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Pause Structure in Narratives of Neurologically Impaired and Control Subjects

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Pausing is important for cognitive planning of spontaneous speech. Pause structure has been regarded as an indicator of underlying cognitive processes in the spontaneous speech of individuals with no history of neurologic damage (Goldman-Eisler, 1968). One could argue that the pause structure in the spontaneous speech of individuals with neurologic impairment may reflect their underlying cognitive and linguistic deficits. Although individuals with neurologic impairment may be expected to pause more than and perhaps at different locations from speakers with no neurologic involvement, few studies have examined the structure of pause behavior during spontaneous speech of individuals with neurologic impairment (Horner, 1987; Panzeri, Semenza, & Butterworth, 1987; Schlenck, Huber, & Willmes, 1987). Information about pause structure would supplement the growing body of literature related to the verbal characteristics of spontaneous speech (Coehlo, Liles, & Duffy, 1991; Glosser & Deser, 1990; Hartley & Jensen, 1991; Joanette & Goulet, 1990; Nicholas & Brookshire, 1993).

Pausing can occur at a number of predictable locations. For example, physiologic pauses occur for all speakers to provide respiratory support for speech production. In speakers without impairment, physiologic pauses frequently occur in parallel with syntactic boundaries. However, some dysarthric speakers with poor respiratory support may need to pause more frequently. Very short pauses (i.e., < 250 msec) indicate articulatory transition for production of phonemes. Individuals with apraxia of speech may evidence increased pausing for this transition. Pausing also occurs at boundaries that Henderson, Goldman-Eisler, and Skarbek (1966) called "cognitive strides," where it serves as an important marker of prosody. Individuals with dysarthria, apraxia of speech, or right hemisphere brain damage may exhibit a decrease in such boundary markers. Finally, the location of pausing relates to verbal planning for spontaneous speech and has been found to precede lexical searches and syntactic structuring of verbal output (Klatt, 1980; Panzeri et al., 1987; Siegman, 1979). Predictability of pause locale in accordance with verbal planning has not been determined. Figure 1 depicts a proposed model, which includes components of cognitive planning for speech production as related to pause behavior. As diagramed, the model represents a top–down approach to cognitive processing and neuromotor control for speech in relation to pause structure.

In regard to pause location and verbal planning, cognitively impaired traumatic brain-injured speakers may have both motor and sensory systems intact for speech production but may fail to make use of that information to coordinate speech systems, organize thoughts, and produce coherent language. These breakdowns may be observed through changes in the overall pattern of pause behavior (i.e., frequency and/or duration of pausing). Cognitively impaired right hemisphere–damaged speakers may not use pauses prior to lexical selection to aid in increasing informative and interpretive content in their spontaneous speech production. Speakers with aphasia and with corresponding lexical and syntactic linguistic processing deficits may evidence increased frequency and/or duration of pausing associated with word finding and syntactic structuring of verbal output.

The purpose of this study was to examine pause structure (i.e., pause frequency, duration, and location) during spontaneous narrative discourse production among speakers with various neuropathologies to determine if pause structure in these speakers differed from pause structures in speakers without neurologic impairments.

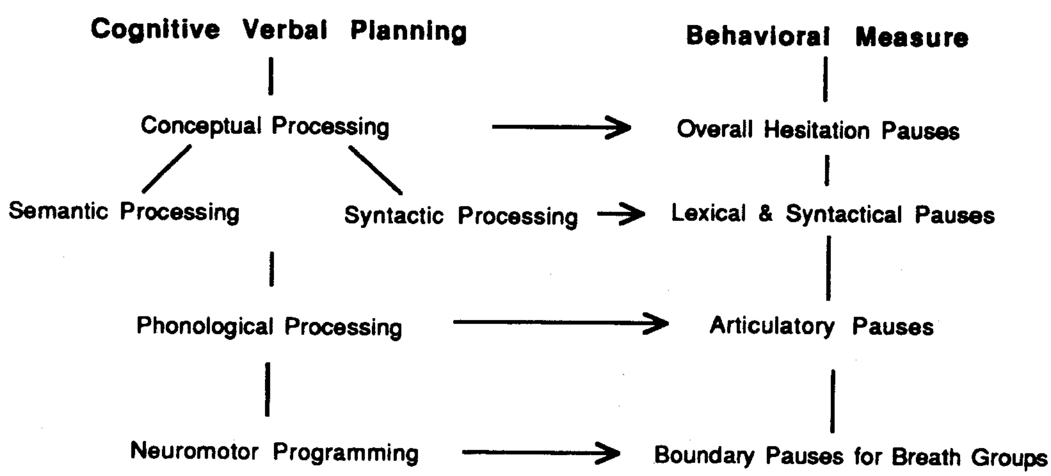

Figure 1. A proposed model of pause structure in verbal discourse production.

METHOD

Subjects and Speech Sample

The spontaneous narrative discourses of three individuals with neurologic impairment were examined and compared with that of a larger control group (N = 40) (Zeches & Yorkston, 1992). Individuals in the control group had no history of neurologic impairment and ranged in age from 18 to 43 years (M = 28), with years of education ranging from 12 to 19 (M = 15.2). One neurologically impaired individual had sustained traumatic brain injury (TBI), the second individual had right hemisphere damage, and the third had left hemisphere damage and exhibited fluent aphasia. Although underlying pathologies differed, all subjects were considered fluent speakers, had a minimum of a high school education, and did not evidence motor speech difficulties. Samples of connected speech were elicited with the cookie-theft picture description from the *Boston Diagnostic Aphasia Examination* (BDAE) (Goodglass & Kaplan, 1983) and were audiotaped.

Analysis

Following transcription, the connected speech samples were segmented according to t-units and mazes (Hedberg & Stoel-Gammon, 1985). From the audiotapes, silent pauses ($\geq$ 250 msec) and filled pauses (interjections and stereotypic fillers, e.g., "ya know," "I guess") were coded for frequency and duration using a digital Sona-graph (Kay DSP Sona-Graph Model 5500). Once pauses were identified, the transcripts were segmented according to pause group, allowing for identification of pause locations using the taxonomy shown in Table 1.

RESULTS AND DISCUSSION

Subject with Traumatic Brain Injury

The subject was a 26-year-old male who had suffered a TBI initially judged as severe based on the *Glasgow Coma Scale*, length of coma, and presence of positive neurologic signs (Uomoto, 1990). This subject performed the speech task 4 months after the onset of brain damage and, at that time, was rated at Level VIII of the *Levels of Cognitive Func-*

Table 1. Taxonomy for Coding Pause Locale in Oral Discourse Production

Code	*Pause Locale*
1	Primary syntactic boundary—pauses (silent and/or filled) occurring at t-unit boundaries
2	Secondary syntactic boundary—pauses (silent and/or filled) occurring at phrase and/or subordinate clause boundaries phrases include —prepositional phrases —participial phrases —infinitive phrases subordinate clauses include —adjective clauses —adverbial clauses —noun clauses —verb clauses
3	Lexical boundary—pauses (silent and/or filled) occurring within phrase or clause boundaries as defined above
4	Maze boundary—pauses (silent and/or filled) occurring at maze boundaries or pauses (silent and/or filled) occurring within a maze

tioning Scale (Hagen, 1984). His discourse was characterized as excessive, with a large number of total words and mazes produced.

The control group paused on average 39% of the total time of the speech sample, whereas the TBI subject paused 24% of the time. Closer inspection of the data in Figure 2 reveals that the TBI subject paused nearly as frequently as the control group average but with a shorter average duration of silent pausing (see Figure 2). In regard to pause location, the TBI subject paused at similar syntactic, lexical, and maze locations as did the control group (see Figure 3). As postulated earlier, an individual with cognitive impairment following neurologic damage may benefit from pausing longer to increase planning for verbal output. In fact, increasing silent pause time was targeted in treatment with this subject, with a positive outcome for increasing organization and communicative efficiency of verbal discourse.

Subject with Right Hemisphere Brain Damage

The 53-year-old male subject with right hemisphere damage performed the task 3 months after the onset of brain injury and was judged as being moderately impaired. The verbal characteristics of his discourse

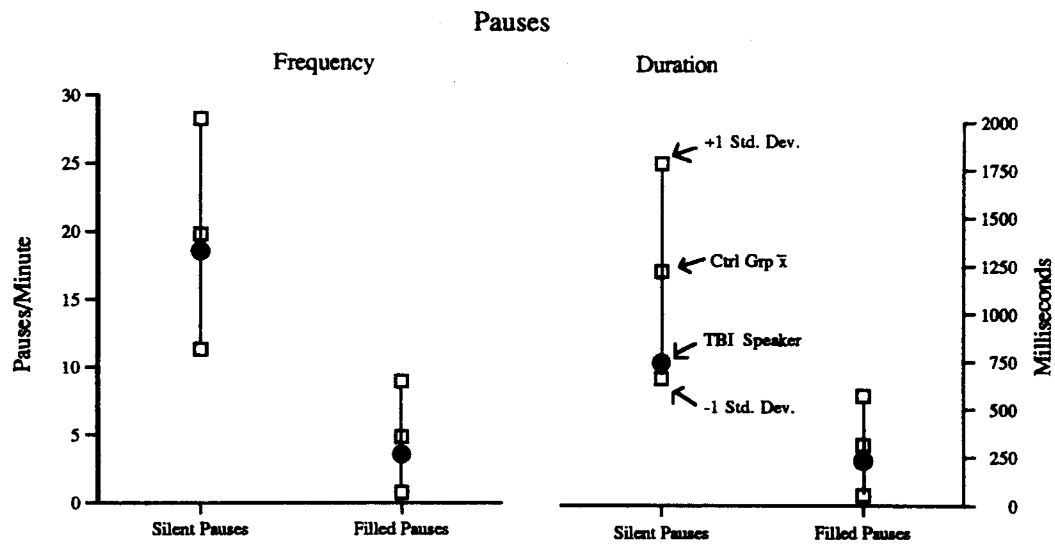

Figure 2. The subject with traumatic brain injury (TBI) compared with the control group on measures of pause frequency and pause duration for silent and filled pauses.

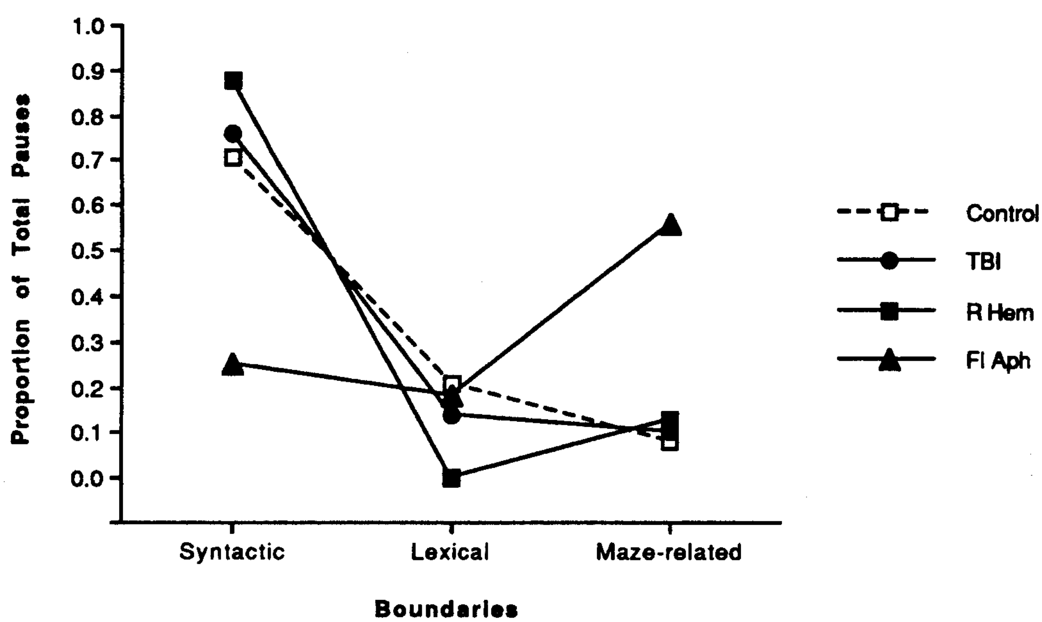

Figure 3. Proportion of pauses produced at syntactic, lexical, and maze-related locations for the three subjects compared with the control group. TBI = subject with traumatic brain injury; R Hem = subject with right hemisphere brain damage; FL = subject with fluent aphasia.

sample were reflective of concrete thought and some inappropriate word choices; however, normal prosody was maintained and his verbal output, although brief, was organized.

This subject spent 40% of his speech production time pausing, which was similar to the control group average of 39%. The majority of his pause time was spent in silent pausing with very few filled pauses produced; duration of pausing was similar to the control group averages (see Figure 4). Figure 3 illustrates that this subject's placement of pauses was syntactically driven, with 88% of his pauses occurring at a syntactic boundary compared with the control group average of 71%. The decreased interpretive content of this subject's speech sample may have led to more syntactically bound pause behavior. Increasing pause time may aid in targeting more abstract language use. Overall, this subject evidenced pause structure very similar to the control group averages. It may be that a task such as the one used here was not sensitive to this subject's reported pragmatic deficits; examining pause behavior during a dyadic interchange may be more meaningful.

Subject with Fluent Aphasia

A 30-year-old female subject had suffered a single left hemisphere cerebral vascular accident 9 months prior to participation in this study. Her aphasia quotient from the *Western Aphasia Battery* (Kertesz, 1982)

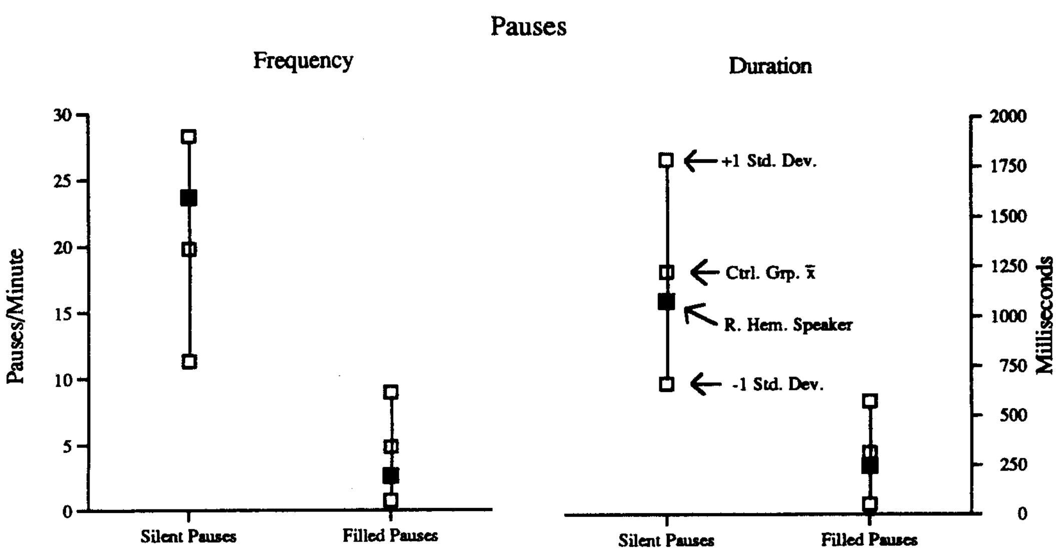

Figure 4. The subject with right hemisphere brain damage (R. Hem. Speaker) compared with the control group on measures of pause frequency and pause duration for silent and filled pauses.

was 68. This subject's connected speech sample was characterized by an intact melodic line and articulatory agility but with lexical search strategies evidenced by ineffective use of extended mazes.

Figure 5 shows that this subject evidenced the most abnormal pattern of pause behavior of the three brain-damaged individuals. The subject spent more time (45%) in pause behavior during the speech sample than the control group average (39%). Her frequency of pausing was high for both silent and filled pauses, whereas silent pause durations were short compared with the long filled pause durations. A reversed pattern of pause location, compared with the control group, is seen for this subject (see Figure 2). Her lowest proportion of pauses occur at syntactic boundaries with the highest proportion of pauses related to maze productions.

The differing pattern of pause behavior in the subject with fluent aphasia points to what Schlenck and colleagues (1987) termed "trouble indicating behavior" in efforts to produce the word or grammatical structure. This is most evident in the subject's ineffective use of fillers, whether as filled pauses or mazes to aid in word retrieval. Filled pauses, in this subject's speech, appear to be a maladaptive strategy for lexical searching. Because filled pauses can be distracting to the listener, they may be a productive treatment target for elimination.

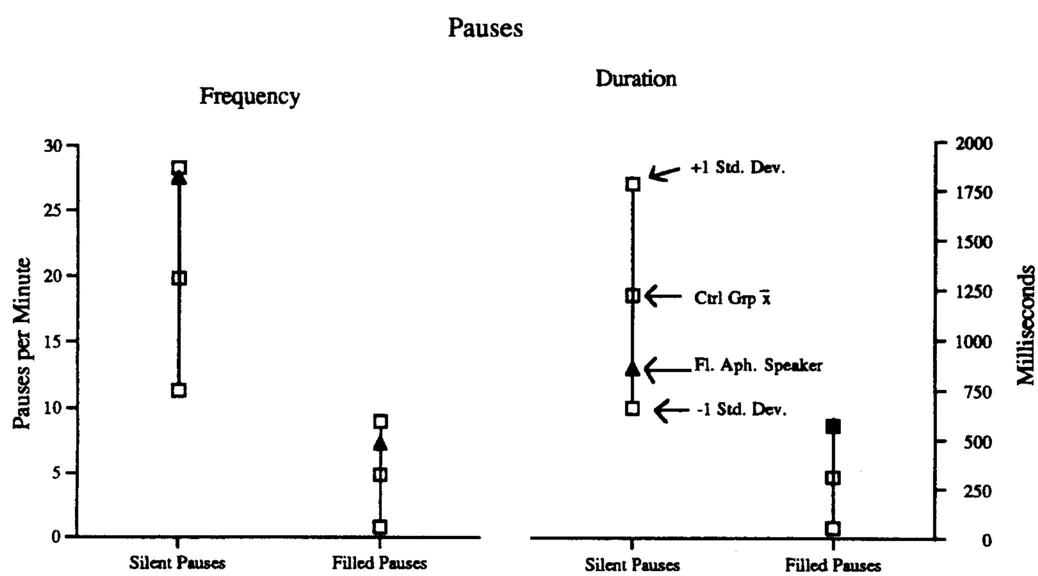

Figure 5. The subject with fluent aphasia (Fl. Aph. Speaker) compared with the control group on measures of pause frequency and pause duration for silent and filled pauses.

CLINICAL IMPLICATIONS

Previous work by Whitney and Goldstein (1989) indicated that as individuals with mild aphasia increase self-monitoring skills, their use of filled pauses decreases. Bernstein-Ellis, Wertz, and Shubitowski (1987) reported that decreasing speech rate with a fluent aphasic individual also resulted in decreased use of filled pauses. In addition, Horner (1987) found that self-monitoring and appropriate revision behaviors occurred following targeted work on pause behavior with a fluent aphasic patient.

Targeting pause behaviors in treatment with neurologically impaired individuals by increasing the use of silent pauses as a positive compensatory strategy, and decreasing the use of filled pauses which may be a maladaptive strategy, would positively influence the verbal characteristics of their discourse production. Directly targeting pause behavior with neurologically impaired patients will provide them with a salient strategy for cognitive processing to enable them to produce more efficient and accurate verbal output at the narrative discourse level (Horner, 1987). Finally, such a strategy may naturally enhance generalization across target areas, because unlike training of particular syntactic structures or lexical items, treating pause structure is not limited to specific stimulus sets.

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