POSTER SESSION 3: PRIMING

Automatic Activation of Cross-Language Word Associates in the Presence of a Production Deficit in a Bilingual Aphasic Patient

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Introduction

Are underlying representations available and activated even in the less recovered language of a bilingual aphasic patient? Studies reporting on recovery from bilingual aphasia have to date documented a variety of recovery patterns and for the most part focused on measuring offline performance in diagnostic batteries and on spontaneous speech. In view of the fact that aphasic performance may be affected by the presence of nonlinguistic deficits, such as apraxia, Kehayia, Singer, & Jarema (1996) directed their investigations using methodology that can bypass the inhibited oral or written production route. This study has shown the existence of an online/offline dissociation in the performance of bilingual aphasic patients thus denoting the availability of underlying mental representations in the presence of nonfluent aphasia with a moderate-to-severe production deficit. While this study has provided information on remaining language capacities within a patient’s language, little is known of the availability of between-language associations presumed to exist in a bilingual’s mental lexicon. Recent studies of the bilingual lexicon in nonimpaired populations have used different word classes such as concrete and abstract words and cognate and noncognate word pairs across languages to investigate formal (e.g., orthographic) and conceptual routes of lexical access. It has been found that cognates show facilitatory effects (Chen & Ng, 1989; de Groot & Nas, 1991) including across languages with different orthographic systems (Gollan, Forster, & Frost, 1997) while noncognates yield less uniform results. These findings indicate that cross-language semantic connections are highly integrated through form.
In the present study we investigated the availability of underlying formal and semantic routes to cross-language word recognition in a patient with moderate to severe word finding difficulties, particularly across her two languages. The use of cognate (pilote—‘‘pilot’’) and noncognate (jupe—‘‘skirt’’) word pairs with both formal (pilote—‘‘pilot’’) and semantic primes (avion—‘‘pilot’’) allowed automatic unconscious activation of both orthographic and semantic routes to lexical access. If mental representations in a bilingual’s two languages are associated both at the semantic and at the formal level, then we should obtain significant priming effects in both the formal and the semantic prime conditions. Furthermore, we predict that our patient, who exhibits an online/offline dissociation of lexical activation within language, will show this same pattern when tested between languages.

Case Report

LB is a 67-year-old right-handed female who had suffered a cerebrovascular accident of embolic nature resulting in nonfluent aphasia. English is her dominant language and language of education while French is her second language. She was tested on the Bilingual Aphasia Test (BAT) (Paradis & Libben, 1987) in English and French. At the time of testing, she was 6 years postonset and presented with relatively good comprehension in both languages both at the word and at the sentence level. However, her production in both languages was moderately impaired with severe word-finding difficulties. Particularly, when tested in translation in the bilingual section of the BAT, LB presented with severe difficulties mostly evident when translating from English into French.

Controls

Two older controls matching LB’s language background were also tested. NP and IS were right-handed females who were 72 and 73 years old, respectively. English was their dominant language; however, they grew up learning French. Both women had the same level of education (12 years) as LB.

Experiment

During two testing sessions, both LB and controls performed a masked primed lexical decision task (LDT) to English target words and in a third session responded to French target words. Forty-eight cognate (pilote—‘‘pilot’’) and 48 noncognate (jupe—‘‘skirt’’) word pairs were seen in three prime conditions. In the first testing session, participants responded to three within-language prime–target word pairs: formal (‘‘pilot’’—‘‘pilot’’), semantic (‘‘airplane’’—‘‘pilot’’), and control (‘‘duck’’—‘‘pilot’’). A second session presented the between-language prime–target word pairs: formal (pilote—‘‘pilot’’), semantic (avion—‘‘pilot’’), and control (canard—‘‘pilot’’). In the
third session, the task was French lexical decision in a between-language condition so that the primes were in English and the targets were in French: formal (‘‘pilot’’–pilote), semantic (‘‘airplane’’–pilote), and control (‘‘duck’’–pilote).

Results and Discussion

LB showed similar priming effects compared to both control subjects. In the within-language English prime–English target condition, LB exhibited significant form and semantic priming for cognates and form priming only for noncognates as did both control subjects. In the between-language French prime–English target condition, LB showed significant form and semantic priming, but only for the crogate word pairs. No significant differences were observed for noncognate word pairs for either LB or the control subjects in the between-language English LDT. In the French LDT, where the prime was in English and the target in French, LB exhibited significant form and semantic priming for cognates and a significant interference effect in the semantic prime condition for noncognates. No significant differences were observed for noncognate word pairs for either LB or the control subjects in the between-language English LDT. In the French LDT, where the prime was in English and the target in French, LB exhibited significant form and semantic priming for cognates and a significant interference effect in the semantic prime condition for noncognates. The control subject, IS, showed this identical pattern, suggesting that for cognates (‘‘pilot’’–pilote; ‘‘airplane’’–pilote), the orthographic similarity speeded lexical access across languages while for noncognates (‘‘skirt’’–jupe; ‘‘short’’–jupe), the absence of orthographic overlap interfered with processing, especially in the semantic condition where a meaning change without form overlap caused interference. The fact that LB showed the same pattern of results compared to the control subjects indicates that automatic between-language activation occurs even in the presence of a production deficit and severe offline word-finding difficulties across the two languages. Therefore, LB’s underlying semantic associations are opeppant although this is not evident from her performance in strictly offline production tasks.

REFERENCES


Identity and Semantic Priming in Schizophrenia
Using a Letter Search Task

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The presence of greater-than-normal semantic priming effects in individuals with schizophrenia who are also thought disordered has been reported by various researchers (e.g., Henik, Nissimov, Priel, & Umansky, 1995) and has been interpreted as evidence for stronger or farther-reaching spreading activation within the associative networks of these patients (Barch, Cohen, Servan-Schreiber, Steingard, Steinhauer, & van Kammen, 1996). Such an explanation infers that the process of lexical access remains intact but that the spread of activation within the network has been altered or disrupted in some way, perhaps through a lack of inhibition of related nodes.

This research was concerned with investigating both the automatic activation of a concept node (the prime word) and the spread of activation to associated concepts using an identity and semantic priming task incorporating a letter search condition (Friedrich, Henik, & Tzelgov, 1991). In the letter search condition, subjects are asked to respond to both the prime word (does it contain a particular letter) and the target word (is it a real word or non-word). Under the letter search condition, the normally robust semantic priming effect does not occur, while identity priming is retained, suggesting that some limited attentional modulation is required for the spread of activation (Rafal & Henik, 1994). The letter search task was employed to investigate the possibility that the greater-than-normal priming effects reported for individuals with schizophrenia may be at least partially due to a disruption in the attentional modulation of the spread of activation.

As a first step in this research, the letter search methodology was pretested on young control subjects to investigate whether a small design alteration (the removal of the first overt response) on the prime word would still yield the expected priming patterns, while being an easier task for individuals with schizophrenia to perform. Part B of the study aimed to investigate whether the presence of thought disorder in individuals with schizophrenia may be related to a disruption to the spread of activation, but not lexical access.

Part A

Method

Subjects. Sixty-six undergraduate University students (mean age 20.36 years, SD = 1.64 years) participated in the study. There were 63 females and 3 males in the sample. Half the subjects were randomly assigned to a
Dual Response Group (DRG) where they were required to respond to information about the prime and the target, and the remaining 33 students were assigned to the Single Response Group (SRG) (make a lexical decision on the target only while still search the prime for a specified letter).

Stimuli. Two stimulus lists of word pairs were created such that each list contained 10 identical word pairs, 10 semantically related word pairs, 20 unrelated pairs, and 20 word–nonword pairs. The prime word of each word pair was accompanied by a probe letter (in every letter position), which appeared above the word on the computer screen, for example,

```
AAAA
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TABLE

For half the trials, the probe letter was present in the prime word, and in the other half of trials it was not.

Procedure. The stimulus-onset asynchrony (SOA) was 250 ms. A Go–No Go procedure was employed where subjects were asked to ignore the letters above the prime word, followed by a letter search task. In the letter search condition, subjects were required to search the prime word for the letter that appeared above it but only those subjects in the DRG were to report the presence or absence of the letter by saying ‘yes’ or ‘no’ following their lexical decision on the target word. Subjects in the SRG were also required to search the prime word for the letter, but were not asked to make any overt response. Reaction times (RTs) to real word targets were the measure of interest.

Results

Following screening for outliers (RTs found to be >2 SD above the means were removed), a MANOVA with two within-subjects factors [task condition either No-letter search (NLS) or Letter search (LS)] and Prime Condition (identity, related, or unrelated) and one between-subjects factor of Response Condition (either Single or Dual response) was performed on the median RTs (refer Table 1). There were significant main effects of Response Condition \((F(1, 128) = 26.851, p < .001)\), Task Condition \((F(1, 128) = 255.23, p < .001)\), and Relatedness Condition \((F(1, 128) = 18.45, p < .001)\), as well as a significant two-way interaction effect between Task and Response Condition \((F(1, 128) = 67.6, p < .001)\) and Task and Relatedness Condition \((F(1, 128) = 8.68, p < .001)\). A significant three-way interaction was found for Relatedness Condition, Task Condition, and Response Condition \((F(1, 128) = 5.25, p < .001)\).

Planned contrasts for the SRG revealed a significant identity priming effect during both the no-letter search task \((F(1, 32) = 26.91, p < .001)\) and the letter search task \((F(1, 32) = 49.86, p < .001)\). A significant related
TABLE 1
Mean RTs of the Single and Dual Response Groups for Each Relatedness Condition, as a Function of Response and Task

<table>
<thead>
<tr>
<th></th>
<th>Identity</th>
<th>Related</th>
<th>Unrelated</th>
<th>Identity</th>
<th>Related</th>
<th>Unrelated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single response</td>
<td>459.08</td>
<td>466.61</td>
<td>492.30</td>
<td>527.27</td>
<td>568.83</td>
<td>580.12</td>
</tr>
<tr>
<td>group</td>
<td>(56.78)</td>
<td>(60.65)</td>
<td>(69.01)</td>
<td>(79.95)</td>
<td>(108.66)</td>
<td>(90.21)</td>
</tr>
<tr>
<td>Dual response</td>
<td>463.76</td>
<td>468.89</td>
<td>502.65</td>
<td>737.34</td>
<td>766.29</td>
<td>737.43</td>
</tr>
<tr>
<td>group</td>
<td>(60.41)</td>
<td>(50.01)</td>
<td>(64.76)</td>
<td>(146.66)</td>
<td>(138.45)</td>
<td>(134.77)</td>
</tr>
<tr>
<td>NTD subject</td>
<td>751.6</td>
<td>771.00</td>
<td>746.95</td>
<td>809.7</td>
<td>869.7</td>
<td>895.42</td>
</tr>
<tr>
<td></td>
<td>(60.87)</td>
<td>(109.49)</td>
<td>(97.04)</td>
<td>(75.77)</td>
<td>(139.38)</td>
<td>(126.53)</td>
</tr>
<tr>
<td>TD subject</td>
<td>445.11</td>
<td>504.44</td>
<td>591.68</td>
<td>573.67</td>
<td>816.70</td>
<td>774.50</td>
</tr>
<tr>
<td></td>
<td>(73.82)</td>
<td>(115.09)</td>
<td>(160.74)</td>
<td>(129.55)</td>
<td>(317.35)</td>
<td>(362.06)</td>
</tr>
</tbody>
</table>

Note. NTD, non-thought disordered; TD, thought disordered. Standard deviations are in parentheses.

The priming effect was observed only for the no-letter search task ($F(1, 32) = 32.50, p < .001$).

In the DRG, a significant identity priming effect ($F(1, 32) = 43.89, p < .001$) and related priming effect ($F(1, 32) = 52.78, p < .001$) was found only for the no-letter search task. In the letter search task, a significant negative priming effect was found ($F(1, 32) = 4.71, p < .05$).

Discussion

The results of Part A revealed that the number of responses required during a letter search task had a marked effect on the priming abilities of normal subjects, a finding in contrast to those reported by Friedrich et al. (1991). Only the SRG demonstrated the predicted priming patterns during the letter search task. Specifically, the additional demands required to perform the dual response task yielded altered patterns of semantic priming in the form of a negative priming effect, suggesting that the DRG performed under conditions of struggle in retrieving semantic information for a prime, similar to conditions of struggle reported for masked priming studies and for recently acquired words (Dagenbach, Carr, & Barnhardt, 1990; Dagenbach, Carr, & Wilhelmsen, 1989). The results of the pre-test indicate that the single response condition is the most suitable and reliable method for investigating priming patterns in schizophrenia.

Part B

Subjects

Two community outpatients with schizophrenia were recruited; one 42-year-old male with 11 years of education who was determined to be non-thought disordered [using the Assessment of Thought, Language and Com-
munication (Andreason, 1986)]. The second subject was a 30-year-old male with 12 years of education who had mild thought disorder.

**Methods**

The two subjects with schizophrenia were tested using only the SR task from Part A.

**Results**

Mean RTs for the various conditions for both subjects are reported in Table 1. The two subjects exhibited different patterns of priming for the NLS and LS conditions, with the non-thought-disordered subject showing reduced or absent identity and related priming effects in the NLS condition and spared identity and related priming in the letter search condition. The thought-disordered subject also demonstrated an identity and a related priming effect in the NLS task and an identity and negative priming effect in the letter search condition.

**Discussion**

The results from the subjects with schizophrenia provide further evidence for disturbed associative processes in the semantic systems of both thought-disordered and non-thought-disordered individuals with schizophrenia, although the pattern of disruption to the spread of activation during both letter and no-letter search conditions was more pronounced for the patient with thought disorder. Tentative explanations for this disruption in thought-disordered individuals with schizophrenia include deficits in selective attention ability and factors related to the attentional demands of the task itself. The task itself shows good utility for individuals with schizophrenia but requires additional testing to examine the stability of the measure in, for example, test retest in acute versus remission states and with larger subject numbers.

**REFERENCES**


Grapheme to Phoneme Conversion Treatment in Patients with Severe Oral Reading and Naming Deficits

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Summary

The use of cognitive neuropsychological models of lexical processing to guide treatment efforts in individuals with reading and naming deficits has received great attention in recent years. Few studies, however, have been reported that are aimed at model based treatment of oral reading and naming deficits (Bastiaanse, Bosje, & Franssen, 1996; Raymer, Thompson, Jacobs, & LeGrand, 1993). Although a relationship between impaired grapheme to phoneme conversion abilities (phonological alexia) and impaired oral reading, naming, and repetition abilities (impaired phonological output lexicon) has been suggested (Friedman & Kohn, 1990), few studies have utilized grapheme to phoneme conversion skills to aid in word reading and word retrieval.

The present experiment was motivated by a model of single-word production and comprehension (Ellis & Young, 1988) to establish deficit patterns and treatment procedures in patients with severe oral reading and naming deficits. Specifically, this experiment sought to investigate the effects of training grapheme to phoneme conversion skills on oral reading, oral naming, and written production skills. As Friedman and Kohn (1990) suggested, an impairment in the phonological output lexicon can be related to an inability to convert graphemes to phonemes, and it is this argument that motivates the rationale of the present treatment. The following predictions were made.
Oral reading. It was hypothesized that training grapheme to phoneme conversion of a target word would result in the strengthening of its phonological representation in POL and, therefore, improvement on oral reading of the trained words was predicted. It was also hypothesized that the rules of grapheme to phoneme conversion trained would be applicable to the untrained words as well; therefore, improvements in oral reading of the untrained words were predicted.

Oral naming. It was predicted that if the phonological representations accessed during oral reading of the trained words were the same as those accessed during oral naming, strengthening the phonological representations of words during oral reading would also improve oral naming of the trained words. However, since untrained words were not specifically targeted in treatment, their phonological representations were hypothesized to be only marginally strengthened. Therefore, minimal generalization effects were predicted for oral naming of untrained words.

Writing to dictation. It was predicted that training grapheme to phoneme conversion as well as phoneme to grapheme conversion would improve written spelling performance of both trained and untrained words. This is because, like oral reading, the newly acquired rules of phoneme to grapheme conversion should generalize irrespective of whether the word was trained or not.

Written naming. It was predicted that training the rules of grapheme to phoneme conversion, and in turn strengthening the phonological representation of the trained words, would result in improved written naming of these trained words. This is because a strengthened phonological representation would facilitate access to trained words in the graphemic output lexicon. However, it was predicted that for untrained words, the partially strengthened phonological representation would not facilitate access of the graphemic representation.

Methods

Subjects. Two aphasic patients, aged 67 and 65 years, both male and right handed, participated in the treatment study. Both patients presented with left parietal lobe lesions and demonstrated a pattern of severely impaired oral reading and naming skills (indicating an impaired phonological output lexicon), in addition to impaired writing, grapheme to phoneme conversion and phoneme to grapheme conversion skills for single words, on the Psycholinguistic Assessment of Language Processing in Aphasia test (PALPA; Kay, Lesser, & Coltheart, 1992).

Design. A single-subject experimental design with multiple baselines across subjects was employed. Prior to treatment, for each subject, performance on oral reading, oral naming, writing to dictation, and written naming of the experimental stimuli (20 pictures and corresponding words) was as-
FIG. 1. Percent correct items on oral reading, oral naming, writing to dictation, and written confrontation naming on trained and untrained experimental probes during baseline and experimental sessions of the study for Subject 1 and Subject 2. See text for details.
FIG. 1. continued
sessed. Three baseline sessions were administered to subject 1 and five baseline sessions were administered to subject 2. The 20 stimuli were randomly divided into a trained ($N = 10$) and an untrained ($N = 10$) set.

**Generalization probes.** During treatment, after every third treatment session, acquisition of oral reading of trained items was assessed. In addition, generalization to oral naming, written naming, and writing to dictation of the trained stimuli and generalization to these four behaviors on the untrained stimuli were tested.

**Treatment.** For each subject, treatment consisted of reading 10 regular words, none of which the subject could name on a pretest. Treatment tasks for each word included (1) oral reading of the word, (2) repetition of the word, (3) oral spelling of the word, (4) selection of letters of the target word from phonological and orthographic distracters, (5) identification of target word letters presented randomly, and (6) reading letters of the target word aloud. Notably, tasks 3 to 6 required grapheme to phoneme conversion and phoneme to grapheme conversion processes.

**Results**

Both subjects improved on oral reading of trained and untrained items, indicating rule-based (grapheme to phoneme conversion) acquisition and generalization of oral reading skills (see Fig. 1). In addition, both subjects demonstrated generalization to oral naming of trained items, indicating a strengthening of the phonological representations of the trained words in the POL. Smaller generalization effects were observed for oral naming of untrained items. Notably, both subjects improved on writing to dictation of trained as well as untrained items (indicating generalization of phoneme to grapheme conversion skills learned during treatment), as well as written naming of only the trained items. Subject 2 also improved on written naming of untrained items and, in general, demonstrated greater improvement on written behaviors than did subject 1, since his writing impairment was not as severe. Performance on these four behaviors (oral reading, oral naming, written naming, and writing to dictation) on irregular words served as control and they were assessed every fifth probe. As expected, no improvement in any of these behaviors for irregular words was observed for either subject, indicating an inability to successfully apply the learned grapheme to phoneme conversion skills to irregular words. Performance on several standardized language tests indicated improvement following treatment for both subjects.

**Conclusions**

In the present experiment, strengthening access to phonological representations during reading resulted in improved naming skills for trained words. In addition, the strengthened phonological representations facilitated access to the graphemic representations. Finally, indirect training of phoneme to grapheme conversion as a course of treatment resulted in improved writing
REFERENCES


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Rehabilitation of Slowed Reading in Pure Alexia with the Multiple Oral Rereading Technique: Further Evidence for Top-Down Facilitation in the Recovery of Reading Speed

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Slow and laborious reading, a major characteristic of pure alexia, can be treated successfully by employing the Multiple Oral Rereading (MOR) method (Moyer, 1979; Moody, 1988; Tuomainen & Laine, 1991, 1993). Interestingly, in some patients, single word recognition as such does not improve but words are recognized faster only in relevant context (Tuomainen & Laine, 1993). These results suggest that the assumed functional deficit (damaged visual word-form system) is not alleviated but, instead, some kind of ‘‘top-down’’ facilitation is employed, and the patients seem to get more skilled in using a compensatory strategy in word recognition. However, this interpretation is based on results obtained on a limited set of (mostly) oral reading tasks. In the current study, we report on a case study, in which reading performance of a pure alexic patient was investigated before and after MOR treatment with an extensive set of online tasks that tap different processing stages in reading.

Participants

The patient, MT, is a 57-year-old Finnish male who suffered a single left-sided tempororooccipital CVA 16 months before the present study. The reading...
deficit of MT could be characterized as pure alexia although at the time of the treatment, he was not a letter-by-letter reader. The Finnish version of the Boston Diagnostic Aphasia Examination (Laine, Niemi, Koivuselkä-Ssallinen, & Tuomainen, 1997) indicated slowed reading speed together with good reading comprehension. No signs of aphasia or agraphia were noted. Further neuropsychological testing revealed mild memory problems. A control group of 11 age-matched (49–62 years) healthy participants was tested for comparison of reading speed and for possible test–retest effects.

Treatment Procedure

MOR treatment consisted of repeated reading of short texts selected from popular magazines. The topics were of general interest. The length of individual texts varied between 900 and 1200 syllables. MT was instructed to read the text twice a day at home for 1 week. The emphasis was on trying to comprehend the content of the text. Each week a new text was selected. Treatment duration was 10 weeks. No other treatment was provided during that time.

Reading Tasks

Reaction times (RTs) were measured using the following reading tasks: single-word recognition without context (lexical decision task), single-word recognition in context (semantic priming task), a sentence verification task, and three text reading tasks (RTs to target sentences). Comprehension of the text was tested by a multiple choice task. The reading battery was administered before and after the treatment. The control subjects received the same tasks twice 10 weeks apart.

Results

The reaction times in the different reading tasks are presented in Table 1. In the control group, a significant main effect of repeated testing in word recognition tasks was observed ($F(1, 10) = 6.98, p = .02$). In text reading, no such difference was found ($F < 1$). For MT, the average response latencies to sentences embedded in text decreased by almost 5 s. In contrast, no significant change was noted in any single-word recognition tasks nor in the sentence verification task.

Discussion and Conclusions

MOR treatment administered 16 months postonset significantly increased reading speed in a pure alexic patient. However, only texts were read faster as no significant changes were noted in single-word recognition. In healthy controls, an opposite pattern was observed; single-word recognition was significantly faster in the second testing, but RTs in text reading task showed
TABLE 1
Reaction Times (s) and Error Rates (%; in parentheses) of the Pure Alexic Patient (MT) and Control Subjects in Different Reading Tasks as Measured 10 Weeks Apart

<table>
<thead>
<tr>
<th></th>
<th>Patient MT</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre  MT</td>
<td>Post MT</td>
</tr>
<tr>
<td>LDT</td>
<td>1.582 (3.5)</td>
<td>1.530 (3.6)</td>
</tr>
<tr>
<td>Priming</td>
<td>1.304 (5.5)</td>
<td>1.147 (2.1)</td>
</tr>
<tr>
<td>Sentence</td>
<td>1.424 (3.3)</td>
<td>1.456 (1.7)</td>
</tr>
<tr>
<td>Text</td>
<td>13.455 (28.5)</td>
<td>8.800 (17.8)</td>
</tr>
</tbody>
</table>

Note. The error rates in the text reading task represent errors in the multiple choice task. (LDT, lexical decision; priming, semantic priming; sentence, sentence verification; text, target sentences embedded in text.)

*p < .05.


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Training a Self-Initiated Written Word Strategy in Aphasia and Apraxia of Speech

Amy P. Lustig and Connie A. Tompkins

Introduction

Speech-language pathologists frequently train the use of self-cueing strategies to facilitate word retrieval and production. However, investigations documenting the efficacy of self-cueing strategies in aphasia and apraxia of speech, particularly at the graphemic level, are found only infrequently in the literature.

The articulatory struggle accompanying apraxia of speech interferes with the accuracy, rate, and prosody of spoken word productions and consequently has detrimental effects on communicative productivity. Efforts at verbal self-correction have been associated with high attempts, low success, and substantial struggle in individuals with Broca’s-type aphasia (Marshall & Tompkins, 1982). Reduced conversational abilities result in diminished opportunities for conversational collaboration, which can erode communicative participation in daily life and produce significant psychosocial consequences (Code, Hemsley, & Herrmann, 1999). As conversational structure appears to be maintained in aphasia (Ulatowska, Allard, Reyes, Ford, & Chapman, 1992), along with preserved cognitive and social competencies (Kagan, 1995), training communication strategies at the conversational level can contextualize such training in a dimension that is inherently meaningful for the participant.

The purpose of this study was to train an individual (LG) with longstanding aphasia and apraxia of speech to substitute a self-initiated written word for protracted articulatory struggle in a conversational context and to see if the use of this strategy could generalize to different treatment conditions. It was predicted that LG could acquire such a strategy even after many years of persisting in verbal struggle and that the use of a self-initiated writing strategy will permit LG to be perceived as a more efficient and efficacious communicator.

Subject and Method

LG, a 52-year-old female, is 9 years postonset left CVA extending into temporal, parietal, and frontal regions. She demonstrates a mild–moderate aphasia with agrammatic language features, a moderate–severe apraxia of speech, and relatively minimal difficulty with tasks involving reading and writing. Prior to study onset, she carried a notebook into which she transcribed words and phrases for practice and was occasionally observed to spontaneously produce a written word that she was having trouble speaking.
LG continues to be highly motivated to improve her conversational abilities and has practiced several speech and language tasks daily for many years.

A single-subject, multiple-baseline across conversation settings (Setting A, with clinician in quiet room; Setting B, with clinician in public cafeteria; Setting C, with unfamiliar conversational partner in quiet) was employed, utilizing loose training principles in an effort to promote generalization. Treatment stimuli consisted of topics for shared conversation (e.g., interesting travel experiences), tailored to be interesting and meaningful to LG and controlled for relevance and complexity using direct magnitude estimate ratings by individuals unaffiliated with the study. Spoken word targets were determined by subject-initiated utterances—specifically, by the words spontaneously provided in conversation elicited by the treatment stimuli.

Treatment sessions lasted an average of 40 min and were scheduled twice weekly. During each session, LG and her conversation partner (clinician or unfamiliar) alternated choosing conversation topics and engaging in short discussions on each topic. For all responses with obvious articulatory struggle of 3+ s on which the writing strategy was not initiated, LG was cued by the clinician to stop verbal attempts and to write the word she was trying to say. Opportunities for strategy use ranged from 10 to 27 per session (M = 18).

Results

Results are graphed in Fig. 1. LG self-initiated the written word strategy on 90% of opportunities after five treatment sessions in Setting A, a substantial increase over baseline measures. This benefit appeared to show delayed generalization to Setting B, where she also achieved 90% self-initiated strategy use in the ninth session. Strategy use did not appear to generalize to Setting C; treatment will be initiated in this setting and maintenance data will be collected. Control measures of sequential motor repetitions (SMRs) and percentages of correct information units (CIUs) on a picture description task show no meaningful changes over time, some evidence that LG’s motor and language skills remained relatively stable during study participation. There was a considerable overall drop in the number of abandoned spoken targets in Settings A and B, along with a lesser drop in Setting C, supporting clinician observations that LG was increasingly self-initiating the writing strategy before articulatory struggle became apparent. Ninety-two percent of LG’s written targets were legible and relevant to the topic under discussion.

Judgments of videotaped baseline and treatment segments by unfamiliar observers were obtained. Preliminary data demonstrate higher ratings of LG’s ease and speed of communication, her apparent level of satisfaction with and enjoyment of the conversation, the extent to which she is understood by her conversation partner, and the observers’ comfort level while watching the conversations, for segments with a high percentage of strategy use.
Discussion

LG was initially resistant to the goals of this treatment. She expressed to the clinician that speaking was the only goal she really valued and that substituting the written for the spoken word constituted "failure." In spite of her fierce commitment to regaining fluent speech, LG was able to acquire and initiate a writing strategy during conversation and to do so in a manner that appeared to anticipate, and consequently mitigate, articulatory struggle. At the same time, her efforts in this respect were perceived to benefit her communicative efficacy and efficiency, as well as her level of satisfaction. These results speak to the value of employing an alternative modality (e.g., writing) to facilitate communication, despite longstanding speech problems, and the productive benefits of such a pragmatically oriented treatment.

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POSTER SESSION 3: TREATMENT OF COMPREHENSION

Using Treatment to Unmask Verb Complexities in Sentence Comprehension

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Introduction

Many explanations of poor comprehension of reversible sentences in aphasia focus on the sentence verb—either its semantic specification (Jones, 1984) or its role in mapping between surface structures and thematic roles (Saffran & Schwartz, 1988). This study takes a new approach to the role of the verb in the assignment of thematic roles by adopting Dowty’s (1991) description of verb protoroles. Dowty has proposed that verbs assign arguments to one of two cluster concepts (Proto-Agent or Proto-Patient) through a set of semantic entailments. Verbs with strong assignment of arguments
to Proto-Agent have meanings that require Agents that are causal, independent of the action, moving relative to other actors, and volitionally involved in the action. Verbs whose meanings encode few of these factors will less compellingly assign an argument to the role of Proto-Agent. Our hypothesis is that aphasic patients with difficulty assigning agency in reversible sentences will have less difficulty with verbs whose semantic specifications contain more entailments to Proto-Agent.

Methods

Subject

JQ is a 61-year-old man who suffered a hemorrhagic CVA involving left temporoparietal/occipital regions, approximately 18 months prior to entering this study. Verbal production was fluent, paragrammatic, and anomic. Auditory single word comprehension was good (PALPA synonyms = 90%). Sentence comprehension was good for nonreversible sentences (93%) and at chance for semantically reversible, active, and passive sentences (65%) (Philadelphia Comprehension Battery).

Materials and Procedures

Pre-/posttreatment assessment. A comprehension test was designed using verbs chosen to reflect three levels of assignment of Proto-Agent. For Type 1 verbs (e.g., bury, wash, kick), the Agent necessarily moves more than the Patient, moves volitionally, and brings about a change of state. For Type 2 verbs (e.g., drop, lift, shove), the Patient moves more than the Agent, while undergoing a change of state. For Type 3 verbs (e.g., follow, hunt, chase), both Agent and Patient move volitionally. Thus, Type 1 verbs should have the most entailments to Proto-Agent, Type 2 verbs have fewer, and Type 3 have the fewest. These predictions were upheld by latency differences obtained from nine normal subjects.

Sentences containing seven verbs of each type were used in a forced-choice sentence/picture matching format (target + one reversal foil). Each verb was presented four times in active and in passive reversible sentences, yielding a total of 84 trials for each sentence voice. Top/bottom target and left/right agent positions were balanced and were represented equally across four presentation blocks.

Treatment. Four verbs (those showing best performance in the assessment) were selected from the Type 1 verb set to serve as treatment stimuli. The assessment pictures (target and foil for sentences containing each of the four treated verbs) were used in a verification format (one picture/one sentence used to elicit a “yes” or “no” response). Each depiction (target or reversal foil) was presented 16 times along with a spoken sentence. JQ was required to respond “yes” if the sentence matched the picture and “no” if it did not. A systematic feedback procedure was used to help him learn to link the
spoken sentence to its correct depiction based on syntactic cues (word order and grammatical form) (see Mitchum, Haendiges, & Berndt, 1995, for a complete description of the treatment).

Results

Baseline assessment revealed poor comprehension of reversible sentences with a pattern clearly favoring active (.76) over passive (.26) sentences; overall performance (.51; active/passive combined) was not different from chance ($z = 0.39$, $p > .15$). Treatment results were assessed by repeating the baseline comprehension test (sentences containing the 21 verbs presented in a forced-choice format). Posttreatment assessment, excluding the four trained verbs, showed significant improvement over baseline (from .48 to .79 correct; $z = 5.3$, $p < .001$; McNemar). Comprehension improved following treatment for sentences containing all verb types (see Fig. 1*). However, posttreatment comprehension of sentences containing untrained Type 1 verbs was significantly better than posttreatment comprehension of sentences containing verbs of Types 2 [Fischer’s exact (FI) = 4.28] or Type 3 (FI = 4.9) (see Fig. 1). Also noted in the posttreatment assessment was attenuation of the active/passive difference obtained at baseline for all sentences. (No active/passive differences were significant in posttesting.)

![FIG. 1. Percentage of correct responses in reversible sentence comprehension assessment before and after treatment. All sentences contained untrained verbs. Number of trials = 12 each (active, passive) for Type 1 untrained verb sentences; $N = 28$ trials each for sentences containing verb Types 2 and 3. *Pre- vs. post; Type 1, FI = 15.24; Type 2, &chi;^2 = 15.24; Type 3, &chi;^2 = 10.74; all verb types, $p < .001$. **Active vs. passive, pretherapy; Type 1, FI = 8.06; Type 2, FI = 12.09; Type 3, FI = 12.21; $p < .001$, all Types. ***Active vs. passive, posttherapy; Type 1 FI = 0.98; Type 2, FI = 0.89; Type 3, FI = 1.48; $p > .15$, all types.](image-url)
Discussion

This investigation supports a theory of sentence comprehension in which information crucial to thematic mapping is dictated by the sentence verb. It also demonstrates the important role that treatment studies can assume in revealing the underlying nature of sentence comprehension impairments. In the case of JQ, differences in comprehension based on verb type were initially masked by a response strategy in which the agent role usually was assigned to the first noun of the sentence. Once treatment removed reliance on this strategy, and highlighted the differences between active and passive voice, the apparent advantage of actives was greatly attenuated. Moreover, sensitivity to verb meaning—especially to features related to the assignment of the Agent role—emerged for both active and passive sentences.

REFERENCES


Sharing Responsibility for Checking Information: A Key to Transmission of Information in Conversation

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Introduction and Statement of the Problem

Language performance on clinical tests often fails to predict whether a person with aphasia can communicate information in a genuine conversation. In conversation, mutual understanding is built up over time; new information is introduced, gets confirmed, provides implications (which may be drawn differently by the participants if they fail to have other background information in common), and gets revised. When a person with aphasia has substantial information to transmit to a partner for whom it is genuinely new, the partner’s help is essential in all of these tasks: in finding words, making sure “who did what to whom,” and identifying shared information.

The present quantitative (content analysis) and qualitative (conversation
analysis) study focuses on the interaction of the people involved in transmitting information, rather than just on the person with aphasia. The specific goal of the present study was to identify particular types of verbal and nonverbal events that differentiate between successful and unsuccessful conversational attempts.

Procedures and Analyses

Participants were 5 people with aphasia, each 2 or more years poststroke, with varied types of moderate-to-severe aphasia, and 20 nonaphasic participants. The aphasic participants each saw four videotaped “I Love Lucy” episodes and immediately retold each story (by any means, including gestures and writing) to a different nonaphasic person, someone who had never seen that episode.

Part one—Quantitative study. The communicative success of these interactive story telling was measured by the amount of correct information the nonaphasic partner produced in retelling the story to the experimenter at the conclusion of the conversation (Menn, Ramsberger, & Helm-Estabrooks, 1994). For four of the five people with aphasia, the amount of information transmitted varied greatly across their four conversations. Thus, within-subject variation could not be due to aphasia type, severity, or other characteristics of the aphasic person. It also could not be accounted for by practice effects (story order was randomized) or by story difficulty (mean difficulty of the story across subjects did not predict the difficulty for the individual). The locus of the variation was thus taken to be the nonaphasic partner and/or the interaction between the partners.

Part two—Qualitative study. Four of the 20 conversations were selected for further qualitative analysis. We chose the most and least effective interactions of two of the aphasic participants. Using conversation analysis (Sacks, Schegloff, & Jefferson, 1974) we found that across these four pairs of partners, a major contributor to successful information transmission was how frequently the nonaphasic partner checked his/her understanding of the unfolding story; the greater the frequency, the more information was transmitted. The responsibility for seeing that such information checks take place seems to rest equally on the two partners. Our data indicate that information checking fails to take place for two reasons: either the aphasic partner does not invite it by his/her behavior or the nonaphasic partner does not make use of the opening provided by the aphasic partner. As the following example illustrates, eye gaze is a important way in which the aphasic partner can invite the nonaphasic partner to take a turn in the conversation, thus creating a pragmatically appropriate opportunity for information to be checked.

Table 1 shows a long monologue by the aphasic partner, “W,” during which she never looks at her conversation partner, “H”. In lines 3 and 16, she produces two names (John, Harry) which are quite unlikely in the “I
Love Lucy’’ context, and in line 4 she attempts to spell ‘‘Ethel,’’ but H makes no move to check any of this information; only after W finally looks at H in line 22 does he venture an information check in line 26 (‘‘Two friends?’’). This initiates a quite effective interchange (lines 22–35), getting from W’s paraphasia ‘‘tubes’’ plus her informative gesture, to the identification of one of the ‘‘two’’ as Lucy’s husband Desi in a few turns.

Comparison of two conversations with a nonfluent aphasic speaker, K, illustrates the importance of the nonaphasic partner in taking the opportunity provided by the speaker with aphasia. The primary difference between K’s
most effective interaction with partner T and her least effective interaction with partner L appears to be differences in the nonaphasic partners’ interaction style. L tended to produce contentless back-channel “mhms” instead of utilizing her turns to produce understanding checks; then, when she did produce a check it contained a large number of content units. T, on the other hand, produced understanding checks on a higher percentage of her turns and each check contained much less information. Thus, the aphasic partner invites initiation of understanding checks by establishing eye contact but the nonaphasic partner must be attentive, receptive, and socially willing to initiate them despite the fact that they slow down the interaction and, worse, openly acknowledge that there may have been difficulty in understanding the aphasic partner.

Conclusion

The qualitative study permits us to see precisely how speakers jointly contribute to the transmission of information in a conversation. This type of information is concrete enough to be used as the basis for individually structured intervention that focuses on coaching a person with aphasia and his/her conversation partner in techniques for more effective communication.

REFERENCES


Treating Attention to Improve Auditory Comprehension in Aphasia

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Aphasia has often been viewed as a purely linguistic deficit, a conceptualization that has profoundly influenced therapeutic approaches. However, other aspects of cognition may influence language performance in aphasia. For example, some aphasic individuals have attentional processing deficits that may have a significant impact on language performance: (1) Some exhibit substantial item-by-item variability on repeated tests of auditory comprehension (McNeil, 1983); (2) extralinguistic stimulation can enhance auditory comprehension performance, for example, slowing rate of input (e.g., Campbell & McNeil, 1985), providing emphatic stress (e.g., Kimelman & McNeil, 1987), and providing an alerting signal (Loverso & Prescott, 1981).
No previous study has directly examined the effects of an attention training program on auditory comprehension skills. The traditional approach to remediating auditory comprehension in aphasia is the language “stimulation” approach. At the same time, aphasia treatment programs that do not directly target linguistic skills have yielded substantial improvement in language performance, for example, the nonvocal Visual Action Therapy (Helm-Estabrooks, Fitzpatrick, & Barresi, 1982). In 1998 Helm-Estabrooks reported a case study of a moderately aphasic man who demonstrated significant improvement in auditory comprehension and nonverbal cognition with 10 sessions of treatment consisting of tasks of attention and concentration. These findings led to the study described here.

Method

Subjects. Subjects were two, premorbidly right-handed, high-school-educated women (Case 1, age 55 years; and Case 2, age 46 years) who sustained unilateral left hemisphere strokes 18 and 16 months, respectively, before entering our Attention Training Program (ATP). Baseline testing was repeated at 1-month intervals prior to initiation of treatment to control for natural recovery and practice effects (see Fig. 1). Prior to attention training, each patient was classified as having mixed nonfluent aphasia according to the Aphasia Diagnostic Profiles (ADP; Helm-Estabrooks, 1992). Case 1 scored at the 29th percentile on the auditory comprehension subtests of the BDAE (Goodglass & Kaplan, 1983) and the 10th percentile for age-matched, healthy adults on the Raven’s Coloured Progressive Matrices (RCPM; Raven, Court, & Raven, 1990). Case 2 scored at the 31st percentile on the BDAE auditory comprehension subtest and the 50th percentile on the RCPM.

Attention training program. The ATP was hierarchically organized beginning with nonlinguistic tasks of sustained attention and progressing to tasks of selective and alternating attention: symbol cancellation, trail-making, repeated graphomotor patterns, auditory continuous performance, and sorting tasks. Within each type of task, stimuli of increasing difficulty were used. Case 1 received 17 twice-weekly sessions of ATP followed by 16 sessions of Melodic Intonation Therapy (MIT) (Sparks, Helm, & Albert, 1974). Case 2 received 16 twice-weekly sessions of ATP followed by 23 weeks of no treatment.

Results and Discussion

Both patients improved with ATP (see Fig. 1). For Case 1, the BDAE auditory comprehension score improved to the 35th percentile (an increase of 6 percentile points), and RCPM to the 66th percentile (an increase of 56 percentile points). With subsequent MIT, her BDAE auditory comprehension score remained at the 35th percentile, but her RCPM dropped to the 50th percentile. For Case 2 the BDAE auditory comprehension score improved
FIG. 1. Percentile scores for the BDAE Auditory Comprehension subtest and Raven's Coloured Progressive Matrices for two aphasia cases. Dotted lines depict pretreatment baseline performance and solid lines indicate treatment effects.

to the 38th percentile (up 13 percentile points), and RCPM to the 75th percentile (up 25 percentile points). When retested after 23 weeks without any treatment, her BDAE auditory comprehension had dropped 6 percentile points (32nd percentile), but her RCPM score remained at the 75th percentile.

We conclude that “attention training” shows promise as a rehabilitation strategy for auditory comprehension deficits in aphasia. Nevertheless, the promising results of our study seem to raise as many questions as they answer. Despite comparable levels of auditory comprehension deficit, these two patients had markedly different nonverbal reasoning skills. This underscores the findings of Helm-Estabrooks, Bayles, Ramage, & Bryant (1995)
and others that aphasia severity is not predictive of general cognitive ability. With ATP, both patients made large gains in RCPM and smaller, but functionally meaningful, gains in auditory comprehension. A key result of this study is that improvement in auditory comprehension and nonverbal reasoning occurred only with the ATP. For Case 1, the MIT program had no effect on auditory comprehension, and, in fact, eroded gains made in cognition. For Case 2, a period of no treatment was deleterious to her auditory comprehension.

These results challenge the conceptualization of aphasia as a purely linguistic deficit. Further, they demonstrate that cognitive deficits of aphasic individuals can be improved. Finally, they suggest that generalization of these improved skills can occur from one type of cognitive domain (i.e., attention) to another (i.e., analogical reasoning). This latter finding is important insofar as those with severe aphasia must compensate for their language deficits by bringing good problem-solving skills to communicative interactions.

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Effectiveness of Intensive Training in a Case of Progressive Nonfluent Aphasia: Evidence of Preserved Brain Plasticity

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Nonfluent progressive aphasia is the most common form of degenerative focal neuropsychological syndrome (Mesulam, 1982). Its presentation with long-standing isolated aphasia and evolution toward late occurring dementia are typical clinical features of a neuropathological condition considered as distinct from Alzheimer’s disease but whose boundaries are still ill-defined. Therefore, progressive aphasia may be taken as a model of focal cortical degeneration and, as such, provides the unique opportunity of studying the effect of focused cognitive therapy or training of a specific subsystem of linguistic processes. Among the different aspects of language impairment in nonfluent progressive aphasia, a phonological deficit has been repeatedly pointed out (Béland & Paradis, 1997; Croot, Patterson, & Hodges, 1998). Moreover, our knowledge of phonological processes in general has benefited of recent advances from different points of view, e.g., brain functional imaging (Démonet et al., 1992) or neuropsychological rehabilitation (Habib, Espesser, Rey, Giraud, Bruas, & Gres, 1999).

We report here a preliminary study using intensive phonological training in one typical case of nonfluent progressive aphasia demonstrating that, at least for the trained functions, significant improvement may occur in spite of progressing degenerative process, thus providing evidence of preserved brain plasticity in neurodegenerative disease.

Case Presentation

MB, a 77-year-old man, was first referred for isolated word-finding difficulties lasting for about 2 years. Formerly a dentist, his intellectual activities had remained unchanged in spite of his increasing language difficulties.

An initial formal evaluation of language functions was performed in December 1998, before any speech intervention. His spontaneous speech remained well informative, mildly dysgrammatic, with rare phonemic paraphasias but obvious circumlocutions revealing his word-finding difficulties. The Boston Diagnostic Aphasia examination showed a profile of mainly expressive, nonfluent aphasia. Items performed below average normal performance were: (7) fluency, sentences length; (15) repetition, abstract sentences; (17) reading aloud, sentences; (22) aphasic transformations, phonemic paraphasias; and (35) writing, description. Interestingly, confrontation naming re-
mained within normal limits and comprehension was normal from auditory input, but borderline on written command.

On a comprehensive neuropsychological testing, the only significant impairment was observed on verbal fluency tests and digit span (five forward, four backward).

A CT scan showed mild nonspecific cortical atrophy, without noticeable asymmetry, and a HMPAO brain scintigraphy showed a clear-cut hypoperfusion zone in projection of the left Broca’s area. A MRI scan confirmed total absence of white matter pathology.

Methods

Training consisted in daily 15- to 20-min exercises tapping syllabic and phonemic segmentation and discrimination skills. Most exercises were on the “odd-one-out model,” e.g., “tell me which of these 3 words do not begin with s sound /t/: ‘tower–donut–tourist.’” In accordance with the temporal theory of phonemic processing (Tallal et al., 1996), facilitation and improvement of auditory perception of rapid transitional elements of speech were targeted through slowing by 166% of the speech signal, along with increasing intensity of formant transition, following a method previously used in the different pathological context of language learning disorders in children (Habib et al., 1999). Training stimuli were recorded on an audio-CD and provided through high-fidelity headphones by a trained speech therapist every day during the training period.

Training involved three successive stages: during the first 30 days, the patient received exercises with acoustically modified speech; next he received 30 days of similar exercises but with normal speech and then again 30 days with slowed speech as in the first stage.

Results

Figure 1 shows MB’s daily performance on phonemic “odd-one-out” tasks: during the first 30 days with specific modified-speech training, a significant, progressive improvement is observed, best manifested in the global slope of the linear transformation curve.

However, this observation does not hold for the second period, with nonmodified speech. Finally, the same tendency appears again, although less significantly than in the first period, during the last 30 days of training with reintroduction of slowed speech.

Globally, this difference between modified and unmodified conditions is statistically significant using a repeated-measure ANOVA ($F = 2.995; p = .0021$).

The BDAE $z$ scores profile has been performed again after the first training period: the general aspect is similar with however significant improvement on three items: articulatory realization, repetition, and spelling on dictation,
FIG. 1. Actual daily mean performance (thin stroke) and linear transformation (thick line) on phonological tasks constitutive of the training exercises. Progression over the 1-month period is significantly different with modified speech exercises (periods 1 and 3) compared to unmodified (period 2).

with a nonsignificant decrease in number of paraphasias. At days 60 and 90 these domains of language function had remain stable, in spite of evident global worsening of fluency and comprehension.

Discussion

This case report provides important arguments in favor of preserved brain plasticity in neurodegenerative disease. This point is particularly relevant to the current debate around the usefulness of therapy in Alzheimer-like pa-
tients with predominantly aphasic symptoms. In this regard, our results would argue for a generalization of such therapeutic practice.

Beyond these practical considerations, it is noteworthy that some language abilities not specifically trained (such as nonword reading, repetition, and spelling on dictation) have been found improved after phonological training, but that these abilities may all relate to phonological processing. Finally, the fact that training with slowed speech rather than normal speech seems efficient suggests that phonological impairment in progressive aphasia is dependent on the temporal features of the acoustic signal, providing further support to current theories about time constraints in auditory perception and processing of human speech.

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POSTER SESSION 3: RIGHT HEMISPHERE LANGUAGE PROCESSING

Changes in Word List Recall by Subjects with Right Hemisphere Stroke

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Introduction

This study assesses the change over time of word list recall of 10 subjects with right hemisphere stroke. Word recall was measured by the California
Verbal Learning Test (CVLT) (Delis, Kramer, Kaplan, & Ober, 1987). The CVLT assesses the recall and recognition of word lists over five trials and provides data regarding normal performance of individuals from 17 to 80 years of age. It also gives information on how a task is solved, including different strategies, processes, and errors an individual may demonstrate. Performance on the CVLT of groups of individuals with acute unilateral right hemisphere stroke has been described previously (Cherney, Halper, & Drimmer, 1995; Halper, Cherney, Drimmer, & Chang, 1996). A subgroup of these subjects was retested to assess changes over time.

Methodology

The CVLT was administered to a heterogeneous group of 10 individuals (7 males, 3 females) with unilateral right hemisphere stroke confirmed by CT scan. All subjects had at least an eighth grade education, spoke English as a primary language, and were right handed. The mean age was 64.9 years (SD = 16.80) and mean education level was 12.6 years (SD = 2.7).

Each subject was followed longitudinally. Two test sessions were conducted, one in the acute phase (less than 6 weeks post onset) and the other at more than 6 months post onset. The mean length of time post onset at initial testing was 28.5 days (SD = 9.9). The mean length of time post onset at the second testing was 8.3 months (SD = 3.90). All subjects received speech-language treatment at the time of initial testing; treatment was discontinued by 3 months post onset.

The administration of the CVLT was videotaped. Responses were transcribed online, checked for any discrepancies from the videotape, and then manually scored.

Results

Table 1 presents the means and standard deviations of the CVLT standard scores at each test period for the 10 stroke patients with unilateral right hemisphere lesions. At initial testing, 9 of the 10 subjects demonstrated below-average performance on all immediate- and delayed-recall trials and on both the free-recall and cued-recall tasks. By comparing performance on free-recall trials with that of cued-recall trials, it appeared that difficulties occurred more in the encoding process rather than the retrieval process.

At the time of the second testing, seven of the patients demonstrated improved but continued below-average performance on these tasks. Significant differences between the first and second testing were obtained for Free Recall List A Trial 1 (p < .05), List A Total Trials 1–5 (p < .05), and short-delay free recall (p < .01). Although improvements were noted in all other areas, these were not significant.
TABLE 1
Means and Standard Deviations (SD) of CVLT Standard Scores for Right Hemisphere Stroke Subjects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Initial testing</th>
<th>Second testing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>List A total recall, Trials 1–5(^a)</td>
<td>31.30</td>
<td>16.74</td>
</tr>
<tr>
<td>List A Trial 1</td>
<td>−1.30</td>
<td>0.68</td>
</tr>
<tr>
<td>List A Trial 5</td>
<td>−1.70</td>
<td>1.95</td>
</tr>
<tr>
<td>List B recall</td>
<td>−0.90</td>
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<tr>
<td>Short-delay free recall</td>
<td>−1.70</td>
<td>1.42</td>
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<tr>
<td>Short-delay cued recall</td>
<td>−1.20</td>
<td>1.40</td>
</tr>
<tr>
<td>Long-delay free recall</td>
<td>−1.60</td>
<td>1.27</td>
</tr>
<tr>
<td>Long-delay cued recall</td>
<td>−1.50</td>
<td>1.78</td>
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<tr>
<td>Percent primacy recall</td>
<td>−1.10</td>
<td>2.28</td>
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<tr>
<td>Percent middle recall</td>
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<tr>
<td>Percent recency recall</td>
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<td>Perseverations</td>
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<td>Free-recall intrusions</td>
<td>0.50</td>
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<tr>
<td>Cued-recall intrusions</td>
<td>0.60</td>
<td>0.97</td>
</tr>
</tbody>
</table>

\(^a\) For List A total recall, Trials 1–5, mean = 50 and SD = 10; for all other indices, mean = 0 and SD = 1.

At the first testing, the subjects were more impaired in recalling words that were in the primacy region of the word list. However, at the second testing recall of words in the primacy region had improved to being comparable to that of normal subjects. Recall of words that were in the middle and recency region of the list was comparable to that of normal subjects at both testings. Production of perseverations and intrusions was also comparable to that of normal subjects at both testings.

Data were analyzed to determine if there was a relationship between the standard scores achieved at initial and second testing. Significant correlations were obtained for Immediate Free Recall Trials 1–5 (\(r = .76; p = .01\)) and for short-delay free recall (\(r = .70; p = .02\)). Therefore, those individuals who achieved higher scores at initial testing tended to perform better at the time of the second testing.

Discussion

In the patient with right hemisphere damage, it has been proposed that limitations in memory may adversely affect performance on a variety of tasks. However, the precise nature of the memory deficits as well as its implications on rehabilitation outcome is not well understood. This study indicates that disruptions in memory do occur after unilateral right hemisphere stroke.
Patients with right hemisphere stroke presented with impairments in both immediate and delayed memory. While improvements were noted over time, subjects continued to demonstrate impaired performance. At both test sessions, these impairments appeared to be related to problems in encoding. Therefore, individuals in a rehabilitation program would benefit from practice, repetition of important information, and the imposition of a strategy that facilitates encoding.

At initial testing, recall of items in the primacy region was poorer than recall in the middle and recency region indicating that the subjects may have a passive learning style. However, at second testing performance on recall of items in the primacy region was within normal limits. As a result, clinicians should consider when the optimum time of treatment should occur. Patients may learn to use compensatory strategies more successfully when treatment is initiated later, when their learning style is more active, rather than earlier post onset.

**Future Directions**

This study has identified some preliminary trends in the performance of individuals with right hemisphere stroke on a test of recall and recognition of word lists over a number of trials. The addition of more subjects to this study is necessary in order to confirm these trends and to better determine the nature of the memory disruptions. Furthermore, in view of the heterogeneity of this population, performance of subgroups based on site of lesion and severity of associated deficits such as unilateral neglect should be studied. This information, together with additional data regarding recall and recognition performance at different intervals post onset, would be important to the professional involved in the rehabilitation of patients with right hemisphere stroke.

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Individuals with focal damage to the right hemisphere (RHD) demonstrate comprehension deficits in interpreting intended meanings, especially when the comprehension process requires selection of one meaning over one or several other possible meanings. Tompkins and colleagues (Tompkins, Baumgaertner, Lehman-Blake, & Fassbinder, 2000) proposed that one underlying cause for these comprehension difficulties in individuals with RHD is an inefficiency in suppressing irrelevant meanings. They conducted an experiment in which individuals with RHD and non-brain-damaged (NBD) control participants judged the relatedness of auditorily presented target words to auditorily presented prime sentences that ended in ambiguous homophones. Target words were presented at 175 and 1000 ms interstimulus interval (ISI). At the short interval, both groups showed interference from the contextually inappropriate meaning of the ambiguous word, but only individuals with RHD showed interference at the long ISI. Based on the Structure Building Framework of Comprehension (Gernsbacher, 1990), Tompkins and colleagues interpreted this interference effect as a deficit in actively suppressing contextually inappropriate lexical activation. After controlling for vocabulary knowledge and working memory capacity, the suppression deficit effect accounted for 12.6% of the variance in error scores on a discourse comprehension test. Therefore, the authors proposed that inefficient suppression contributes significantly to comprehension problems in individuals with RHD.

However, the authors pointed out that the results were also consistent with the hypothesis that participants with RHD had a slow rate of lexical–semantic activation, resulting in later activation for the unintended meanings as well as later inhibition of these meanings. While evidence for slowed lexical–semantic activation would not rule out the suppression deficit account, slowed lexical–semantic activation alone could account for the finding of lingering interference.

To address the question whether individuals with RHD have a specific deficit in the speed of activation of lexical–semantic information, the time course of interference in the relatedness judgment paradigm was further investigated. Following Perfetti & Hart (1999), it was argued that slower lexical–semantic activation would reduce interference at an earlier interval than previously measured, because the contextually incongruent meaning of the ambiguous word would be activated to a lesser degree compared to later
intervals. Therefore, interference was measured at an ISI of 0 ms and compared to interference at an ISI of 1000 ms, the interval at which the RHD and control groups differed.

The slowed activation hypothesis would predict that individuals with RHD would show no or only very low interference at 0 ms ISI and have more interference at 1000 ms ISI. Thus, the degree of interference between 0 ms ISI and 1000 ms ISI should increase in this group. Normally aging adults should have more interference at 0 ms ISI and show no or very low interference at 1000 ms ISI. Thus, the degree of interference between 0 ms ISI and 1000 ms ISI should decrease in this group.

Given the tendency of elderly individuals to respond more cautiously in speeded reaction time paradigms, a response deadline procedure was introduced to speed reaction times.

**Method**

**Participants.** So far, four individuals with RHD and four NBD controls have participated. Selection criteria are identical to those reported in Tompkins et al. (2000).

**Materials.** Experimental stimuli consist of prime sentences which end in ambiguous words (e.g., “He dug with a spade”), followed by target words related to the contextually incongruent meaning of the ambiguous word (e.g., “CARDS”). Comparison stimuli use the same target words, but prime sentences end in unambiguous words (e.g., “He dug with a shovel”). The correct relatedness judgment for both types of stimuli is a “no” response. When the contextually incongruent meaning of the ambiguous word is activated, reaction times for the accurate “no” response should be slowed compared to those for the comparison stimuli. Experimental and control stimuli are identical in each condition.

**Procedure.** Participants are tested in two sessions separated by at least 2 days. All stimuli are presented via headphones. Participants respond by pressing a “yes” or “no” button.

**Response deadline.** The response deadline was individually adjusted based on simple response times to the words “yes” or “no.” Piloting data from five participants suggested that a response deadline of twice the average simple response time would result in a substantial reduction in response times without being too taxing.

**Results and Discussion**

Results were analyzed by comparing the ratio of experimental stimuli minus comparison stimuli, divided by response times for comparison stimuli. This “suppression ratio” corrects for differences in individual processing speed. A positive suppression ratio reflects interference. In Tompkins et al. (2000), at 175 ms RHD and NBD participants had suppression ratios of 0.06
TABLE 1
Suppression Ratio at 0 ms ISI and 1000 ms ISI with Response Deadline

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Interstimulus interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 ms</td>
</tr>
<tr>
<td>Right-hemisphere-damaged</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.10</td>
</tr>
<tr>
<td>2</td>
<td>-0.08</td>
</tr>
<tr>
<td>3</td>
<td>-0.06</td>
</tr>
<tr>
<td>4</td>
<td>-0.04</td>
</tr>
<tr>
<td>M</td>
<td>0.02</td>
</tr>
<tr>
<td>Non-brain-damaged</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-0.01</td>
</tr>
<tr>
<td>2</td>
<td>-0.01</td>
</tr>
<tr>
<td>3</td>
<td>0.02</td>
</tr>
<tr>
<td>4</td>
<td>-0.05</td>
</tr>
<tr>
<td>M</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

\( \text{sup} = (\text{RT experimental} - \text{RT comparison}) / \text{RT comparison} \)

Note. Positive suppression ratios reflect interference from the contextually inappropriate meaning of the sentence-final ambiguous word.

and 0.05, respectively, whereas at 1000 ms the results were 0.05 and 0.01, respectively.

Results so far (Table 1) replicate the previous finding of lingering interference in individuals with RHD at 1000 ms ISI, compared to a lack of interference for normally aging adults. At 0 ms ISI, the results so far are unexpected. Against the prediction, none of the normally aging participants showed any interference at 0 ms ISI. This raises the question whether the normal activation process does not result in enough activation of the contextually inappropriate meaning at 0 ms ISI or whether slowed lexical–semantic activation is a concomitant of the normal aging process. The latter hypothesis, though controversial, has been proposed by some authors (e.g., Bowles, 1994). To address this possibility, further research would need to compare younger and older adults in the same experimental paradigm.

REFERENCES


The Evaluation of the Ability of Right-Hemisphere-Damaged Patients to Process Speech Acts: An Ecological Approach

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Individuals with right hemisphere damage (RHD) can encounter difficulties with the understanding of the nonliteral meaning of indirect requests. Until now, four studies (Heeschen & Reisches, 1979; Hirst, Ledoux, & Stein, 1984, Foldi, 1987; Weylman, Brownell, Roman, & Gardner, 1989) have examined the processing of speech acts by RHD patients, whereas a fifth study by Stemmer, Giroux, & Joanette (1994) has investigated the ability of RHD subjects to process and produce nonconventional indirect requests. Although the findings of these studies seem to suggest that RHD patients do process less efficiently indirect requests, the ecological validity of the tasks used can be questioned. Indeed, most of these studies have relied on tasks exposing the subjects to nonnatural, nonecological communicative context. Generally speaking, tasks used in these studies require the subject to imagine various interactions between virtual characters and then to judge whether these hypothetical situations are plausible or not. It is possible that previous studies measured the ability to judge whether statements which express an indirect speech act are plausible or not, rather than really looking at the ability to process indirect speech acts. Consequently, for both theoretical and clinical reasons, it is important to ascertain whether or not RHD individuals truly exhibit difficulties in the interpretation of indirect speech acts in a natural—ecological—communicative context. The purpose of the present study was thus to explore whether the difficulties of RHD patients to interpret indirect speech acts reported in a series of nonecological studies are present in a natural and pseudo-natural communicative contexts.

Method

Subjects. Twenty-eight subjects participated in this study: 14 RHD patients (mean age = 60.3 years, SD = 18.4 years) and 14 normal control subjects (mean age = 60.4 years, SD = 18.8 years). All subjects were
French-speaking right handers, without any previous psychiatric, alcoholic, or neurological history.

**Tasks.** Three different tasks were used: natural (N), nonnatural (NN), and pseudo-natural (PN). The natural task consisted of an interview dealing with the subjects’ general health. Subjects had to respond verbally or through action according to their interpretation of the direct and indirect speech acts that were addressed to them. The nonnatural task was representative of the nonecological tasks used up until now. It consisted of a French adaptation of the Weylman et al. protocol (1989). In brief, this task consisted of short stories that end in an interrogative utterance that could be interpreted as a literal, direct question or as a nonliteral, indirect request. The subjects were required to choose among four possible choices, the one which corresponded best to the situation. Finally, in the pseudo-natural task, the requests were the same as those used in the interview for the natural task, but they were presented in the context of a short story with choice of response similar to task 2.

**Results**

Statistical analyses (ANOVA) on the percentage of correct answers were carried out for each task (see Fig. 1). Results show that RHD subjects process

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**FIG. 1.** Mean percentage of correct answers produced by right-hemisphere brain-damaged (RHD) and normal control (CTR) subjects for each form of speech act (Direct and Indirect) in each task (Natural, Nonnatural, and Pseudo-natural).
speech acts as efficiently as control subjects in a natural and a pseudo-natural communicative context (tasks N and PN). The direct and indirect speech acts are processed significantly worse by RHD subjects than by control subjects in a non-natural communicative context (task 2) \( (F(1, 26) = 6.703, p < .05) \). Moreover, we sought to determine whether or not the three tasks had a different degree of difficulty according to their ecological level. The findings suggest that the nature of the communicative context influence subjects’ processing of speech acts. In other words, all subjects better process speech acts when they occur in a natural context rather than in an unnatural context (tasks N and PN).

**Conclusion**

The results of this study suggest that it is possible for RHD subjects to interpret speech acts correctly when the communicative context is natural. Therefore, it seems important to use ecological situations to clinically evaluate the ability to process speech acts. The conditions used in the studies published until now do not correspond to ecological conditions. For example, the task used by Weylman et al. (1989) ask subjects to make a metajudgment on the speech acts, as well as to judge the plausibility among a choice of answers (Gardner, Brownell, Wapner, & Michelow, 1980). Preliminary studies by Picard (1993) suggest that RHD patients may have a deficit affecting their ability to correctly make a plausibility judgment. If such was the case, the difficulties mentioned in the literature could end up being a by-product of a methodological artifact. Finally, it must be mentioned that the present results could merely reflect the difficulties associated with the processing demands of the different tasks rather than the actual difficulty of processing speech acts as such. Whatever the exact reasons, the present results command future studies on the question taking into account the naturalness of the communication tasks.

**REFERENCES**


Voicing Discrimination in Stop Consonants by Brain-Damaged Patients: The Role of Overt Segmentation

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It has traditionally been held that segmental aspects of speech perception are a function of left temporal lobe regions (e.g., Blumstein, 1998; Geschwind & Levitsky, 1968; Zatorre, Evans, Meyer, & Gjedde, 1992). However, recent investigations have hypothesized that left frontal lobe regions—in particular, Broca’s area—may be implicated in overt segmentation processes required in certain speech perception tasks; speech perception that does not require such segmentation is believed to invoke left temporal lobe mechanisms (Burton, Blumstein, & Small, 1998; Zatorre, Meyer, Gjedde, & Evans, 1996). In particular, although Zatorre et al. (1996) found left frontal lobe activation in a PET study for a task requiring final consonant discrimination, Burton et al. (1998) did not find Broca’s area activation in a similar fMRI task. A main difference between the studies lies in the requirements of the task. The CVC stimuli in the Zatorre et al. study differed in terms of both final consonant identity and preceding vowels. Thus, to perform the final consonant discrimination, subjects had to initially segment the CVC utterance into its component parts. In contrast, in the Burton et al. study, the stimuli could be discriminated without the need for overt segmentation, as they differed only in a single consonantal feature. The speculative conclusion that was drawn from the differences in results is that overt segmentation invokes processing in the left frontal lobe; however, speech perception that does not require such overt segmentation relies on temporal lobe mechanisms (Burton et al., 1998). The present investigation was designed in an effort to test this hypothesis in brain-damaged patients.

Subjects

Four groups of subjects participated in this experiment (to date): 10 LHD nonfluent aphasic patients, 6 LHD fluent aphasic patients, 7 RHD patients, and 10 age- and education-matched normal controls. All participants were
Stimuli and Procedures

Stimuli consisted of 10 triplets of real CVC words, all with syllable-initial alveolar stops, created as follows. Ten [d]-initial words were identified which had [t]-initial word cognates (e.g., “tip” “top”). An additional set of words was derived by altering the vowel in the stimuli (e.g., “tip” “top”). An AX discrimination task was created testing stop voicing discrimination. To perform the discrimination, subjects were required to segment the syllable into its component phonemes for half \( n = 20 \) of the stimulus pairs (e.g., dip-tip, tip-tip). For the other half of the trials \( n = 20 \), no such segmentation was required (e.g., dip-tip, tip-tip). There were 20 “same” trials and 20 “different” trials; half of the “same” trials began with a voiced stop and half with a voiceless stop. Stimuli within each trial were paired with a 250-ms interstimulus interval (ISI) and presented 10 times each in random order with a 4-s intertrial interval. Stimuli were presented to listeners who were seated in front of a response board with buttons labeled “same” and “different.”

Results and Discussion

Mean percent correct discrimination scores were computed for four conditions: different stimuli with the same vowel, same stimuli with the same vowel, different stimuli with a different vowel, and same stimuli with a different vowel. The latter two conditions presumably require segmentation for a decision to be made; notably, the “same” responses for stimuli with a different vowel were expected to be the most difficult for the braindamaged patients. As illustrated in Fig. 1, consonant discrimination performance for the normal controls was near ceiling under all conditions. For the RHD patients, one individual exhibited a “same” bias, almost never responding “different.” The performance of the remaining patients showed relatively high accuracy, with somewhat reduced discrimination for same stimuli with a different vowel. The fluent aphasic patients’ performance was also fairly good across conditions, with relatively poor discrimination only for same stimuli containing a different vowel. In fact, the low group mean performance was largely due to a single subject whose responses under this condition were based consistently incorrectly on the vowel rather than the consonant. Excluding this individual, mean accuracy for the fluent group under this condition increases to 80%. Finally, performance of the nonfluent aphasic patients was poor for different stimuli containing the same vowel and was not different from chance (binomial distribution) for same stimuli containing a different vowel. The nonfluent patients seemed to have difficulty when the stimuli contained any conflicting information; however, the segmentation requirements of the task did not seem to be a major factor in their discrimination accuracy. The nonfluent aphasic patients even exhibited errors
for nonconflicting stimuli, suggesting a more general impairment in consonant discrimination abilities in these individuals. In fact, the vocalic information seemed to play a prominent role in influencing their discrimination judgments. These findings are consistent with a left hemisphere lateralization for the processing of consonantal information, but are not in keeping with a left temporal lobe localization of such functions, as the nonfluent aphasic patients tended to have frontal (rather than temporal) lobe lesions. Performance of the fluent aphasic patients and the RHD patients was more normal, except for stimuli for which the vocalic information rendered “same” judgments questionable. Implications of the findings for models of the neural substrates of speech processing are considered.

REFERENCES

Speech Reading and Its Role in Auditory Processing

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“Speech reading” is the term applied to the use of visual information in auditory processing. The term has been changed from the more familiar “lip reading” on the basis that the information gained is not only from the lips but also from facial muscles, tongue, jaw, and so on. In recent years, the importance of visual (speech read) information in the interpretation of spoken stimuli has become apparent and increasing attention has been paid to its role in the auditory processing of subjects with unimpaired hearing. Dodd & Campbell (1987) argued that speech reading “far from being epiphenomenal to speech processing, [or] to cognitive processes, . . . may provide essential clues about how these skills are organized” (p. ix). We would argue that an investigation of the effects of speech reading should be an essential part of any analysis of auditory processing deficits, and this paper will demonstrate the insights that can be gained from this approach to assessment.

Case Study

KRJ, a 67-year-old artist, suffered a left hemisphere cerebrovascular accident (CVA) in June 1996. Initially, KRJ presented with both receptive and expressive language deficits. He could not follow conversation and relied on written messages to communicate with his family. Although his spontaneous speech was generally fluent, he also had word-finding difficulties and produced phonological and semantic errors and frequent circumlocutions. The results reported here regarding the effects of speech reading on phoneme perception, spoken-word recognition, auditory comprehension, and speech repetition were investigated at 18 months post-CVA. For each task, stimuli were presented both with speech reading (+SR) and without speech reading (−SR), using split halves with order counterbalanced in an ABBA design over two sessions (1 week apart). The results are summarized in Table 1.

Summary of Results

Phoneme perception. The effect of speech reading on phoneme perception was studied by using two nonword minimal pairs tests (same and different voice minimal pairs; Franklin, Turner, & Ellis, 1992). Thus there was no influence of speech reading in either minimal-pair task, although performance was close to ceiling.

Spoken-word recognition. The effect of speech reading on spoken-word recognition was studied by using an auditory lexical decision task with words varying in frequency and imageability (P5; Kay, Lesser, & Coltheart, 1992).
Speech reading resulted in a highly significant improvement in auditory word recognition.

**Auditory comprehension.** Auditory comprehension was measured by two different tests: word-to-picture matching with phonological distractors (P4; Kay et al., 1992) and auditory synonym judgments with high and low imageability words (P49; Kay et al., 1992). Both tests were administered with and without speech reading.

In the word/picture matching task, there was no effect of speech reading. This may have been due to a ceiling effect. His performance on the synonym judgments test was below ceiling and showed a nonsignificant trend for facilitatory effects of speech reading.

**Speech repetition.** This was tested with two separate tasks, one using words (the 80 words from the Auditory Lexical Decision task referred to above—P5; Kay et al., 1992) and the other using 65 nonwords (of one, two, and three syllables; Nickels, 1992). There was no effect of speech reading on accuracy of nonword repetition. In contrast, speech reading significantly improved word repetition performance, but only for words high in imageability or high in frequency. KRJ only showed a significant effect of imageability with speech reading (although there was a trend in the same direction without speech reading). There was no significant effect of frequency on word repetition.

**Theoretical Implications**

There are two main competing hypotheses regarding the locus of the effects of speech reading on KRJ’s performance. First, it could be acting at
the more peripheral levels of phonological analysis or the phonological input buffer, and second it could be acting at the level of the phonological input lexicon. These two competing hypotheses have rather different predictions regarding the pattern of effects.

1. Speech reading acts at the level of phonological analysis or the phonological input buffer.
   An effect of speech-reading at either of these levels would predict improved repetition for *both* words and nonwords—this did not occur. There was only selective facilitation for word repetition.

2. Speech reading acts at the level of the phonological input lexicon.
   This would predict improved spoken word recognition (auditory lexical decision) and word repetition but no improvement in nonword repetition. This was exactly the pattern that was found.

Thus we may conclude that any theory which assumes that the effects of speech reading are confined to early levels of processing is untenable given the specificity of the effects shown with KRJ. We shall further specify alternative accounts of speech reading and critically evaluate their adequacy.

REFERENCES


POSTER SESSION 3: MEMORY AND APHASIA

Short-Term Verbal Memory in a Patient with Conduction Aphasia

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Harold Goodglass Aphasia Research Center, Boston University School of Medicine

Repetition difficulty in conduction aphasia has been attributed to a deficit of short-term memory (STM) by some investigators (e.g., Cappa & Pasquali, 1998). However, other investigators view the difficulty as primarily a linguistic deficit (e.g., Goodglass, 1993). Lindfield, Barresi, & Goodglass (unpublished manuscript) reported on a man (VM) with conduction aphasia and poor repetition who showed difficulty in the immediate recall of auditorally
presented words. However, this occurred only when the correct sequential order was required. Lindfield et al. concluded that the basis of the repetition difficulty in this patient was linguistic and not a deficit of STM.

Unlike long-term retention of verbal information, STM is vulnerable to fast decay. Presumably, introducing a delay would exacerbate repetition difficulty if the problem with repetition in conduction aphasia is one that is memory based. Thus, we further investigated the issue of a linguistic versus a memory deficit in VM by introducing the opportunity for decay in two ways. (1) We added 5- and 10-s delays between auditory presentation and repetition of single words. (2) We reexamined memory for short lists of words with a delayed pointing condition after immediate attempts at repetition.

Method

Case description. VM is a 77-year-old right-handed man with 3 years of college education who suffered a left hemisphere stroke in the posterior perisylvian language area 2 years prior to our study. His language performance on the Boston Diagnostic Aphasia Examination (Goodglass & Kaplan, 1983) was consistent with a diagnosis of conduction aphasia. He had fluent, well-articulated, and fully grammatical verbal output with numerous phonemic paraphasias which he often unsuccessfully attempted to correct. Auditory and reading comprehension were excellent; confrontation naming was marked by phonemic paraphasic errors, some of which were self-corrected; and repetition was disproportionately impaired compared to his spontaneous verbal productions. Neuropsychological testing revealed superior learning and retention on visual memory subtests (Wechsler, 1981). By contrast, his verbal memory span was reduced; he had a digit span of 5 and a word span of 3.

Materials

Experiment 1: Repetition. Stimuli consisted of a total of thirty words. There were 12 two-syllable words, half with initial syllable stress (e.g., “window”) and half with final syllable stress (e.g., “ballet”). There were 18 three-syllable words, with equally distributed stressed syllables (e.g., “photograph,” “umbrella,” “violin”). The two- and three-syllable word were balanced for word frequency.

Experiment 2: Recall. Stimuli consisted of five lists of one-syllable words and five lists of two-syllable words with five words in each list. The words were derived from the Snodgrass and Vanderwart (1980) pictures, and lists were counterbalanced for word frequency.
TABLE 1
The Mean Number of Items Repeated and Recalled in Experiments 1 and 2

<table>
<thead>
<tr>
<th>Delay</th>
<th>Repeat Mean (SE)</th>
<th>Recall Mean (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 30)</td>
<td></td>
</tr>
<tr>
<td>0 delay</td>
<td>18.0 (2.7)</td>
<td>Total correct</td>
</tr>
<tr>
<td>5-s delay</td>
<td>15.9 (2.7)</td>
<td>Correct order</td>
</tr>
<tr>
<td>10-s delay</td>
<td>15.0 (2.7)</td>
<td>Delayed order</td>
</tr>
</tbody>
</table>

Procedure

Experiment 1: Repetition. The 30 words were orally presented by the examiner for VM to repeat. There were three conditions of delay presented in the following order: (1) repetition after a 10-s delay, (2) immediate repetition, and (3) repetition after a 5-s delay.

Experiment 2: Recall. For each list presented, VM read the five words aloud and was asked to repeat them in the same order. Following VM’s repetition attempts, he was presented with a card containing eight words (the five list words and three foils) randomly scattered on the card. He was asked to point to the words in the order in which he had previously read them aloud.

Results

Data for the two experiments are presented in Table 1.

Experiment 1: Repetition. A multivariate analysis of variance (MANOVA) with three dependent measures (no delay, 5-s delay, and 10-s delay) revealed no significant effect of repetition in the three delay conditions, $F(2, 58) < 1$.

Experiment 2: Recall. Means were obtained for the total number of words repeated regardless of order, words repeated in the correct order, and words recalled in the correct order by pointing.

A MANOVA with three dependent measures (total correct, correct order, and delayed pointing) revealed a significant main effect of response type, $F(2, 98) = 8.14, p < .001$. Further analyses to reveal the source of the main effect revealed a significant preference for delayed pointing compared to repetition in the correct order, $t (49) = -3.90, p < .01$.

Discussion

The finding that VM’s repetition errors did not differ following immediate, 5-s, and 10-s delay conditions suggests that delay did not interfere with his ability to retain the phonological form of the word. Furthermore, VM’s ability to point to the words in their correct order following unsuccessful overt verbal production also suggests that he was able to maintain the phonological
representation of the word. Thus our results suggest a linguistic rather than a memory basis for the repetition difficulty in our patient with conduction aphasia.

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Serial-Position Effects for Information Unit Production: The Role of Memory in the RAPP Story Retell Procedure for Normals and Persons with Aphasia


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This study reports the results of an investigation designed to investigate the role of recency and primacy memory effects in the *Story Retell Procedure (SRP) (Doyle & McNeil, 1998), a connected language sampling procedure designed for the assessment of aphasia. In this procedure, individuals provide an immediate retell of a subset of 12 recorded stories originally derived from the *Discourse Comprehension Test (DCT) (Brookshire & Nicholas, 1993). In this standardized language sampling procedure, retellers are provided with concurrent picture presentation when listening to and providing their immediate retell (Doyle, McNeil, Spencer, Goda, Cottrell, & Lustig, 1998). The
number of possible information units (IUs)\textsuperscript{1} is predetermined for each story and information transfer is measured by the percentage of IUs produced (McNeil, Doyle, Fossett, & Park, 2000). IUs are coded as those specific words reproduced from the story (direct IUs) or their legitimate synonyms (alternative IUs).

SRP performance potentially involves the amount of information a reteller comprehended as well as the formulation and production requirements of the task and the limitations of the speaker. One way to assess the memory demands inherent in the task and those imposed on the retellers is to investigate the serial-position effect. Recency and primacy effects have been demonstrated in story retellings by normal and traumatic brain damaged subjects (Hall & Bornstein, 1991). However, while memory impairments for linguistic material are well documented in persons with aphasia (Burgio & Basso, 1997; McNeil, 1988), no study has investigated the serial-position effects in a connected language story retell in this population.

Therefore, this study examined the serial-position effects of IU production in normal individuals and in individuals with aphasia. It was hypothesized that recency and primacy effects would be demonstrated for stated IU productions for both normal and aphasic subjects. Conversely, we predicted that no such effect would be demonstrated for alternative IUs. Additionally, it was hypothesized that the magnitude of the information recalled and the slope of the serial-position effect would be reduced in the aphasic subject group. These findings would further define the processing demands of the SRP and the memory limitations of persons with aphasia on connected-level language material.

\textit{Method}

Thirty-one adults screened for linguistic and neurologic normalcy ($M = 43.2$ years; range = 22–80 years) and 15 persons ($M = 63.87$ years; range = 47–79 years) with documented mild to moderate aphasia (PICA $M = 77$th percentile; range = 43rd to 95th percentile) served as subjects.

The 12 SRP stories were presented in a randomized order and subjects were instructed to retell each story in their own words. Retellings were recorded and orthographically transcribed by trained and reliable scorers. IUs were then identified and categorized as direct or alternatives. The total number of IUs produced for each story by each subject was then tallied and converted to a percentage based on the a priori determined possible number of IUs. The total number of IUs for each story was normalized and weighted across stories, as the number of identified IUs was not equivalent for each original story ($M = 152$; range = 111–162). The four series of data were

\textsuperscript{1}An IU is a word or word string with informative and accurate content related to the story.
then analyzed by fitting several alternative regression models to obtain a model of best fit for the data.

**Results**

The four series of data had high levels of autocorrelation. The autocorrelation function plots decayed to zero at about 20 IUs in the sequence for the direct IUs from the normal subjects. This value was used to modify all series using a moving average of 20 IUs. The resulting series were analyzed using regression models with autocorrelated errors. Both linear and quadratic autoregressive models were fit to each series. The quadratic series still included a significant negative AR(1) term.

The direct IUs for both groups of subjects showed stationary time series and an autocorrelation of zero with a 20-point lag (correlations computed at 20 consecutive IU points; $r^2 = .05$ for each). A quadratic autoregressive regression line fit to the direct IUs from normal subjects had an $R^2$ value of .61, while the function for the aphasic subjects resulted in an $R^2$ of .41. The alternative IUs for normal and aphasic subjects had linear regression lines with small values for $r^2$ (.01 and .05, respectively) and virtually no slope. The plots and respective regression lines for the four data sets are seen in Figs. 1 and 2.

Normal subjects produced an average of 36% of the total possible direct IUs and 13% (36% of the direct) alternative IUs for each story. The difference between direct and alternative IUs for normal subjects was significant ($p < .05$). Individuals with aphasia produced 17% direct and 5% (29% of
FIG. 2. Plot of direct and alternative IUs with corresponding regression lines for aphasics.

the direct) alternative IUs for each story. The difference between direct and alternative IUs for individuals with aphasia was not significant ($p > .05$).

Discussion

The results show a recency and primacy effect for direct IU production and no such effect for alternative IU production in both normal and aphasic subject groups. As hypothesized in this study, reported by Hall & Bornstein (1991) in traumatically brain-damaged individuals, and found in this study, persons with aphasia had a reduced number of recalled IUs relative to the normal subject group. The two deficit groups did, however, show a similar serial-position effect. These findings illustrate the role of auditory memory in the SRP for both normal and aphasic individuals and further define the processing demands of this task.

REFERENCES


Strategies Underlying Category Free Recall in Anterior versus Posterior Aphasia

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There has been a long history of reports of short-term verbal memory impairments accompanying aphasic language disturbance (e.g., Jodzio & Lindfield, 2000). More recently, there have also been reports of disturbances of long-term memory in aphasia, particularly with regard to the acquisition and subsequent recall of recently learned events (episodic recall) (e.g., Besson, Bayles, Rubens, & Kasznia, 1993; Ween, Verfaellie, & Alexander, 1996).

It is well known from the classical memory literature that when a person encounters a memory list, he/she spontaneously organizes the list into higher-order units which are then relied upon to cue recall of the individual words (e.g., Tulving, 1968). This organizational strategy is reflected in the temporal properties of subjects’ verbal retrieval reports. For example, in a subject’s recall of a categorizable word list, the list items will be clustered by categories with long pauses between items from two different categories and short pauses between individual words of a category (e.g., Wingfield, Lindfield, & Kahana, 1998).

In order to reveal the underlying nature of long-term memory retrieval deficits in aphasia, we examined the temporal properties of the items recalled during episodic recall of a categorizable word list. Performance was compared in two groups of aphasic subjects: those with anterior lesions who are known to have impairment in executive functioning and those with posterior lesions who may have deficient semantic representations. Another focus of this investigation was to examine the extent to which participants’ learning rates benefited from list structure. Thus, we compared recall accuracy of a word list that was categorizable versus an uncategorizable word list in the two aphasic groups.
Method

Participants. Participants were six aphasic patients divided into two groups according to whether their lesion was located anterior or posterior to the Rolandic fissure. The anterior group (n = 3) had a mean age 63.7 years, completed 13.0 years of formal education, and had a mean Boston Naming Test (BNT) score of 31.3 items. The posterior group (n = 3) had a mean age of 63.7 years, completed 13.3 years of formal education, and had a mean BNT score of 48 items. All patients had a single, unilateral left hemisphere lesion as a result of stroke and were tested at greater than 2 years post-stroke onset.

Stimuli and procedure. There were two conditions: in the Structured Condition, participants were presented with a list of words that could be categorized by semantic category. In the Unstructured Condition, they were presented with lists of completely unrelated words. The structured word list consisted of nine items belonging to three semantic categories and the unstructured word list consisted of nine unrelated items. Category items in the structured word list were matched for prototypicality across categories. Items in each list were matched for mean word frequency.

The words in each study list were presented in a random order at the center of the computer screen, at a rate of one item per second. Once the end of the list was reached, subjects were asked to recall aloud into a microphone as many of the words from the study list as possible, in any order they wished. Each study list was presented for 10 consecutive trials or until all of the items on the list had been recalled.

Results

Recall accuracy. Figure 1 shows the average number of words correctly recalled over the 10 learning trials for the Unstructured and Structured Conditions. As expected, both the anterior and the posterior groups on average were able to recall more items on each trial in the Structured Condition compared to the Unstructured Condition. Figure 1 also shows that the posterior group recalled more items on each trial than the anterior aphasic group. This recall advantage for the posterior aphasic group was evident in both the Unstructured and Structured Conditions.

Temporal properties of recall. The anterior and posterior groups both showed evidence of clustering by semantic category with longer IRTs between items recalled from two different categories (Between-Category (B-C) IRTs) and shorter IRTs between items recalled from within the same category (Within-Category (W-C) IRTs). For both groups, the B-C IRTs were shorter for the shift between the first and second categories than the shift between the second and third categories. A comparison of B-C IRTs between anterior and posterior groups revealed longer latencies for the anterior group that increased in magnitude for the shift between the second and
third categories. The W-C IRTs were longer for the shift between the first and second items of a category compared to the shift between the second and third items. No discernible differences in W-C IRTs were found for the two aphasic groups.

**Discussion**

Preserved ability to make use of category structure in the learning and retrieval of word lists was evident for both anterior and posterior aphasic groups. However, consistent with previously published reports, recall was worse for the anterior group versus the posterior group (e.g., Beeson et al., 1993). The IRT clustering analysis revealed that the anterior patients’ recall difficulty was related to the retrieval of the categories, rather than the retrieval of the individual items. We conclude that anterior aphasic patients may be deficient in their ability to organize a word list into higher-order units (i.e., categories) and subsequently relying on those categories as cues to guide retrieval.

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