Application of Melodic Intonation Therapy Using Linguistic Principles: Acquisition and

Generalization Effects

Melodic Intonation Therapy (MIT; Albert, Sparks, & Helm, 1973) has been available as a treatment approach for nonfluent aphasia for almost 40 years. It is a hierarchically structured treatment program that employs melodic intoning, hand-tapping, therapist modeling, and repeated practice to facilitate productive verbal language. Treatment is typically focused on production of functional words and phrases (Sparks, 2008).

An apparent resurgence in interest in MIT has occurred recently (Breier, Randle, Maher, & Papanicolaou, 2010; Hough, 2010; Schlaug, Marchina, & Norton, 2008; Schlaug, Marchina, & Norton, 2009; Wilson, Parsons, Reutens, 2006). In part, this renewed attention appears to be related to MIT's potential for engaging both the right and left hemispheres, which is of interest in terms of neurorehabilitation and neuroimaging.

With respect to the behavioral effects of MIT, there has been a surprising lack of attention given to understanding the generalization effects of treatment. Although improvements in formal test scores (Bonakdarpour, Eftekharzadeh, Ashayeri, 2003; Sparks, Helm, & Albert, 1974) and production of content (Schlaug et al., 2008) have been noted, there has been no systematic investigation of the effects of treatment on linguistically controlled, untrained productions. Hough (2010) recently reported modest changes in production of untrained utterances, but did not describe the features of utterances that improved and those that did not.

Linguistic theory has been applied successfully with other treatments for agrammatism in terms of promoting and explaining generalization (see Thompson & Shapiro (2007) for a review). Although MIT was developed to improve functional utterance production, such a focus is not incompatible with the incorporation of linguistic principles. The purpose of the present investigation was to study the acquisition and generalization effects of MIT using linguistic principles in the selection of treatment and generalization stimuli. Question production was selected for treatment in order to maximize functionality of treatment. Thompson and colleagues' research with *wh*-question training served as the basis for stimuli selection (Thompson, Shapiro, Tait, Jacobs, & Schneider, 1996).

Method

Participant

The participant in this investigation was a 48 year old woman who was four years post-onset of a single, left-hemisphere, middle cerebral artery, ischemic stroke. She was a native-English speaker, passed a hearing screening, had completed high school, and lived at home with her husband. The participant was not receiving any other speech/language treatment at the time of the study and had not received speech/language therapy for six months prior to the investigation.

She presented with moderate acquired apraxia of speech (AOS) and Broca's aphasia. Her verbal and written productive language was agrammatic and typically consisted of single words or short phrases, with a predominance of nouns. Her speech was characterized by symptoms

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consistent with a diagnosis of AOS (McNeil, Robin, & Schmidt, 2009). That is, she exhibited slow rate of speech, sound errors that were relative consistent in terms of location and type of error, error types that were often distortions, and prosodic disruptions.

The participant's speech/language characteristics were consistent with those recommended for candidates for MIT: good auditory comprehension, poor repetition ability, a paucity of verbal output, effortful speech production, emotional stability, and strong motivation for therapy (Sparks, 2008).

Pre treatment test results are shown in Table 1.

Experimental Design

A single-subject, multiple baseline design across behaviors was utilized. Verbal production of four types of *wh*-questions was measured repeatedly in baseline probes. Following demonstration of stable baseline productions, treatment was applied to *who*-questions. Treatment will then be extended to another set of wh-questions. It is expected that *who*-training will result in generalization to *what*-questions. If this occurs, then treatment will be extended to *when*-questions. If generalization to *what* does not occur, then treatment will be applied next to *what*-questions, followed by treatment of *when*-questions.

During the treatment phase, probes identical to those conducted in baseline were conducted with treated and untreated items. The question type under treatment and question type with the same movement were probed following every two treatment sessions. The other question types not under treatment were probed in alternating sessions.

Following completion of treatment, follow-up probes will be conducted at 2, 4, and 6 weeks post-treatment.

Experimental Stimuli

Wh-questions representing argument movement (*who* and *what*) and adjunct movement (*when* and *where*) were selected based upon stimuli developed by Thompson et al. (1996) (Appendix A). For *who*, *what* and *when*, 10 questions were selected to serve as training items; these 10 questions also served as probe items for measuring acquisition effects of treatment. Five additional items were also selected for *who*, *what* and *when*, to remain untrained and serve as response generalization items. In addition, five generalization items were chosen for *where*.

A declarative sentence was developed to correspond to each question (e.g., Who is the nurse pushing? The nurse is pushing the baby.). These sentences were used during probes as part of the question elicitation procedure (described below).

Dependent Measures

Accurate production of target questions in probes served as the primary dependent variable. Probe procedures similar to those employed by Thompson et al. (1996) were used. The examiner presented each declarative sentence verbally as well as in printed form. The participant was then asked to form a question corresponding to each sentence.

Examiner: "The nurse is pushing the baby."
"You want to know the person the nurse is pushing, so you ask….."

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Target production: "Who is the nurse pushing?"

The questions were elicited one at a time, with items randomized within question type. Responses were audio recorded as well as recorded in writing by the examiner. A qualitative scoring system based upon that used by Thompson et al. (1996) was developed and used for scoring accuracy of productions (Appendix B). As seen in Appendix B, responses that included all target morphemes, or included the correct *wh*-morpheme, subject and correctly inflected verb were scored as correct.

In addition to question production, production of correct information units (CIUs) in discourse was measured prior to treatment and will be measured following completion of treatment (Nicholas & Brookshire, 1993).

Treatment

The MIT treatment protocol (Sparks, 2008) was employed using the target questions as the treatment stimuli. Treatment was applied three times per week in the participant's home. The following criterion was established for continuing treatment with each question type: 1) 80% or greater accuracy of production of treated, target questions in two consecutive probes, or 2) completion of 20 treatment sessions.

Results

Accuracy of question production in probes is shown in Figure 1. Each graph represents responding to a different set of *wh*-questions. As seen in Figure 1, question production was rarely accurate across the four baseline probes, with responding at low, stable levels. Following application of treatment to who-questions, increases in accuracy were observed for trained and untrained who-questions. Additionally, slight improvements have been observed for what-questions.

Effect sizes (d-index statistics) will be calculated for each set of items following completion of treatment.

Discussion

Results will be discussed relative to similarities and differences of previous MIT and TUF research. Discussion will also address implications for clinical application and directions for future study.

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Table 1

Participant Assessment Results

Participant	RCPM	AIDS Word Intelligibility	WAB Aphasia Quotient	PICA Overall Percentile Score	WAB Aphasia Type
P1	30/36	70%	43	49	Broca's

Note: RCPM = Raven's Coloured Progressive Matrices; AIDS = Assessment of Intelligibility of Dysarthric Speech; WAB = Western Aphasia Battery; PICA = Porch Index of Communicative Abilities

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Accuracy of Question Production in Probes

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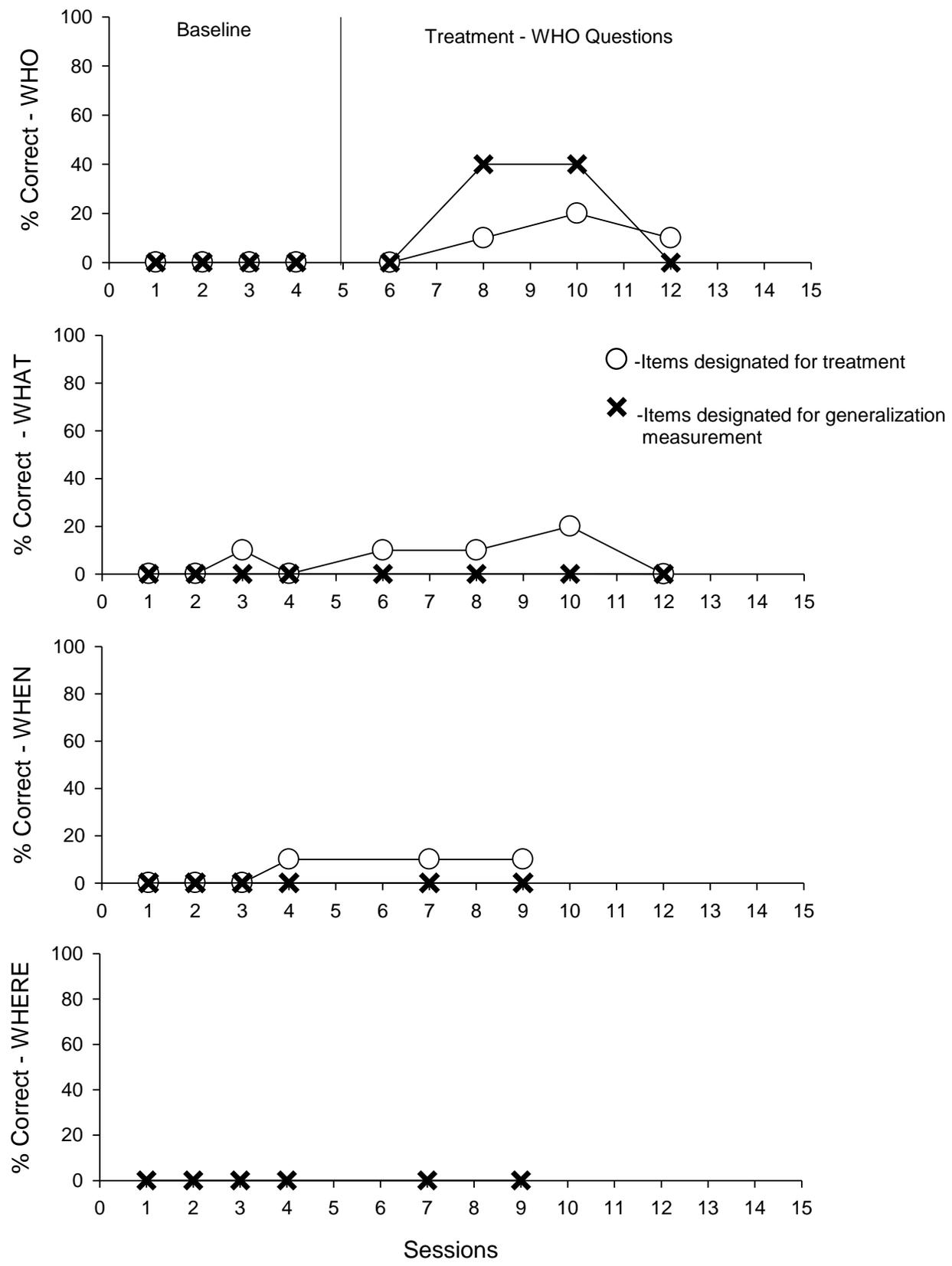
Argument Movement Questions

WHO – Treatment Items	**WHAT – Treatment Items**
Who is the nurse pushing?	What is the man pulling?
Who is the baby hugging?	What is the lady pushing?
Who is the husband kissing?	What is the girl singing?
Who is the nurse helping?	What is the boy chasing?
Who is the child kicking?	What is the woman making?
Who is the cop pulling?	What is the girl kissing?
Who is the man taking?	What is the woman attacking?
Who is the dog chasing?	What is the child sewing?
Who is the teacher watching?	What is the farmer feeding?
Who is the man pushing?	What is the cop teaching?

WHO – Generalization Items	**WHAT – Generalization Items**
Who is the father chasing?	What is the man signing?
Who is the thief watching?	What is the man hitting?
Who is the woman meeting?	What is the cop riding?
Who is the father hitting?	What is the guard reading?
Who is the coach teaching?	What is the man helping?

Adjunct Movement Questions

WHEN – Treatment Items

When is the man hitting?
When is the boy pulling?
When is the nurse lifting?
When is the baby hugging?
When is the husband kissing?
When is the student helping?
When is the snake attacking?
When is the bear sleeping?
When is the teacher reading?
When is the cop driving?

WHEN – Generalization Items	**WHERE – Generalization Items**
When is the woman cooking?	Where is the thief pushing?
When are the girls playing?	Where is the donkey kicking?
When is the mother kissing?	Where is the woman kissing?
When is the cow chasing?	Where is the man helping?
When is the man walking?	Where is the student chasing?

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Appendix B
Scoring System

Responses Scored as Correct

11 – Correct wh-morpheme, functors, subject, and verb (correctly inflected).
      Who is the nurse pushing?

10- Correct wh-morpheme, subject, and verb. Functors omitted.
      Who nurse pushing?

Responses Scored as Incorrect

9- Correct wh-morpheme and verb but argument addition or substitution.
      Who pushing baby? *or* Who nurse pushing baby?

8- Correct wh-morpheme and verb only.
      Who pushing?

7- Correct wh-morpheme and adjunct or argument only.
      Who nurse? or Who baby?

6- Incorrect wh-morpheme but semantically correct (functors optional).
      When nurse pushing?

5- Incorrect wh-morpheme and argument substitution or addition.
      When pushing baby? *or* When baby pushing?

4- Incorrect wh-morpheme with appropriate verb.
      When pushing?

3- Incorrect wh-morpheme and adjunct or argument only.
      Who nurse? or Who baby?

2- No wh- morpheme but semantically appropriate selections.
      Nurse pushing baby.

1- Single word.
      Cry.

0- No Response