

## Conversational use of writing in severe aphasia: A group treatment approach

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*Background:* Several studies have documented the ability of individuals with severe aphasia to relearn the spelling of target words so that written communication can augment limited spoken language abilities. To date, there has been little documentation of clinical methods to facilitate the conversational use of written communication in such individuals.

*Aims:* The present study was designed to examine treatment outcomes in response to single-word writing treatment complemented by a group treatment approach to facilitate the use of writing for conversation.

*Methods & Procedures:* Four individuals with chronic, severe aphasia and agraphia received copy and recall treatment (CART) that included repeated copying and recall trials for spelling target words, as well as small group writing treatment. Single-subject multiple baseline designs were implemented to document progress on sets of words sequentially targeted for treatment. Writing was probed in the context of individual treatment sessions, structured group conversation, and in conversation with an unfamiliar person.

*Outcomes & Results:* All four participants responded positively to treatment by demonstrating improved spelling of target words in individual sessions, and use of single-word writing in structured group conversations. In addition, all subjects showed the ability to use telegraphic written communication with new people, albeit with fewer words written in the most naturalistic context.

*Conclusions:* Single-word writing abilities may improve with treatment despite persistent impairments to spoken language and considerable passage of time since the onset of aphasia. Group treatment appears to be an appropriate context to facilitate conversational use of written communication in such individuals.

Several recent studies have documented re-learning of single-word spelling in individuals with severe aphasia using an approach referred to as copy and recall treatment (CART) (Beeson, 1999; Beeson, Hirsch, & Rewega, 2002). The purpose of the relatively simple CART protocol is to strengthen specific orthographic representations and their associated links to semantics, so that written communication becomes a viable option for those with limited spoken language. Using CART, the semantic system is activated using a

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combination of input modalities (speech, writing, and pictures), and spelling is trained in a context that relates word meaning to its written form. During CART, the clinician provides semantic information about target words as the participant repeatedly copies the word and subsequently attempts to recall the spelling from memory. The result of successful treatment using CART is a corpus of words that can be written in response to visual and verbal cues; that is, the ability to perform written picture naming and writing-to-dictation of targeted words. Similar results have been documented with other lexical approaches to writing treatment with individuals demonstrating a range of aphasia severity (Aliminosa, McCloskey, Goodman-Schulman, & Sokol, 1993; Carlomagno, Iavarone, & Colombo, 1994; Hillis, 1989; Rapp & Kane, 2002; Robson, Marshall, Chiat, & Pring, 2001; Robson, Pring, Marshall, Morrison, & Chiat, 1998).

In cases of severe aphasia with limited spoken language, the ultimate clinical goal of writing treatment is the functional use of written words in everyday interactions. Demands for the conversational use of writing are clearly greater than those in the context of structured naming tasks. Written words must be generated that are appropriate to individual needs and desires in a context that is more naturalistic and less supportive than clinician-solicited responses to pictured stimuli. To date, anecdotal evidence suggests some conversational use of written words by individuals with severe aphasia who responded positively to CART (see Beeson, 1999; Beeson et al., 2002), but it has also been apparent that individuals with severe aphasia do not consistently generalise the use of written words to functional situations. It appears that specific training in the use of written words for conversation may be necessary; however, there has been limited research to examine such treatment. Robson et al. (2001) reported on written "message therapy" with six individuals with jargon aphasia, with only one participant showing improved written communication.

The purpose of this study was to examine the effects of a writing treatment programme that included pragmatic training for conversational use of single-word writing in four individuals with severe aphasia. Each participant demonstrated an ability to relearn the written production of target words through participation in previous studies of writing treatment (Beeson et al., 2002; Beeson, Rising, & Volk, in press). In the present study, CART was complemented by group treatment in which loosely structured scripts were used to elicit written communication of target words in a conversational exchange. In effect, participants were trained in the use of telegraphic written communication to take advantage of their ability to relearn spellings of personally relevant vocabulary. The conversational training was conceptualised as a treatment stage to complement or follow CART, or other similar lexical approaches to writing treatment. A single-subject, multiple-baseline design was used to document individual response to treatment.

## METHOD

### Participants

The four participants in this study ranged from 5½ to 8 years post-onset of stroke and aphasia (Table 1). All had at least a high-school education and were reported to have been competent communicators with normal written spelling abilities prior to their stroke. At the time of this study, all were classified with severe Broca's aphasia with Aphasia Quotients (AQ) less than 26 according to the *Western Aphasia Battery (WAB)* (Kertesz, 1982). All four participants had evolved from global aphasia and their auditory comprehension composite scores on the *WAB* fell just above the cut-off for classification as global aphasia. Their severity rating on the *Boston Diagnostic Aphasia Examination*

TABLE 1  
Demographic and cognitive characteristics of participants

	<i>Participant</i>							
	<i>SL</i>		<i>DR</i>		<i>WD</i>		<i>AD</i>	
Age	66		72		68		61	
Sex	Male		Female		Male		Male	
Handedness Pre/Post	R/L		R/L		L/L		L/L	
Education (years)	20		16		16		12	
TPO (years)	8		6		6		7	
AQ	25.8		22.0		23.5		22.2	
Aphasia Type	Severe Broca's		Severe Broca's		Severe Broca's		Severe Broca's	
	PreTx	PostTx	PreTx	PostTx	PreTx	PostTx	PreTx	PostTx
Pyramids and Palm Trees	41/52	43/52	44/52	45/52	33/52	25/52	47/52	48/52
Raven's CPM	33/36	34/36	33/36	32/36	20/36	25/36	34/36	34/36
Visual Lexical Decision	77/120	85/120	82/120	77/120	117/120	118/120	91/120	94/120

No significant differences were obtained for the pre–post treatment (Tx) measures of visual and cognitive function (all chi-squared values yielded  $p > .05$ ). TPO = time post-onset of stroke; Pre/Post = before and after stroke; AQ = Aphasia Quotient.

(Goodglass & Kaplan, 2001) was 1. For each participant, aphasia resulted from a large left perisylvian lesion that damaged both anterior and posterior language areas. Spoken language was severely limited for each participant and clinical treatment directed towards speech production resulted in limited success, so there was a significant need for alternative communication strategies. In previous research, each participant had responded to CART in an item-specific manner, suggesting that it was necessary to rebuild orthographic knowledge one word at a time. All participants used the left hand for writing; two were pre-morbidly left-handed and two used the nondominant left hand due to right hemiparesis.

### Pre- and post-treatment assessment

Prior to treatment, three measures were used to evaluate skills not directly involved in spelling. The picture form of the *Pyramids and Palm Trees Test* (Howard & Patterson, 1992) provided an indication of the status of the semantic system. The test simply requires matching a target picture to a semantically related picture from a field of two. An estimate of nonverbal visual problem-solving ability was obtained using the *Coloured Progressive Matrices (CPM)* (Raven, 1976). In addition, the visual lexical decision subtest from the *Psycholinguistic Assessment of Language Processing in Aphasia (PALPA Subtest 25)* (Kay, Lesser, & Coltheart, 1992) was administered to examine word recognition ability. This test required the differentiation between real words and ortho-

graphically legal nonwords presented visually. Significant changes in performance on these measures were not expected in response to writing treatment, so they provided an index of cognitive and neurological stability over the course of treatment.

### Treatment materials

A list of functionally significant words was generated for each participant with input from the individual, their spouse, and clinician. The general content of the word lists was kept similar to facilitate conversation in the group setting, with the words centred around the following themes: biographical information, family, employment history, hobbies/interests, favourite foods, and restaurants. Target words were allowed to vary in terms of lexical features such as word frequency, spelling regularity, grammatical class, and word length, so that individual choices for functional target words were given greatest priority. All four participants had previously demonstrated the ability to relearn spelling of a variety of high-content words, suggesting that control of lexical features was not a major concern. Target words were personally relevant proper and common nouns (in roughly equal proportion), along with a common list of words trained to facilitate the request of information from others (*name?*, *family?*, *work?*, *from?*, *eat out?*, and *hobby?*). Target words ranged in length from 2 letters (e.g., NY) to 13 letters (e.g., Las Margaritas), with an average word length between 5.2 and 6.7 letters across participants. To represent each word, a line drawing or photograph was obtained or created. Family member names and pictures were obtained and photographs of favourite restaurants were taken with a Polaroid camera. The visual representation of each target word was affixed to an index card. The word lists for each participant were divided into sets of five words each that were grouped by conversational topic (see example list in Appendix). Written spelling was probed for each set on two or more occasions in the group setting prior to the initiation of treatment. Because all four participants had previously received writing treatment, each had mastered some of the words targeted in this study, as reflected on some of the pre-treatment probes. Those words were included in this study for the purpose of allowing similar conversational topics across participants. After two pre-treatment baseline probes had been conducted for word sets 1 and 2, weekly treatment sessions commenced. Each participant was seen for one hour-long individual session and one hour-long group session each week.<sup>1</sup>

### Individual treatment sessions

Individual treatment sessions were conducted in a quiet room either at the university clinic or the participant's home. Sessions lasted approximately 1 hour and included a writing probe, clinician-directed writing treatment for the word set being trained, review of homework, and conversational practice with target words. During the beginning portion of each individual session, written spelling was probed for a given participant's targeted word sets. Pictured images depicting the words were presented in random order, along with a verbal request to write the name. The CART protocol was then implemented to train the written spellings of words in the target set, as described in Figure 1. Performance was recorded on a data sheet created for each participant, such as that shown in the Appendix. Following the probe and the training of currently targeted spellings,

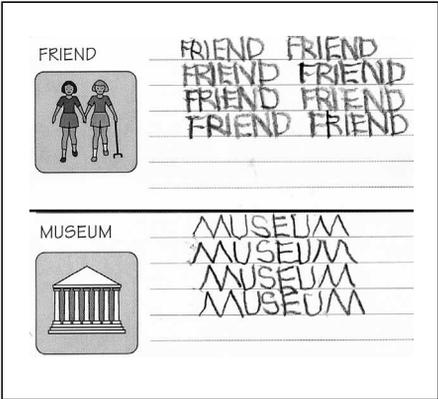
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<sup>1</sup>For simplicity, the data from individual and group sessions within a given week are plotted on the same session number. In reality, however, the interval between individual and group sessions varied from 0 to 3 days across participants.

1. Present a representative picture of a target word with verbal cue (e.g., "Friend. Can you write the word friend?").  
 Correct: Present next word.  
 Incorrect: Proceed through the following steps.
2. Present a handwritten model of the word.
3. Ask the participant to copy the word. (e.g., "It looks like this. Can you copy it?")  
 Repeat three times.
4. Remove all examples of the written word. Present line drawing with verbal cue, "Try to write it again." Repeat recall tasks three times.  
 Correct: Present the next word.  
 Incorrect: Repeat steps 2-4. If participant is unable to correctly write the word without a model after several trials, proceed to next item. Return to the word later in the session, if possible.

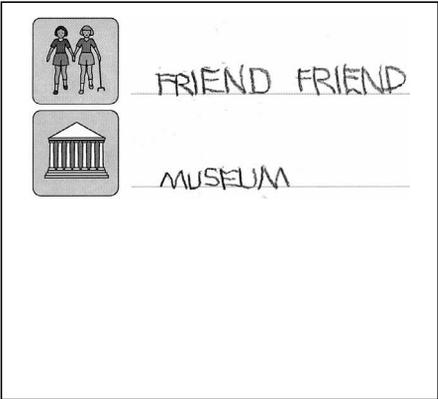
Example homework pages.

Copying



The 'Copying' section shows two rows. The first row is for the word 'FRIEND', featuring a small icon of two children and a large, bold, handwritten 'FRIEND' on a line. Below this, the word 'FRIEND' is written in a smaller, regular font on a line, followed by three more lines of blank handwriting lines. The second row is for the word 'MUSEUM', featuring a small icon of a museum building and a large, bold, handwritten 'MUSEUM' on a line. Below this, the word 'MUSEUM' is written in a smaller, regular font on a line, followed by three more lines of blank handwriting lines.

Recall



The 'Recall' section shows two rows. The first row is for the word 'FRIEND', featuring a small icon of two children and a large, bold, handwritten 'FRIEND' on a line. Below this, the word 'FRIEND' is written in a smaller, regular font on a line, followed by three more lines of blank handwriting lines. The second row is for the word 'MUSEUM', featuring a small icon of a museum building and a large, bold, handwritten 'MUSEUM' on a line. Below this, the word 'MUSEUM' is written in a smaller, regular font on a line, followed by three more lines of blank handwriting lines.

Figure 1. Copy and Recall Treatment (CART) protocol.

homework from the past week was reviewed. The clinician drew attention to any errors and prompted self-correction.

The remainder of the session was used to train pragmatic use of the words already learned and for the target set in training. This was done in a conversational manner between the participant and clinician. For example, the clinician would say, "Tell me about your family." The participant was encouraged to respond in writing, and additional prompts were provided as needed, such as asking, "Who is George?" to evoke *brother*, or direct instruction, such as "George is your brother, right? Can you write *brother*?"

### Homework

Homework packets were given to each participant on a weekly basis during individual treatment sessions. One packet was completed at home six out of seven days of every week. Each packet contained all of the words in the currently targeted set, and a subset of words from previously targeted sets. For each word, the representative picture was photocopied on the homework page with the word written beneath it and 20 blank lines provided for copying (see example in Figure 1). Participants were instructed to copy the written word at least 20 times per day. The frequency of homework for already-mastered

words varied across participants due to differences in total number of target words, motivation, and ease of graphomotor production. The last page in each daily homework packet provided only the target pictures and one blank line per picture to provide the opportunity for recall of target words without a written model.

Following 13 weeks of individual treatment, a month-long break was taken over the winter holidays. During that time, homework was provided for trained word sets, and the additional word set that had been probed but not yet trained. Follow-up probes were obtained during individual sessions following the break, 5 to 6 weeks after group sessions ended.

### Group sessions

Weekly group sessions were implemented to simulate a naturalistic communication environment in which the four participants were able to practise conversational use of their written words. In order to provide the opportunity for each participant to use each target word, group conversation was consistently structured around the topics of biographical information, family, employment history, interests, favourite foods and restaurants. It should be emphasised that the group sessions did not include pictured stimuli and therefore placed greater demands on auditory comprehension and more closely approximated semantically mediated retrieval of words during conversational exchange. During group conversation, each participant was encouraged to provide information using written words. The clinician served as the conversation facilitator, leading the direction of discussion as illustrated in Figure 2. In order to approximate natural conversation, a verbatim script was not employed, but the clinician systematically probed responses to each of the conversational questions during the session. The con-

Clinician: "Where is everyone from? Where are you from originally?"  
 AD writes *NY*.  
 Clinician to AD: "You were born in NY." [Shows other group members AD's written response.] "AD is from New York. What about everyone else? Where are you from?"  
 SL writes *ILL*.  
 Clinician: "And SL is from Illinois." [Show others his response].  
 DR writes *HONDURAS*.  
 Clinician: "And DR is from Honduras, originally. [Shows group her response.]  
 WD writes *FL*.  
 Clinician: "WD is originally from Florida." [Shows group his response.]  
 "So, AD is from New York, SL is from Illinois, DR is from Honduras, and WD is from Florida. Do you want to ask me where I'm from?"  
 AD writes *from?* [but without clearly indicating that he is asking a question of the clinician.]  
 Clinician: "You wrote *from* with a question mark. Are you asking me?"  
 AD points to clinician, then turns paper so that clinician can see it and points to written word *from?*  
 Clinician: "He wants to know where I'm from." [Shows written question to rest of group]  
 Well, I'm originally from Indiana [writes *Indiana* and shows group].

Figure 2. Sample conversation exchange from a group session.

versation was allowed to stray from the topic when appropriate, and was subsequently guided back to address the topics to be probed. All responses were recorded live by the clinician and a second observer who attended all group sessions. Reliability was examined by comparing the recorded data from the clinician and observer, and those data were compared with the actual written responses collected from each participant during the course of the session. It was not surprising that reliability was virtually 100%, given that responses were produced at a slow pace and available for visual inspection during and following the sessions.

If the participant did not appear to understand or did not correctly recall a target item, the clinician provided a verbal cue for the target word by saying, for example, "You like to eat out at Sakura, right? Can you write *Sakura*?" If this resulted in the correct written production by the participant, then the item was counted as correct (with a verbal cue). An example of a conversational exchange from a group session is included in Figure 2. If the target word was attempted, but spelled incorrectly, it was scored as incorrect. Such misspellings and other error responses were typically followed by provision of a model of the correct spelling by the clinician, but copied responses were not given credit. When a participant occasionally responded with an appropriate spoken response, it was acknowledged and the participant was encouraged to write the word as well.

Criterion for mastery of conversational use of target words was correct writing of at least four out of five words in a set on two consecutive weekly probes during the group sessions. When a set was mastered, training of the next word set commenced in the following individual session. As noted previously, homework continued for mastered word sets throughout the maintenance phase, but with reduced frequency.

## New person interactions

Once a participant mastered a word set in group sessions, a conversation interaction was arranged with an unfamiliar person as the communication partner. This presented the opportunity for the participant to use target words in less supported, more naturalistic communication. The new person was generally a graduate or an undergraduate student in speech-language pathology. These interactions occurred in the therapy room with the participant, the new person, and the clinician present. The new person was informed that the participant had been working on writing for communication, and was given a list of topics to inquire about including name, family, location of birth, occupation, hobbies/activities, favourite foods and restaurants. In order to increase the likelihood that the participant would also ask questions, the new person was instructed not to volunteer their own personal information unless asked by the participant. The new person was given no additional guidance and was simply encouraged to get to know the participant. At the end of the interaction, the participant was asked whether there was anything else that he/she would like to know about their new acquaintance, thus providing a final opportunity for the participant to "ask" a question. It should be noted that whereas all words in a given target set were probed during individual and group sessions, the conversational interaction with a new person did not necessarily evoke (or probe) all target words in a set. Throughout the interaction, the investigator sat quietly in the corner of the room and recorded the performance, causing minimal disturbance to the naturalism of the exchange. Conversational probes were initially planned to occur following mastery of each word set; however, scheduling difficulties resulted in less frequent probes ranging from two to five occasions per participant.

## Data analysis

Treatment outcomes were analysed for each participant by visual inspection of multiple baseline data, documentation of attainment of criterion for the word sets, and calculation of the treatment effect sizes using the  $f$  statistic (Kromrey & Foster-Johnson, 1996).<sup>2</sup> For the data collected in the context of the group sessions, an  $f$  statistic was computed to index change in level of performance from baseline to treatment/maintenance phases for each word set. Put differently, the  $f$  statistic was used to indicate the magnitude of change in the number of words correctly written before versus after the initiation of treatment. Average  $f$  values were computed for each participant that were weighted for the number of observations obtained for each word set targeted for treatment. The magnitude of  $f$  was interpreted relative to guidelines suggested by Cohen (1988). Specifically, we took the square root of the  $f^2$  values suggested by Cohen, so that 0.14, 0.39, and 0.59 were considered to reflect small, medium, and large effects, respectively. Pre- and post-treatment assessment measures were compared using chi square test of association.

## CASE REPORTS

### Participant 1: SL

SL<sup>3</sup> was a 66-year-old right-handed male who experienced a left hemisphere stroke at the age of 58. The stroke resulted in severe nonfluent aphasia, impaired auditory comprehension, and right hemiparesis. SL had been continuously enrolled in aphasia group therapy since several months post-stroke. One year prior to the initiation of this study, he participated in a writing treatment programme, which resulted in his mastery of the written spelling of 15 functional words (Beeson et al., in press).

At the time of the present study, SL was 8 years post-onset of aphasia. On the *WAB*, his AQ was 25.8 with an overall language profile consistent with severe Broca's aphasia. SL was able to communicate limited information via speech. His conversation consisted primarily of single words including "fine, fine", "yes", "no", "well", and "wow", produced with varied prosody to convey meaning. He was able to repeat some single-word utterances. Following the 8 weeks of writing treatment reported by Beeson et al. (in press), SL showed the ability to use a small corpus of words in structured conversation with his clinician. He occasionally used single-word writing to communicate in other contexts, but success was limited at the time this study was initiated, due in part to the small number of spellings that he had mastered.

On the pre-treatment assessment, SL earned a score of 41 out of 52 (better than chance,  $p < .001$ ) on the *Pyramids and Palm Trees* Test, reflecting a mild impairment of semantic knowledge (Table 1). On Raven's *CPM*, SL scored 33/36 items correct ( $> 95$ th

<sup>2</sup> The  $f$  statistic was calculated based on equations from Kromrey and Foster-Johnson (1996). To compute the effect size associated with change in level of performance, we used the equation:

$$f = \sqrt{(R^2_{\text{adjusted for trends}} - R^2_{\text{combined}}) / (1 - R^2_{\text{adjusted for trends}})}$$

where  $R^2_{\text{adjusted for trends}}$  represents the coefficient of determination for the regression equation in which separate lines of best fit are computed for the baseline and treatment/maintenance conditions that are adjusted for different trends (slopes); and  $R^2_{\text{combined}}$  represents the coefficient of determination for the regression in which one line is fitted to the data across the baseline and treatment/maintenance conditions. We report  $f$  rather than  $f^2$  because squared values exaggerate the separation of effect sizes that are greater than 1 and those that are fractions.

<sup>3</sup> Participant initials have been changed.

%ile), indicating excellent nonverbal problem solving abilities. On the lexical decision subtest, SL correctly identified only 77 of 120 items (24/60 real words and 53/60 non-words), reflecting marked impairment of word recognition.

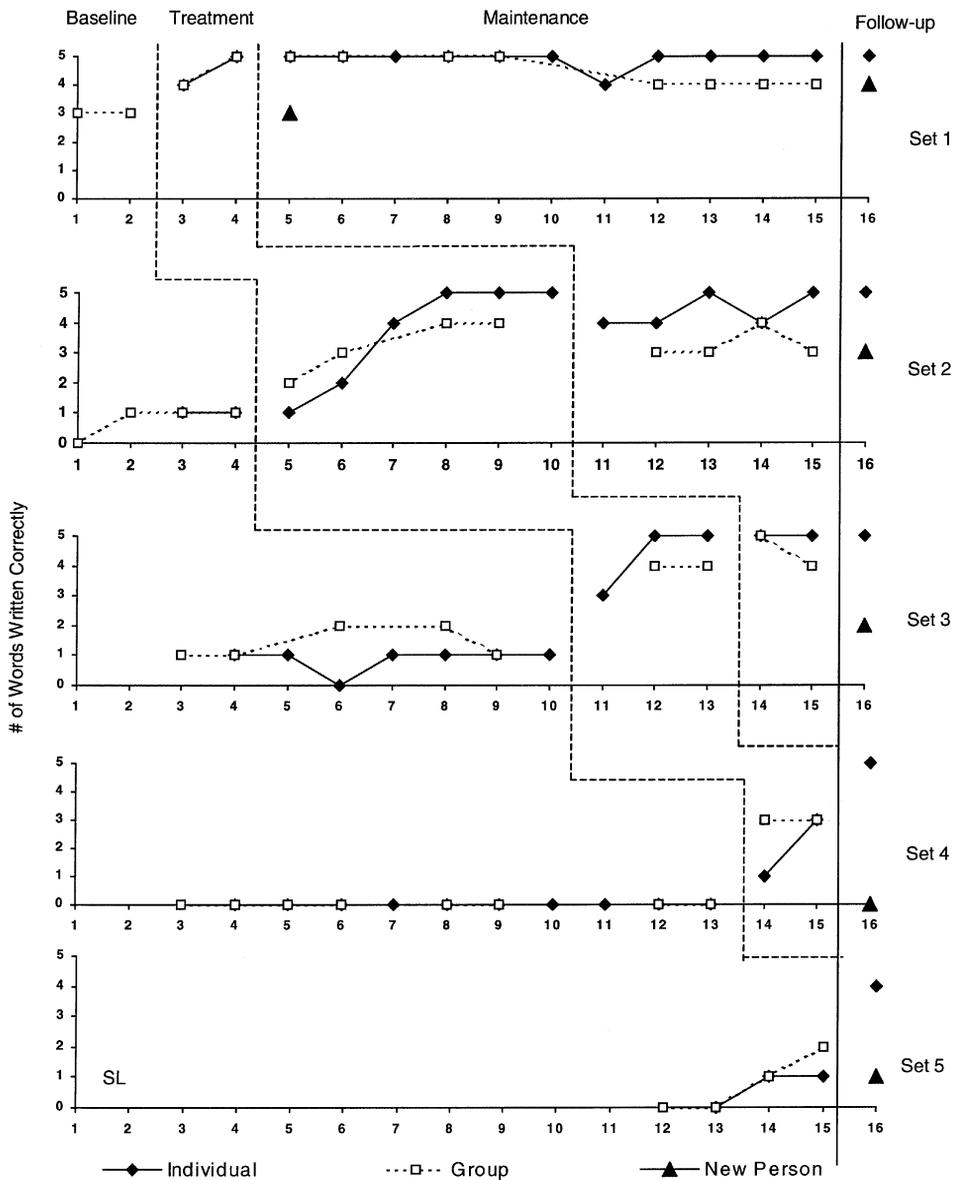
*Response to treatment.* SL was seen for 13 individual treatment sessions and participated in 12 of the 15 group sessions. Five sets of words (5 in each set = 25 words) were selected for SL reflecting his personal background and interests relative to the predetermined topics. Pre-treatment probes revealed relatively stable baselines for each word set, and also reflected SL's prior mastery of 6 of the 25 words. When treatment was initiated, SL consistently completed all CART homework, except for occasional inadvertent omissions. As seen in Figure 3, SL's spelling improved in both individual and group sessions. SL reached criterion for sets 1–3 in the group setting, and was approaching mastery of set 4 by the end of group treatment. He showed additional learning during the homework-only interval between sessions 15 and 16 (Figure 3). In the group setting, SL typically wrote words in response to conversational questions, with only 12% of his written responses requiring a verbal cue from the clinician. In such circumstances, for example, if SL failed to respond to a question such as, "What kind of work did you do?", the clinician said, "You told me you worked with plants, is that right? Can you write *plants*?" Following this cue, SL wrote *plants*. In instances when SL failed to respond correctly, he often showed partial word-form knowledge, typically consisting of the first letter of the word followed by a line to indicate that he did not know the remainder. Quantitative analysis of treatment effects measured in the group setting (baseline compared to treatment/maintenance conditions for word sets 1–4) documented large changes in performance level,  $f = 1.23$  (Table 2).

Conversational probes with a new person were only conducted on two occasions with SL because his individual treatment sessions were conducted at his home where new people were unavailable. When probed during sessions 5 and 16 (at 6 weeks following treatment), SL appropriately wrote 3 and 10 trained words, respectively. Although written communication with a new person lagged behind his performance in the more supported group sessions, SL was able to successfully converse using writing with an unfamiliar person. These changes in writing occurred in the absence of significant change on the pre–post treatment measures as shown in Table 1.

## Participant 2: DR

DR was a right-handed, 72-year-old female who experienced a left hemisphere stroke at the age of 65. The stroke resulted in severe nonfluent aphasia, impaired auditory comprehension, apraxia of speech, and right hemiparesis. DR had received continuous language therapy since her stroke, with periods of concomitant individual therapy and group therapy. Prior to the initiation of this study, she had participated in a writing treatment programme that resulted in her relearning the written spellings of 20 functional words (Beeson et al., in press). Although writing, gesture, and drawing were possible alternative means of communication, DR did not typically use these modes without prompting, and her tendency was to attempt speech with limited success.

Prior to the present treatment at 6 years post-onset, DR scored an AQ of 22 with a classification of severe Broca's aphasia on the *WAB*. Her speech in conversation consisted of the stereotyped utterance "What is that?", "yes", "no", and effortful production of a small corpus of words. She was able to repeat some single words, although this was extremely effortful due to the apraxia of speech.



**Figure 3.** SL's writing of single words on probes during baseline, treatment/maintenance, and follow-up sessions for five sets of words. Probes were taken in the context of weekly individual treatment sessions, conversation group, as well as periodic conversations with an unfamiliar person. Follow-up probes occurred 5 to 6 weeks after the last group session.

On the pre-treatment assessment, DR scored 44 out of a possible 52 (better than chance,  $p < .001$ ) on the *Pyramids and Palm Trees Test*, reflecting a mild impairment of semantic knowledge (Table 1). She scored a 33/36 (> 95th %ile) on the Raven's *CPM*, indicating normal nonverbal problem-solving skills. On the lexical decision task, DR correctly identified 82 of 120 items (50/60 real words and 32/60 nonwords) indicating impaired word recognition abilities.

TABLE 2  
Response to treatment measured in conversational settings

	Participant			
	SL	DR	WD	AD
Mean # correct spellings (per set of 5)				
Pre-Tx	1.45	0.85	0.78	1.86
Post-Tx	4.14	3.80	4.12	4.88
Follow-up				
# words written/# targeted for Tx	25/25	20/25	27/30	33/40
(% mastered)	(100%)	(80%)	(90%)	(82.5%)
Effect size ( <i>f</i> statistic)	1.23*	0.62*	0.95*	0.59*

\* Large effect size. (See Footnote 2 for details regarding *f* statistic.)

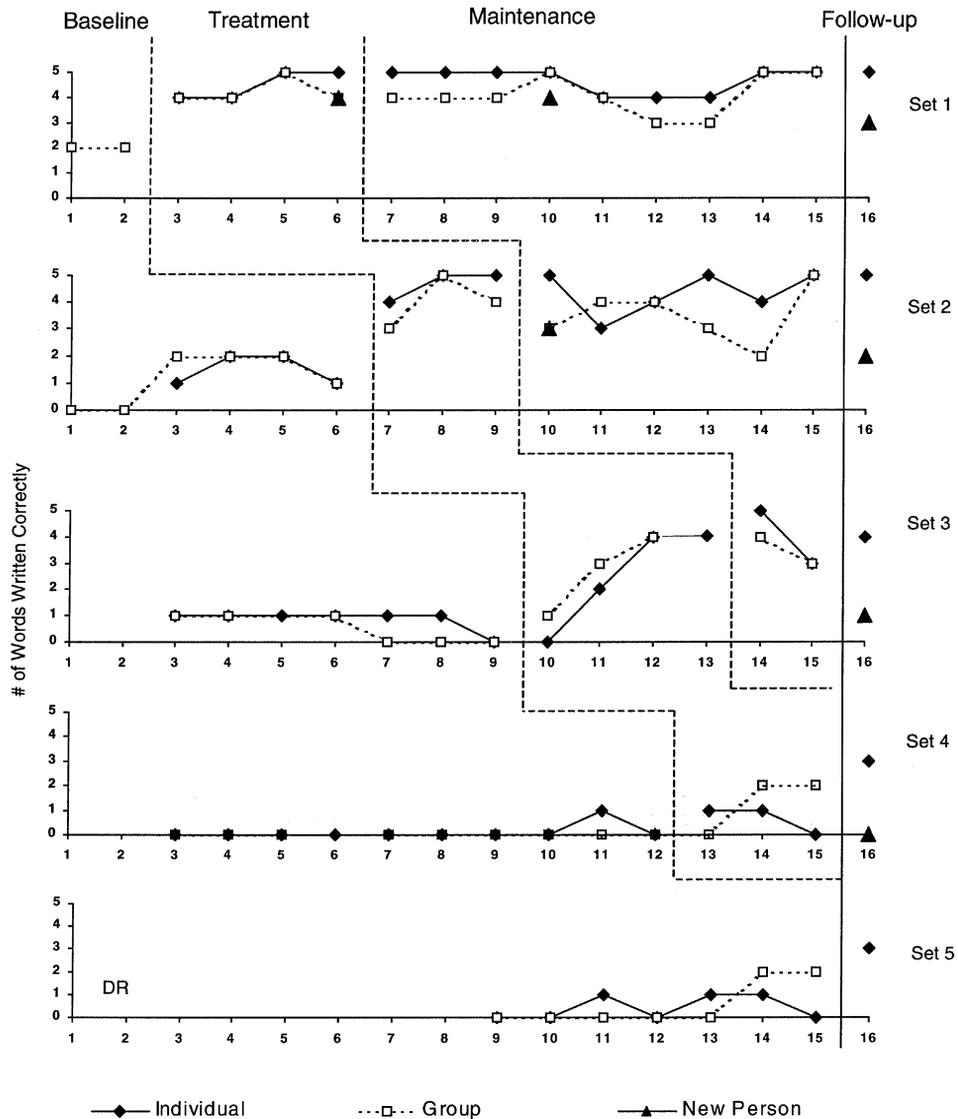
Mean # correct spellings pre-treatment (Pre-Tx) were calculated from baseline measures across all treated word sets in group setting. Mean # correct spellings post-treatment (Post-Tx) were calculated from performance during maintenance phase for all treated word sets in group setting. Number of words written at follow-up refers to the number of different target words correctly written during individual session. Effect sizes reflect change in level of spelling performance in the group setting.

*Response to treatment.* DR was seen for 13 individual sessions and 15 group sessions. Five sets of words (25 words total) were selected for DR reflecting her personal information and interests. As seen in Figure 4, pre-treatment probes revealed relatively stable baselines for each word set, and also reflected her prior mastery of five words. During treatment, DR completed approximately 75% of her homework, copying each word approximately 30 times every week. She improved her written spelling in both individual and group settings as shown in Figure 4. DR reached criterion for word sets 1–3 in group conversation, showing a large treatment effect size,  $f = 0.62$ , for baseline compared to treatment/maintenance conditions. DR required a verbal cue for 27% of her correct written responses in group sessions. Incorrect responses were characterised by recognisable misspellings (e.g., *GERHAND* for *GERHARD*), so that they facilitated functional communication despite the errors. As shown in Figure 4, word sets 1–4 were included sequentially as homework, whereas set 5 was probed but not assigned as homework. However, DR correctly wrote three of the words from that set at the follow-up probe and it appeared that she independently practiced the spellings for those words during the homework-only interval.

DR's use of writing was probed in conversation with a new person on three occasions. As shown later in Figure 7, she used four, seven, and six written words to communicate on the respective occasions. The words she used were those that conveyed personal information, and did not include any of the question words. Like SL, DR's performance in new person interactions lagged behind her performance in group sessions, although she demonstrated the ability to use some written words in this less supported conversation with an unfamiliar person. As seen in Table 1, DR's improvement in writing occurred in the presence of stable performance on the pre- and post-treatment measures.

### Participant 3: WD

WD was a 68-year-old left-handed male who experienced a left hemisphere stroke at the age of 62. The stroke resulted in severe, nonfluent aphasia, with impaired auditory comprehension, and right hemiparesis. WD received speech-language treatment



**Figure 4.** DR's writing of single words on probes during baseline, treatment/maintenance, and follow-up sessions for five sets of words. Probes were taken in the context of weekly individual treatment sessions, conversation group, as well as periodic conversations with an unfamiliar (new) person. Follow-up probes occurred 5 to 6 weeks after the last group session.

immediately following the stroke and had participated in aphasia group therapy continuously since 6 months post-onset. Prior to this study, WD participated in a writing treatment programme that resulted in his relearning the written spelling of 20 functional words (Beeson et al., 2001).

When tested at the outset of this study, WD received an AQ of 23.5. His conversational speech was primarily limited to "yes", "no", and "okay", and he was able to repeat some single words. His overall communication profile was consistent with severe Broca's aphasia. When prompted, WD made some use of single-word writing, drawing,

or gesture as alternative modes of communication. Intermittent perseveration on ideas or written words limited his communicative effectiveness.

Prior to treatment, on *Pyramids and Palm Trees*, WD correctly matched 32 out of 52 semantically related pairs (= chance level), reflecting significant impairment of semantic knowledge (Table 1). He was able to correctly solve 20 of the 36 items on the Raven's *CPM* (~35th %ile), reflecting some preservation of visual problem-solving abilities. On the lexical decision task, WD correctly identified 117 of 120 items, indicating preserved written word recognition.

*Response to Treatment.* WD attended 11 individual treatment sessions and 15 group sessions. Six sets of words were selected for treatment, totalling 30 words. Of those, WD had mastered the spelling of seven words during previous training. As shown in Figure 5, his baseline data were relatively stable. Over the course of treatment, WD consistently completed all of the required homework, and he reached criterion for word sets 1–4 in group sessions (see Figure 5). He mastered sets 5 and 6 with four weeks of homework-based CART only. As with SL and DR, treatment effect size was large relative to changes in performance from baseline to treatment/maintenance conditions for sets 1–4,  $f = 0.95$  (see Table 2).

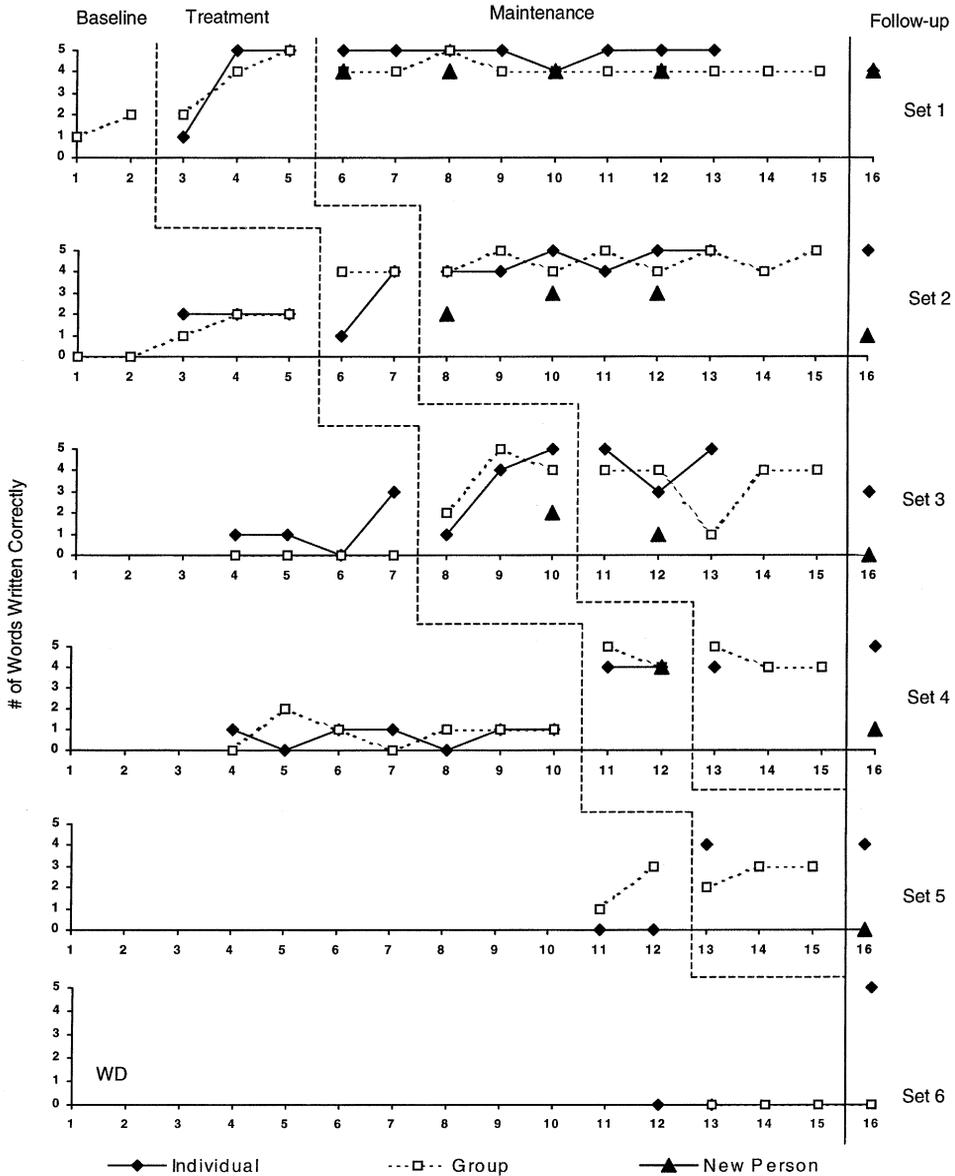
WD typically performed as well or better in group sessions than he did in individual sessions; however, he required a verbal cue for 41% of his correct written responses. In some instances, his initial error responses were completely off-target rather than inaccurate spelling attempts at the appropriate target word. For example, on one occasion he wrote his name instead of *FL* to indicate where he was from. Although he was able to write most words when instructed to do so, he sometimes was unable to appropriately link the meaning to the written word, suggesting degraded semantic knowledge (or the link from semantics to orthography). WD also showed some perseveration during probes and conversational training, which interfered with retrieval of correct responses. In some cases, it was necessary to provide a fresh sheet of paper so that all other written words were out of sight.

WD's use of written communication was probed with a new person on five occasions over the course of treatment. He provided 4, 8, 9, 12, and 6 appropriate, correctly spelled words on those respective occasions (see Figure 7) showing improved ability to retrieve and spell appropriate target words in conversation. This improvement in writing occurred in contrast to stable performance on the post-treatment measures (Table 1).

#### Participant 4: AD

AD was a left-handed 61-year-old male who experienced a left hemisphere stroke at the age of 54. The stroke resulted in a severe nonfluent aphasia, impaired auditory comprehension, and right hemiparesis. Following the stroke, AD received inpatient and outpatient speech-language treatment. He began attending aphasia group therapy 6 months post-stroke, and had participated in groups continuously since that time. He also participated in a writing treatment programme that resulted in his mastery of written spellings of 35 functional words (Beeson et al., 2002).

AD had AQ of 22.2 on the *WAB*, with a profile consistent with severe Broca's aphasia and apraxia of speech. His speech in conversation was limited to stereotyped utterances including, 'yes', 'no', 'why?', 'I don't know', and 'okay'. Like the other three participants, AD was able to communicate limited information through speech alone, but



**Figure 5.** WD’s writing of single words on probes during baseline, treatment/maintenance, and follow-up sessions for six sets of words. Probes were taken in the context of weekly individual treatment sessions, conversation group, as well as periodic conversations with an unfamiliar (new) person. Follow-up probes occurred 6 weeks after the last group session.

following initial writing treatment he had begun to use writing to augment his communication with relative frequency. Written communication was limited by the size of his written vocabulary, so that he was often unable to spell a word that he wanted. Participation in writing treatment was important to AD to help him increase his written vocabulary to thus enhance the content of his communication. Of the participants in this study, AD was judged to be the most assertive communicator, not easily giving up or becoming

frustrated when attempting to convey a message. Additionally, he was the most functionally independent; he held a part-time job cutting meat at a deli throughout the duration of this study and used public transport to commute to work and therapy.

On the pre-treatment measures, AD's performance was similar to that of DR (see Table 1). On *Pyramids and Palm Trees*, he correctly matched 47 out of 52 items, reflecting normal semantic knowledge. His score of 34 out of 36 (> 95th %ile) on the *Raven's* indicated performance within normal limits for nonverbal cognitive skills. On the lexical decision task, AD correctly identified 89 of 120 items (56/60 real words and 33/60 nonwords), indicating some impairment of word recognition.

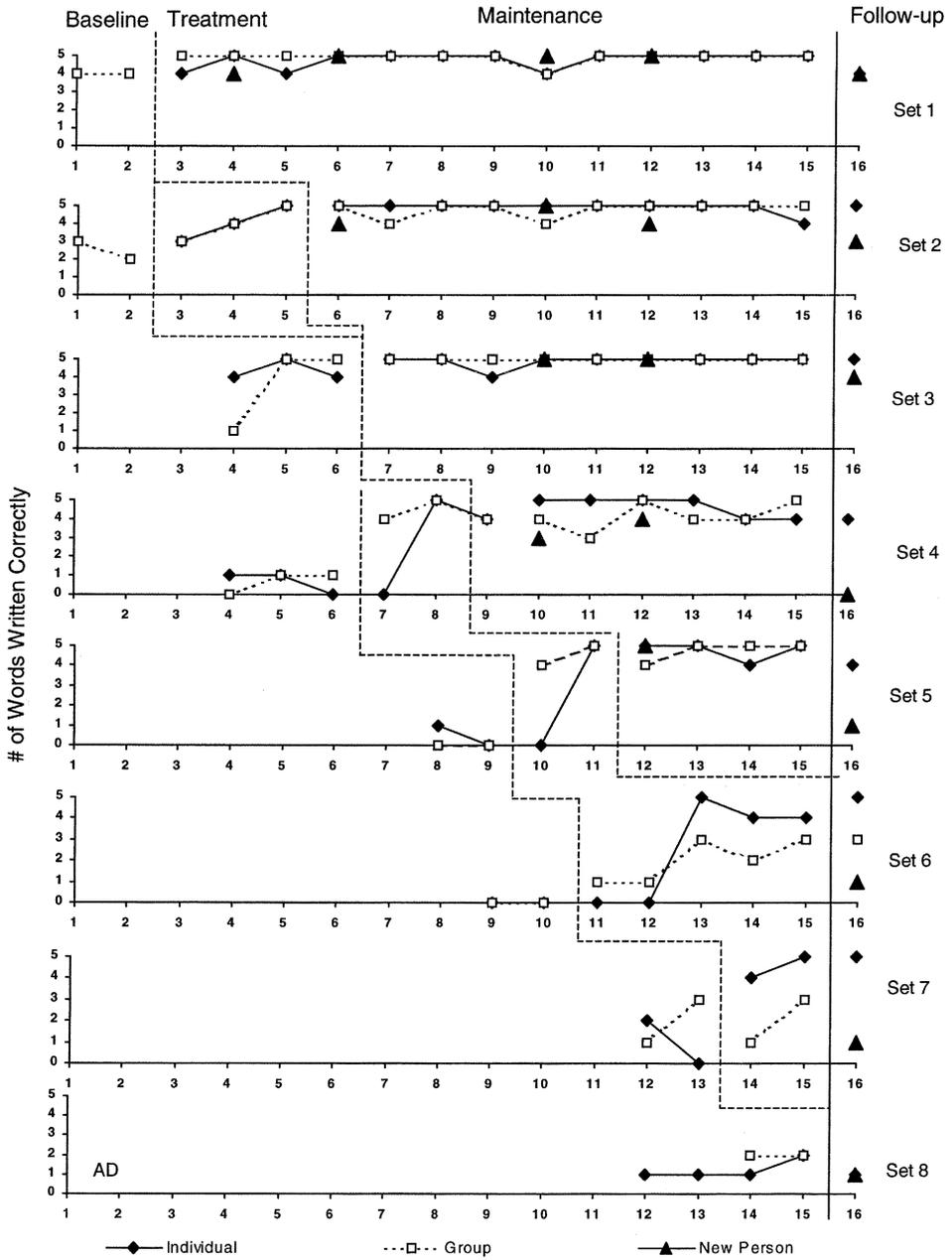
*Response to treatment.* Eight sets of target words were selected for AD, totalling 40 words. Of those words, he had previously mastered the spellings of nine words, so that elevated baseline levels were noted for some word sets as shown in Figure 6. AD's baseline performance on word set 1 was at criterion level, so those words were simply included as homework, but were not considered among those treated during this study. AD participated in 13 individual sessions and 15 group sessions. Over the course of treatment, he consistently completed all of his CART homework and often added lines for additional copying. In addition, it was evident that AD also independently developed homework for some words not yet targeted for treatment. In particular, AD independently learned the words in set 3 (which contained family member names and relations) after only one probe by adding them to his homework. Over the course of treatment, AD learned word sets 2–7 in individual treatment and he reached criterion for sets 2–5 in group sessions. Set 8 was probed, but not entered into treatment.

Quantitative analysis of treatment effects showed large changes in performance in the group setting,  $f = 0.59$ , for word sets 2–7 (see Table 2). Of the four participants, AD showed the greatest ease in his use of written words for conversation; he required a verbal cue for only 16% of his correct written responses. During group, he frequently provided assistance to other members when they were struggling with one of their target words. As noted above, he also targeted additional words (some of which he found in his picture dictionary) and copied them repeatedly in the margins of his homework pages. In other words, AD independently expanded his written vocabulary beyond the words targeted in this study.

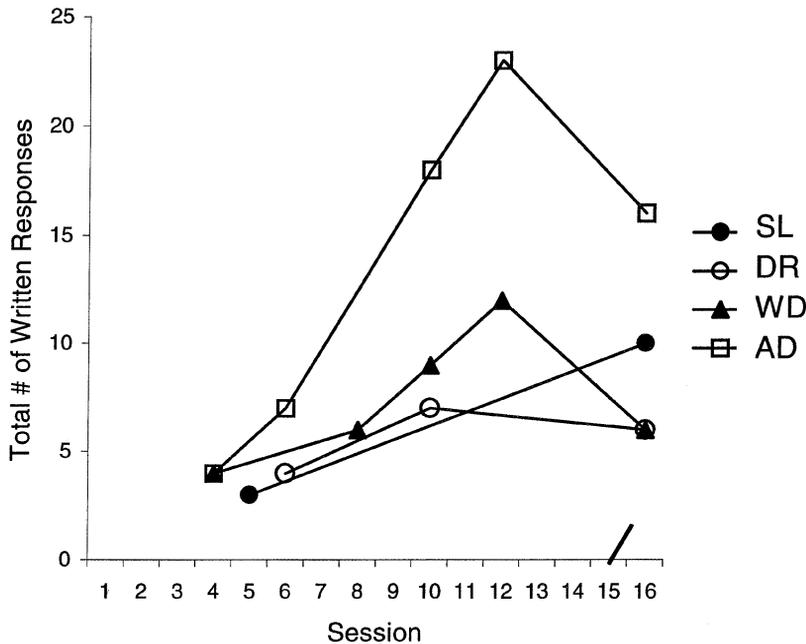
On five occasions, conversational interaction was observed between AD and an unfamiliar person. During those respective interactions, AD wrote 4, 9, 12, 27, and 15 targeted words as well as additional words that he had acquired that were not targeted in this study. For example, when asked about favourite restaurants, AD wrote one of three restaurant names that had been trained along with the name of another restaurant that he had targeted on his own during the course of this treatment. AD's increase in his written vocabulary occurred in the context of stable performance on the post-treatment assessments (Table 1).

## GENERAL DISCUSSION

The purpose of this study was to examine the outcomes of a treatment approach using a group setting in conjunction with clinician-directed CART to facilitate written conversation in severely aphasic adults. The positive response documented in all four of the participants in this study suggests that group sessions are a successful way to facilitate pragmatic use of written words. Despite the weekly repetition of discussion topics, the group atmosphere was conversational and genuine. Group members were extremely



**Figure 6.** AD's writing of single words on probes during baseline, treatment/maintenance, and follow-up sessions for eight sets of words. Probes were taken in the context of weekly individual treatment sessions, conversation group, as well as periodic conversations with an unfamiliar (new) person. Follow-up probes occurred 6 weeks after the last group session.



**Figure 7.** Total number of written words (from target list) appropriately used in conversation with an unfamiliar person. The hash mark between sessions 15 and 16 indicates the 5–6 week break between the end of treatment sessions and the follow-up probe.

supportive of one another, providing added psychosocial benefit to participants. Thus, the use of the group setting for conversational training appeared to be an appropriate complement to individual treatment for spelling using CART or some other approach.

The data collected during conversational interactions with new people offered an opportunity to examine the use of writing in a more naturalistic context. It was apparent that the participants in this study were able to employ written communication with an unfamiliar person, but performance lagged behind that observed in a supported group conversation. It was not surprising that target words were used with greater frequency in the group setting in which they were specifically probed in a context that became familiar and routine. Examination of the written responses during conversational interactions with new people indicated that words in the earliest-trained sets were used more than words from the later-trained sets. Given that the early sets had been practised for a longer period of time, and spelling of these words was most consistent, their use in conversation may reflect greater consolidation and ease of access as a result of repeated stimulation. It appeared that newly learned spellings were somewhat fragile and required considerable practice before they were likely to be used in the more natural conversational setting. Thus, the need to maintain consistent stimulation of writing was evident, and the drop in the use of written words in conversation with a new person by AD and WD on the final probe may have reflected a reduction in written conversation during the holiday break. In order to maximise the use of written communication on a daily basis, it may be most appropriate to directly train functional written communication with family members and close friends to ensure frequent stimulation.

It is worthy of note that some conversational partners appeared to be more adept than others in terms of soliciting written information from the participants. We allowed this

factor to be uncontrolled as a reflection of variability observed in the general population, but acknowledge that the training of conversational partners is likely to increase the functional impact of such alternative communication strategies (Hopper, Holland, & Rewega, 2002). While we encouraged written communication with family members in this study, it was not a focus of treatment, and reports suggested that only AD used writing in the home to a great extent.

As noted, AD made the best use of written communication of those who participated in this study. He mastered the spellings of the greatest number of words, and his use of written communication generalised to the group and new person conditions. It also was evident that AD had the greatest need to communicate with people outside his immediate family. As mentioned earlier, he was more independent in everyday life, traveling on public buses and working part-time. This provided AD with many opportunities to interact with people outside his family and a greater need to communicate with unfamiliar people. In contrast, the other participants rarely travelled without their spouse, and opportunities for independent communication were primarily limited to their visits to the clinic. Thus, AD showed greater motivation to improve his writing skills for communication as evidenced by his independent targeting of additional words to learn that allowed him to have more varied written conversation. It is important to note, however, that written communication was not a self-selected strategy for AD. As described in Beeson et al. (2002), AD initially participated in writing treatment at a time when he clearly preferred to attempt spoken language. In other words, the transition to written communication was prompted, trained, and reinforced in the clinical setting. While he remains motivated to improve speech production, severe apraxia of speech limits his success in this modality, and he has adopted telegraphic writing to accomplish much of his daily communication with family, friends, clinicians, and strangers.

Some additional comments are warranted regarding the best candidates for writing treatment. The four individuals in this study were selected based on prior success with CART, and they were similar in many respects. They did not differ markedly with regard to aphasia severity or profile, but there were some differences in performance on the pre-post treatment measures. WD had the lowest score on the *Pyramids and Palm Trees* test of semantic relations and showed variability in his pre-post treatment performance on that measure. This indication of impairment to the semantic system was consistent with WD's tendency to write incorrect words and to perseverate on written responses to a greater extent than other participants. Despite the fact that WD could relearn spellings, he showed evidence of weak links from semantics to the orthographic representations so that while writing was a relatively effective means of communication for WD, the semantic impairment imposed some limitations. In contrast, WD showed relatively intact visual lexical decision skills, whereas the other three participants showed some impairment in access to the orthographic input lexicon, or to the orthographic representations themselves. It appeared, however, that writing treatment served to strengthen specific orthographic representations so that this deficit did not significantly interfere with success.

In summary, the present study serves to contribute to a growing body of evidence supporting the notion that individuals with severe aphasia may be responsive to writing treatment when spoken language is resistant to change. While we did not directly compare treatment directed towards writing with treatment directed towards speech production, all subjects previously showed limited improvement in response to treatment directed towards speech. The group setting appeared to be an appropriate context for facilitating written communication and providing an opportunity for more genuine exchange of information than that in individual treatment sessions. In particular, it was

noted that the use of question words (e.g., work? eat out?) was useful as they served to solicit information from other group members, and ultimately from new people as well. Finally, it was noted that the group setting also served to “normalise” the use of writing for on-line communication, so that what began as an admittedly unusual means of communication became quite natural after several weeks in the writing group.

## REFERENCES

- Aliminosa, D., McCloskey, M., Goodman-Schulman, R., & Sokol, S. M. (1993). Remediation of acquired dysgraphia as a technique for testing interpretations of deficits. [Special Issue: Cognitive neuropsychology and aphasia treatment: An opportunity for applied research]. *Aphasiology*, 7, 55–69.
- Beeson, P. M. (1999). Treating acquired writing impairment: Strengthening graphemic representations. *Aphasiology*, 13, 367–386.
- Beeson, P. M., Hirsch, F. M., & Rewega, M. A. (2002). Successful single-word writing treatment: Experimental analyses of four cases. *Aphasiology*, 16, 473–492.
- Beeson, P. M., Rising, K., & Volk, J. (in press). Writing treatment for severe aphasia: Who benefits? *Journal of Speech-Language-Hearing Research*.
- Carlomagno, S., Iavarone, A., & Colombo, A. (1994). Cognitive approaches for writing rehabilitation: From single case to group studies. In M. J. Riddoch & G. W. Humphreys (Eds.), *Cognitive neuropsychology and cognitive rehabilitation*. Hove, UK: Lawrence Erlbaum Associates Ltd.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.
- Goodglass, H., & Kaplan, E. (2001). *Boston Diagnostic Aphasia Examination* (3rd ed.). Baltimore: Lippencott Williams & Wilkins.
- Hillis, A. E. (1989). Efficacy and generalization for aphasic naming errors. *Archives of Physical Medicine and Rehabilitation*, 70, 632–636.
- Hopper, T., Holland, A., & Rewega, M. (2002). Conversational coaching: Treatment outcomes and future directions. *Aphasiology*, 16, 745–761.
- Howard, D., & Patterson, K. (1992). *The Pyramids and Palm Trees Test*. Bury St. Edmunds, UK: Thames Valley Test Company.
- Kay, J., Lesser, R., & Coltheart, M. (1992). *Psycholinguistic Assessment of Language Processing in Aphasia (PALPA)*. Hove, UK: Lawrence Erlbaum Associates Ltd.
- Kertesz, A. (1982). *Western Aphasia Battery*. New York: The Psychological Corporation.
- Kromrey, J. D., & Foster-Johnson, L. (1996). Determining the efficacy of intervention: The use of effect sizes for data analysis in single-subject research. *The Journal of Experimental Education*, 65, 73–93.
- Rapp, B., & Kane, A. (2002). Remediation of deficits affecting different components of the spelling process. *Aphasiology*, 16, 439–454.
- Raven, J. C. (1976). *Coloured Progressive Matrices*. London: H. K. Lewis & Co Ltd.
- Robson, J., Marshall, J., Chiat, S., & Pring, T. (2001). Enhancing communication in jargon aphasia: A small group study of writing therapy. *International Journal of Language and Communication Disorders*, 36, 471–488.
- Robson, J., Pring, T., Marshall, J., Morrison, S., & Chiat, S. (1998). Written communication in undifferentiated jargon aphasia: A therapy study. *International Journal of Language and Communication Disorders*, 33, 305–328.

## APPENDIX

Example of scoring form for writing treatment

Target	Production	Probe	C	C	C	R	R	R	Conversation
<b>Name?</b>									
Ramona									
Ken									
Husband									
Joyce									
<b>Family?</b>									
Anne									
Sister									
George									
Brother									
<b>From?</b>									
NY									
<b>Work?</b>									
Museum									
Director									
<b>Hobby?</b>									
Art									
Movie									
Concert									
Muffy									
<b>Eat out?</b>									
Lobster									
Shrimp									
Sakura									
Beef									

**Scoring**

Production: transcribe exact written production

Probe: + recorded for correct spelling produced without cueing

C = Copy: + recorded for each correct copy of the target;—for incorrect copy

R = Recall: + recorded for each correct recall of the target;—for an incorrect recall

Conversation: + recorded if target used correctly in conversation