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Effects of Repetition and Rate/Rhythm Treatments for Acquired Apraxia of Speech

Numerous therapies have been shown to have positive effects in the treatment of acquired apraxia of speech (AOS) (Wambaugh, Duffy, McNeil, Robin, & Rogers, 2006). All of the treatments that have been developed for AOS have been comprised of a combination of techniques (Wambaugh et al.). Only recently have investigators begun to examine components of treatment (e.g., Austerman Hula, Robin, Maas, Ballard, & Schmidt, 2008) or to compare treatments (Brendel & Ziegler, 2008; Rose & Douglas, 2006).

An element of treatment that is common to all AOS therapies is repeated practice (Wambaugh et al., 2006). Repeated practice has been demonstrated to be a critical aspect of nonspeech motor learning (Schmidt & Lee, 2005), and is likely to be crucial in the rehabilitation of AOS. Additionally, if treatments or treatment components are to be compared, it is important to understand the contribution of repeated practice to treatment effects.

The purpose of this investigation was to examine the effects of repeated practice treatment on sound production accuracy in speakers with AOS. The study was also designed to determine if the addition of rate/rhythm control to treatment provided further benefits (after maximal improvements were achieved with repeated practice treatment).

Five speakers with chronic AOS and agrammatic aphasia served as participants. Findings from five other participants with AOS were reported previously (presentation reference omitted for anonymity) and this investigation represents additional indirect replications. Previous findings indicated strong positive effects of repetition treatment for all participants with limited additional benefits from the addition of rate/rhythm treatment.

Method

Participants

Five adults with chronic, moderate AOS and agrammatic aphasia served as participants. All demonstrated speech behaviors that were consistent with AOS diagnostic criteria described by McNeil et al. (1997; 2009). The participants were native-English speakers, passed hearing screenings and demonstrated performance within normal limits on a test of nonlinguistic intelligence.

As shown in Table 1, all participants were male, ranged in age from 33 to 60 years and were 15 to 357 months post stroke.

Experimental Design

A combined ABCA and multiple baseline across behaviors and subjects design was employed with each participant.

The experimental design was selected to allow examination of the effects of repetition treatment ***alone***, with treatment continuing until maximum gains were achieved. Following a period of five probe sessions with no additional improvements, rate/pacing treatment was ***combined*** with repetition treatment to determine if additional improvements could be obtained.

For each participant, five lists of target items were devised and randomly assigned to the following conditions:

List 1 – repetition treatment, then rate/pacing control ***plus*** repetition treatment

List 2 – repetition treatment only, simultaneously with Set 1

List 3 – repetition treatment, then rate/pacing control ***plus*** repetition treatment; application delayed

List 4 – ***no*** treatment, probed daily

List 5 – no treatment, probed at end of treatment phases

Following a baseline phase (A), repetition treatment (B) was initiated with Sets 1 and 2. Treatment continued until pre-established criteria were met. Rate control ***plus*** repetition treatment (C) was then applied with Set 1 while repetition treatment only continued with Set 2. Then the preceding treatment sequence (B - C) was applied with Set 3, with repetition treatment continuing with Set 2.

Follow-up probes were completed at 4 and 8 weeks after cessation of all treatment. Please note that P10 is currently completing the final phase of treatment.

Experimental Stimuli

Experimental stimuli were as follows: P6 - bi-and trisyllabic words with word initial clusters and word final fricatives/affricates, P7 (E) - ; P8 (P) - ; P9 - bi- and trisyllabic words containing clusters, and P10 – bi- and trisyllabic words containing clusters.

All lists were carefully selected and balanced for each participant and will be described in more detail for the presentation. There were 20 items per list for each participant.

Dependent Measures

Probes of accuracy of production of target items were conducted in baseline and throughout the treatment phases. The items in each set were randomized and the participant was asked to produce the word as accurately as possible following the examiner's model. No feedback or instruction was provided during probes. Productions were scored for accuracy on-line and were audio-recorded for verification purposes. Percentage of accuracy was calculated for each set of items. Probes were conducted at the start of daily sessions, prior to the application of treatment for the day.

Treatment

Repetition treatment consisted of presenting the target item verbally and requesting the participant to produce the item 5 times in succession. Only ***general*** feedback about the accuracy of the grouped productions was provided (e.g., "those all sounded perfect", "there were a few sound errors", etc.).

Rate/pacing control treatment entailed provision of a verbal model of the item by the examiner and repeated practice (as above) of the item with hand-tapping in time to a metronome. The metronome was set to a rate that approximated a fifty percent reduction in the participant's typical rate of production. Again, only general feedback was provided.

In each treatment session, two sets of stimuli underwent treatment. The order in which the sets were submitted to treatment was counterbalanced. The 20 items in the treatment set were presented in random order, with this process completed a total of three times. Then a 10-30 minute break was taken prior to treatment being applied with the remaining set.

Treatment was continued in each phase until 1) 90% accuracy in two consecutive probe sessions was achieved, or 2) no gains were achieved for five probe sessions following the highest level of probe performance (if at least 10 treatment sessions had been completed).

Additionally, if performance reached at least 85% accuracy with repetition treatment ***only***, then rate/pacing treatment was not applied (i.e., the "C" phase was omitted for that set of items).

Results

Results are shown Figures 1 – 5 for Participants 6 – 10. The plotted data in each graph represent accuracy of production of target items for that list *during probes*. Effect sizes were calculated for each phase of treatment and d-index statistics are displayed on the graphs.

For the repetition treatment phases, Participants 7, 8, and 9 demonstrated clear gains in accuracy of articulation for all applications, with effect sizes ranging from d=3.75 to d=12.7. Participants 6 and 10 demonstrated minimal improvements with the application of repetition treatment, although modest positive effect sizes were achieved (i.e., d=1.59 – d= 4.35).

No additional gains were observed with application of rate/rhythm treatment for Participants 6 and 10. However, Participants 7 and 9 achieved additional gains with the addition of rate/rhythm treatment (d=1.97 – d=3.8). Participant 8 did not receive rate/rhythm treatment because he achieved at least 85% accuracy of production with repetition treatment alone.

Gains of approximately 30% and 40% accuracy were observed for Participants 7 and 9, respectively, for the untreated items that were probed frequently (List 4 items). The other participants did not demonstrate gains with the untreated, frequently exposed list.

Improvements in production of untreated items in the lists that received limited probing (i.e., List 5), were minimal for all participants.

Discussion

Findings for three of the participants were similar to our previously reported results. However, different results were found for two participants, who demonstrated minimal gains with both repeated practice treatment and rate/rhythm control. Positive and negative treatment effects will be discussed relative to participant characteristics and models of speech learning/production.

References

Austermann Hula, S. N., Robin, D. A., Maas, E. Ballard, K. J., & Schmidt, R. A. (2008). Effects of feedback frequency and timing on acquisition, retention, and transfer of speech skills in acquired apraxia of speech. *Journal of Speech, Language, and Hearing Research*, 51, 1088-1113.

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Wambaugh, J. L., Duffy, J. R., McNeil, M. R., Robin, D. A., & Rogers, M. (2006). Treatment guidelines for acquired apraxia of speech: Treatment descriptions and recommendations. *Journal of Medical Speech Language Pathology, 14(2),* xxxv-ixvii.

Table 1

Participant Descriptive Data

Participant	Gender	Etiology	Age	MPO	WAB-AQ	PICA - Overall	Aphasia Type-WAB
P6	M	CVA	60	124	51.6	47th %ile	Broca's
P7	M	CVA	54	35	64.8	55th %ile	Broca's
P8	M	CVA	33	15	24.8	40th %ile	Broca's
P9	M	CVA	56	28	73.7	66th %ile	Broca's
P10	M	CVA	52	357	40.6	43rd %ile	Broca's

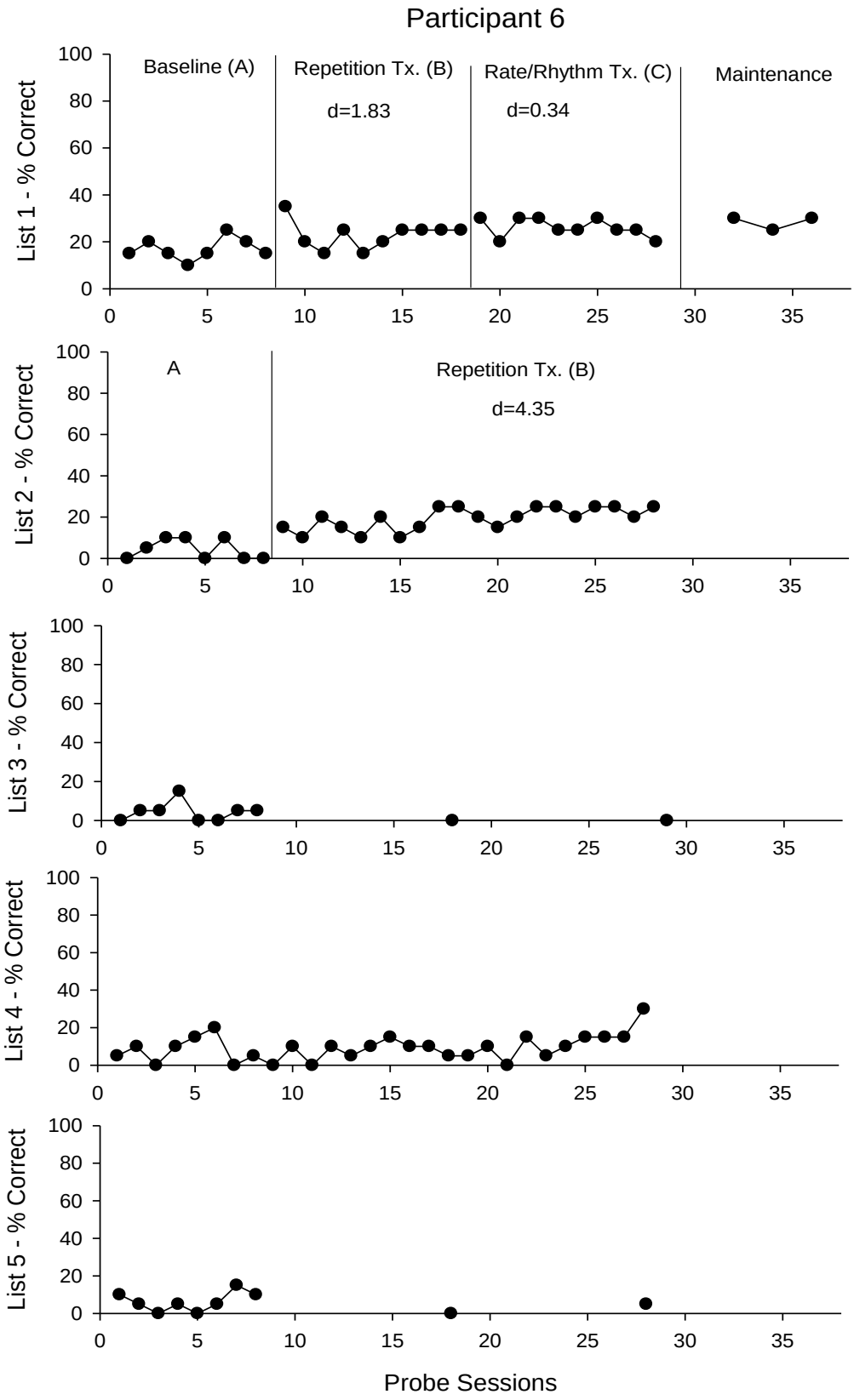

Figure 1. Accuracy of production of target items in probes for Participant 6.

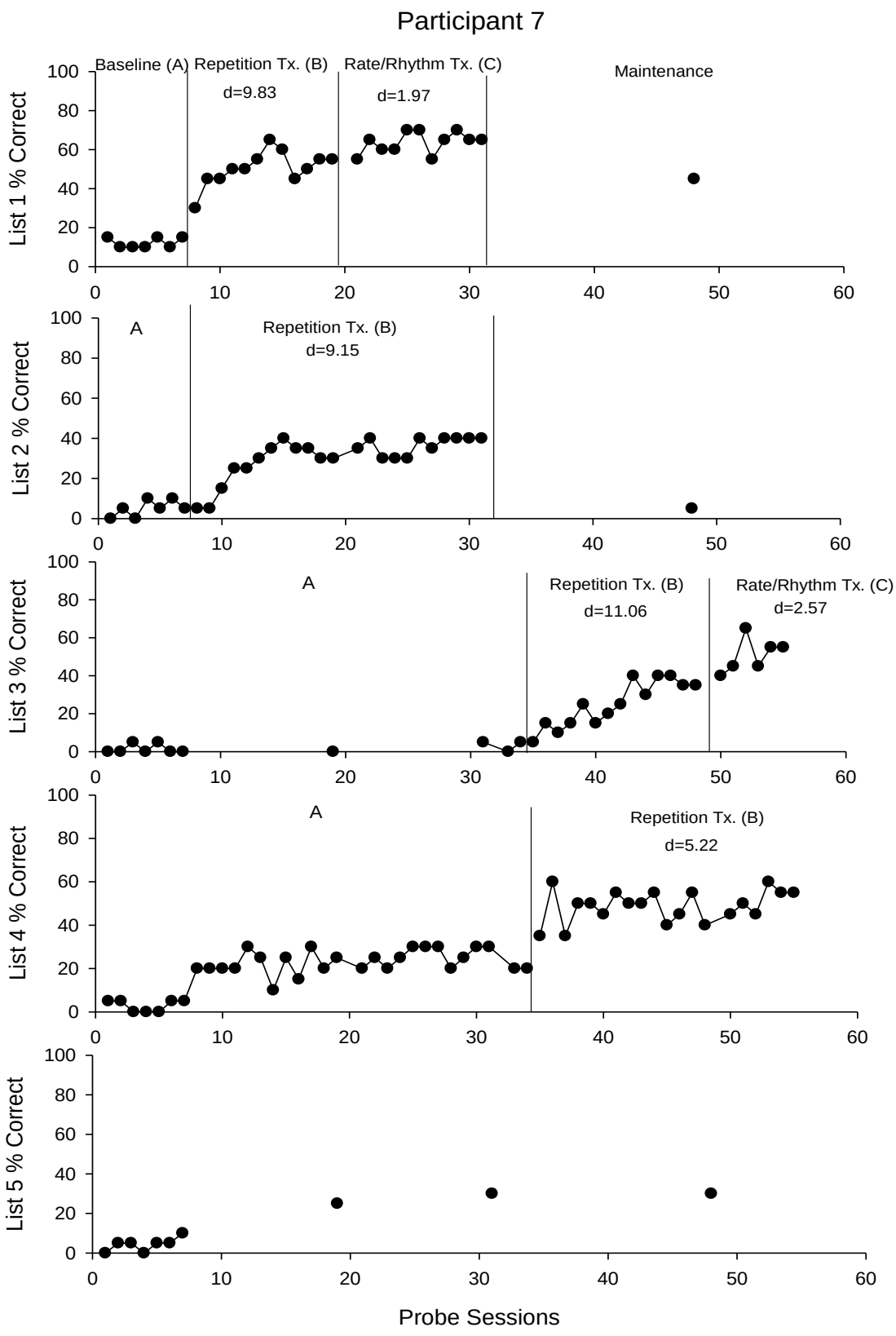

Figure 2. Accuracy of production of target items in probes for Participant 7.

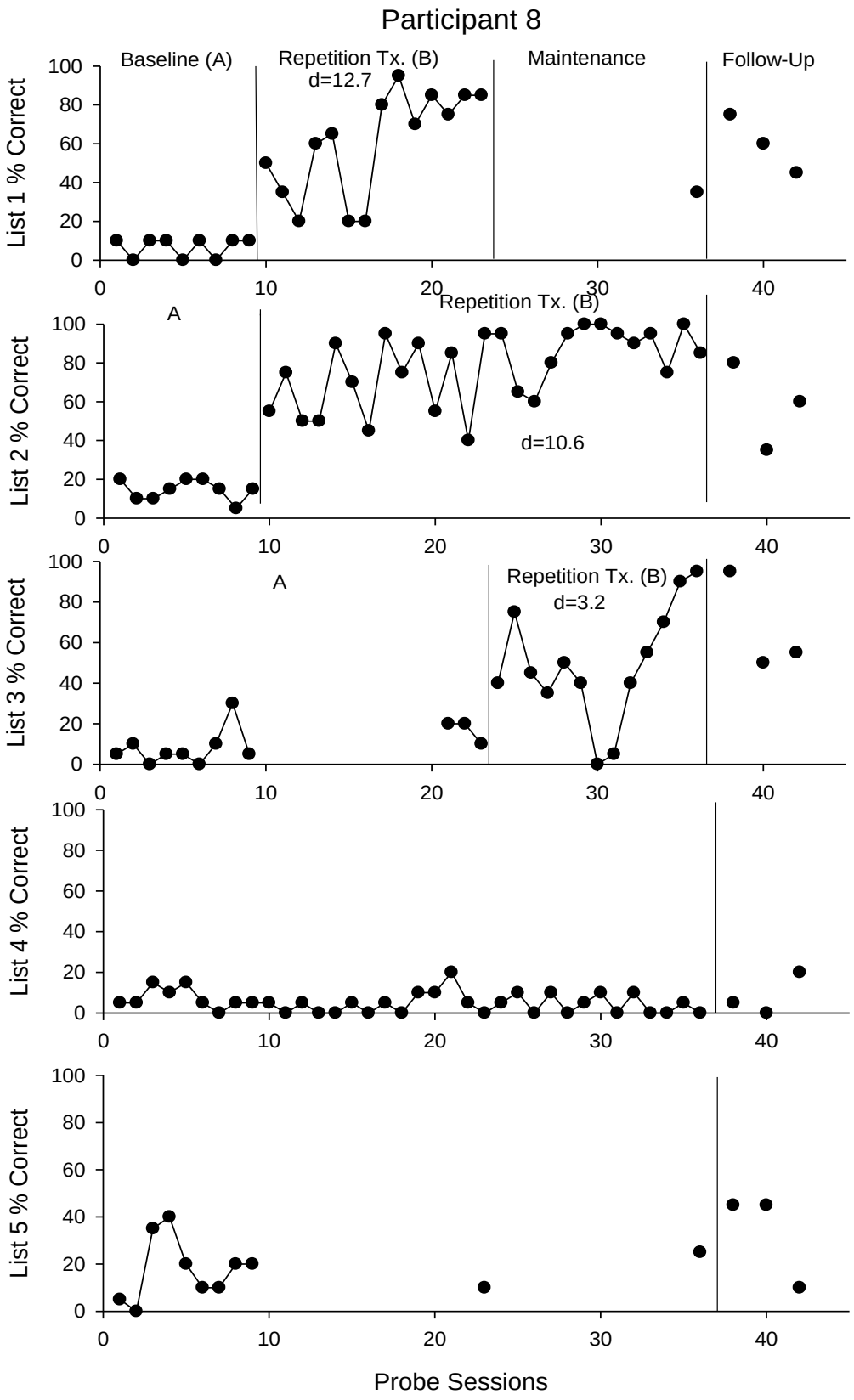

Figure 3. Accuracy of production of target items in probes for Participant 8.

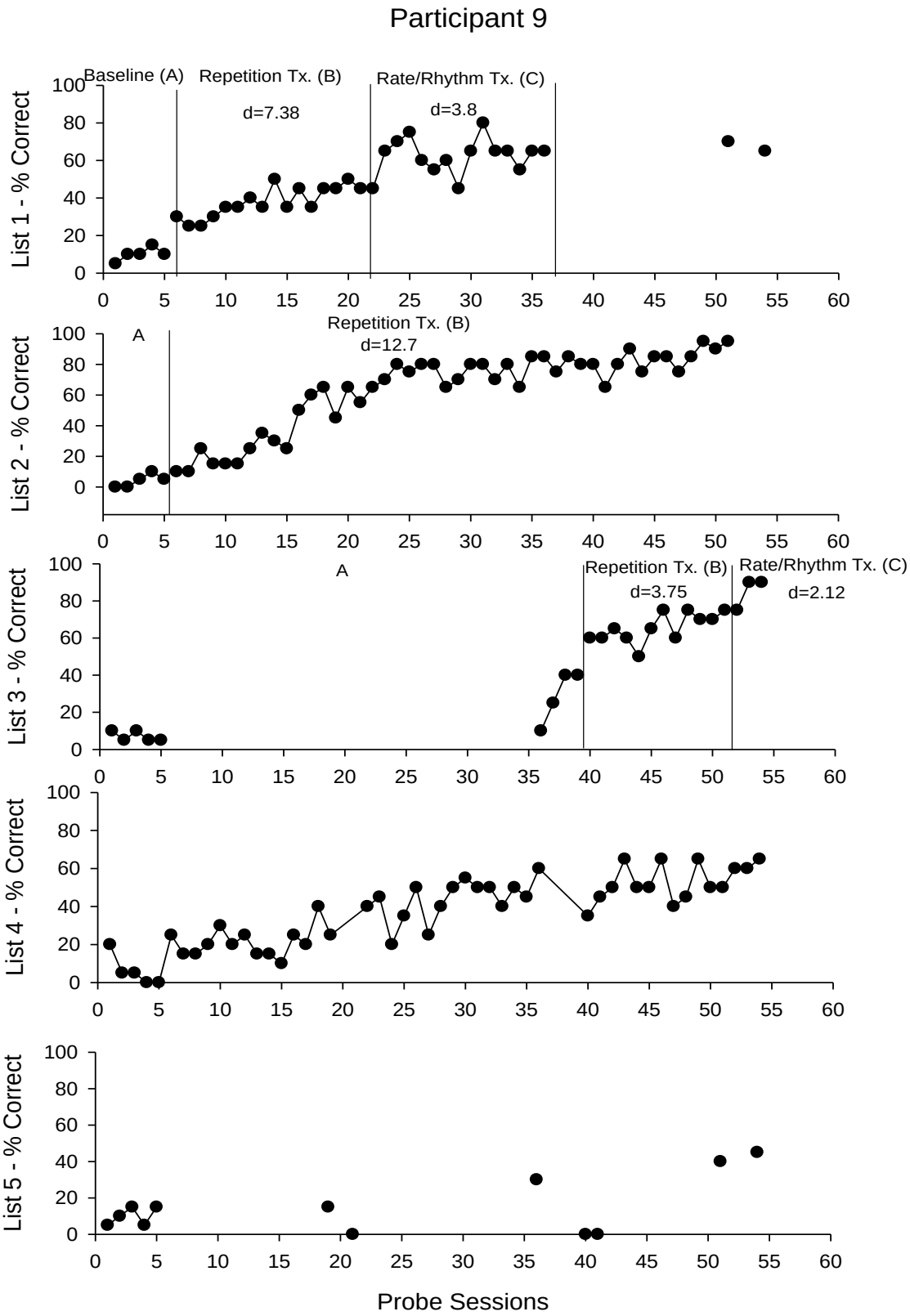

Figure 4. Accuracy of production of target items in probes for Participant 9.

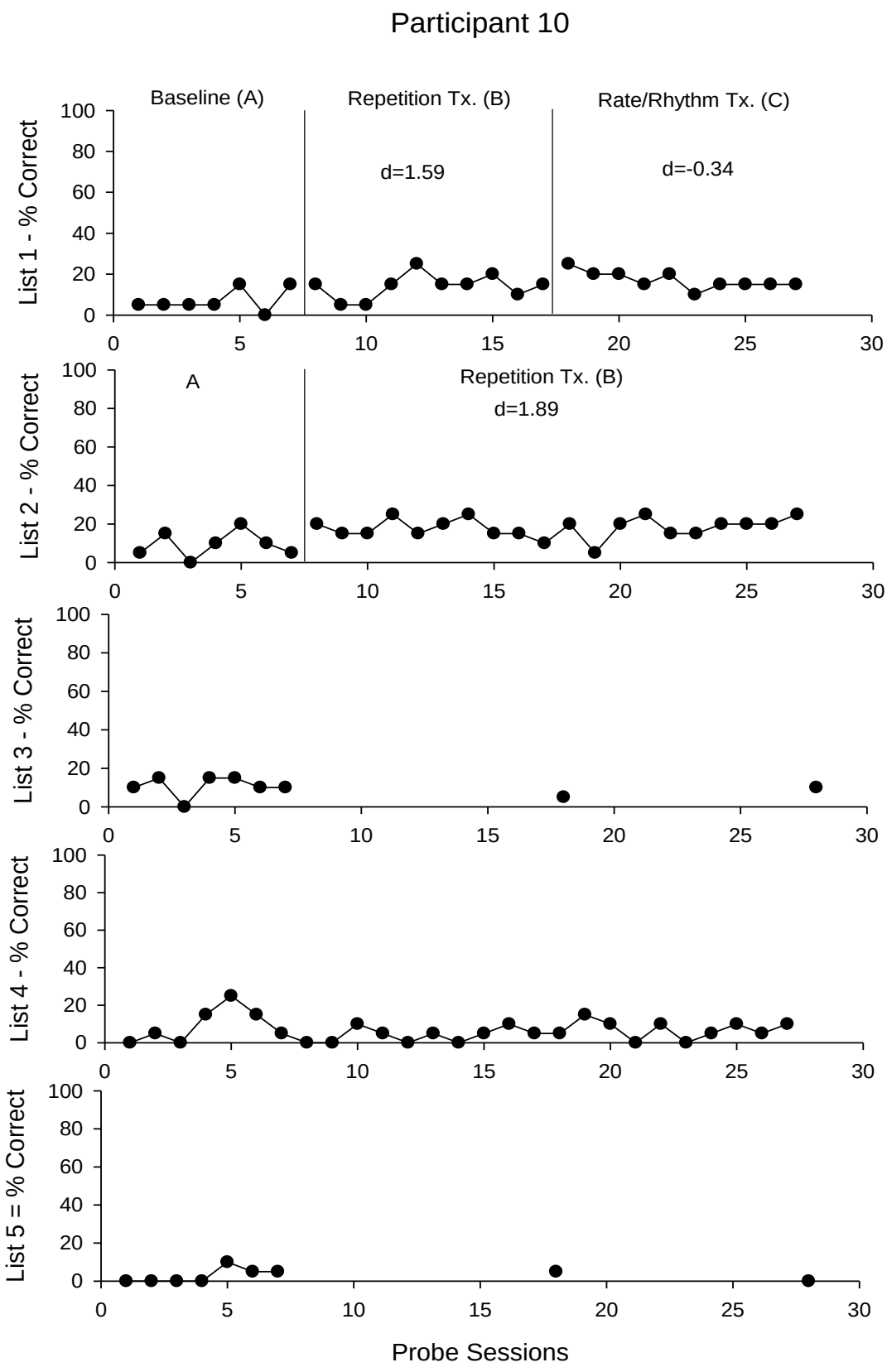

Figure 5. Accuracy of production of target items in probes for Participant 10.