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Facilitation of written sentence production by direct treatment of oral sentence production—A longitudinal case study of a Broca's aphasic

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Introduction

A major challenge facing clinicians providing language therapy to aphasic individuals is the issue of *carryover* or *transfer* of therapy effects either from treated to untreated items, or from one modality to another, or across settings and behaviours. A common observation is that the individual improves on those language aspects which are the target of intervention, but not on untreated items and/or there is little carryover to other modalities or to natural communicative settings. In this paper we report on an individual with Broca's aphasia, whose written sentence production and verbal communicative abilities in everyday situations improved significantly consequent to language therapy aimed at remediating oral sentence production. Analyses of spoken and written sentence production are presented and hypotheses regarding *how* and *why* improvements in oral sentence production carried over to written sentence production are proposed.

Method

Participant

T.H., a 42-year-old, right-handed male, with the profession of radio announcer, suffered a left frontolateral intracerebral hemorrhage after a mycotic aneurysm and then a massive left hemisphere CVA. Initially, T.H. presented with global aphasia. At 14.5 months post onset language testing revealed a Broca's aphasia with severe agrammatic oral sentence production, apraxia of speech, and asyntactic comprehension. Verb retrieval was particularly impaired. T.H.'s written language was more severely impaired than his spoken output.

Procedure

Beginning 15 months post onset T.H. participated in three therapy programs each consisting of 60 1-h sessions with extensive pre- and post-therapy language testing. The programs incorporated a seven step procedure aimed at facilitating oral sentence production to picture stimuli. These stimuli included 4–6 pictures from the previous session and 4–6 new pictures. Each session was audio- and videotaped and transcribed for analysis.

The first two therapy protocols minimally used written language. Written language was required for the homework, which consisted of writing down the new sentences T.H. could recall from the last session. The homework was to provide the therapist with information on T.H.'s retention of the sentences practiced in therapy. The homework was given to the therapist at the beginning of each session. The third therapy protocol was provided to achieve qualitative changes in written language. During therapy, T.H. was required to write each sentence after it was practiced orally once.

Results

Table 1 presents data from randomly selected early, middle, and late therapy sessions from each program (a) 1, 2 and (b) 3. The data are summarized in terms of:

(a) A ratio of orally produced sentences (correct first trial and second trial) and oral total,
(b) The average length of the orally produced sentences across trials in each session and
(c) The same ratio for the written sentences.

For both oral and written sentence production, a significant increase in sentence length is observed. Significant differences are found for: written sentence production program 1 versus program 2 (Wilcoxon Signed Ranks Test, Asymp. Sig. (two-tailed) =0.028), for written sentence production program 2 versus 3 (Wilcoxon Signed Ranks Test, Asymp. Sig. =0.028) and for oral production and written production in program 1 (Wilcoxon Signed Ranks Test, Asymp. Sig. =0.028). The correctness of his productions also shows marked improvement over time.

Below are language samples from pre- and post-therapy testing and homework that illustrate T.H.'s improved (1) oral sentence production and (2) written homework.

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Table 1
Summary of oral and written sentence production for (a) Protocol 1, (b) Protocol 2, and (c) Protocol 3

	Oral first trial correct	Oral second trial correct	Oral Total correct	Average sentence length across trials	Written homework	Average number of written words
(a) Protocol 1						
Prot 1						
Early	1/4	2/4	3/8	6	0/4	1.25
Early	0/4	2/4	2/8	4.5	1/4	3.25
Mid	2/5	4/5	6/10	6	0/5	3.8
Mid	2/5	1/5	3/10	6	1/5	3.6
Late	1/5	4/5	5/10	6.2	2/5	3.8
Late	2/4	4/4	6/8	7.2	2/4	4.75
Total Prot 1	8/27 (30%)	17/27 (63%)	25/54 (46%)		5/27 (18%)	
(b) Protocol 2						
Prot 2						
Early	3/5	4/5	7/10	7.2	1/5	4.6
Early	3/4	4/4	7/8	6.5	1/4	4.8
Mid	4/5	5/5	9/10	6.6	3/5	6
Mid	4/5	3/5	7/10	8	3/5	5.75
Late	3/6	6/6	9/12	8.8	6/6	9
Late	4/6	6/6	10/12	7.5	5/6	7.2
Total Prot 2	21/31 (68%)	28/31 (90%)	49/62 (79%)		19/31 (61%)	
(c) Protocol 3						
Prot 3						
Early	4/5	5/5	9/10	8.3	4/4	8.4
Early	4/5	5/5	9/10	9.3	5/5	8.6
Mid	4/5	5/5	9/10	9.2	5/5	8.6
Mid	3/5	5/5	8/10	8.6	5/5	9
Late	5/5	5/5	10/10	9.2	5/5	10.2
Late	4/5	5/5	9/10	10.8	5/5	10.6
Total Prot 3	24/30 (80%)	30/30 (100%)	54/60 (90%)		29/29 (100%)	

(1) For the target sentence "The boy is giving the girl a present," T.H.produced:?
Pre-therapy: Uh…boy and … girl … uh…. Uh … um ~ present(??) .
Post-therapy: The boy is giving the … girl's .. a … gift.
(2) Written homework:
Early: The girl socks [Target: The girl is putting on socks].
Late: The girl is combing the boy's hair with the pink comb.

Discussion

Longitudinally, T.H. showed marked gains in oral and written sentence, and discourse production. From the middle of the second program, the written sentences show an increase in length and correctness. The sentences that T.H. was writing on his own as homework in the first and second program were facilitated by the direct treatment of oral production. In the third program, the sentences written for homework reflect a qualitative improvement in performance, e.g., spelling accuracy.

Several factors can account for *why* T.H.'s written sentence production, which he practiced on his own, but which was not directly treated, improved so markedly in the first two therapy protocols. Therapy was directed mainly at formulating sentences to picture stimuli for oral production. Transfer from spoken to written production could occur because both modalities share similar formulation processes (cf. Jacobs & Thompson, 2000; Mitchum, Haendiges & Berndt, 1993). The intensive training in formulating and producing sentences not only resulted in improved verb and argument retrieval, but also strengthened the graphemic output lexicon both directly from the semantic system (i.e., the lexical-semantic route) and indirectly via the phonological output lexicon.

Additionally, therapy procedures encouraged a deep level of processing which may have promoted more carryover to written production (Craik & Lockhart, 1972). T.H. was given ample time to produce sentences before feedback was provided, resulting in an exhaustive search for retrieving lexical items. Also, productions were always independently produced by T.H., unless they were semantically incorrect. The main cues used were personalized and semantic cues which are thought to promote a deeper level of processing (Freed, Celery, & Marshall, 2004). These components of the therapy program provided a context conducive to a transfer of sentence production abilities across modalities even though written language was not targeted directly.

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