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The effects of concurrent picture presentations on retelling of orally presented stories by adults with aphasia

PATRICK J. DOYLE†‡, MALCOLM R. MCNEIL†‡, KRISTIE A. SPENCER†, AMY JACKSON GODA†, KIM COTTRELL†‡ and AMY P. LUSTIG†‡

† Aphasia Rehabilitation Research Laboratory and Clinic, VA Pittsburgh Healthcare System, Pittsburgh, USA
‡ Department of Communication Science and Disorders, University of Pittsburgh, Pittsburgh, USA

Abstract

This study investigated whether measures of verbal productivity, verbal disruption, information content, grammatical complexity, and grammatical well formedness would vary as a function of experimental conditions in which the presence of pictured stimuli was manipulated during the oral presentation and retelling of stories. Fifteen adults with aphasia retold stories under three experimental conditions: (i) concurrent presentation of oral and pictured versions of stories followed by a picture-supported retell, (ii) concurrent presentation of oral and pictured versions of stories followed by a 'free' retell, and (iii) orally presented stories followed by a free retell. Group analyses revealed no significant differences across experimental conditions for any of the dependent measures. Analyses of individual subjects' data revealed clinically important differences for several measures of information content, with individual subjects responding differently to the experimental conditions.

Introduction

The effects of stimulus characteristics and elicitation conditions on discourse performance in adults with aphasia have received considerable attention in recent years (Bottenberg *et al.* 1987, Correia *et al.* 1990, Doyle *et al.* 1994, 1995, Potechin *et al.* 1987, Ulatowska *et al.* 1981). These studies have found that many variables, including measures of content, verbal disruption, cohesion, and story grammar, may vary as a function of the characteristics of the elicitation stimuli and the cognitive and linguistic demands of the task.

Two tasks that are frequently used to examine discourse production are retelling orally presented stories and describing pictured stories. The demands of the former require the speaker to retain story elements and their temporal order, retrieve these elements from memory, and reformulate them linguistically. The latter task reduces the memory load, but requires the speaker to generate story elements and narrative structure.

Address correspondence to: Patrick J. Doyle Ph.D., Director, Aphasia Rehabilitation Research Laboratory and Clinic, Pittsburgh VA Health Care System, 7180 Highland Drive, Pittsburgh, PA 15206, USA.

Few studies have made direct comparisons of performance across picture narration and story retelling tasks within a single group of aphasic subjects. Ulatowska and colleagues used two such conditions to examine discourse production in normal and aphasic adults (Ulatowska *et al.* 1981, 1983). However, these studies focused on between-group comparisons and the data were collapsed across picture narration and story retelling conditions as preliminary findings revealed no differences in language characteristics produced under these conditions. In contrast, Shadden *et al.* (1991) reported that the connected discourse of normal older women had more verbal disruptions under a story retelling condition than in a picture description task. It has also been reported that children with specific language impairments (Schneider 1996) and children with learning disabilities (Ripich and Griffith 1988) produced more information during story retelling tasks than during picture descriptions, albeit that samples produced under story retelling conditions contained significantly more verbal disruptions.

Another type of discourse elicitation task is one in which pictures corresponding to a story are presented concurrently with the oral reading of the passage and/or following the reading of the passage. Although these sampling methods may facilitate comprehension and reformulation of story content and reduce the verbal disruptions associated with free recall tasks, they have received no attention in the aphasia literature. Studies in the child language literature that have examined similar sampling methods reported equivocal results regarding whether picture stimuli presented concurrently or thereafter facilitated processing and reformulation of the oral version of the story (Gibbons *et al.* 1986, Pratt and MacKenzie-Keating 1995, Schneider 1996).

In summary, it is difficult to draw conclusions from the existing literature regarding whether pictures facilitate or hinder reformulation of a story when presented during or following the oral version, or whether these conditions result in significantly different performance from those in which subjects are asked to retell stories based upon oral presentations alone. The current study was designed to investigate whether measures of verbal productivity, verbal disruption, information content, and grammatical complexity and well formedness would vary significantly as a function of three experimental conditions: (i) concurrent oral/picture presentation of stories followed by picture-supported retell, (ii) concurrent oral/picture presentation of stories followed by free retell, and (iii) oral presentation of stories followed by free retell.

Method

Subjects

Fifteen adults with aphasia due to a single left-hemisphere CVA participated in the investigation. All subjects were native speakers of English and passed a pure-tone audiometric screening at 35 dB HL at 500, 1000, 2000, and 4000 Hz unilaterally. The diagnosis of aphasia was based upon clinical criteria specified by Darley (1982) and was determined by clinical examination and formal testing conducted by the investigators. Descriptive information is displayed in table 1. Review of these data reveals a relatively mild group of aphasic subjects with overall severity, as measured by the *Porch Index of Communicative Ability* (Porch 1981), ranging from the 51st to the 97th percentile for left-hemisphere brain-injured adults.

Table 1. Descriptive subject information

Subject	Age	MPO	Estimated pre-morbid IQ	RTT percentile	ABCD ratio	Raven's score	PICA OA percentile	PICA VRB percentile	ABA
1	59	139	123·8	51	100	30	*	92	None
2	76	44	112·8	60	118·18	18	53	58	Moderate–severe
3	51	156	110·6	45	166·67	27	53	51	Mild–moderate
4	67	236	118·3	40	100	25	87	88	Mild
5	66	96	132·9	31	75	35	83	76	None
6	54	22	128·9	60	118·18	32	72	79	None
7	55	84	111·2	95	100	31	87	86	None
8	50	65	120·7	32	111·11	32	81	58	Moderate
9	42	212	119·4	94	100	34	97	96	None
10	74	307	120·4	71	93·75	26	87	72	None
11	62	2	118·4	54	100	35	86	64	Mild
12	67	543	100·3	23	114·28	22	68	79	Moderate–severe
13	57	77	108·2	80	100	24	86	75	Mild
14	73	63	110·3	92	92·31	17	94	97	None
15	57	306	111·6	21	90·91	32	62	58	None
Mean	60·7	157	116·52	56·6	105·36	28·00	78·29	75·27	N/A
SD	9·77	144	8·43	25·37	20·37	5·87	14·31	14·90	N/A

MPO = Months post onset; Estimated pre-morbid IQ based on Wilson *et al.* (1979); RTT = *Revised Token Test* (McNeil and Prescott 1978), percentile compared to adults with left-hemisphere damage; ABCD ratio = *Arizona Battery for Communication Disorders of Dementia* (Bayles and Tomoeda 1993) ratio, determined by number of delayed recall items/number of immediate recall items × 100; Raven's score = *Raven's Coloured Progressive Matrices* (Raven 1976) raw score out of a possible 36; PICA = *Porch Index of Communicative Ability* (Porch 1981), percentile compared to adults with left-hemisphere damage, OA = overall percentile and VRB = verbal percentile; ABA = *Apraxia Battery for Adults* (Dabul 1979), overall presence/severity of apraxia; * indicates missing data.

Stimuli

Twelve stories from the *Discourse Comprehension Test* (Brookshire and Nicholas 1993) served as stimuli. These stories are controlled for number of words, number of sentences, mean sentence length, number of subordinate clauses, number of *T*-units, ratio of clauses to *T*-units, listening difficulty, and number of unfamiliar words. The stories were read and digitally recorded at a rate of 170 words/min by a male speaker seated in a double-walled sound booth. Each story was also illustrated by an artist as a six-plate black and white drawing. These drawings were then digitized. A PC-based computer program was developed to present and record the experimental conditions. Appendices 1 and 2 provide a sample story and its illustration.

Experimental conditions

Subjects were seated individually in a quiet room in front of a computer workstation with a 13 inch monitor and external speakers. All stories were presented 40 dB HL above each subject's pure tone average at 1, 2, 3, and 4 kHz. Eye to monitor distance was also held constant at 30 inches (76 cm). The 12 stories were presented in random order to each subject and were counterbalanced across subjects and conditions such that every story was presented in each condition an equal number of times and every subject was presented four stories in each of the three conditions. Prior to each story, subjects were instructed regarding the nature of the presentation condition and following each story presentation, subjects were instructed regarding their task in the retell condition. These instructions were pre-

recorded and digitized into the computer program running the experiment and are contained in Appendix 3. Retellings were limited to 3 minutes in length. Subjects received no feedback during the experimental sessions.

Condition A: Concurrent oral and picture presentation of stories followed by picture-supported retell

In this condition, the pre-recorded oral versions of the stories were played while subjects viewed the monitor. As they listened, individual pictures comprising the six-plate sequence appeared on the screen in temporal correspondence with the oral version of the story. Immediately following the oral and illustrated presentation of the story, all six plates appeared on the monitor together and subjects were instructed by the program to use the pictures to retell the story in their own words.

Condition B: Concurrent oral and picture presentation of stories followed by free retell

This condition was identical to condition A with the exception that following the concurrent presentation of the oral and illustrated versions of the story, the monitor was blackened and subjects were instructed by the program to retell the story in their own words.

Condition C: Oral presentation of stories followed by free retell

This condition differed from conditions A and B in that only the sound files of the program were activated. That is, no illustrations were presented either during or after the oral presentation of the story and subjects were again instructed by the program to retell the story in their own words.

Transcription and dependent variables

Recordings were orthographically transcribed into a microcomputer using transcription conventions described by Campbell and Dollaghan (1987) and analysed with respect to measures of (i) verbal productivity, (ii) verbal disruption, (iii) information content, and (iv) grammatical complexity and well formedness. The measures obtained for each category are listed and defined in Appendix 4. To determine measurement reliability, one transcript was selected from each experimental condition for each subject (i.e. 25% sampling rate) and was scored independently by two trained raters. Point to point agreement was calculated by dividing the total number of agreements by the total number of agreements plus disagreements and multiplying by 100 for measures of utterance segmentation (100%), mazes (94%), silent pauses greater than two seconds (96%), correct information units (91%), story proposition identification, accuracy, and completeness (85%), and independent/dependent clause and prepositional phrase identification, accuracy, and completeness (85%).

Results

All dependent measures were compared with a one-way repeated measures ANOVA with α corrected for multiple comparisons set at $< 0{\cdot}003$. Table 2 displays the means and standard deviations for measures of verbal productivity and disruption. There were no significant differences among conditions for these measures (all $F(14,2) < 1{\cdot}724$, $p > 0{\cdot}003$). However, a group trend toward

Table 2. Measures of verbal productivity and disruption—means and (standard deviations)

Variable	Condition A	B	C
Total words	474·1 (224)	445·6 (216)	439 (224)
Words/min	52·5 (24)	50·1 (22)	47·7 (22)
Number of utterances	40·7 (12)	37·9 (12)	38·3 (10)
MLU	11 (3·32)	11·1 (3·00)	10·9 (3·76)
Number of utterances with mazes	29·4 (10·00)	27·9 (8·80)	30·6 (11·50)
Total pause time (s)	41·8 (52)	45·3 (63)	45 (46)

MLU = mean length of utterance.

Table 3. Measures of information content—means and (standard deviations)

Variable	Condition A	B	C
Number of CIUs	305 (159)	278 (173)	265 (171)
CIUs/min	32 (19)	29 (19)	27 (18)
% CIUs	60 (17)	55 (20)	53 (18)
Story propostions			
% Accurate/complete	47 (31)	42 (28)	43 (34)
% Accurate/incomplete	31 (16)	29 (15)	29 (18)
% Inaccurate	2 (3)	2 (3)	3 (6)
% Absent	21 (19)	28 (24)	26 (25)

CIUs = correct information units.

increased verbal productivity and decreased verbal disruption was noted for condition A relative to conditions B and C.

Table 3 displays the means and standard deviations for measures of information content. There were no significant differences among conditions for these measures (all $F(14,2) < 4{\cdot}305$, $p > 0{\cdot}003$). However, consistent with measures of verbal productivity, a trend toward greater informativeness in condition A relative to conditions B and C was observed.

Table 4 displays the means and standard deviations for measures of grammatical complexity and well formedness. These measures were not significantly affected by the experimental conditions (all $F(14,2) < 0{\cdot}959$, $p > 0{\cdot}003$).

Table 4. Measures of grammatical complexity and well formedness—means and (standard deviations)

Variable	Condition A	Condition B	Condition C
Ratio of dependent to independent clauses	0·63 (0·34)	0·65 (0·22)	0·64 (0·29)
Percentage accurate and complete independent and dependent clauses	67 (27)	68 (26)	68 (26)

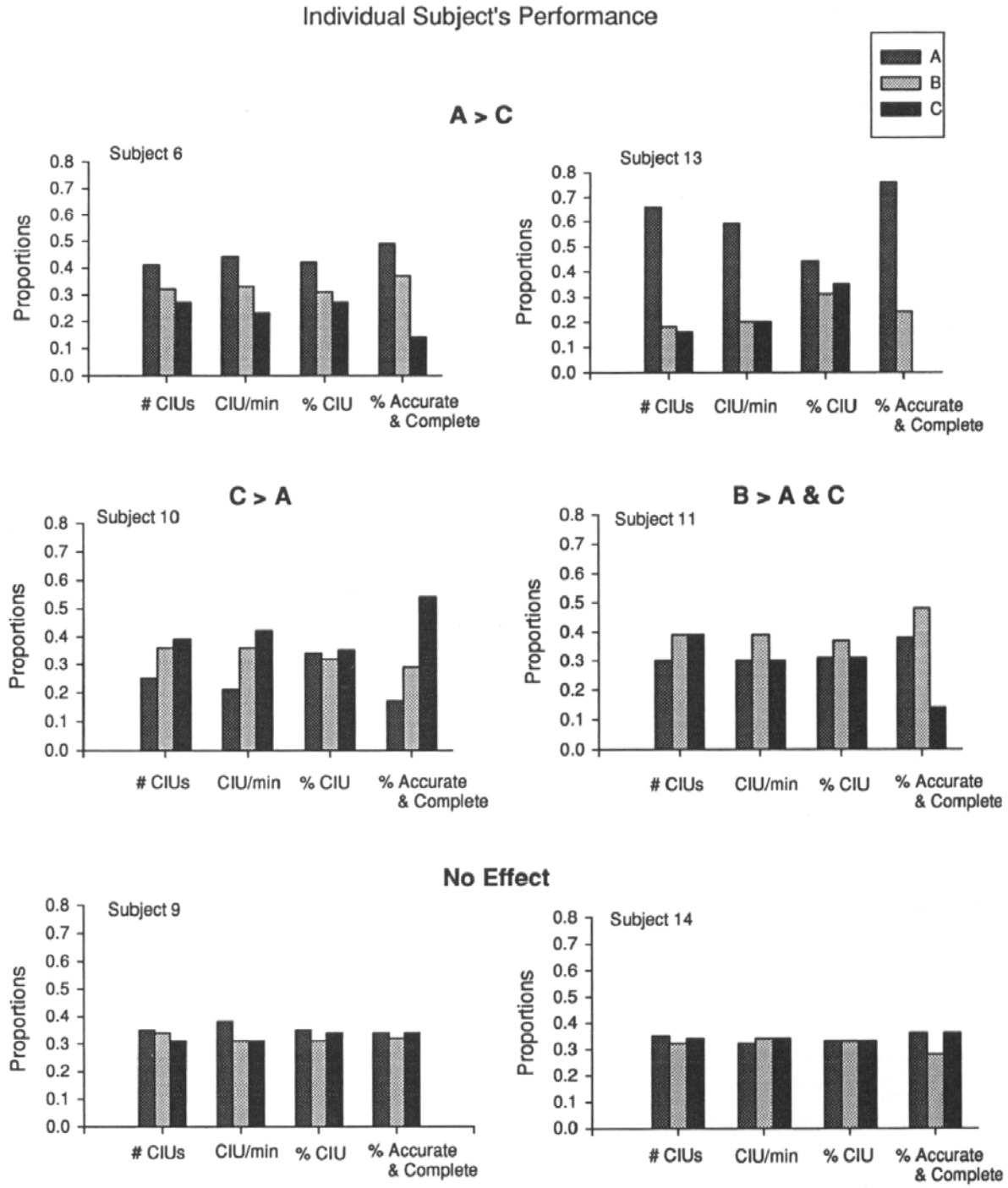

Figure 1. Individual subjects' patterns of performance across experimental conditions on measures of information content. CIU = correct information unit. % Accurate & Complete = % of accurate and complete story propositions.

Table 5. Language characteristics of subjects according to performance profiles

	Subjects					
	S6	S13	S10	S11	S9	S14
	Performance profiles					
Variables	A > C	A > C	C > A	B > A&C	No effect	No effect
WAB AQ	83	81	89	89	98	94
WAB type	Anomic	Anomic	Anomic	Anomic	Anomic	Anomic
RTT percentile	60	80	71	54	94	92
ABCD ratio	118	100	94	100	100	92
Raven's score	32	24	26	35	34	17
PICA percentile	72	86	87	86	97	94
ABA	None	Mild	None	Mild	None	None

WAB AQ = *Western Aphasia Battery*, aphasia quotient (Kertesz 1982); RTT = *Revised Token Test* (McNeil and Prescott 1978), percentile compared to adults with left-hemisphere damage; ABCD = *Arizona Battery for Communication Disorders of Dementia* ratio (Bayles and Tomoeda 1993), determined by the number of delayed recall items/number of immediate recall items × 100; Raven's score, *Coloured Progressive Matrices* (Raven 1976), score out of a possible 36; PICA percentile = *Porch Index of Communicative Ability* (Porch 1981), percentile compared to adults with left-hemisphere damage; ABA = *Apraxia Battery for Adults* (Dabul 1979), overall presence/severity of apraxia.

To examine individual subjects' patterns of performance across experimental conditions for the classes of dependent measures studied (i.e. verbal productivity, verbal disruption, information content, and grammatical complexity and well formedness) the data for each variable were converted to ratios that represented the proportionate occurrence of a variable within each condition relative to the occurrence of that variable across all conditions.

Examination of these data on measures of verbal productivity, verbal disruption, and grammatical complexity and well formedness revealed considerable variability across experimental conditions and subjects, with no clear patterns of performance emerging. In contrast, four distinct patterns of performance emerged for measures of information content. Specifically, subjects 6, 7, 12, and 13's pattern of performance was consistent with the group trend noted above for measures of information content. That is, each of these subjects produced more information in condition A than in C. In contrast, subject 10 produced more information in condition C than in A, and subjects 11 and 15 produced relatively more information in condition B than in conditions A or C. Finally subjects 1, 4, 9, and 14's performance on measures of information content was not substantively affected in any particular way by the experimental conditions. Data representative of each pattern are displayed in figure 1 for selected individual subjects. Table 5 displays the language characteristics of these subjects. Examination of these data revealed no differences in overall severity of aphasia, auditory comprehension, verbal memory, naming, or speech production that might account for the differences in their individual patterns of performance shown in figure 1.

Discussion

The purpose of this study was to determine whether measures of verbal productivity, verbal disruption, information content, and grammatical complexity

and well formedness would vary as a function of experimental conditions in which the presence of pictured stimuli was manipulated during the oral presentation and retelling of stories. The results of the group analyses indicated that none of the dependent measures examined were significantly affected by the experimental conditions in this sample of adults with aphasia. However, given the conservative α level employed (i.e. $p < 0{\cdot}003$) to avoid type I errors and the lack of desired statistical power for many of the individual analyses of dependent measures, these negative findings should be considered preliminary and interpreted with caution. Indeed, analysis of individual subjects' data revealed several subjects whose performance on measures of information content was substantively affected by the experimental conditions. Subjects 6, 7, 12, and 13 demonstrated a pattern of performance that showed a clear and positive effect under picture-supported presentation and retell conditions. This pattern was consistent with the trends noted in the group data and supports the observation that the productive language performance of adults with aphasia may benefit from multi-modality stimulation. In contrast, one subject's performance (i.e. subject 10) was consistent with reports in the child language literature which found that linguistically impaired children produced better narratives under oral only presentation conditions (Hickman 1982, Schneider 1996). These authors concluded that the processing demands of simultaneous presentation of stories in both auditory and visual modalities may actually hinder retelling performance due to the processing demands of such tasks.

Subjects 11 and 15 were most informative under the concurrent oral/picture presentation and free-retell condition. This pattern of performance suggests that some subjects may benefit from pictured information during presentation of the story, but not during the retelling of the story. That is, narratives produced from pictured information may be constrained or limited by the pictured events.

Finally, subjects 1, 4, 9, and 14 (the least impaired subject in the sample) were unaffected by the experimental conditions. It appears as though neither the cognitive demands of the tasks nor the different modes of stimulus presentation were sufficiently robust to have either an adverse or facilitative affect on these subjects' connected discourse.

These findings suggest that pictured information presented concurrently or following oral presentations of stories may have a robust effect on individual subjects' performance in very different ways that may not be predicted on the basis of standard measures of language comprehension and production such as those used in the current study. Because connected discourse is being used on an increasingly frequent basis, both in clinical assessment and in clinical research as a means for evaluating the productive language skills of aphasic adults, it is important to understand how different sampling methods can result in different estimates of the language production skills of adults with aphasia. While it has been shown by a number of investigators that several variables, including stimulus characteristics, mode of presentation, cognitive demands, and discourse type will affect many different measures of language production in individual subjects' connected discourse (Doyle *et al.* 1994, 1995, Ripich and Griffith 1988, Schneider 1996, Shadden *et al.* 1991, Ulatowska and Chapman 1989), the precise way in which these variables affect subjects' performance and how they may interact with patient characteristics such as the degree of working memory impairment or the severity of productive and/or receptive language processing deficits remains poorly understood. The clinical implications of the current state of our knowledge in this

area warrants the use of a battery of different discourse tasks that sample a range of stimulus attributes, presentation modes, cognitive demands, and discourse types suspected to influence patient performance. Future research would benefit from the development of a standard set of presentation stimuli that samples discourse types and presentation modes and a standard set of operationally defined dependent measures that sample a range of discourse parameters.

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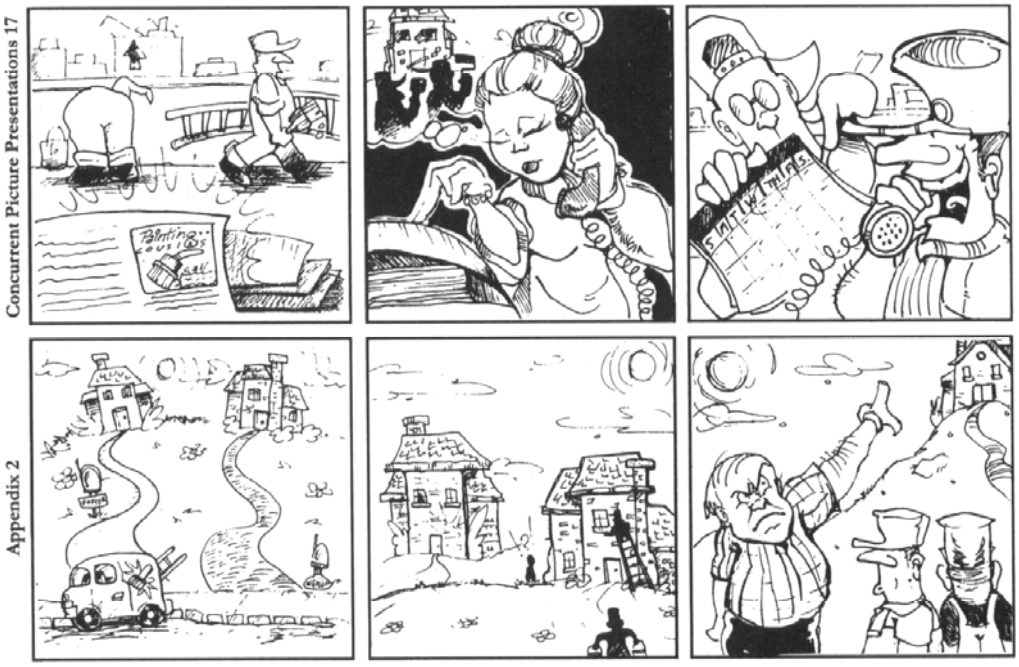
Appendix 1

[1][**Fred and Ben were cousins who decided to go into business together painting houses**. They put an **ad in the paper** and then spent all day Sunday getting their supplies organized.] [2][The next day, a woman named **Mrs Foster called and offered them their first job**. She told them she needed her house painted before Saturday because she wanted it to look nice for her daughter's wedding.] [3][Fred and Ben promised to work quickly and have the house painted by Thursday. They also **offered to do the job at a reduced price** because Mrs Foster was their first customer. Mrs Foster was pleased with their offer and told them to start painting whenever they were ready.] [4][Early the next morning, the men arrived at the Fosters' house and immediately went to work.] [5][By three o'clock they **had finished the front of the house and were painting the trim on the upstairs windows**. Then **a man walked around the corner of the house and asked them what they were doing there**. 'Oh, you must be Mr Foster', Ben responded. 'I guess your wife forgot to tell you that she had hired us to paint the house'.] [6][The man frowned and replied, 'But **my name is Nelson. The Fosters live next door**'.]

The Painters, *Discourse Comprehension Test* (Brookshire and Nicholas 1993). **Bold text** indicates essential story propositions. Underlined words indicate key elements of story propositions that must be produced to be scored accurate and complete. Superscripts [1–6] indicate the individual picture (Appendix 2) presented during the oral reading of the [bracketed] text.

Appendix 2



Appendix 3

Instructions for condition A

Presentation instructions

You are about to hear a short story. As you listen, pictures that go with the story will appear on the screen. Listen to the story and watch the pictures carefully. When the story is completed the pictures will be shown on the screen and you will be asked to retell the story.

Retell instructions

These are the six pictures that go with the story you just heard. Use them to retell the story in your own words.

Instructions for condition B

Presentation instructions

You are about to hear a short story. As you listen, pictures that go with the story will appear on the screen. Listen to the story and watch the pictures carefully. When the story is completed you will be asked to retell the story.

Retell instructions

Retell the story in your own words.

Instructions for condition C

Presentation instructions

You are about to hear a short story. Listen to the story carefully. When the story is completed you will be asked to retell the story.

Retell instructions

Retell the story in your own words.

Appendix 4: Operational definitions of dependent variables

Measures of verbal productivity and disruption

Total number of words

All words that were intelligible in context to someone familiar with the story being discussed. Context refers to what the transcriber knows about the story and what the transcriber knows from the speaker's prior words. Words did *not* have to be accurate, relevant, or informative to be included in the word count.[1]

Number of words per minute

Total number of words in the word count divided by time taken (in minutes) to provide each story.

Number of utterances

Utterances were segmented by the transcriber according to syntactic, prosodic, semantic, and pausal indicators. Primary weight was given to syntactic and prosodic indicators, although the overall pattern of a subject's production (e.g. pausal patterns) was considered when bracketing utterances.

Mean length of utterance in words (MLU)

The average number of words per utterance. Contractions were counted as two words.

Number of utterances with mazes

Mazed productions included words or partial words that were not intelligible in context to someone who knew the story being discussed (e.g. 'He went to the *frampi*'; 'He had a *st*... *sn*... steak') and non-word fillers (e.g. um, er, uh). Mazed words were not included in the total word count.[1]

Total duration of silent pauses in seconds

Silent pauses equal to or greater than 2 s in duration were added for a combined total; this includes pauses within an utterance, between utterances, and within a maze.

Measures of information content

Number of correct information units (CIUs)

CIUs are words that are intelligible in context, accurate in relation to the story, and relevant to and informative about the content of the story. Words did *not* have to be used in a grammatically correct manner to be included in the CIU count. Each

CIU consisted of a single word; only words that were included in the word count could be considered for inclusion in the CIU count.[1]

Number of CIUs per minute

Total number of CIUs divided by time (in minutes) taken to provide each story.

Percentage of CIUs

Total number of CIUs divided by the total number of words.

Percentage of accurate and complete story propositions

Story propositions that accurately and completely contained all 'essential' information. Essential components of each story proposition were underlined in the listings of the story propositions. The wording of essential information did not have to be the same as that of the listed story proposition, but the general meaning must have been the same. Essential information did not have to be given in standard grammatical form or standard word order, as long as deviations did not lead to miscomprehension of the essential meaning of the concept.[1, 2]

Percentage of accurate but incomplete story propositions

Part of the essential information of the story proposition was accurate, but one or more essential components was missing. If non-specific words or ambiguous pronoun referents were given as part of a story proposition, the proposition was also considered incomplete.[1, 2]

Percentage of inaccurate story propositions

One or more parts of the essential information of the story proposition were inaccurate.[1, 2]

Percentage of absent story propositions

None of the essential information of a story proposition was given. The speaker said nothing that appeared to be an attempt to communicate the essential information of the story proposition.[1, 2]

Measures of grammatical complexity and well formedness

Grammatical complexity

The ratio of dependent clauses and prepositional phrases to independent clauses. All clauses and phrases were included in the ratio regardless of their accuracy or

[1] Adapted from Nicholas and Brookshire (1993, 1995).

[2] The percentage of each of the four types of story propositions is determined by the total number of the target story proposition divided by total number of possible story propositions.

completeness. Utterances that were composed only of a dependent clause or prepositional phrase were eliminated from the calculation.

Grammatical well formedness

The number of accurate and complete clauses (including independent clauses, dependent clauses, and prepositional phrases) divided by the total number of clauses and phrases.