Modified Response Elaboration Training: A Systematic Extension with Replications

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Abstract

Background: Response Elaboration Training (RET; Kearns, 1985) has been found to consistently result in increased production of content in discourse with persons with aphasia. Positive treatment effects have been reported for persons representing a variety of aphasia types and severities. RET was modified for application with persons with acquired apraxia of speech and aphasia and positive outcomes were also associated with the modified treatment (Wambaugh & Martinez, 2000). Although RET has received systematic study, its stimulus generalization effects are not well understood.

Aims: This investigation was designed to measure the stimulus generalization effects of modified RET (M-RET) in a variety of conditions as well as to further study the effects of M-RET applied to a personal recount condition.

Methods & Procedures: Multiple baseline designs (across behaviors and participants) were utilized to examine treatment effects. Treatment was applied sequentially to picture sets and a personal recount condition with six persons with chronic aphasia. Production of correct information units (CIUs) was measured in the following conditions: 1) discourse production in response to sets of trained and untrained pictures, 2) home conversations, and 3) production of discourse in structured tasks. Formal measures of functional communication were also completed prior to and following treatment.

Outcomes & Results: Increases in production of CIUs in response to pictures were observed for 11 of the 12 applications of M-RET to picture sets. Response generalization to untrained picture sets was associated with M-RET applied to pictures sets; increases were slight and were greater for untrained sets that were probed more frequently. Maintenance of gains was generally strong for the participants with non fluent aphasia, but was minimal for the participant with fluent

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aphasia. Gains were not evident for M-RET applied to personal recounts; only one participant evidenced changes possibly associated with treatment in the personal recount condition. Improvements in structured discourse samples and a functional communication measure were observed for the majority of the participants following treatment. Lack of compliance in completion of recordings of home conversations limited the utility of that measure.

Conclusions: M-RET applied to pictures resulted in improvements in production of content in treated and untreated picture conditions for the majority of the participants. Treatment effects extended to additional outcome measures. Although some positive changes were observed for the participant with fluent aphasia, maintenance was problematic. Application of M-RET to a personal recount condition was not associated with improved performance for most of the participants.

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Response Elaboration Training (RET; Kearns, 1985) is a spoken language production treatment for aphasia that has consistently resulted in improved production of content in discourse (Gaddie, Kearns, & Yedor, 1991; Kearns 1985; Kearns & Scher, 1989; Kearns & Yedor, 1991, Yedor, Conlon, & Kearns, 1993). RET has potential for broad clinical application in that positive effects have been demonstrated with persons with a variety of aphasia types and severities. The current investigation was designed to extend and replicate the findings of a modified version of RET (Wambaugh & Martinez, 2000).

RET was developed to facilitate increased verbal productivity in terms of content and length of utterances in persons with aphasia (PWA). Conceptually, it was developed to capitalize on patient-initiated productions in order to promote flexible and generalized language use (Kearns, 1985). An underlying premise of this loose-training procedure (Stokes & Baer, 1977) is that commonly employed, convergent-type aphasia therapies may constrain creative and generative use of language. Consequently, RET encourages the PWA to initiate a topic of his/her choice and then clinician modeling and forward-chaining are employed to assist in expanding upon that topic. RET combines behaviorally-oriented techniques (i.e., modeling and forward chaining) and principles (i.e., train loosely) with aspects of cognitive stimulation. Specifically, Chapey (2008) states that "RET stimulates fluency, flexibility, originality, and elaboration – or divergent semantic thinking as well as functional spontaneous speech, which necessitates all five mental operations" (p. 496).

Application of RET entails elicitation of verbal productions of the patient's choice in response to minimally detailed action pictures. Following the production of any relevant verbalization, RET requires the patient to expand upon his or her initial utterance. The expansion is combined with the original production through modeling and the combined phrase/sentence(s)

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is practiced. Although errorless learning typically involves convergent responses (Fillingham, Hodgson, Sage, & Lambron Ralph, 2003), RET could be considered an errorless (or at least, error reduced) procedure. That is, the only possible erroneous responses are those that are totally inappropriate to the eliciting stimuli.

Kearns and colleagues conducted a systematic series of investigations to examine the effects of RET on production of discourse (Gaddie, Kearns, & Yedor, 1991; Kearns, 1985; Kearns & Scher, 1989; Kearns & Yedor, 1991; Yedor, Conlon, & Kearns, 1993). Wambaugh and colleagues (2000, 2001) studied a modification of RET and Conley and Coelho (2003) examined the effects of RET combined with Semantic Feature Analysis (SFA; Boyle & Coelho; 1995). A summary of RET investigations is presented in Appendix A.

As seen in Appendix A, RET has resulted in positive acquisition effects with all participants; increases in the amount of information produced in response to trained picture stimuli has consistently been observed. Acquisition effects reflect the participants' verbal productions in response to pictures used in treatment under probe conditions (i.e., when no treatment or performance-contingent reinforcement has been provided.). Acquisition effects also indicate short-term maintenance effects of treatment.

All of the RET investigations were designed to evaluate response generalization effects of treatment by measuring verbal productions in response to untrained picture stimuli. Kearns and colleagues found variable response generalization effects across their participants with responses ranging from strong to minimal. Similarly, Wambaugh and Martinez (2000) found that response generalization effects paralleled acquisition effects for two of their three participants, with the remaining participant exhibiting weak effects.

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In an effort to explain differing response generalization performance, Yedor et al. (1993) performed post-hoc analyses to identify factors that may have been associated with degree of response generalization. They found that response generalization was predicted moderately well by peak mean difference scores on verbal subtests of a standardized aphasia test for the four fluent participants, but not for the five nonfluent participants. They also found that a baseline measure of variety in content production was a good predictor of generalization for the fluent patients and a moderately good predictor for the nonfluent patients. Wambaugh and Martinez (2000) suggested that word-retrieval skills may have played a role in generalized responding (which may relate to Yedor et al.'s measure of variety of content).

Stimulus generalization effects of RET have not been studied as extensively as acquisition and response generalization effects. Stimulus generalization refers to the use of trained behaviors in conditions that differ from training. The measurement of stimulus generalization may take many different forms, such as measuring effects with a different clinician, with a spouse, in a different location, or in a different speaking condition. Kearns and colleagues measured stimulus generalization with five participants (Kearns & Scher, 1989; Kearns & Yedor, 1991). Two of those participants received a convergent treatment simultaneously with RET which confounded stimulus generalization findings (Kearns & Yedor, 1991). Hence, Kearns and colleagues provided across-context data for RET (alone) for three participants (Kearns & Scher, 1989).

Kearns and Scher (1989) reported stimulus generalization effects for several different measurement conditions. Stimulus generalization was measured across clinicians (i.e., a clinician other than the treatment clinician conducted probes) and was reported to be good in terms of generalized production of content words for all three participants. Similarly, Kearns and Scher

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noted good generalization to conditions in which a participant's spouse administered probes. When probes were conducted in a different location (i.e., senior center), strong generalization effects were observed with one participant. Production of content words was measured by eliciting speech through the use of open-ended questions or by obtaining descriptions of taped news segments. Results from elicited speech samples varied across participants: the participant with Broca's aphasia showed no or minimal changes, the participant with anomic aphasia displayed good generalized responding, and the participant with conduction aphasia exhibited an initial increase, followed by a decrease in performance.

Wambaugh and Martinez (2000) conducted a measure of stimulus generalization effects of modified RET by asking participants to produce expository discourse in the form of a personal recount. They reported modest changes in content production during recounts for two of three participants as a result of picture level training with RET.

Overall, promising stimulus generalization results have been reported for RET. However, the examination of these effects has been rather exploratory in nature. That is, stimulus generalization effects have been measured with only a few participants and measurement conditions have varied across participants.

Wambaugh and Martinez (2000) modified Kearns' (1985) procedure to accommodate speakers with apraxia of speech (AOS) as well as aphasia. That is, speakers with AOS sometimes experience difficulties in initiating utterances and the original RET protocol did not provide an option for persons who were unable to initiate a response to the picture stimuli. One of the modifications provided in the Wambaugh and Martinez protocol included the provision of modeled response options in the event of no response (i.e., examples of a noun phrase and a verb

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phrase were provided). Additional modifications included the use of integral stimulation in the event of difficulty in repetition of the expanded response and repeated practice of that response.

In an attempt to more fully realize the potential of "loose training" by approximating naturalistic communication situations, Wambaugh and Martinez (2000) eliminated the picture stimuli and applied modified RET (M-RET) to a personal recount context (following application of M-RET to pictures). This application of M-RET resulted in clear additional gains in the personal recount condition for one speaker, equivocal gains for another speaker, and no gains for the remaining speaker. As noted by Wambaugh and Martinez (2000), possible order effects confounded the outcomes observed with treatment in the personal recount condition; treatment in the personal recount condition always followed treatment in the picture conditions.

The purpose of the current investigation was two-fold: 1) to further examine the effects of M-RET applied to a personal recount condition (while controlling order effects), and 2) to systematically examine stimulus generalization effects of M-RET in a variety of different measurement conditions.

Method

Participants

Six adults with moderate to severe aphasia served as treatment participants for this investigation. According to available medical records, each of the participant's aphasia resulted from a single episode stroke. At the time of the study, participants ranged in age from 46 to 70 years and were between 19 and 96 months post onset of stroke. All participants passed a pure tone audiological screening and performed within normal limits on a test of nonverbal intelligence: the *Test of Nonverbal Intelligence-3* (TONI-3; Brown, Sherbenou, & Johnsen, 1997) or the *Coloured Progressive Matrices* (Raven, Raven & Court, 1998). All were White

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(non Hispanic/Latino), monolingual, native speakers of English and reported negative histories of premorbid speech/language difficulties, alcohol/substance abuse, significant psychological disorders, or neurological conditions other than the stroke. All of the participants resided in their own homes. None of the participants received any other speech/language therapy during the course of this study. Participant characteristics are summarized in Table 1.

Insert Table 1 about here

The diagnosis of aphasia was determined by assessment of language skills using the *Western Aphasia Battery* (WAB; Kertesz, l982) and the *Porch Index of Communicative Ability* (PICA; Porch, 2001). Four of the participants had co-existing AOS as evidenced by characteristics consistent with criteria described by McNeil and colleagues (McNeil, Robin, &Schmidt, 1997; 2009) (Participants 1 - 4). Pretreatment assessment results are presented in Tables 2 and 3.

Insert Tables 2 and 3 about here

Five of the participants exhibited nonfluent aphasias and one presented with fluent aphasia as determined by performance on the *Western Aphasia Battery* (WAB; Kertesz, 1982). All of the participants had significant word-retrieval difficulties as seen in Table 3. Samples of discourse (orthographically transcribed) from a picture description task are presented in Appendix B for each participant (i.e., "birthday party" picture from the Nicholas and Brookshire (1993) discourse elicitation procedure).

Six additional PWA were enrolled in the investigation, but did not complete the investigation, or were withdrawn for the following reasons: one participant experienced another stroke during the first phase of treatment, two participants completed part of the treatment protocol and then asked to discontinue, one participant relocated to another state during the pre

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treatment phase, one participant withdrew during the baseline phase because he did not want to perform the personal recounts, and one participant experienced a hospitalization due to alcohol abuse.

Thirty non-brain-damaged participants provided comparison data relative to the experimental stimuli. Fifteen of the participants ranged in age from 20 to 44 years (mean age of 30.9) (younger group) and fifteen ranged in age from 50 to 73 years (mean age of 62.6) (older group). All were at least high school educated: the younger group's education level ranged from 12 to 24 years of education (mean = 14.7 years) and the older group's education level ranged from 12 to 22 years (mean = 14.9). All were native speakers of English and reported negative histories for alcohol/substance abuse, mental illness and neurological conditions. Additionally, all reported no speech/language difficulties, which was consistent with observations during experimental procedures. These participants all passed a pure tone audiological screening and were within normal limits on the *TONI-3* (Brown et al., 1997). Of the younger group, all were White and 14 were non Hispanic/Latino and one was Hispanic. All participants in the older group were White (non Hispanic/Latino). There were eight females and seven males in each of the comparison groups.

Experimental Design

Single-subject multiple baseline designs across participants and behaviors were utilized to measure the effects of treatment on production of correct information units (CIUs; Nicholas & Brookshire, 1993) in discourse. Production of CIUs in several elicitation contexts was measured repeatedly in baseline prior to the initiation of treatment to allow for the determination of behavioral variability. In keeping with the multiple baseline design across participants, baseline probes were extended across participants. Five baseline probes were designated a priori as the

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minimum for any given participant. In addition to ensuring that the number of baseline probes was extended across participants, performance constraints were employed in the determination of length of baseline. Probing was continued until each participant's performance on the final three probes directly preceding the initiation of treatment did not vary by more than 10% across those probes.

The multiple baseline across behaviors component of the designs required measurement of several behaviors concurrently, with treatment being applied sequentially to those behaviors. The behaviors and/or contexts (i.e., multiple baselines) that comprised these designs and to which treatment was applied were as follows: 1) discourse production in response to a set of 10 pictures, 2) discourse production in response to another set of 10 pictures, and 3) production of a personal recount. Additional contexts that were used to measure generalization effects, but did not receive treatment were as follows: 1) discourse production in response to a third set of 10 pictures, 2) production of conversation with a family member or friend, and 3) production of discourse in structured tasks.

Following establishment of stable baseline measurements, M-RET was applied sequentially to the measurement contexts of interest. Probes, identical to those conducted in baseline, were conducted continually throughout the course of treatment in all measurement conditions. Treatment was applied in a given context until pre-established performance criteria were met or until 20 treatment sessions were completed (see "Treatment" below). Treatment was then extended to the next designated context and subsequently to the third context. Treatment application was counterbalanced across the measurement conditions (e.g., Picture Set 1 → Picture Set 2 → Personal Recount; Personal Recount →Picture Set 2 → Picture Set 1). Assignment of a given treatment sequence was randomized across participants.

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Probes were conducted at 3 and 6 week intervals following the completion of treatment.

Experimental Stimuli

Thirty line drawings depicting common actions were used as the experimental stimuli. Action pictures were selected from re-drawn pictures from *An Object Action Naming Battery* (Druks & Masterson, 2000). Thirty-three of the pictures were initially presented to the two groups of non-brain-damaged control speakers. The speakers were shown the pictures one at a time and asked to tell the investigator as much as possible about the picture (see instructions for "Picture Sets" below). Their responses were audio recorded and transcribed orthographically. Average CIU production was calculated for each picture for each group and was used to assist in forming three sets of ten pictures. The sets were balanced for 1) number of CIUs elicited from the control speakers, 2) familiarity, 3) argument structure, 4) homophonous noun root, and 5) image agreement. Lists of items that comprised each experimental picture set are provided in Appendix C along with the average number of CIUs produced per picture by the comparison participants.

Dependent Variable

Production of CIUs in discourse conditions (described below) served as the variable of interest. As described by Nicholas and Brookshire (1993), CIUs reflect the accuracy, relevancy, and informativeness of words produced by a speaker relative to a particular topic. Procedures described by Nicholas and Brookshire (1993) for tallying words and CIUs were followed. Consensus scoring was utilized for determination of CIUs in all probe conditions (see "Probes"). That is, one hundred percent of the probes from each phase of the study were reviewed and rescored by an examiner other than the original examiner and CIUs recalculated. When a discrepancy was found between the original scorer (OS) and the reliability scorer (RS), the

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discrepancy was discussed, the rules for CIU scoring were reviewed, and a determination for the appropriate score was agreed upon between the two scorers. Discrepancies between the two scorers across the participants ranged from approximately two percent (Participant 1) to five percent (Participant 3) of calculated CIUs.

Probes

Production of discourse was elicited in probes through presentation of the three picture sets and by requesting five minute personal recounts (i.e., four conditions). The order of presentation of the conditions was randomized within each baseline probe session and each follow-up probe session. The schedule of probing of the conditions followed a predetermined schedule throughout the treatment phases in order to minimize probing time for daily sessions (see Appendix D). The condition currently under treatment was probed following every second treatment session (at the start of the next treatment session) and the other conditions were probed on a reduced probing schedule.

Picture sets. The ten pictures within each set were presented one at a time in random order. The investigator instructed the participant as follows: "*Tell me as much as you can about this picture. You can talk about this picture or anything it reminds you of*." The participant was allowed as much time as he/she required to discuss the picture. When the participant indicated completion of the description/discussion or stopped talking for 15 seconds, the investigator provided one prompt: "*Is there anything else?*" A fifteen second period of silence was chosen to allow sufficient time to accommodate word-retrieval difficulties and/or other language formulation difficulties. Silence was chosen rather than observation of continued processing effort for the purpose of providing consistency within and across examiners in probing procedures.

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Personal recounts. At least one day prior to a scheduled personal recount probe, the participant was instructed, *"Next time I see you, I'm going to ask you to talk for at least 5 minutes about anything that you would like. For example, you could talk about something that happened since I saw you last or something that is going to be happening. You can talk about your daily routine or the news…whatever you like".* At the time of the probe, the participant was provided with the preceding instructions again ("*Next time I see you*" was omitted). If the participant discontinued talking before five minutes had elapsed, the clinician provided one additional prompt (e.g., "*You still have some time left. Could you tell me anything else?")*
All probes were video and audio recorded. Probes were orthographically transcribed and number of CIUs calculated from the transcriptions. No feedback was provided other than general reinforcers (e.g., you're doing a good job, you're really trying).

Additional Measurement Conditions/Outcome Measures

Home conversations. Participants were asked to identify a family member or friend who would be willing to participate in five minute weekly conversations over the course of the investigation. The communication partner was identified early in the baseline phase.

The investigator provided one training session to explain how to obtain the conversation sample and provide communication guidelines. The communication partner was also provided with a high quality tape recorder, microphone, cassette tapes, and written instructions. Following the training session, the communication partner was asked to complete one practice tape with the participant. This tape was reviewed by the clinician and feedback provided to the communication partner to ensure understanding of the procedure. The communication partner was then asked to complete at least one tape during the baseline phase and a weekly tape during

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the treatment phase. The investigator requested the completed conversation tapes each week. Tapes were orthographically transcribed and number of CIUs calculated for each conversation.

Structured discourse elicitation tasks. Samples of narrative and procedural discourse were obtained prior to and following completion of all treatment using procedures established by Nicholas and Brookshire (1993). Number of CIUs and words were calculated following instructions specified by Nicholas and Brookshire.

In addition, pre treatment and post treatment story retells were elicited using materials and procedures developed by Doyle and colleagues (Doyle, McNeil, Park, Goda, Rubenstein, & Spencer, 2000; McNeil, Doyle, Fossett, Park, & Goda, 2001). Four parallel forms, consisting of three stories each, are available for eliciting story retells (Doyle et al., 2000). Stories are presented via laptop computer (auditory and visual stimuli); participants are required to retell each story after its presentation. McNeil et al. (2001) delineated the information units (IUs) necessary for complete retelling of the stories. Percent of requisite IUs produced for the three stories per form were calculated for each participant's retells.

Mean length of utterance (MLU). Pre treatment and post treatment MLU was calculated for each participant using the narrative and procedural discourse samples (Nicholas & Brookshire, 1993).

Functional communication measures. The C*ommunicative Effectiveness Index* (CETI; Lomas et al., 1989) was completed during the baseline phase and following completion of all treatment phases. Each participant identified a family member or friend to complete the CETI. Procedures for administration described by the developers were followed with one exception; raters were not provided with the original ratings at the time of completion of the post treatment ratings.

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The *Communication Activities of Daily Living – 2* (Holland, Fratalli, & Fromm, 1999) was also administered prior to and following treatment.

Blinded Examiner

An examiner who was blinded to 1) the order of treatment presentation, and 2) the assignment of picture sets to treatment completed one probe in the baseline phase and again following each of the treatment conditions. It should be noted that at the final probe, the examiner was blinded only to picture set assignment as it was known that treatment had concluded. Consensus scoring was completed with the blinded examiner and an investigator who was not serving as the participant's therapist as described above.

Treatment

Treatment was administered by ASHA certified speech-language pathologists (SLPs); for two participants (Participants 1 and 2) graduate students also provided treatment. The students provided approximately two of three sessions per week, and participated in probes in all phases of the design. The graduate students had completed at least one semester of graduate practicum, had completed a graduate level course in "Aphasia", had completed directed readings pertaining to the treatment, and had received training in application of the treatment. The students were supervised at all times by certified SLPs (project staff). Each student treated only one participant.

Participants were scheduled for treatment three times per week and were seen in their homes or in the research laboratory according to their preference: P1 – home, P2 – home and laboratory, P3 – home and laboratory, P 4 – home and laboratory, P5 – laboratory, and P6 – home. The conditions in the home and laboratory settings were as distraction free as possible. All radios/televisions/computers were turned off. There was always a comfortable seating arrangement with adequate space for picture presentation. If a family member chose to watch a

session (an infrequent occurrence), they sat out of the line of sight of the participant and were asked to not make comments to the participant.

All participants received treatment applied to three treatment conditions (i.e., two picture conditions and a personal recount condition). The counterbalanced order of conditions (see Experimental Design) was randomly assigned for each participant.

Picture description context. Pictures from the set selected for treatment were randomized prior to each treatment trial. The pictures were presented one at a time with the instruction, "*Tell me about this picture.", "What does this remind you of?", "Tell me what's happening."* Treatment was then applied sequentially through the six steps of the treatment hierarchy (see Appendix E). Based on the participant's response, substeps of the hierarchy were implemented as appropriate. Two complete trials with the 10 picture set constituted one treatment session.

Personal recount context. No picture stimuli were utilized when M-RET was applied to the personal recount context. Instead, the clinician requested, "*Tell me something about anything you would like to talk about."* The six steps of the treatment hierarchy were then applied as with the picture context. In step 6, the clinician requested a reiteration of the elaborated response rather than a re-description of the picture. A treatment session consisted of 12 to 20 topic elaborations.

Treatment continued until a maximum of 20 treatment sessions were completed per phase or until performance on treatment probes met a criteria of 100% increase in CIU production over three consecutive probe sessions for participants who produced less than 4 CIUs per picture or personal recount. For participants who produced 5 or more CIUs per item, the criterion was a

50% increase in CIU production. If performance on consecutive probes continued to increase by 10% or more, treatment was continued so as not to impose an artificial ceiling.

Results

Production of CIUs in Experimental Conditions

Data representing number of CIUs produced in the different experimental conditions during probes are shown in Figures 1 – 6 for Participants 1 – 6, respectively. Within each figure, the separate graphs represent production of CIUs in response to presentation of the pictures in each set (two treated sets and one untreated set) and in the personal recount condition. The order of the graphs from top to bottom in each figure indicates the order of application of treatment to the different conditions. Graphed data for the picture sets reflect total number of CIUs produced for all ten pictures in the set. The scaling of the Y axes varies by participant to accommodate the relatively wide range of number of CIU productions across participants.

Production of CIUs in response to picture sets. As seen in Figures 1-6, acquisition effects (i.e., production of CIUs in response to trained picture sets in probes) were positive for 11 of the 12 applications of M-RET in picture contexts. Increases in CIU production exceeding pre treatment baseline levels were observed in all cases with the exception of Participant 1 for the second treatment set.

Effect sizes (d-index; Bloom, Fischer, & Orme, 2003; Cohen, 1988) were calculated for all experimental contexts and are shown in Table 4. For effect size calculations associated with changes that occurred in the treatment phases, all baseline probe values for each behavior (i.e., all probes preceding the application of treatment for the behavior) and the last three probe values at the end of the treatment phase were used. These effect sizes indicated magnitude of change associated with each separate phase of treatment, excluding any possible previous generalization

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effects for the particular behavior. To calculate effect sizes for the follow-up phases, all "true" baseline probe values for the behavior (i.e., initial probes conducted prior to the application of *any* treatment) and the two follow-up probe values were utilized. These effect sizes reflected the *cumulative* effects of all applications of treatment on the behavior.

The d-Index equation is as follows:

$$d = \frac{M_1 - M_2}{SD_{pooled}} \qquad \text{where} \qquad SD_{pooled} = \sqrt{\frac{(SD_1^2 + SD_2^2)}{2}}$$

Insert Table 4 about here

The following benchmarks for interpreting the magnitude of calculated effect sizes have been suggested by Beeson and Robey (2006): d=2.6, 3.9, and 5.8 for small, medium, and large-sized effects, respectively. These values were derived from effect sizes calculated as part of Robey and colleagues' review of single-subject design treatment investigations in aphasia (Robey, Schultz, Crawford, & Sinner, 1999). The investigations included in that review represented a variety of treatment approaches, with a predominance of studies focused on verbal production. As such, the proposed benchmarks may have utility for interpreting the effect sizes obtained in the current investigation.

As seen in Table 4, effect sizes for the picture set treatment phases ranged from d = -1.23 (P 1 – second picture set) to d = 8.69 (P 2 – second picture set).

Maintenance of gains at three and six weeks post treatment was strong for the majority of the treated picture sets for the participants with nonfluent aphasia. With the exception of Participant 5's first picture set, production of CIUs remained at levels well above baseline; effect sizes at follow up for these participants ranged from 1.89 (P 5 – first picture set) to 19.45 (P 2 – second picture set). Participant 6's performance in follow up probes varied across picture sets. At

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both follow up times, Participant 6 demonstrated production of CIUs slightly above baseline levels for the second treated set (d = 2.27). However, Participant 6's performance in follow up probes with the first treated set was highly variable with baseline level performance at three weeks post treatment and high levels of production at six weeks post treatment (d = .85) (note: a high degree of variability was also observed in the baseline phase).

Small increases in production of CIUs in response to an untrained picture set were observed with all participants upon treatment being applied in the picture context (i.e., slight positive response generalization). More improvements were evident with the untreated picture set that was probed more frequently (in comparison to the picture set that was probed only at the end of treatment phases). As seen in Table 4, positive effect sizes ranging from 1.15 to 10.61 were obtained for the untreated picture set for Participants 1 – 6.

Along with Table 4, the following description summarizes the magnitude of change observed at follow-up periods with respect to the Beeson and Robey's (2006) benchmarks: 1) first treated picture set – large effects for P2 and P3, medium effects for P1, small effects for P4, and minimal effects for P5 and P6; 2) second treated picture set – large effects for P2, P3, P4, and P5, and minimal effects for P1 and P6, and; 3) untreated picture set – large effects for P3, medium effects for P2, and minimal effects for the remaining participants.

Production of CIUs in personal recounts. Consistent improvements in production of number of CIUs in the personal recounts above baseline levels were observed only for Participant 3. As seen in Table 4, effect sizes associated with the personal recount treatment phase ranged from -1.27 (P 2) to .97 (P 3). Effect sizes associated with the follow up phase for personal recounts ranged from -1.02 (P 1) to 5.02 (P3). Thus, there was a medium effect size associated with personal recounts for Participant 3 and negligible effect sizes for the remaining

participants. Small improvements in CIU production in untreated personal recounts may have been associated with picture context treatment for Participants 3, 4, and 5.

Percentage of words that were CIUs. The preceding analyses pertained to production of ***number*** of CIUs produced in the experimental probe conditions. In order to take into account the number of words in relation to the number of CIUs produced, the percentages of CIUs per words were calculated. Table 5 displays the percentages of CIUs for the baseline, end of treatment, and follow up phases for the experimental conditions by participant. The lowest and highest percentages obtained in baseline are shown to allow comparison with the treatment and follow-up phase data.

As seen in Table 5, consistent improvements in percentages of CIUs (i.e., scores exceeding baseline maximum values) were evident in the following cases: P1 – second picture set, P2 – both picture sets, and P4- both picture sets.

Insert Table 5 about here

Production of CIUs in Home Conversations

Recordings of home conversations were not completed consistently on a weekly basis as requested/planned. The numbers of CIUs, words, and turns produced by the participants in home conversations are shown in Table 6. The data represent the participants' last conversation produced in the baseline phase, the last conversations from each phase of treatment, and follow up phase conversations. As seen in Table 6, the data were highly variable within participants and no trends were apparent within or across participants.

Insert Table 6 about here

Pre Treatment – Post Treatment Measures

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Post treatment assessment results are shown in Table 2 along with the corresponding pre treatment findings for the following measures.

Structured discourse. Increases in production of number of CIUs and percent CIUs (i.e., CIUs/words) in the narrative/procedural discourse samples (Nicholas & Brookshire,1993) were found for Participants 2, 3, 4, and 5. Decreases in both number and percent CIUs were observed for Participants 1 and 6. Findings from the story retells (Doyle et al., 2000) directly corresponded to the Nicholas and Brookshire (1993) discourse results with increases in percent of IUs seen for Participants 2, 3, 4, and 5, but not for the remaining participants.

MLU. Increases in MLU were observed for Participants 1, 2, 3, and 6; slight decreases were found for Participants 4 and 5.

Functional communication measures. Post treatment ratings on the CETI (Lomas et al., 1989) were higher than pre treatment ratings for all of the participants with the exception of Participant 3. However, improvements were slight for Participants 1, 2, and 5. Improvements in CADL-2 scores were also seen for all participants.

Other. The PICA (Porch, 2001) was not selected as an outcome measure, but was readministered following treatment for five of the six participants for descriptive purposes. Increases were found in PICA overall percentile in all cases.

Blinded Examiner

Performance on probes conducted by blinded examiners is included in each figure. As seen in Figures 1 – 5, data points for blinded probes fell within the range of corresponding values of non blinded probes for Participants 1 – 5. For Participant 6, blinded probe values were similar to non blinded probes, with the exception of the untreated picture set; blinded probes as the end of each phase of treatment were lower with the blinded examiner than with the non blinded

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examiner, but fell within the range of blinded and non blinded baseline values for this set of items.

Discussion

The effects of M-RET applied to picture sets were consistent with previous RET investigations and provide further support for use of this treatment. That is, acquisition effects were evident for all participants and response generalization effects were also present, albeit variable. The participants with non fluent aphasia demonstrated a better response to treatment in terms of maintenance effects. We had planned to provide data from similar numbers of fluent and non fluent participants. Unfortunately, only one participant with fluent aphasia completed the protocol; of the six "drop-outs", four had fluent aphasia.

The findings concerning M-RET applied to personal recounts were disappointing. In a preliminary investigation of this treatment, clear improvements had been evident with one of three participants and equivocal increases had been observed with another participant (Wambaugh & Martinez, 2000). The participants in the previous investigation were similar in terms of type and severity of aphasia and degree of word-retrieval difficulties to those in this investigation.

The one participant in this investigation who demonstrated improvements in the personal recount condition received treatment for two picture sets prior to receiving treatment in the personal recount condition; this was the same order of treatment as in the previous investigation. Increases in CIUs in the personal recount for Participant 3 started during the picture condition treatments. Three additional personal recount probes were conducted prior to beginning treatment in that condition to ensure behavioral stability. Personal recount treatment appeared to

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slightly increase and stabilize gains for Participant 3. It may be that extended picture level treatment is necessary prior to application of personal recount treatment.

Participant 5 also received personal recount treatment following treatment of two picture sets. He evidenced slight gains in CIU production in personal recounts with treatment of pictures. Similar to Participant 3, he also demonstrated increased stability of performance in personal recounts upon application of treatment in that condition; baseline performance had been highly variable for CIU production in personal recounts.

Gains that were achieved during application of M-RET to picture sets were maintained at relatively high levels for the participants with nonfluent aphasia. Participants 1-4 demonstrated post treatment CIU values similar to, or exceeding values attained during treatment. Participant 5 demonstrated a decrease from levels achieved during treatment, but performance remained well above baseline levels.

For the participant with fluent aphasia, gains from the picture context treatment were maintained for only one set. Not surprisingly, during the baseline phase, production of total number of CIUs was substantially higher for Participants 6 in comparison to the participants with non fluent aphasia. Average number of CIUs produced by Participant 6 per picture ranged from approximately 9-23. These values were lower than the averages for the comparison speakers (see Appendix C), but were often within the low range of "normal". Because Participant 6 often produced relatively high numbers of CIUs, it was anticipated that treatment might impact the percentage of words that were CIUs rather than total number of CIUs. That is, treatment focused on provision of content with limited opportunity to provide extraneous words; we expected that redundant and/or non meaningful word production might decrease. Although Participant 6

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exhibited some improvements in percentages of CIUs, these increases were not maintained at the 6 week follow-up probe.

Increases in the provision of information in the post treatment structured discourse tasks were largely consistent with findings from the experimental picture conditions. Participants 2, 3, 4, and 5 achieved improvements with both treated picture sets and these were the participants who demonstrated improved production of information in the story retells (Doyle et al., 2000) and the Nicholas and Brookshire (1993) discourse samples. There was good correspondence between performances on the structured discourse tasks; changes in post treatment performance were consistent across these measures. Increases in CADL-2 scores (Holland et al., 1999) were found for all participants which was also consistent with M-RET findings.

Changes in CETI (Lomas et al., 1989) ratings were not in keeping with M-RET findings for some of the participants. Participants 1, 2, and 5 received slightly improved ratings and Participant 3 received a slightly lower rating. As noted previously, the raters were not provided with the original ratings. The follow-up ratings for Participants 1, 2, 3, and 5 would seem to indicate minimal to no change in the raters' perceptions of functional communication abilities. The preceding ratings were not surprising. Greatly improved ratings were provided for Participants 4 and 6. In particular, the improved rating for Participant 6 was unexpected. Although the raters did not receive the original ratings to use as a basis for providing the post treatment ratings, they knew that treatment had concluded. It is possible that raters were trying to please the examiners and/or wanted to represent the participants in an improved light (i.e., a form of Hawthorne Effect). Alternatively, it is possible that treatment resulted in improvements that were not revealed by our primary measures.

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The number of participants who withdrew from the investigation was high and atypical in comparison to other treatment investigations that we have conducted. Two of the withdrawals were due to issues not concerning the study (i.e., stroke and relocation), but the remaining three were related to aspects of the investigation. The participant who withdrew in the baseline phase expressly indicated a dislike of being required to produce five minutes of expository discourse in the personal recount condition; he also indicated consternation in being asked to repeatedly discuss the action pictures.

The participants who withdrew during treatment did so in different phases of therapy. One participant, with anomic aphasia, completed six sessions of M-RET applied to a picture set prior to requesting to terminate her participation. She noted that the treatment was not what she had expected. The remaining withdrawn participant, who presented with conduction aphasia, completed 20 sessions of M-RET applied to a picture set and 10 sessions of M-RET applied to the personal recount condition. He had demonstrated a great deal of variability in production of CIUs in all baseline conditions and had not made consistent progress in either treatment condition. This participant indicated that he did not enjoy the treatment.

The treatment and the probe sessions involved in this investigation were demanding in terms of the amount of talking required of the participants. In particular, the personal recounts placed a large communicative load on the participants. The considerable burden of the personal recounts and the limited measurable effects of treatment in that condition should serve to make clinicians and clients cautious in considering this treatment option.

The findings from this and previous RET investigations (Gaddie, Kearns, & Yedor, 1991; Kearns, 1985; Kearns & Scher, 1989; Kearns & Yedor, 1991, Wambaugh & Martinez, 2000; Yedor, Conlon, & Kearns, 1993) indicate that RET may be expected to result in improved

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production of content for PWA. Positive outcomes appear to be probable for conditions beyond those that are trained. Application of M-RET to personal recounts may be considered for use, but should likely follow application with pictures. Findings from Conley and Coelho (2003) suggest that RET may potentially be combined with other treatment approaches for aphasia.

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Table 1

Participant Characteristics

Participant	Gender	CVA Location/ Type	Months post stroke	Age	Years of Education	Previous Occupation	Residence
P1	Male	R MCA ischemic	96	56	14	bookkeeper	own home
P2	Female	L MCA ischemic	33	46	12	office manager	own home
P3	Male	L MCA ischemic	33	56	20+	physicist	own home
P4	Female	L MCA ischemic	19	55	13+	accountant	own home
P5	Male	L MCA ischemic	42	64	14	military	own home
P6	Male	L PCA ischemic	44	70	16	biologist	own home

Note: CVA = cerebral vascular accident; R = right; L = left; MCA = middle cerebral artery; ACA = anterior cerebral artery; PCA = posterior cerebral artery

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Table 2

Pre and Post Treatment Assessment Results

Participant	*CETI (out of 100)*		CIUs in Nicholas & Brookshire (1993) Discourse Task		*CADL -2 (out of 100)*		*PICA (overall percentile)*		Story Retells (McNeil et al.)		Mean Length of Utterance	
	pre	post	pre	post	pre	post	pre	post	pre	post	pre	post
P 1	50	51	CIUs: 75 Words: 148 51% CIUs	CIUs: 60 Words: 143 42% CIUs	72	75	58	na	Form A 3.79%	Form A 3.57%	1.48	1.54
P 2	29	31	CIUs: 23 Words: 248 9% CIUs	CIUs: 48 Words: 183 26% CIUs	71	74	45	49	Form C 1.05%	Form B 1.90%	1.10	1.37
P 3	45	41	CIUs: 2 Words: 60 3% CIUs	CIU: 28 Words: 240 12% CIUs	57	62	36	43	Form D .47%	Form A 1.33%	1.0	1.12
P 4	37	59	CIUs: 365 Words: 735 50% CIUs	CIUs: 395 Words:712 55% CIUs	87	96	64	69	Form B 12.26%	Form D 14.69%	3.94	3.53
P 5	48	52	CIUs: 78 Words: 204 38% CIUs	CIUs: 91 Words: 218 42% CIUs	74	95	59	65	Form B 3.59%	Form C 5.67%	2.98	2.82
P 6	36	56	CIUs: 335 Words: 590 57% CIUs	CIU: 255 Words: 476 54% CIUs	62	67	36	47	Form B 11%	Form C 6.0%	3.4	5.36

Note: CETI = Communicative Effectiveness Index: *CADL-2 = Communication Activities of Daily Living. 2nd Edition; PICA= Porch Index of Communicative Ability (Vol.2)*

Table 3

Participant Pre Treatment Assessment Results

Measure	P1	P2	P3	P4	P5	P6
Western Aphasia Battery (Kertesz, 1982)						
Aphasia Quotient	50.5	38	35.3	71.2	65.8	64
Aphasia Type	Broca's	Broca's	Isolat.	Broca's	Broca's	Trans.S.
Test of Adolescent/Adult Word Finding (German, 1990)						
Total Raw Score	15/107	4/107	4/107	57/107	28/107	27/107
Comprehension	94%	89%	64%	98%	100%	92%
Verb & Sentence Test (Bastiaanse, Edwards, & Rispens, 2002)						
Sentence comprehension	18/40	18/40	21/40	37/40	32/40	22/40
Grammaticality judgment	35/40	33/40	0/40	38/40	39/40	18/40
Finite verbs	0/10	0/10	0/10	4/10	1/10	2/10
Infinitives	0/10	3/10	0/10	8/10	3/10	6/10
Sentence construction	0/20	0/20	0/20	8/20	0/20	1/20
Sentence anagram w/ picture	10/20	9/20	8/20	19/20	8/20	0/20
Sentence anagram w/o picture	10/20	15/20	5/20	17/20	5/20	0/20
Wh anagrams	1/20	2/20	0/20	19/20	8/20	0/20
Presence of AOS Characteristics (McNeil et al 1997; 2009)	AOS	AOS	AOS	AOS	no AOS	no AOS
Assessment of Intelligibility of Dysarthric Speech (Yorkston & Beukelman, 1981)						
Word Intelligibility - transcription	42%	50%	46%	94%	70%	74%

Note: Isolat. = Isolation; Trans. S. = Transcortical Sensory

Table 4

Effect Sizes: d-Index for Number of CIU Productions in Experimental Conditions

Condition/Phase	P1	P2	P3	P4	P5	P6
First Treated Picture Set						
End of Treatment	3.79	4.66	13.6	6.18	2.97	.92
Follow Up	5.11	6.76	14.47	3.69	1.89	.85
Second Treated Picture Set						
End of Treatment	-1.23	8.69	6.08	3.70	2.35	1.88
Follow Up	.58	19.45	9.43	16.19	6.05	2.27
Personal Recount						
End of Treatment	.37	-1.27	.97	-.14	.43	.81
Follow Up	-1.02	.29	5.02	.14	.96	1.66
Untreated Picture Set						
Follow Up	2.11	4.16	10.61	2.28	1.15	1.97

Note: CIU = correct information unit

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Table 5
Percentages of Words that Were CIUs by Probe Conditions

Condition/Phase	P 1	P 2	P 3	P 4	P 5	P 6
1st Picture Set						
Baseline min – max	53-79	15-27	2-14	28-46	23-52	23-37
Last three probe values of tx. phase	79, 79, 78	28, 32, 40	13, 10, 9	67, 60, 64	46, 46, 43	40, 37, 47
Follow up probe values	88, 69	28, 32	13, 13	62, 77	45, 45	40, 34
2nd Picture Set						
Baseline min – max	38-64	15-22	3-20	32-47	36-50	24-43
Last three probe values of tx. phase	100, 54, 88	31, 40, 43	9, 11, 12	67, 61, 63	46, 45, 42	38, 37, 59
Follow up probe values	92, 86	40-45	12, 13	71, 70	57, 49	46, 31
Personal Recounts						
Baseline min – max	38-100	10-22	3 – 16	28-52	14-58	5-60
Last three probe values of tx. phase	77, 43, 50	9, 13, 16	6, 16, 11	49, 52, 34	28, 48, 57	59, 37, 63
Follow up probe values	15, 36	40, 14	12, 12	47, 54	46, 38	41, 53

Note: CIUs = correct information units; tx. = treatment

Table 6

Home Conversations: Number of CIUs, Words, and Turns

Participant	Measure	Last Baseline	End of Phase 1	End of Phase 2	End of Phase 3	3 week post	6 week post
P 1	CIUs	84	38	29	58	na	na
	Words	234	102	66	132	na	na
	Turns	32	27	25	41	na	na
P 2	CIUs	21	26	16	11	13	14
	Words	82	65	55	60	67	154
	Turns	33	35	27	33	35	18
P 3	CIUs	14	13	24	22	19	27
	Words	69	79	98	117	78	139
	Turns	33	29	29	37	40	37
P 4	CIUs	46	131	108	77	86	114
	Words	141	250	188	196	208	197
	Turns	5	9	5	14	11	3
P 5	CIUs	30	35	42	45	17	21
	Words	66	67	64	84	19	62
	Turns	18	28	24	33	17	32
P 6	CIUs	73	59	95	60	50	103
	Words	191	166	140	143	174	191
	Turns	8	8	7	23	11	14

na = not available; CIUs = correct information units

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Figure Captions

Figure 1: Number of CIUs Produced In Experimental Conditions for Participant 1

Figure 2: Number of CIUs Produced In Experimental Conditions for Participant 2

Figure 3: Number of CIUs Produced In Experimental Conditions for Participant 3

Figure 4: Number of CIUs Produced In Experimental Conditions for Participant 4

Figure 5: Number of CIUs Produced In Experimental Conditions for Participant 5

Figure 6: Number of CIUs Produced In Experimental Conditions for Participant 6

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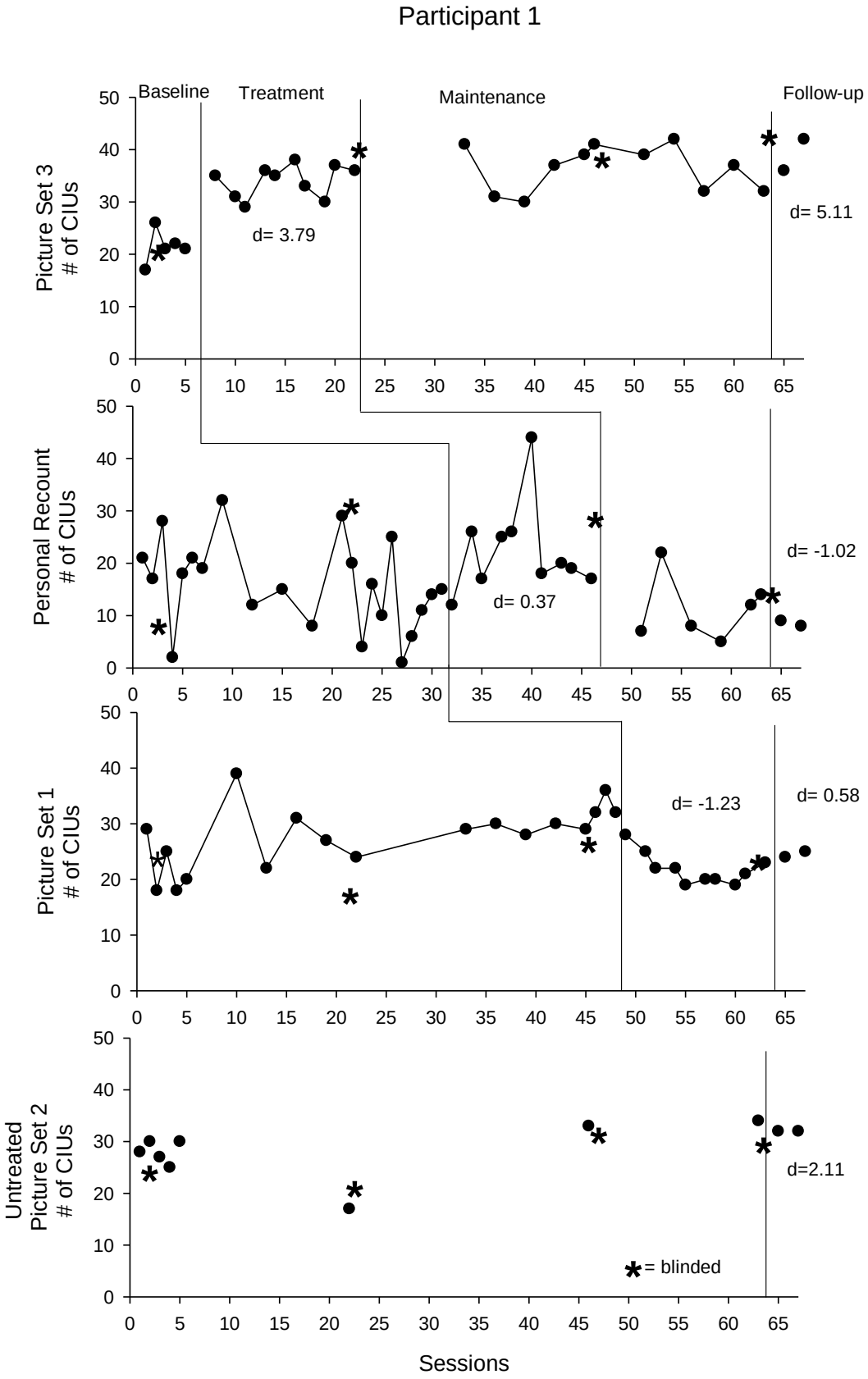

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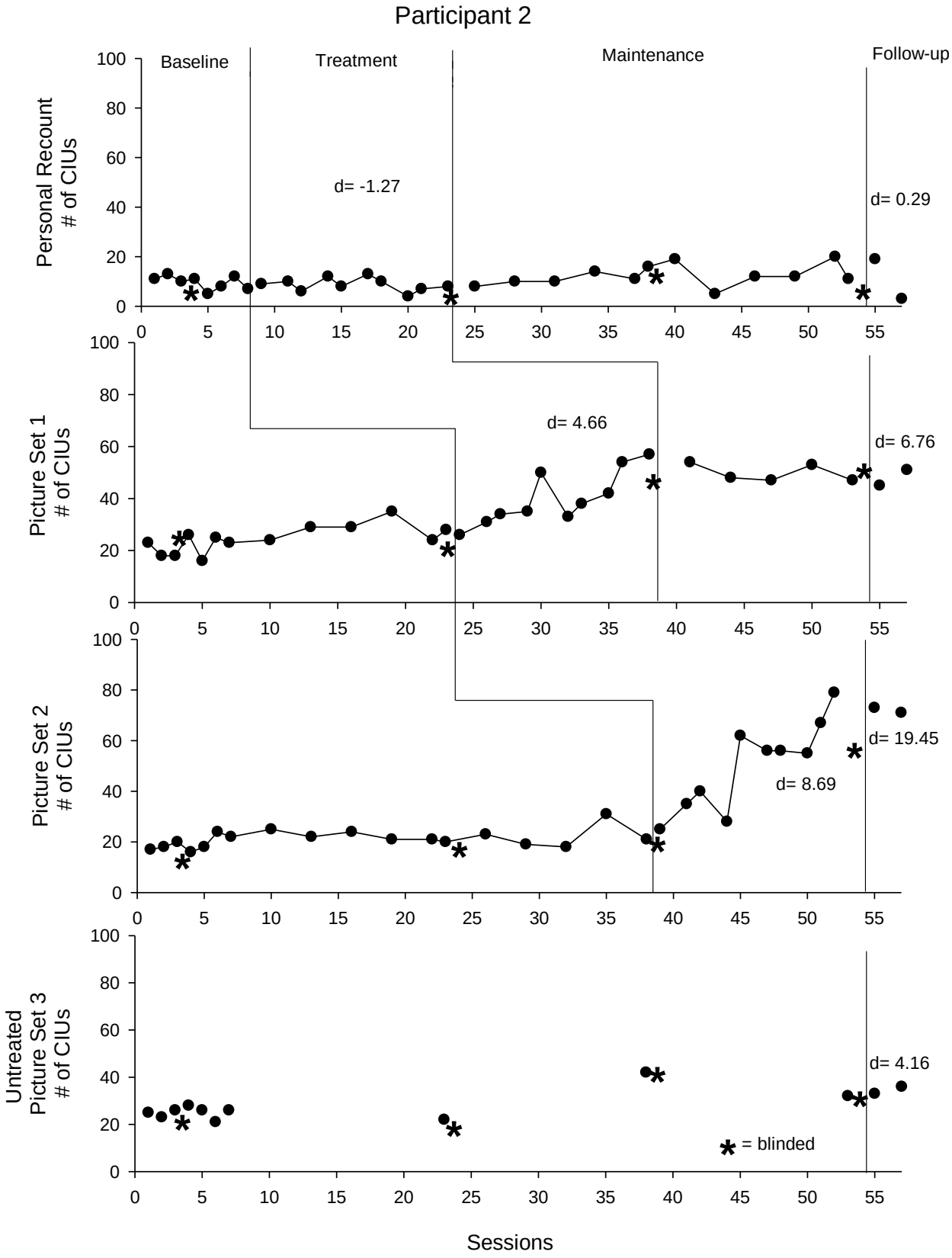

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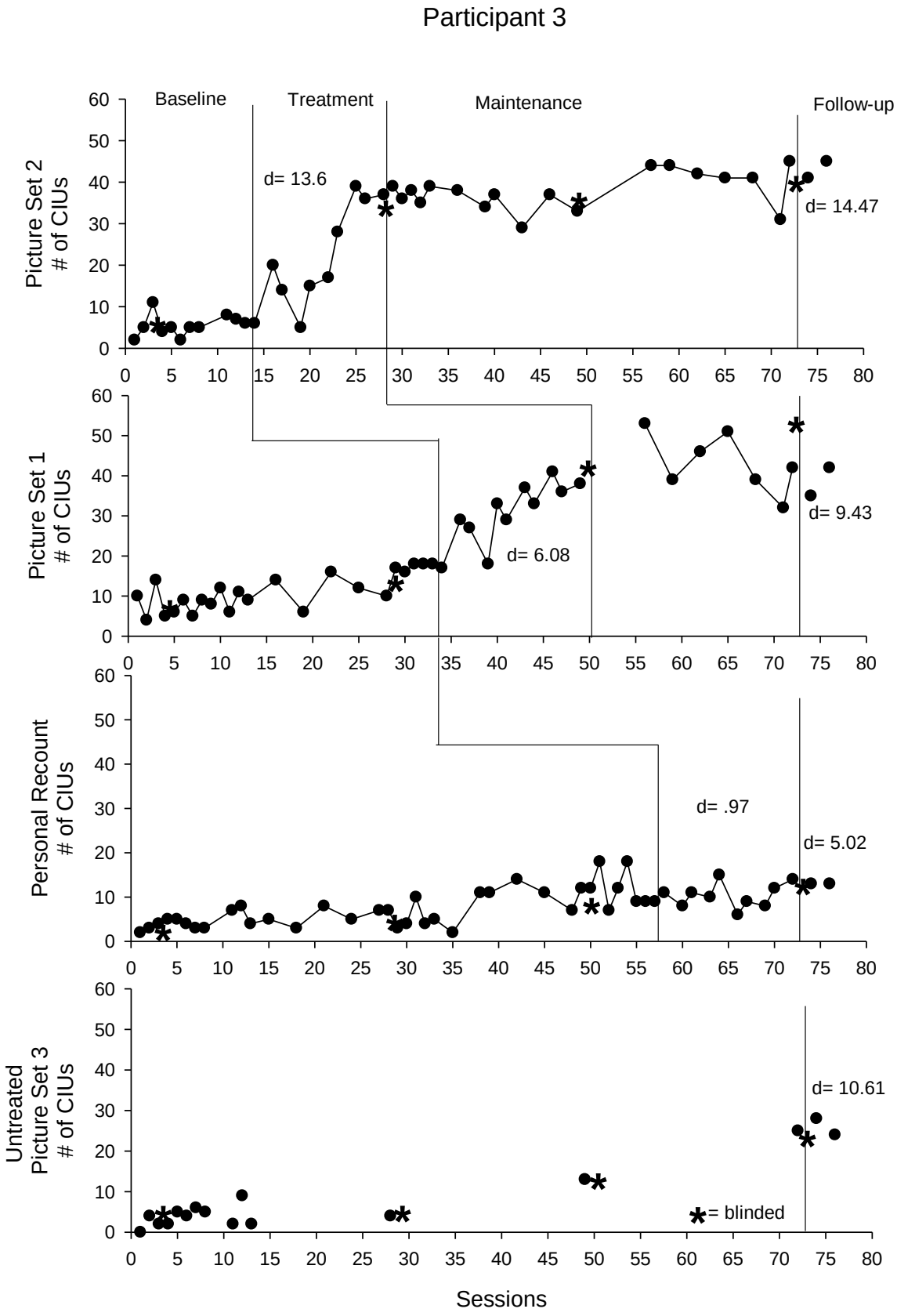

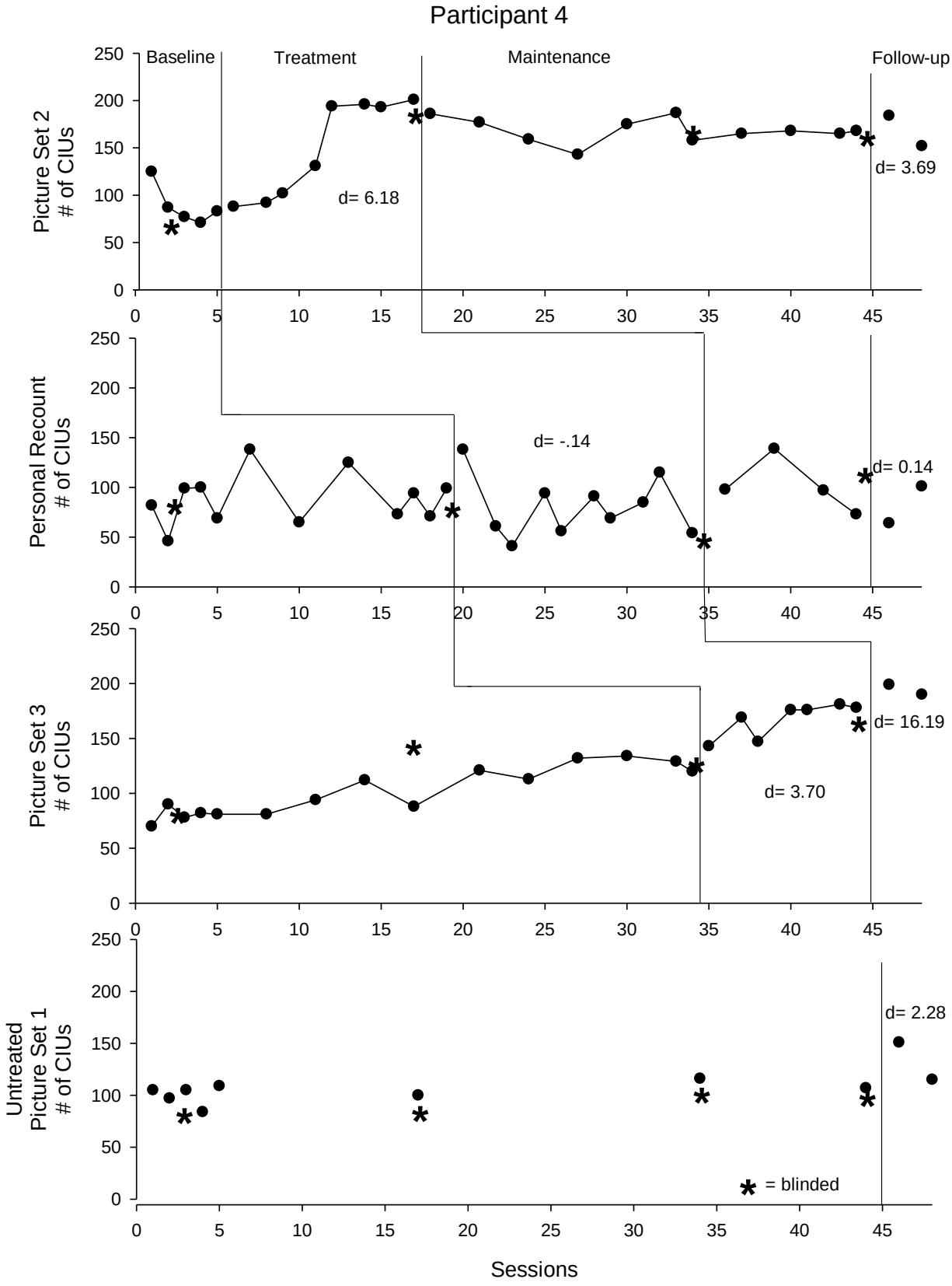

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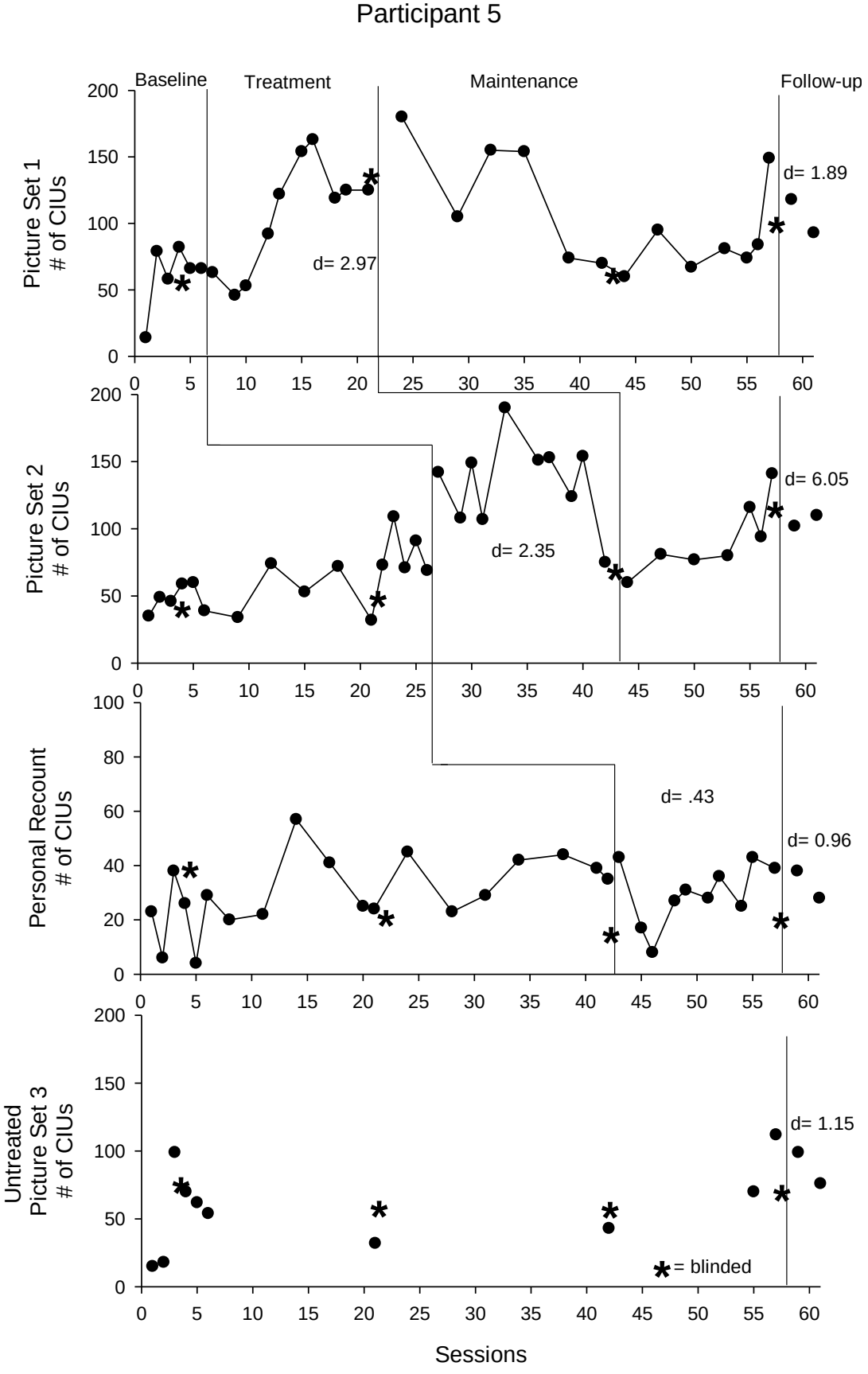

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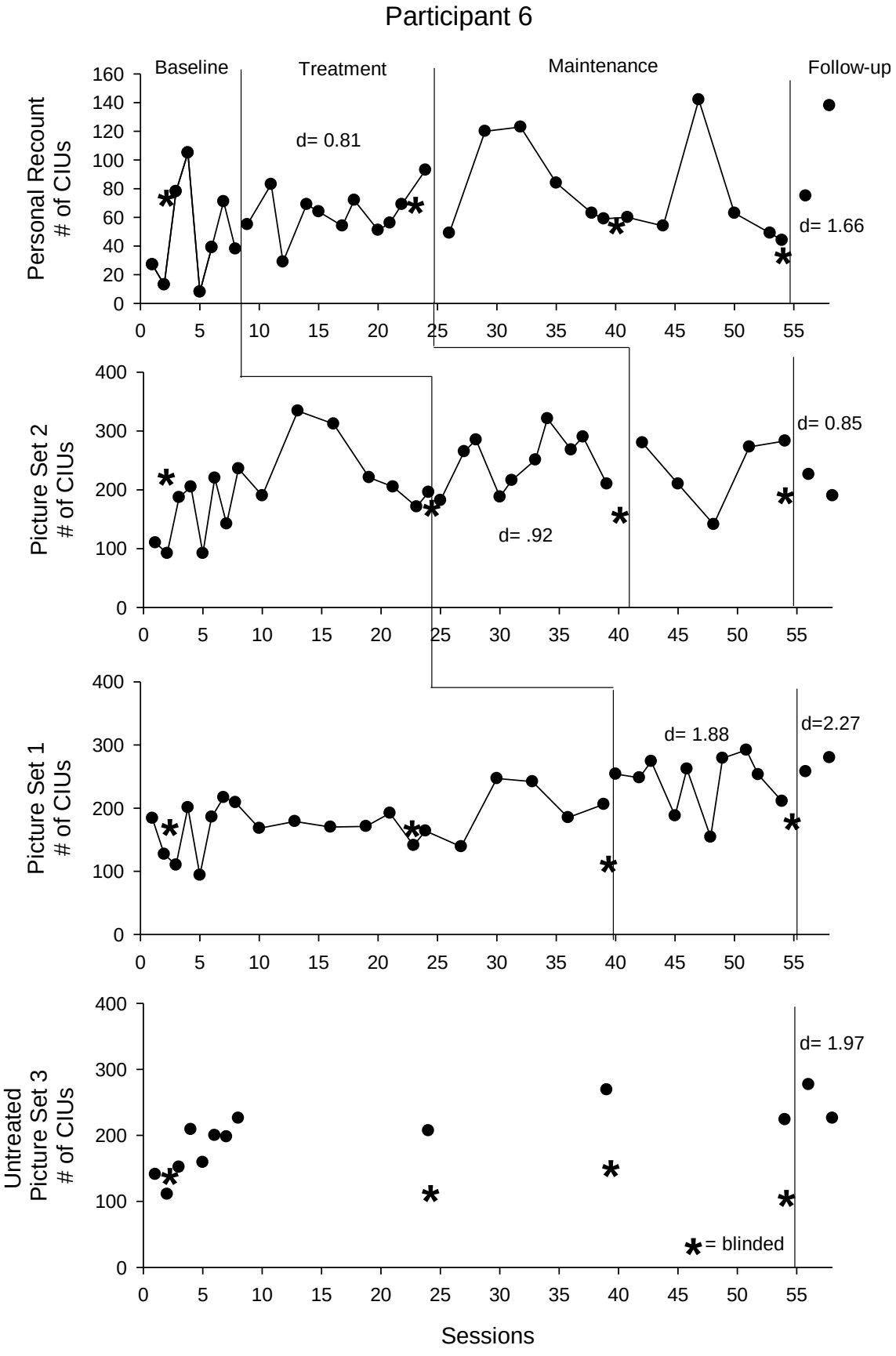

Appendix A

Brief Summary of RET Studies

Study/ Design	n	Type of Aphasia	Test Scores	MPO	DVs	Acquisition	Maintenance	Response Generalization	Stimulus Generalization
Kearns, 1985 MBD	1	Severe Broca's	PICA 10.65	36	relevant content words	Set 1 – positive Set 2 – positive	Set 1 - positive no follow up	Set 2 - 10-20%	not reported
Kearns & Scher, 1989 MBD & multiple probe	3	P1- C P2 -A P3 -B	WAB (PICA) P 1- 68.4(10.5) P 2 89.6(14.3) P 3 35.4(10.4)	P1-144 P2- 6 P3-20	content words	<u>P1</u> Sets 1&2- positive <u>P2</u> Sets 1&2- positive <u>P3</u> Sets 1&2- positive	<u>P1</u> positive at 2 & 3 month follow up for all sets <u>P2</u> positive at 2 wk follow up for all sets <u>P3</u> positive at 5 month follow up for all sets	<u>P1</u> Set 3 – w/ Set 1 tx - inconsistent w/ Set 2 tx – positive <u>P2</u> Set 3 – w/ Set 1 tx - none w/ Set 2 tx –positive <u>P3</u> Set 3- w/ Set 1 tx –positive w/ Set 2 tx –positive	<u>P1</u> <u>Other clinician</u> Sets 1&2—positive <u>Senior Center</u> Sets 1&2- positive <u>P2</u> <u>Other clinician</u> positive <u>Other speech tasks</u> positive <u>P3</u> <u>Other clinician</u> positive <u>Spouse</u> positive only at follow up but may have been confounded
Kearns & Yedor, 1991 MBD & ATD compared RET to convergent tx.; only RET results shown here	2	mod. Broca's	WAB P1-65 P2-61	P1-7 P2 - 37	content words & novel content	<u>PI</u> Sets 1&2- positive <u>P2</u> Sets 1&2- positive	<u>P1</u> Set 1 - positive f-up - positive <u>P2</u> Set 1 –positive f-up – positive f-up was 4 weeks post tx.	<u>P1</u> w/ set 2 tx- 10% Set 3- w/ set 1 tx- 20% w/ set 2 tx- 20% <u>P2</u> no r-gen to untrained set	<u>P1</u> <u>Other clinician</u> similar to acquisition <u>Elicited Speech Samples</u> after Set 1tx – no increase after Set 2 tx– positive <u>P2</u> <u>Other clinician</u> similar to acquisition <u>Elicited Speech Samples</u> no increases note: gen.samples possibly influenced by both txs.

Gaddie et al., 1991 MBD	3	Broca's	WAB 34.8-54.3 PICA 44th -64th %tile	13-108	content words efficiency novel words (in selected probes)	<u>P1</u> positive for both trained sets limited data provided	<u>P1</u> Set 2 - positive no f-up	<u>P1</u> w/ Set 2 tx- positive to two other sets w/ Set 1 tx - no additional gen.	na
Yedor et al., 1993 post-hoc qualitative analysis	9	post-hoc B =5 C=2 A=2 4 participants reported before	na	na	GQ = the improvement that occurred for trained stimulus and for untrained sets	na	na	overall, increases in untrained items were approximately 33% of trained; large range of performance across participants	na
Wambaugh & Martinez, 2000 & 2001 MBD	3	mod. – severe Broca's	WAB 37 29.8 54.4	P 1-12 P 2- 25 P 3 20	CIUs	<u>P1</u> Set 1- positive Set 2- no additional following gen. from Set 1 tx. <u>P2</u> Sets 2 & 3 – positive <u>P3</u> Set 2- positive	<u>P1</u> Sets 1&2-positive f-up – positive at 4 weeks post for both sets <u>P2</u> Sets 2 & 3 – positive f-up – positive at 4 weeks post but reduced <u>P3</u> Set2 – positive f-up – positive at 4 weeks for all sets	<u>P1</u> w/ Set 1 tx. – positive to two other sets w/ Set 2 tx. – positive to remaining set <u>P2</u> w/ Set 3 tx – positive to two sets w/ Set 2 tx – positive to remaining set <u>P3</u> w/ Set 2 tx – positive to two sets	<u>All participants</u> 5-15% increase in Personal Recount(PR) CIU's Tx effects in PR context varied from 5-50% additional gains
Conley & Coelho, 2003 ABA	1	mod.-severe Broca's	WAB 46.3	~96	object noun words	tx set positive	na	untreated set positive	na

Note: MBD = multiple baseline design, ATD = alternating treatments design, ABA = withdrawal design, C = conduction aphasia, B = Broca's aphasia, A = anomic aphasia, gen. = generalization, r.gen.= response generalization, mpo = months post onset, DVs = dependent variables, WAB = Western Aphasia Battery, PICA = Porch Index of Communicative Ability, tx. = treatment, f-up = follow-up, tx. = treatment, na= not available; mod. = moderate

Appendix B

Discourse Samples: Birthday Party Picture Descriptions (Nicholas & Brookshire, 1993)

Participant 1
woman mad because dog boy man boy another woman woman girl cake that's it

Participant 2
yes bye um Muffin Muffin no no no (stern inflection like saying "no" to a dog) my xxxxx dis um yeah um xxx (sound effect) um Muffin Muffin Muffin what xx xx xxx (sound effect) what is x x ess Muffin um what what um okay Muffin Muffin um x kaych cake cake yeah um um

Participant 3
oh okay doggie pi um eh um but um eh xxxx I don't know

Participant 4
Oh gosh that's so eww the dog was getting the cake and his birthday is five and uh-huh she's getting the cake but oh gosh! My mom is getting the dog with the broom and uh that kids are um um um uh the ki his mother and his er yeah and they was oh gosh so upset and they er yeah yeah and the dog er um put in that and cut it off yeah yup and uh the girls and boys they was happy because the mother cut that off hahaha

Participant 5
okay the clown was on xxx ku kid for a birthday party and it is and then the you got this (gesture bite) so (gesture swat) ayi no

Participant 6
well, here's a a begal or something and he is moved off of that to there and you can see he's invaded some pie and he's xxx spread it around to the floor house and uh just xxx is xxx to get lil get her take it and um xxx things are xxx xxx having to be regardless of xxx well that's it I guess

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Appendix C

Items Depicted in Picture Sets: Average Number and Standard Deviation of CIUs Produced per Picture by Comparison Groups

Picture/Action	Younger Comparison Group (20-44 years)		Older Comparison Group (50-73 years)	
	Mean CIUs	*SD* CIUs	Mean CIUs	*SD* CIUs
Set 1				
Biting	119.60	76.57	92.87	74.15
Climbing	62.53	33.32	87.27	95.24
Driving	71.00	67.35	76.67	66.87
Eating	65.20	42.10	66.60	68.68
Marching	88.93	86.26	72.93	79.26
Playing	76.13	89.39	79.40	70.91
Pushing	63.40	39.77	85.33	58.09
Riding	67.67	81.23	71.27	49.43
Swimming	46.27	30.16	64.13	48.77
Watering	51.33	28.81	60.60	39.75
Set 2				
Blowing	50.47	27.72	69.33	56.92
Building	81.80	66.11	85.47	101.39
Dancing	50.20	28.81	66.67	69.47
Dropping	66.93	43.08	70.53	85.61
Ironing	63.47	45.97	80.93	71.60
Melting	95.57	106.72	84.67	52.37
Reading	58.67	63.13	65.67	54.29
Ringing	68.87	60.06	80.20	79.94
Shaving	49.60	43.43	67.20	95.46
Watching	74.40	43.24	71.80	56.65
Set 3				
Bleeding	60.33	32.13	75.73	62.41
Bouncing	56.33	71.54	62.80	55.16
Cooking	76.07	75.88	84.00	66.95
Drinking	72.33	64.65	73.20	71.97
Painting	57.00	34.02	63.33	51.34
Sailing	59.47	24.86	92.73	73.60
Swinging	56.53	32.97	61.60	56.53
Typing	57.80	56.41	66.13	83.74
Walking	65.73	42.66	76.53	66.11
Waving	68.93	45.37	85.47	108.94

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Appendix D

Treatment Phase Probe Schedule: Picture Sets and Personal Recounts

Probes During Picture Set Treatments

Following treatment #:

2—Probe current treatment list

3—Probe Personal Recount

4—Probe current treatment list and next/previous treatment list

5—No probe

6—Probe current treatment list

7—Probe Personal Recount

8—Probe current treatment list and next/previous treatment list

9—No probe

10—Probe current treatment list

11—Probe Personal Recount

12—Probe current treatment list and next/previous treatment list

13—No probe

14—Probe current treatment list

15—Probe Personal Recount

16—Probe current treatment list and next/previous treatment list

17—No Probe

18—Probe current treatment list

19—Probe Personal Recount

20—Probe all conditions

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Probes During Personal Recount Treatment

Following treatment #:

1—No Probe

2—Probe Personal Recount

3—Probe Picture Sets ___ and ___

4—Probe Personal Recount

5—No Probe

6—Probe Personal Recount

7—Probe Picture Sets ___ and ___

8—Probe Personal Recount

9—No Probe

10—Probe Personal Recount

11—Probe Picture Sets ___ and ___

12—Probe Personal Recount

13—No Probe

14—Probe Personal Recount

15—Probe Picture Sets ___ and ___

16—Probe Personal Recount

17—No Probe

18—Probe Personal Recount

19—Probe Picture Sets ___ and ___

20—Probe all conditions (Picture Sets: 1, 2, 3 and Personal Recount)

Note: For probes 3,7,11,15 and 19, probe the two picture sets selected for treatment.

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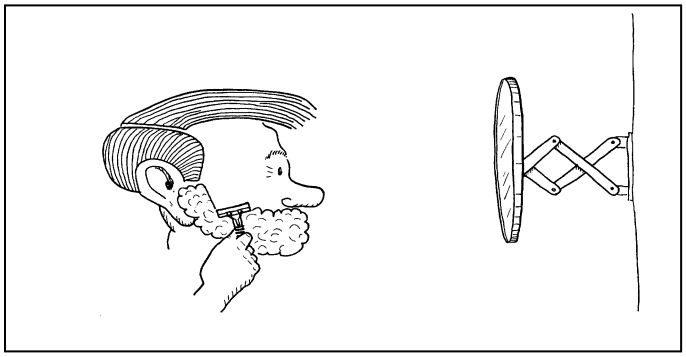
Appendix E

Modified Response Elaboration Training (after Wambaugh & Martinez, 2000)

Step 1. Present a picture (random order) with a prompt (e.g. "Tell me about this picture", "What does this remind you of?", "Tell me what's happening.").



A. Upon an appropriate response (any utterance related to the picture), go to Step 2
B. Upon an inappropriate or no response, verbally provide two response examples and request a response (e.g. "You could say something like *noun phrase* [hairy man] or *verb phrase* [shaves face]."; "You could say something like *noun + verb* [man shaves] or *verb phrase* [shaves beard]).

1) Upon an appropriate response, go to Step 2.
2) Upon an inappropriate or no response, provide a one word model and request a repetition (e.g., "Say *noun* [man]." or "Say *verb* [shaves]."

a. Upon an appropriate response, go to Step 2.
b. Upon an inappropriate or no response, use integral stimulation with a maximum of four attempts to elicit the noun or verb production (e.g., "Watch me, listen to me, say it with me…man"). Upon an appropriate response, go to Step 2. Upon an inappropriate or no response, present the next item.

Step 2. Repeat the participant's production and reinforce it. (e.g., "Man…great, that's a man". Go to Step 3.

Step 3. Request an elaboration of the production from Step 1. If possible, use a "wh" question. (e.g. `What's happening with the man?').

A. Upon an appropriate response, go to Step 4.
B. Upon an inappropriate or no response, model two response examples and request a response (e.g. "You could say something like noun phrase [foamy face] or verb phrase [shaves beard].")

1) Upon an appropriate response, go to Step 4.
2) Upon an inappropriate or no response, provide a one word model and request a repetition (e.g., "Say *noun* [beard]." or "Say *verb* [shaves]."

a. Upon an appropriate response, go to Step 4.

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b. Upon an inappropriate or no response, use integral stimulation with a maximum of four attempts to elicit the noun or verb production (e.g., "Watch me, listen to me, say it with me…shaves"). Upon an appropriate response, go to Step 4. Upon an inappropriate or no response, present the next item.

Step 4. Reinforce the participant's production from Step 3 and model a phrase/sentence that combines the participant's productions from Steps 1 and 3 (e.g. `Right, shaves. Man shaves.") Go to Step 5.

Step 5. Model the combined production again and request a repetition.

A. Upon a correct response (all target words produced intelligibly), request three repetitions of the utterance using integral stimulation as needed. Go to Step 6.

B. Upon an incorrect or no response, attempt to elicit four productions of the target utterance, using integral stimulation. Go to Step 6 following correct or incorrect productions.

Step 6. Remove the picture, wait for approximately five seconds, return the picture and request that the participant again describe the picture.

A. Upon production of the entire elaborated utterance, reinforce the production and go to the next item.

B. Upon production of a partial elaborated utterance, reinforce the production, model the entire elaborated utterance, and requested a production with integral stimulation. Go to the next item.

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