**The functional relation between syntactic and morphological recovery in aphasia: A case study**

Introduction

Morphological and syntactic impairments often co-occur in individuals with aphasia. Whether the two impairments are causally related has been an issue of long-standing debate (see Izvorski & Ullman, 1999, Friedmann, 2001). Many researchers have been interested in seeing whether a single factor may explain both deficits, or whether one deficit may be reduced to the other (for example, whether the morphological deficit is a side-effect of the syntactic one). A unified explanation of the two would be desirable for both theoretical and practical reasons. Theoretically, such an explanation would provide a simpler and more restrictive characterization of aphasic language disorders. Practically, such a unification would open up new venues for the treatment of those disorders. Therapy which results in improvement in one deficit should be expected to result in improvement for the other. For example, if the morphological deficit can be reduced to the syntactic one, as has been claimed under the Tree-Pruning Hypothesis (Friedmann & Grodzinsky, 1997), then treatment which remediates the syntactic deficit should be expected to remediate the morphological deficit as well.

This paper reports a case study testing this possibility, examining the course of syntactic and morphological recovery in one individual entered into linguistically-motivated treatment. The treatment protocol used, Treatment of Underlying Forms (TUF; Thompson, 2001), has been shown to stimulate production of sentence types (such as Wh- movement questions) which require access to the syntactic structure responsible for licensing grammatical morphology often impaired in aphasia (such as complementizers like if, that, and whether). More specifically, TUF has been shown to stimulate access to CP, the layer of syntactic structure which hosts Wh-movement and which licenses complementizers. If morphological deficits can be reduced to impairments in generating syntactic structure, TUF treatment should improve production of not only sentences which require CP but the morphology associated with CP.

Methods

Participant

CL is a 56 year-old male diagnosed with moderate Broca's aphasia subsequent to a single left-hemisphere CVA. He was premorbidly right-handed with no previous history of language or neuropsychological disorder. At the time of testing, he was 48 months post-onset with a WAB AQ (Kertesz, 1983) of 66.8. His speech was non-fluent, and he exhibited limited capacity to produce syntactically complex utterances and little use of grammatical morphology at the time of diagnosis.

## Procedures

### Grammatical morphology testing

CL was tested for production of grammatical morphology using the functional category production tasks eliciting both verb inflection and complementizers (Thompson, in progress). These tasks were administered twice, pre- and post-treatment.

### Treatment protocol

Subsequent to grammatical morphology testing, CL was enrolled in the treatment using the TUF protocol. Two baseline probes were administered, assessing comprehension and production of sentences with Wh- movement: object Wh- questions ("Who did the thief chase?"), object clefts ("It was the artist who the thief chased"), and object relative clauses ("The man saw the artist who the thief chased"). Successful production of these sentences requires successful production of CP, as discussed above.

CL was entered into treatment targeting production of sentences involving Wh-movement, training object relatives. During each treatment session, CL was asked to produce 15 target object-relative sentences in response to a picture stimulus and based on a clinician-provided model. After the participant attempted to produce the target sentence on his own, training was administered showing the participant how to construct the abstract syntactic structure of the sentence. Training included the following steps: (a) thematic role training with line drawings, (b) construction of the sentence using written sentence constituent cards, (c) reading target sentence, (d) reassembly of scrambled written sentence constituent cards, and (e) re-reading sentences. (See Thompson, 2001, for further details regarding the administration of the TUF protocol.)

Training was administered in two two-hour sessions per week, starting with probes of production and comprehension, assessing treatment gains for the structure being trained (object relatives) and generalization to untrained sentences (object clefts, object Wh- questions). Each of these treatment probes was half the length of a baseline probe, so that two treatment probes together were equal to a single baseline probe. Treatment continued for 8 weeks and a total of 15 sessions. A single set of follow-up comprehension and production probes was administered 6 weeks after training to assess maintenance of any treatment gains.

## Results and discussion

CL's results for baseline, treatment, and follow-up probes for TUF treatment are shown in Figure 1. Treatment probe scores from every two sessions were added together so that they would have the same number of observations as a single baseline probe. Each treatment-probe observation in Figure 1 is thus based on probe data from two treatment sessions.

As can be seen from the data, CL showed no ability to produce any of the sentence types in baseline, but he rapidly acquired production of Wh- questions, the least syntactically complex of the sentence types. By the final treatment sessions, he also showed some evidence of acquiring the more-complex object-relative and object-cleft structures. Follow-up probe scores indicate that he maintained significant gains in the production of Wh- questions post-treatment as well as gains in production of object-relative and object-cleft sentences. These results are consistent with previous results with the TUF protocol, showing generalization to syntactically-related but untrained structures, particularly if those structures are less complex than the structures being trained (Thompson, Shapiro, Kiran & Sobecks, 2003). These results also indicate that TUF improved CL's production of CP, since sentences with Wh- movement require access to CP.

CL's pre- and post-treatment results for the grammatical morphology production tasks are shown in Figure 2. As the data show, CL's production of verb inflection (licensed by IP) showed some improvement following treatment. In contrast, CL's production of complementizers (licensed by CP) declined following treatment. The decline in CP-related morphology is surprising if morphological deficits in aphasic individuals are due to their deficits in generating the syntactic structures which license that morphology, as under the Tree-Pruning Hypothesis (Friedmann & Grodzinsky, 1997). The results for CL's production of Wh- movement sentences show that his production of/access to CP was improved by TUF, but his production of CP-related morphology nonetheless declined. This pattern indicates that recovery of morphological production must be at least partially independent of recovery of syntactic production in aphasia.

## Conclusions

CL's patterns of recovery in response to linguistically-motivated treatment show that improvements in syntactic production are not necessarily accompanied by improvements in morphological production. This suggests that the morphological deficit cannot be reduced to a syntactic one for all individuals with agrammatic Broca's aphasia, as under some approaches (Friedmann & Grodzinsky, 1997, Izvorksi & Ullman, 1999). However, his spontaneous improvement in IP-related verb inflection morphology, consistent with previous results from TUF (Thompson & Shaprio, 1995), indicates that linguistically-motivated treatment can facilitate grammatical morphology production (viz. Thompson, in progress).

## References


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Figure 1: CL's performance in baseline, treatment and follow-up probes for TUF protocol (WH=Object Wh- questions; OC=Object cleft; OR=Object relative clause).

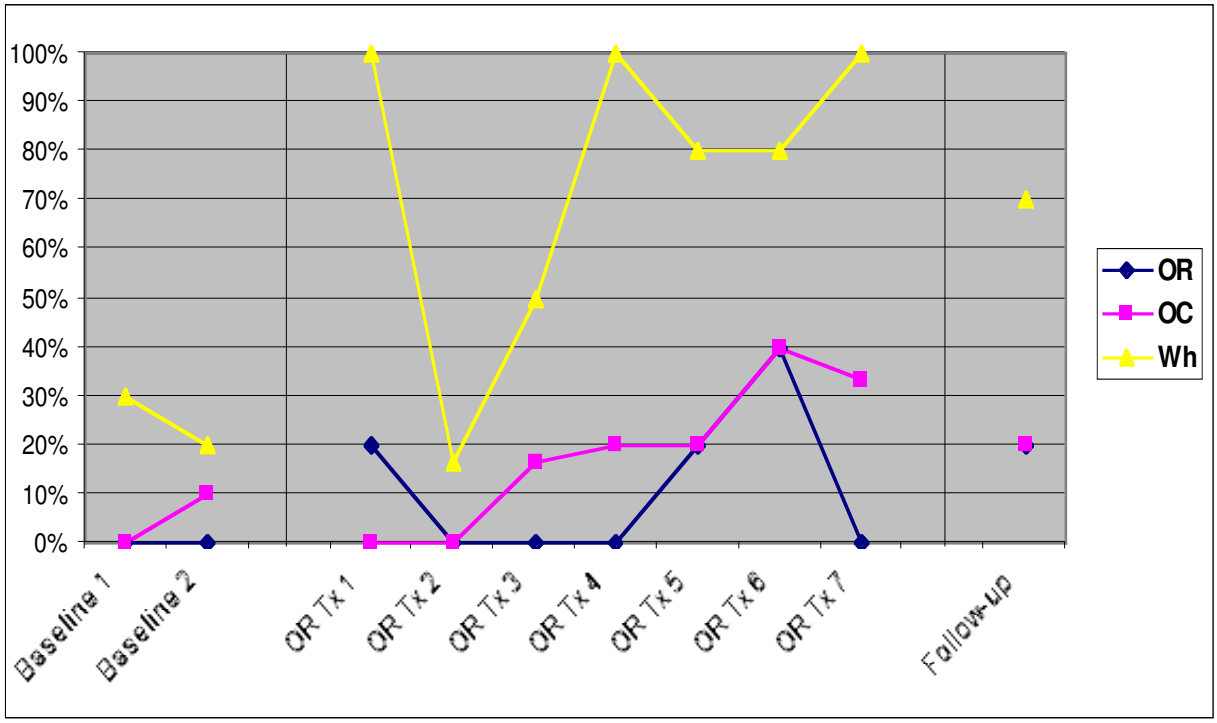

Figure 2: CL's performance in grammatical morphology production tasks (COMP=Complementizers; Vinfl=Verb inflections).