14-minute conversational discourse sample for each subject. The order in which structured and conversational discourse samples were elicited was counterbalanced across subjects.

Transcription and Scoring. The structured and conversational discourse samples for each subject were transcribed from audio recordings into a microcomputer by a trained research assistant. The transcripts of the structured discourse samples were scored by the second and third authors according to the published procedures and rules for correct information units (Nicholas & Brookshire, 1993) and main concepts (Nicholas & Brookshire, 1995) to obtain the following measures for each sample: total words (TW), number of correct information units (NCIUs), percentage of correct information units (PCIUs), and percentage of accurate/complete main concepts (PACMCs).

Conversational discourse samples were segmented into speaker turns, which were further segmented into minimal discourse units based upon operational criteria described in Appendix A. To accomplish this task, the second and third author listened to the audio-taped samples while reading the corresponding typed transcript. Subjects' utterances were then analyzed to yield the following measures for each sample: TW, NCIUs, PCIUs, and percentage of informative minimal discourse units (PIMDUs).

Interrater Agreement. To assess interrater agreement for transcription and for segmenting turns into minimal discourse units, the second and third authors were provided with each other's transcripts and corresponding audio-recordings for both structured and conversational samples and instructed to indicate any disagreements with respect to content and segmentation. Disagreements were resolved by consensus.

Point-to-point interrater agreement was calculated for CIUs, main concepts, and informative minimal discourse units by having the second and third authors independently score the structured and conversational discourse samples of 5 randomly

TABLE 1. Descriptive data for individual subjects with aphasia.

Subject	Gender	Hand	Age	MPO	EPIQ	PICA %ile	WAB Classification
1	M	R	69	22	116.58	90	Anomic*
2	M	R	62	45	132.26	87	Anomic
3	M	L	70	91	115.8	73	Conduction
4	F	R	65	29	107.48	89	Anomic
5	M	L	53	15	105.5	74	Transcortical motor
6	M	R	70	152	118.77	95	Anomic
7	M	R	63	188	120.55	73	Broca's
8	F	R	60	10	112.57	82	Anomic
9	M	R	72	72	115.13	78	Conduction
10	M	R	66	4	110.13	57	Anomic
11	M	R	76	15	116.8	78	Broca's
12	M	R	58	203	111.7	52	Broca's
13	F	R	79	201	121.7	80	Broca's
14	M	R	45	19	121.4	55	Broca's
15	M	R	66	26	118.1	92	Broca's
16	F	R	68	15	113.9	75	Broca's
17	M	L	45	27	132.3	72	Broca's
18	M	R	72	9	107.8	54	Anomic
19	F	R	57	3	98.71	49	Anomic
20	M	R	40	110	116.6	59	Broca's
<i>M</i>			62.8	62.8	115.69	73.20	
<i>SD</i>			10.55	69.87	8.09	14.37	

*Subject's overall naming subtest score was above the cutoff level to be classified as anomic aphasia (Kertesz, 1979). However, during connected discourse, subject demonstrated frequent word finding difficulties. MPO = months postonset. EPIQ = estimated pre-morbid intelligence quotient. PICA = Porch Index of Communicative Ability. WAB = Western Aphasia Battery.

TABLE 2. Point-to-point interrater agreement for measures derived from structured and conversational discourse samples.

Subject	Structured Discourse		Conversational Discourse	
	ACMC	CIUs	IMDU	CIUs
1	0.79	0.83	0.83	0.86
2	0.81	0.97	0.83	0.81
3	0.87	0.92	0.79	0.91
4	0.98	0.96	0.84	0.90
5	0.87	0.94	0.93	0.90
<i>M</i>	0.86	0.92	0.84	0.88

Note. IMDU = Informative minimal discourse units. CIUs = Correct information units. ACMC = Accurate and complete main concepts.

selected subjects. The data displayed in Table 2 were obtained by dividing the number of agreements by the number of agreements plus disagreements for each variable.

Results

Individual subject's scores on measures derived from structured and conversational discourse elicitation conditions are presented in Tables 3 and 4, respectively. Four one-way repeated measures ANOVAs were performed on these data to examine differences in the measures across conditions. To control for Type I familywise error, an alpha level of .01 was selected. Results revealed that the number of words [$F(1,19) = 6.96, p = .016$] and the number of correct information units [$F(1,19) = 1.26, p = .27$] produced by subjects did not differ significantly across the two sampling conditions.

In contrast, subjects produced a significantly greater percentage of correct information units in conversational discourse [$F(1,19) = 10.99, p = .004$], and a significantly greater percentage of informative minimal discourse units during conversation as compared to accurate and complete main concepts during the structured discourse task [$F(1,19) = 9.90, p = .005$].

To examine the strength of the relationship between subject's communicative informativeness and efficiency across sampling conditions, four Pearson Product Moment Correlations were computed. Figures 1a through 1c show data points for individual subjects and associated regression lines for comparisons of total words ($r = 0.78, p < .001$), number of correct information units ($r = 0.70, p < .001$), and

percentage of correct information units ($r = 0.91, p < .001$) across structured and conversational discourse conditions.

Figure 1d shows the data points for individual subjects and associated regression lines for the percentage of accurate and complete main concepts derived from structured discourse samples, and the percentage informative of minimal discourse units derived from conversational discourse ($r = .71, p < .001$).

Discussion

The purpose of this investigation was to compare the communicative informativeness and efficiency of aphasic adults' connected discourse under structured and conversational sampling conditions, and to examine the strength of the relationship between subjects' performance under structured elicitation conditions and their performance under conversational sampling conditions. The results revealed that although the number of informative words produced across the two conditions did not

differ significantly, the efficiency with which information was communicated as measured by the percentage of correct information units was greater during conversational discourse.

Several explanations may account for these findings. As indicated previously, the functional purpose, contextual elements, and cognitive demands of the structured and conversational sampling methods employed in this investigation were substantively different, and each of these factors and/or their interaction may have influenced subjects' performance. Previous studies have reported that aphasic adults' conversational discourse varies on measures of verbal complexity (Glosser, Wiener, & Kaplan, 1988) and proportionate use of communicative functions (Doyle, et al., 1994; Wambaugh, Thompson, Doyle, & Camarata, 1991) when setting events such as the familiarity of the sampling environment and the mode of stimulus presentation are manipulated. Shadden, Burnette, Eikenberry, and DiBrezza (1991) reported differential

TABLE 3. Individual subject performance on measures derived from structured discourse task.

Subject	TW	NCIUs	PCIUs	PACMC
1	1296	883	68	55
2	646	339	52	13
3	686	315	46	19
4	1301	441	34	43
5	1113	54	5	0
6	556	456	82	72
7	962	325	34	34
8	478	376	79	74
9	2609	630	24	53
10	659	297	45	45
11	318	98	31	9
12	92	37	40	2
13	422	197	47	13
14	411	170	41	9
15	519	362	70	62
16	748	271	36	26
17	829	282	34	26
18	504	67	13	8
19	347	243	70	43
20	463	150	32	11
<i>M</i>	747.95	299.65	44.15	30.85
<i>SD</i>	541.73	203.16	20.85	23.60

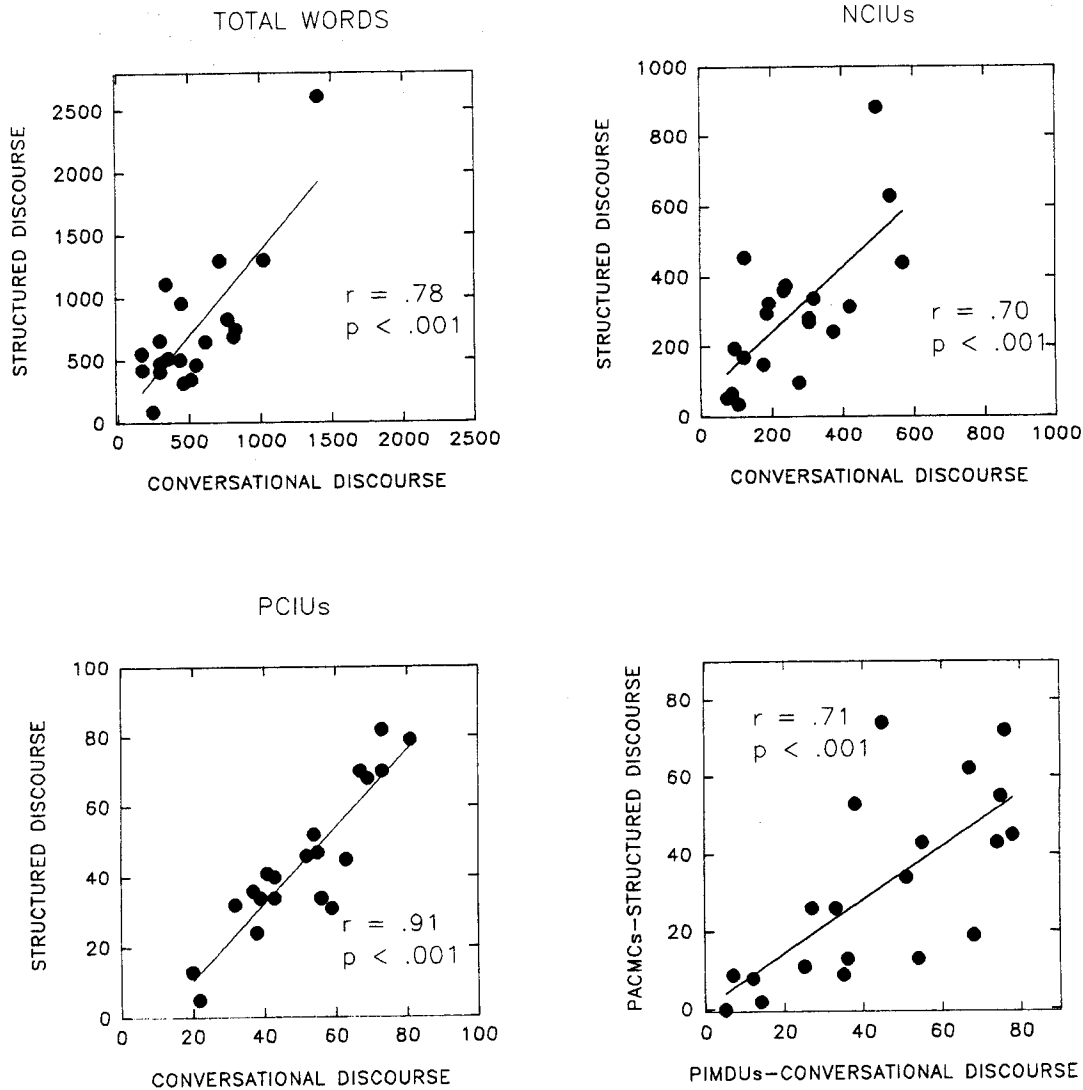
Note. TW = Total word count. NCIUs = Number of correct information units. PCIUs = Percentage of correct information units. PACMC = Percentage of accurate and complete main concepts.

TABLE 4. Individual subject performance on measures derived from conversational discourse task.

Subject	TW	NCIUs	PCIUs	PIMDU
1	718	498	69	75
2	618	320	54	36
3	815	422	52	68
4	1028	571	56	55
5	342	74	22	5
6	171	125	73	76
7	451	193	43	51
8	297	241	81	45
9	1408	536	38	38
10	299	188	63	78
11	467	277	59	35
12	248	106	43	14
13	175	97	55	54
14	298	123	41	7
15	351	235	67	67
16	827	307	37	33
17	775	306	39	27
18	444	89	20	12
19	515	375	73	74
20	551	178	32	25
<i>M</i>	539.90	263.05	50.85	43.75
<i>SD</i>	313.81	153.13	17.18	24.26

Note. TW = Total word count. NCIUs = Number of correct information units. PCIUs = Percentage of correct information units. PIMDU = Percentage of informative minimal discourse units.

FIGURE 1. Data points for individual subjects and associated regression lines for the (a) total words, (b) number of correct information units, and (c) percentage of correct information units produced in structured and conversational sampling conditions, and (d) the percentage of accurate and complete main concepts produced during structured discourse, and the percentage of informative minimal discourse (PIMDU) units produced during conversational discourse.
 Note: PIMDU = Percentage of informative minimal discourse units. PACMC = Percentage of accurate and complete main concepts.



performance across discourse tasks on a number of linguistic variables such as the number of words per clause, clauses per T unit, and proportion of semantically accurate T units. Shadden et al. suggested that factors such as (a) the specificity, complexity, relevance, and presentation modality of the stimuli; (b) memory, sequencing and organizational demands of the task; (c) the degree of shared reference among task participants; and (d) more general task constraints may account for differences in discourse performance.

The contextual factors distinguishing the structured from the conversational sampling procedures used in the present

study included familiar conversational partners, personally relevant and somewhat controversial conversational topics, and a familiar mode of stimulus presentation (i.e., viewing a television segment versus describing line drawings). Such contextual factors and the opportunity afforded by conversational interaction to provide information using a variety of speech acts may have facilitated the ease with which aphasic speakers were able to retrieve and produce informative words.

The differences observed between the percentage of accurate and complete main concepts and informative minimal discourse units are more difficult to interpret.

Although both measures were designed to evaluate subjects' abilities to convey information at the propositional level, main concepts by definition represent only the most relevant, important, and essential aspects of information in the discourse as a whole, and comprise a closed set within the stimulus battery developed by Nicholas & Brookshire (1993, 1995). In contrast, informative minimal discourse units quantify successful attempts at communicating any propositional message regardless of its centrality to the overall theme of the discourse, and are open-ended in any given conversation. As such, the differences in subjects' performance on these

two measures may reflect the inherent differences of these two constructs, as well as those arising from the characteristics and cognitive demands of the sampling procedures.

Nevertheless, the correlational data revealed a fairly robust relation between subjects' performance in the two sampling conditions for all measures, and, most important, the percentage of correct information units produced under structured elicitation conditions was found to be an extremely accurate predictor of subjects' performance during conversational sampling procedures, accounting for 82% of the variance between conditions.

These findings suggest that the structured elicitation procedures and measures of communicative informativeness developed by Nicholas and Brookshire (1993, 1995) may be used to predict the communicative informativeness of aphasic adults during conversational interactions similar to those described in the current study. However, the extent to which subjects' performance under the conversational sampling conditions used in the present investigation may be generalized to their performance under the variety of interpersonal communicative exchanges and contexts encountered in daily life is an empirical question that warrants further investigation. Finally, the predictive validity of the structured sampling procedures used in this investigation relates only to measures of communicative *informativeness*. Interactional elements of conversation such as turn-taking, topic shifting, and the use of specific communicative functions may not be predicted on the basis of the current findings.

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Appendix A

Definitions

1. Minimal Discourse Units (MDUs). MDUs are related word strings marked by syntactic (e.g., clause boundaries), prosodic (e.g., terminal junctures/contours), or semantic (content or contextual relatedness) features, or combinations thereof, which serve to separate the word string from adjacent words or word strings, and indicate that a communicative attempt was completed. MDUs serve the single purpose of segmenting word strings into units that represent discrete attempts to communicate a propositional message. Because we are interested in attempts to communicate propositional messages, the following types of utterances will not be

considered to meet the classification criteria for MDUs: (a) comments on the task itself, (b) social greetings or conventions, and (c) utterances that are interrupted by the conversational partner or environmental distracters. These types of utterances may occur rather frequently in the conversations of both normal and brain-injured adults and will be coded as "Others" (O).

2. Informative Minimal Discourse Units (IMDUs). These are minimal discourse units that communicate a single unambiguous message that is intelligible in context, and relevant to and informative about the topic of conversation (adapted from

Nicholas & Brookshire, 1993). Informative minimal discourse units (IMDUs) must provide new information to the communicative exchange. They may not contain vague, empty, or inappropriate vocabulary; given/new information errors; or inaccurate cohesive references. IMDUs that are used repetitively and/or stereotypically will not be considered to be informative.

3. Percentage of Informative Minimal Discourse Units (PIMDUs). This measure is derived from the formula $IMDUs/MDUs \times 100$ and serves to quantify how efficiently subjects use related word strings to communicate messages.