Treatment of verb production: A multiple single-case, multiple baseline study

Introduction

The efficacy of aphasia treatment is a much discussed topic in aphasiology. However, since the introduction of the multi-baseline single-case study design (Kearns, 1992; Thompson et al., 1996), it has been shown that aphasia therapy can be effective when it focuses on the underlying disorder (e.g., Thompson et al., 1996; Kiran & Thompson, 2003; Peach & Wong, 2004).
Little attention has been given to treatment of verb production, although verb production is impaired in most individuals with Broca's aphasia (e.g., Jonkers, 1998; Kim & Thompson, 2000), not only at the word, but also at the sentence level (Bastiaanse & Edwards, 2004).
The present study focuses on treatment of verb finding problems at the sentence level. So far, two aphasic individuals have finished the complete protocol.

The treatment program: Verb production at the Word and Sentence level (VWS)

Several stages of verb production in a sentence can be distinguished:

1) retrieval of the verb from the lexicon (lexical stage);
2) embedding the verb in a sentence frame (syntactic stage);
3) inflection of the verb for tense and agreement (morphosyntactic stage);
4) production of the intended sentence (sentence level).

The program (for Dutch, Bastiaanse et al., 1997; for German, Bastiaanse et al., 2004) consists of four steps, corresponding to these four stages. Each step contains 60 items (the same at each level).

- *Step 1: naming of actions* The pictures of the actions have be to named with a single verb.
- *Step 2: filling in infinitives* A picture is presented with a printed sentence underneath in which the infinitival verb is left out (see Figure 1).The sentence should be read aloud (with or without help of the therapist) with the verb.
- *Step 3: filling in finite verbs* Same as Step 2, but now a finite verb has to be filled in (see Figure 1).
- *Step 4: sentence construction* A picture is presented and the client should make a sentence.

For the present study, only steps 2-4 were trained, because in our view verbs should be trained at the sentence level.

[Figure 1 about here]

Design

Inclusion criteria: The aphasia should exist for at least three months and be due to a single lesion. There was no restriction on aphasia type, but the client should have verb finding problems: 75% or less correct on Action Naming and 70% or less correct on Filling in Finite Verbs on the *Verb and Sentence Test* (VAST, Bastiaanse et al, 2002).

Control tests: The *Aachen Aphasia Test* (AAT; Graetz et al., 1993) and the *Amsterdam-Nijmegen Everyday Language Test* (ANELT; Blomert et al., 1993) were administered before the baseline tests. Also, a spontaneous speech sample (semi-standardized interview) was recorded and analyzed with respect to morphosyntactic and lexical variables.

Baseline: A test related to the treated material (with verbs that were not trained during therapy) was administered five times. This test was also used to measure generalization during therapy and was administered at the beginning of every week. Additionally, an unrelated test was used (repetition of nonwords for one client, reading nonwords aloud for the other) once at baseline and then every week during training, to assure that improvement on the related tests was due to specific treatment and not to treatment as such.

Treatment: Each step was treated for 4 weeks, in 3 sessions of 30 minutes a week. One client started with Step 2 (infinitives), one with Step 3 (finite verbs). After 4 weeks, treatment of this step stopped and changed to the other step. Finally, the client was trained for 4 weeks on Step 4 (sentence construction).

Follow-up testing was done 1 month and 3 months post-treatment for the baseline and unrelated tests and 1 week and 3 months post-treatment for the AAT, ANELT and spontaneous speech.

Participants

Mr. M. was 56 year old and suffered a stroke in his left hemisphere 8 months before inclusion. On the AAT, his aphasia was classified as a Broca's. His spontaneous speech consisted mainly

of one and two word utterances (MLU=1.5); he produced no finite verbs but the number and diversity of nouns and verbs was normal.

Mrs. F. was a 53 year old, also aphasic due to a single stroke in the left hemisphere. When she was included, she was 3 months post-onset. The aphasia was classified as Broca's on the AAT. Her spontaneous speech was nonfluent and characterized by short sentences, which were often incomplete (MLU=2.87); the proportion of finite verbs was normal (but the finite verbs were virtually always modals and copulas, produced more frequently than in normal speech). The number and diversity of nouns and verbs are below normal.

Results

Mr. M

Although Mr. M had an unstable baseline, he was included, because there was sufficient space for improvement. His score profile on the verb tests is shown in Figure 2. After treatment phases 1 and 2 (infinitives and finite verbs, respectively) there was no significant improvement, but after phase 3 (sentence construction), the production of finite verbs had significantly improved compared to the end of the baseline ($chi^2(1)=7.03$, $p<0.01$). There was no improvement on the unrelated test (reading nonwords aloud). After 3 months, this improvement on finite verbs was still significant.

There was significant improvement on the sentence construction task of the AAT (but not on the treatment-unrelated Token Test and sentence comprehension) and on the comprehensibility scale of the ANELT, according to the norms of these tests. In spontaneous speech, the MLU ($t(111)=0.718$, $p<0.001$) and the proportion of finite verbs ($chi^2(1)=8.28$, $p<0.01$) were significantly better. The improvement on all control tests was stable: after three months the differences were still significant.

[Figure 2 about here]

Mrs. F

Mrs. F. started with finite verbs and after this treatment phase, the production of finite verbs improved significantly compared to the end of the baseline ($chi^2(1)=4.33$, $p=0.05$). Her production of finite verbs further improved ($chi2(1)=15.17$, $p<0.001$). Filling in infinitives

improved ($chi^2(1)=10.00$, $p=0.01$) after sentence construction was trained, but there was already improvement in week 1, before treatment started. There was no improvement on the unrelated test (repetition of nonwords).

On the AAT, both naming and sentence construction improved significantly and comprehensibility on the ANELT was also significantly higher. In spontaneous speech, MLU was significantly longer ($t(119)=4,992$, $p<0.001$); the number of modals and copulas diminished and was now within the normal range; the diversity of nouns and the number of verbs increased and were now within the normal range. The improvement on all variables and tests remained stable during follow-up testing. This is graphically represented in Figure 3.

[Figure 3 about here]

Discussion

When treatment started, both clients were better at producing infinitives than finite verbs in sentences. Mrs. F. improved on the infinitives (last baseline compared to end of treatment), but this improvement was not related to a specific training phase and might be due to her variable behavior on this task. Both clients improved on finite verbs, to a level comparable to that of the infinitives. For Mr. M., this improvement did not take place during the training of finite verbs, but became apparent after the next phase (training sentence construction). Mrs. F. improved significantly on finite verb production after training and further improved during the other treatment phases. It may be that for clients like Mr. M., training finite verbs is only useful or more effective in relation to sentence construction. On the basis of only two clients, it is hard to draw any conclusions on the right way or order to apply the program. The most important finding is that for these two aphasic clients, training with the program was effective: both on the control tests and in spontaneous speech/language in daily life, there is significant improvement, whereas no improvement is found on any of the unrelated tests.

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the girl can ….. on the sidewalk

the farmer ….. the cow

Figure 1: Examples of Step 2 and 3 of the treatment program.

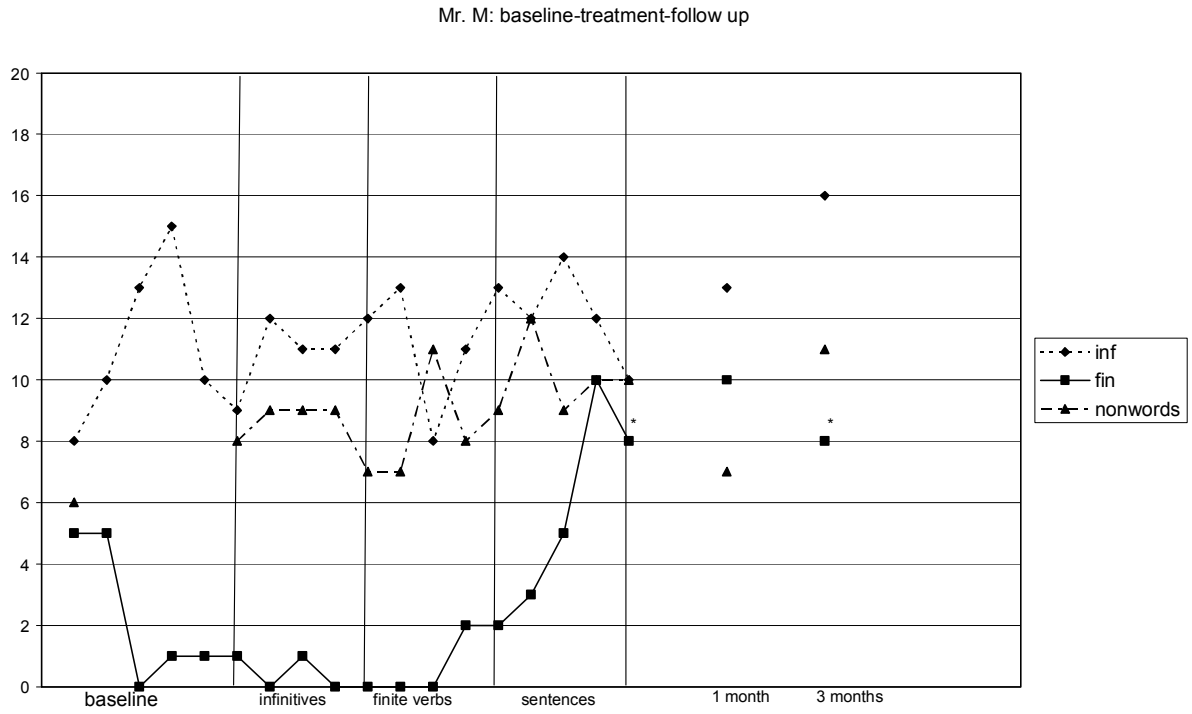

Figure 2: Graphical representation of Mr. M's scores on the related and unrelated tests (*significant improvement).

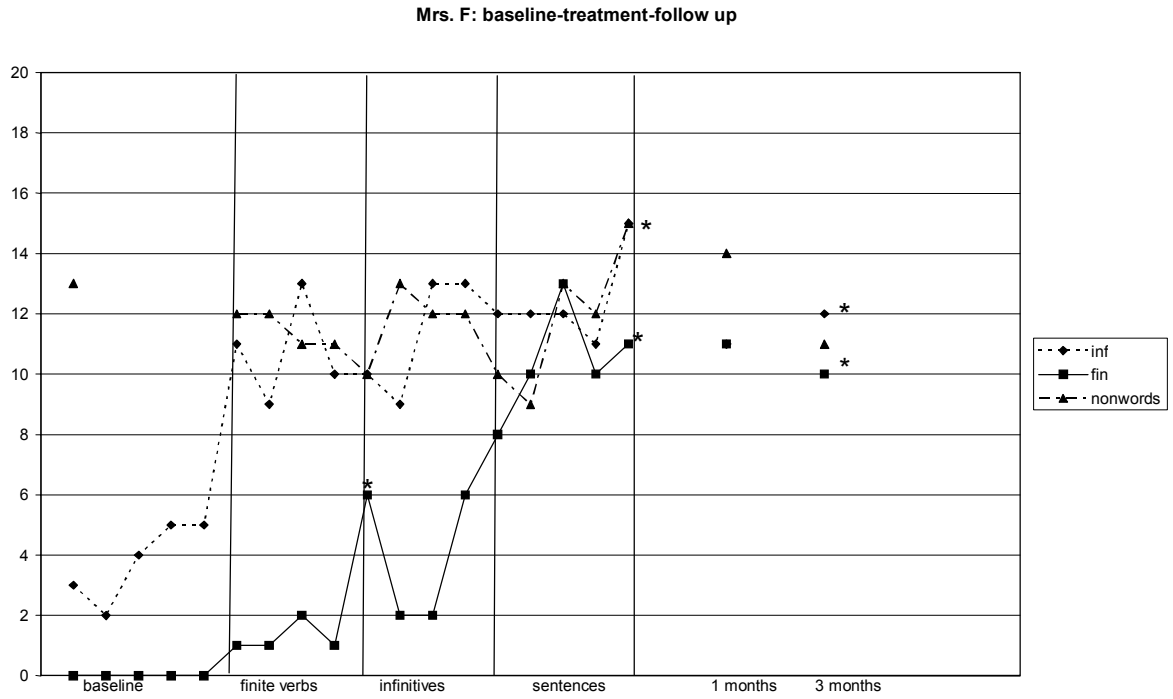

Figure 3: Graphical representation of Mrs. F's scores on the related and unrelated tests (*significant improvement).