A Comparison of Naturalistic and Analog Treatment Effects in Children with Expressive Language Disorder and Poor Preintervention Imitation Skills

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Abstract: The participants in this study were 4 children diagnosed with Expressive Language Disorder who displayed poor imitation skills, with scores significantly below typical levels on the Sentence Imitation subtest of the *Test of Language Development-2: Primary* (Newcomer & Hammill, 1988). The purpose of this study was to compare the treatment effects of both naturalistic (conversational recast) treatment and analog treatment in these participants. The results indicate that children with poor preintervention imitation skills required higher numbers of analog presentations to establish production of the language structures than was observed under the naturalistic treatment. Clinical implications of these results are discussed.

Various language intervention methods are currently available to clinicians treating children with disabilities, including analog imitation treatment methods (i.e., Connell & Stone, 1992) and more naturalistic, conversational recast treatment methods (i.e., Camarata & Nelson, 1992; Camarata, Nelson, & Camarata, 1994; Nelson, Welsh, Camarata, Butkovsky, & Camarata, 1995, 1996). Camarata et al. reported individual differences in response to these types of interventions and suggested that intervention methods be tailored to individual child characteristics, but no specific methods for doing this were provided. In a retrospective study of didactic and milieu teaching, Yoder, Kaiser, and Alpert (1991) found that developmental language level was a predictor of differential treatment effects in children with developmental delays, suggesting that preintervention parameters may be useful for initial selection of intervention methods.

Given the wide use of analog methods as a primary (i.e., Connell, 1987; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993) or secondary (Kaiser, Yoder, & Keetz, 1992) component of language intervention, preintervention levels of imitation competence may be a potentially useful parameter for predicting intervention outcome. As mentioned above, imitation is a commonly used intervention procedure. Connell proposed that imitation tasks are well suited to treatment of children with specific language impairment (SLI) because these tasks involve structured production and support access and practice of the rule-based system of language within clinically controlled contexts. Both Lovaas and McEachin et al. proposed that intensive intervention be based on behavioral interventions that include extensive imitation and prompting. This proposition has been supported by studies in which children with disabilities were enrolled in imitation-based analog treatment, resulting in successful outcomes. Connell attributed such improvement to a basic difference in children who develop language normally and those who do not. He concluded that children who are learning language typically will be most successful in a training situation that simulates natural language learning (see also Nelson, 1989) but that children with disabilities require decontextualized presentation coupled with imitation practice to support language learning. Lovaas and McEachin et al. provided similar arguments, discussing analog treatments as an important component of delivering effective behavioral intervention.

In contrast, Koegel, O'Dell, and Koegel (1987) and Camarata et al. (1994) have argued that intervention that parallels more naturalistic methods can be more effective in treating children with disabilities. For example, Camarata et al. reported that children with language impairment who were enrolled in conversational recast treatment and in imitative treatments (with order of treatment type randomly assigned) learned generalized use of grammatic and/or

syntactic targets treated under the conversational condition with, on average, fewer clinician presentations than those treated through imitative methods. Meta-analysis (Delprato, 2001) indicated a consistent advantage for naturalistic intervention when directly compared to analog treatment.

A likely source for these disparate findings is heterogeneity in the population of children with language disorders. Although such children share the characteristic of reduced verbal output, their other strengths and weaknesses vary (Leonard, 1998). When discussing the relative merits of differing treatments for language disorders, one potentially important parameter is the preintervention imitation skill of the child with disabilities. Some children readily imitate on request, but others may refuse to imitate or require specialized training to learn how to imitate (as described in Lovaas, 1987). This suggests that preintervention imitation skills may be a predictor of treatment efficiency in children with disabilities. Imitation skills are routinely included in many preintervention assessments for expressive language (Camarata, 1991). Examples of standardized imitation measures include the *Carrow Elicited Language Inventory* (CELI; Carrow, 1974) and the Sentence Imitation subtest of the *Test of Language Development–2: Primary* (TOLD-2:P; Newcomer & Hammill, 1988). These standardized measures require imitation of sentences in the absence of meaningful context, a milieu that is similar to the initial phases of many analog interventions. This information is therefore often readily available to clinicians providing language intervention to children with disabilities. Any relationship between preintervention imitation skills and subsequent treatment effects under analog and/or naturalistic intervention is thus potentially very useful.

Thus, this investigation was designed to compare the effects of imitation treatment and conversational recast treatment on children with expressive language disorder (ELD) who demonstrated poor preintervention imitation skills. Cumulative growth curves were constructed for each child to illustrate the efficiency of each treatment condition. For this purpose, a more efficient treatment is defined as one in which fewer clinician presentations of the target structure are required before the child uses the target structure in an unprompted context (conversely, a less efficient treatment is one in which a greater number of clinician presentations and prompts are required before the child's target use). This relationship was explored using data collected as part of a larger study of treatment efficacy (Camarata et al., 1994; Nelson et al., 1996).

Table 1. Participant Description

			TOLD-2:P		
Participant	Gender	Age	SI	LQ	Leiter IQ
A	girl	6:8	6	106	103
B	boy	4:3	6	94	110
C	boy	4:4	4	85	87
D	boy	6:5	4	76	92

Note. *Age is presented as Years:Months;* Test of Language Development–2: Primary *(TOLD-2: P; Newcomer & Hammill, 1988) scores are presented for Sentence Imitation subtest (SI;* M = *10,* SD = *3) and Listening Quotient (LQ;* M = *100,* SD = *15).*

Method

PARTICIPANTS

Participants for the present investigation were selected on the basis of preintervention testing in which they received low scores (one and one-half deviations or more below the mean; standard score equivalent < 78) on the Sentence Imitation (SI) subtest of the TOLD-2:P. Participants included in this project were four children (3 boys, 1 girl), ranging in age from 4 years 3 months to 6 years 8 months (M = 5 years 5 months), who were identified as having ELD by meeting all of the following criteria (adapted from the *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition* [*DSM-IV*]; American Psychiatric Association, 1994; Stark & Tallal, 1981): (a) having expressive language skills were a minimum of 1.5 standard deviations below the mean on one or more expressive subtests of the TOLD-2:P and significantly below expected levels for mean length of utterance (MLU) on spontaneous language samples gathered with the mother (as per MLU norms); (b) passing an audiometric screening prior to the onset of testing and training (25dB @ 500, 1000, 2000, & 4000 Hz); (c) performing within the normal range (84–116) on the *Leiter International Performance Scale* (Arthur, 1952); (d) having no reported history of frank neurological trauma or impairment; and (e) having no reported history of emotional disturbance. In addition, to determine each child's receptive language skills, comprehension was assessed using the revised *Test for the Auditory Comprehension of Language* (TACL-R; Carrow-Woolfolk, 1985) or the Listening Quotient from the TOLD-2: P. One of the participants scored more than 1.5 deviations below the mean on this measure. However, comprehension level was not used to exclude participants. Therefore, these children also met the *DSM-IV* description for Expressive Language Disorder (American Psychiatric Association, 1994). Participant information is presented in Table 1.

TREATMENT PROVIDERS AND OBSERVERS

Initial testing, language sampling, and treatment for this study was provided by licensed speech-language patholo-

gists (SLPs) or graduate students enrolled in a speech-language pathology degree program under the supervision of a licensed SLP (hereafter referred to as "clinicians"). Treatment scoring was completed by SLPs, graduate students in speech-language pathology, or undergraduate students with specialized training in the procedures utilized in this study.

PROCEDURES

The following procedural description parallels what was published in the original report of the results of the larger study from which these data were drawn (Camarata et al., 1994).

Target Selection

Samples of mother–child conversation in free play were taken once at the child's home and once in the clinic setting prior to onset of treatment. Transcriptions of these samples following the procedures of Miller (1981) were used as the basis for calculating MLU for the children and for determining the children's use of syntactic structures before intervention in their conversations with their mothers and with the clinicians. MLU is calculated by determining the average length of a child's utterances in morphemes from a language sample (# of morphemes/# of utterances). Each language sample included a minimum of 100 spontaneous productions.

Targets for training were totally absent from the preintervention sample and for grammatical morphemes to be included in these samples, they must have been omitted in a minimum of three obligatory contexts. Also, any forms that were absent from the spontaneous samples were probed using elicitation procedures to ensure that these were indeed absent from the child's system. The probes were similar to the dynamic assessment procedures presented by Olswang, Bain, and Johnson (1992): Grammatical morphemes were probed using a cloze procedure, and complex sentences were probed using a combination of elicitation questions and indirect modeling (see Olswang et al., 1992, Table 1, p. 203). For example, to probe for a grammatical target such as irregular past tense, the clinician would act out a scene with a baby doll. The clinician would demonstrate that the doll was eating, while saying, "Eat, eat, eat. Yummy." Then the clinician would have the doll stop eating. The clinician would then look at the child and say, "All done! What did she do? She . . ." providing the child the opportunity to complete the sentence with the word "ate." All developmentally appropriate targets (i.e., below those expected at the child's age level) were probed, and missed, a minimum of five times with this procedure in order to be included in the treatment procedures. Actual targets included grammatical morphemes and complex sentence structures that met the above criteria. In addition, in order to control for developmental language level, the targets included in training for any individual child were not more than one of Brown's stages (Miller, 1981) apart from one another. To further enhance experimental control, the targets that met the above criteria were randomly assigned to either of the training conditions (naturalistic or analog). Actual targets for each participant are presented in Table 2.

Training Procedures

The training procedures included analog treatment and naturalistic conversational recast treatment conditions. The details of these procedures, including setting, activities, and reliability, are provided below.

Analog Treatment

Imitative procedures used in this study were similar to those used in programs such as the Monterey Language Program (Gray & Ryan, 1973) and the analog treatments used by Lovaas (1987) and by Connell and Stone (1992) within their model plus prompt procedure. In the present analog treatment condition, the child was required to imitate the target following a clinician model and prompt. The model and prompt were paired with an appropriate picture or object stimuli, and verbal and/or token reinforcers

Table 2. Target Assignment with Examples

Participant	Imitation treatment	Conversational recast treatment
A	relative clause *Here's one that's blue.*	passive *The ball was kicked by the boy.*
B	regular third-person singular *Girl walks*	irregular past tense *Boy ate*
C	infinitive with different subjects *I want you to go.*	wh-noninfinitive *I know who called.*
D	relative clause *Here's one that's blue.*	inverted wh-questions *When did you leave?*

were delivered following correct responses. Feedback was provided following incorrect responses.

After the child reached criterion on this phase of treatment, defined as 90% accuracy, treatment shifted to a prompting phase in which appropriate pictures or objects were provided, and the child was prompted to label accordingly, without the clinician providing a model of the target. These prompts included directions such as "Tell me about the boy," which could be used to prompt the present progressive tense (-ing) with the desired response "He is running." As in the earlier phase of treatment, reinforcers were given for correct responses, and feedback was given following incorrect responses.

Throughout analog treatment sessions (regardless of whether the child was receiving clinician models paired with prompts, or prompts only), opportunities were given for the child to engage in play with toys outside of the imitation and prompting tasks. These breaks in treatment gave the clinician the opportunity to see if the participant would produce the target without prompting, which would imply that generalization of the targets was emerging.

Naturalistic Training

The conversational activities were derived from the theoretical perspectives of Koegel et al. (1987) and Nelson (1977, 1989) and directly replicated from the procedures presented in Camarata and Nelson (1992), Camarata et al. (1994), and Nelson et al. (1996). In this condition, the clinician structured the setting in a manner designed indirectly to elicit child attempts of the target. For example, when the present progressive was targeted, the setting would include toys such as cars, movable figures, trains, baby carriages, and other objects that are likely to be used for ongoing play activities. These play activities included naturalistic interaction between the child and clinician and could include open-ended statements by the clinician to encourage the child to verbalize (e.g., "Tell me about these toys," "Tell me what happened"; see Miller, 1981, pp. 9–12). However, no imitative prompts or tangible reinforcers were delivered within this condition.

Following a child production that omitted the target, the clinician delivered a "growth recast" (Nelson, 1989) that included the target incorporated in a reply that recast basic semantic information from the child's utterance. For some children, this response may act as a "natural reinforcer," as discussed in Koegel et al. (1987), given that responsiveness and adult attention to the child's utterance can be viewed as reinforcing the communicative act. As an example, assume that the target for a child is the auxiliary form ("to be" verb used before -ing verb, as in "He *is* running"), that the setting has included items such as those described above for the present progressive, and that the child has said, "Car going." In response, the clinician would deliver a growth recast: "Yes, the car is going." If the child said, "Cars going," the clinician would respond, "Yes, the cars are going." Complex sentences treated under this condition were presented using similar procedures.

The training context was constructed to elicit attempts and to support production by the child. For example, the context for relative clause (modifies the subject, as in "Here's one *that's blue*") training included several items that were similar in many dimensions but different with regard to minor details (e.g., Fisher-Price™ figures that were similar in terms of gender but different with regard to attire, such as some wearing hats, different colors of clothes, or scarves). While playing with these figures, the child would often comment on the activities of the figures, which the clinician would then use as a platform for the recast. For example, if the child was playing with two figures (one with a hat, one without) and commented, "The woman is going into the house," the clinician recast would be the relative clause form, "The woman who's wearing a hat is going into the house."

For the grammatical morphemes and for the complex sentences, the recast retains the semantic base of the child's core utterance while providing a model of the target form. Within this kind of presentation, it is likely that the child is attending to the context (because the child initiates the interaction and provides the sentence that serves as the base for the adult recasts). The recast thus provides a direct contrast to the child's own sentence structure but can be detected because it is also directly contiguous to and similar to the child's production (Nelson, 1989). Given that all targets studied were absent before intervention, all the recasts for each child met the definition for "growth" recasts by providing structural additions to the child's preintervention language system.

SETTINGS AND TRANSCRIPTIONS

Two 50-minute language therapy sessions were completed each week in a 2.5 × 3.0 m clinic room. This room contained a small table and chairs and decorations appropriate for children. All sessions were recorded on color videotape. Each session was divided equally between the imitation treatment and the conversational recast treatment with order counterbalanced across sessions. Participants' use of intervention targets and clinicians' presentations of target forms was coded from the videotapes of the sessions. Clinician presentations under both treatments were defined as any clinician production of the target structures. Additional clinician behaviors coded were requesting imitation, prompting production, delivering recasts, and providing verbal or token reinforcers.

For the purpose of the present study, child productions of the intervention targets were defined as correct uses of the targets during any portion of the treatment session. These productions were subclassified as either prompted (in the case of responses to imitation treatment) or elicited. Elicited productions occurred without explicit

clinician prompting and could occur in both imitation treatment and conversational recast treatment. For example, if the clinician were targeting relative clauses, any production of a relative clause (e.g., "The truck that has broken wheels got stuck") during either the treatment of the relative clause or treatment of the child's other target was classified as elicited. The present investigation addresses only these elicited productions and is not concerned with prompted productions, which would occur only during the imitation treatment condition.

INTER- AND INTRAJUDGE MEASUREMENT RELIABILITY

Direct comparisons of independently prepared transcripts for 10 of the language sampling sessions indicated that interobserver agreement for target selection (i.e., identifying a target as absent) was 92%. Comparisons of independently transcribed analyses of 10 treatment sessions (20% of the total sessions included in this investigation) were also completed. Interobserver agreement for child target production during treatment of absent targets was 82%, whereas agreement for identifying clinician presentations (prompts, presentations, and recasts) was 99%. For the measurement of clinician presentations prior to each of the child's elicited productions, interobserver correlation was 0.81.

Results

CUMULATIVE GROWTH CURVES

Cumulative growth curves were plotted for each participant and are presented in Figure 1. The curves show the number of clinician presentations of each target in its respective treatment condition (analog or naturalistic) prior to each of the child's elicited productions of the target during the treatment session.

Consistent differences existed between the two interventions across children, with naturalistic intervention producing target productions with fewer presentations than analog treatment. Although the differences between the two treatments were most modest for Participant A, whose growth curves for analog treatment and naturalistic treatment crossed at the junction of 250 target presentations (by the clinician) and 10 elicited productions (by the participant), it is notable that this participant crossed the threshold of 5 elicited productions after only 67 target presentations under the naturalistic treatment, whereas she required 245 target presentations under the analog treatment condition to reach this same level of elicited target usage. Thus, this participant required more clinician presentations under the analog treatment condition to elicit targets than in the naturalistic treatment in the beginning of the treatment period.

Participant B demonstrated a consistent pattern of difference between the two treatments early in the treatment period. This participant reached the threshold of 5 elicited productions after 35 target presentations under the naturalistic treatment but required 244 target presentations under the analog treatment condition to reach this same level. Participant A eventually reached similar levels of production for both treatments, but Participant B maintained consistent differences between treatments.

Like Participants A and B, Participant C initially required a greater dose of analog treatment to yield elicited target productions. There was an initial advantage for naturalistic in the initial phase of treatment. And ultimately, like Participant B, this participant showed more elicited productions of the target assigned to naturalistic treatment with fewer clinician presentations.

Participant D exhibited the most striking contrast in his response to the two treatments. For the target assigned to naturalistic treatment, this participant began producing elicited productions almost immediately (after only 3 clinician presentations of the target) and continued producing them regularly throughout treatment. For the target assigned to analog treatment, his first elicited production occurred after 150 clinician presentations and was only observed one more time during the course of treatment (after 229 clinician presentations had been provided). Thus, all four participants demonstrated an initial advantage for naturalistic intervention, and Participants B, C, and D maintained a consistent difference across treatments.

Discussion

For these participants, each of whom showed poor preintervention imitation skills, naturalistic treatment was a more efficient therapeutic procedure than analog treatment. It is notable that Camarata et al. (1994) and Nelson et al. (1996) reported main effects favoring conversation-based intervention in children with ELD, regardless of preintervention imitation levels. These results were discussed by Snow, Swisher, McNamara, and Kiernan (1996), whose review concluded that the Camarata et al. study (from which these data were drawn) provided convincing evidence that nonimitative treatments can be a successful means of teaching grammatical and syntactic structures. Such success was attributed to differences in learning styles among children with disabilities. In analog training paradigms, it is hypothesized that the target being trained is more salient than in conversation because it is stripped of meaningful context. However, this requires the trainee to pragmatically match the trained target to natural production through inference. This additional demand may eclipse the hypothesized advantage of increased salience, particularly for children who do not imitate known language structures well (see Camarata, 2000, for a discussion), creating a distinct advantage in naturalistic treatment because such de-

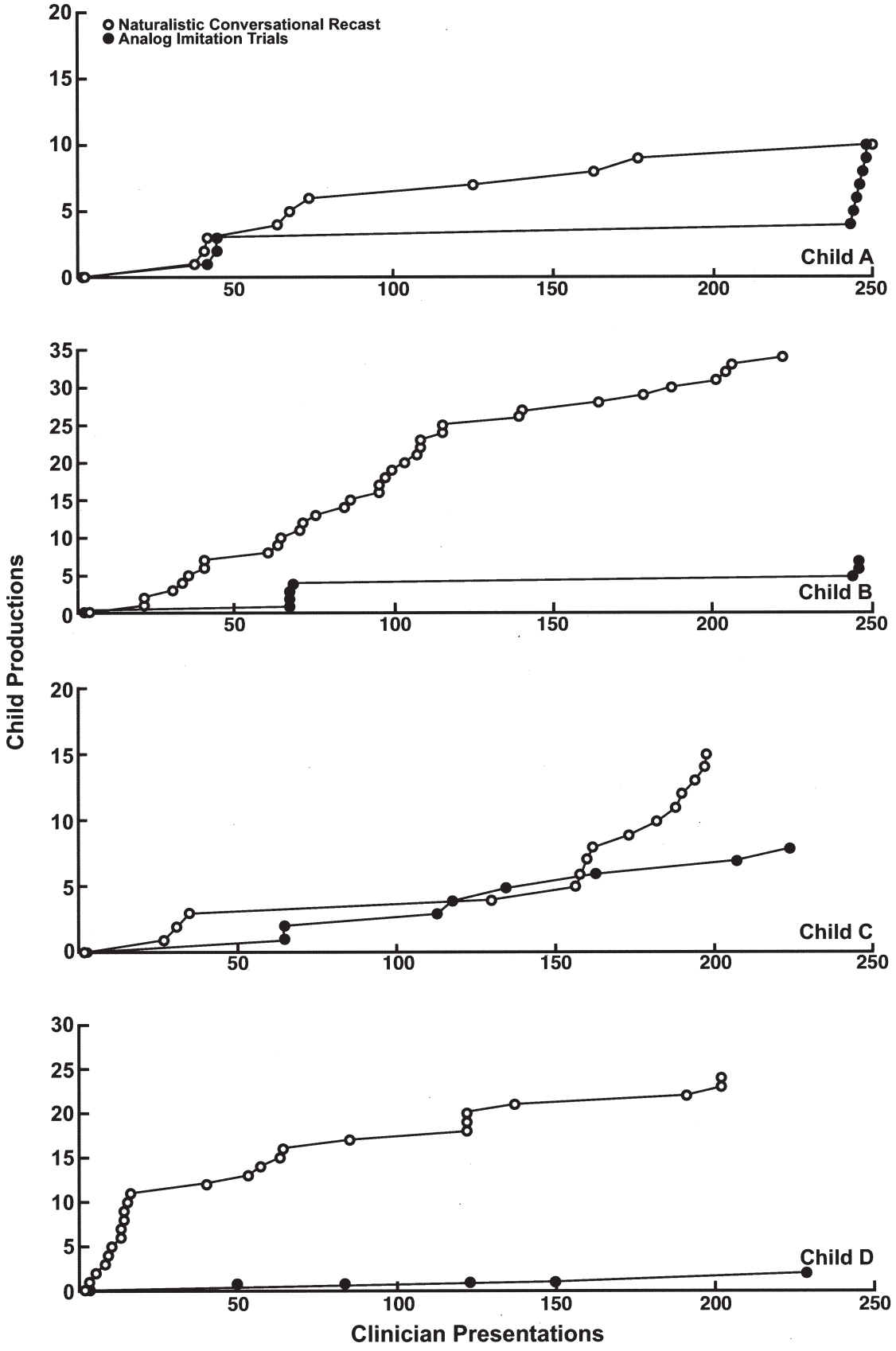

Figure 1. Cumulative growth curves for participants.

mands for mapping pragmatic parameters are reduced. These results support other recent findings. Koegel, Koegel, and Surratt (1992) reported that many children with language learning disabilities are not good candidates for imitation-based intervention, contrary to some intervention programs that recommend analog treatment for all children with disabilities (Lovaas, 1996). Recent meta-analysis (Delprato, 2001) yielded similar conclusions in a sampling of 10 controlled studies that compared the effectiveness of analog and naturalistic interventions used to teach language to children with autism. Naturalistic procedures were consistently more effective for teaching language to such children.

These results are not consistent with those of Connell and Stone (1992), who found that the participants in their studies were more successful in an analog, imitative treatment condition. This discrepancy may be associated with methodological differences in gathering dependent measures. For example, Connell and Stone's condition for spontaneous use was very similar to the training task. Because of this, the imitation condition itself may be considered a closer match to the outcome measure in Connell and Stone's methods. It is also possible that individual differences (such as imitative proficiency) among the participants in these studies yielded different results, although no effort to exclude poor imitators was explicitly claimed in either of these studies. Perhaps more important, the results of the current study suggest that imitation methods are not well suited to all children with disabilities.

The observed association between testing and treatment effects in this study provides a rationale for clinicians to consider the results of individual standardized measures to determine the child's strengths and weaknesses prior to selecting the most appropriate treatment program. It is important that clinicians appreciate that a child's lack of proficiency in imitation is likely to limit the effectiveness of imitation-based procedures for that child (see also Koegel et al., 1992). Future research in this area is warranted in order to determine whether this relationship between preintervention skills and treatment outcomes can be replicated and whether this finding extends to other children with language impairments (e.g., those with concurrent diagnoses, such as other types of developmental delays). In addition, assessment methods other than imitation available on standardized instruments, such as cloze procedures and nonimitated elicited production, should be examined to determine whether such tasks are also significant predictors of treatment effects.

Future research is also needed to determine which developmental profiles are best treated with naturalistic intervention procedures. Although the results of the present study indicate that children with poor pretreatment imitation skills are not good candidates for analog treatment, Camarata et al. (1994) reported a main effect for naturalistic treatment for all children with language disabilities, regardless of initial levels of imitation ability. Given these positive effects for naturalistic treatments, one avenue for future research should focus on whether there are conditions that might favor analog treatment.

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AUTHORS' NOTES

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