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Parent-implemented natural language paradigm to increase language and play in children with autism

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Abstract

Three parents of children with autism were taught to implement the Natural Language Paradigm (NLP). Data were collected on parent implementation, multiple measures of child language, and play. The parents were able to learn to implement the NLP procedures quickly and accurately with beneficial results for their children. Increases in the overall rate of vocalizations were observed for all three children with a shift from imitative language at the beginning of intervention to spontaneous language at the end of intervention. Clear improvements in play were observed for two of three children while ceiling effects were observed for a third child who already played effectively. In response to a social validity questionnaire, parents indicated that they found the study useful and the NLP procedures simple to implement and that that they would continue to use NLP at home following the conclusion of the study.

Keywords: Autism; Parent training; Language; Play; Spontaneous; Natural language paradigm

Naturalistic teaching strategies were developed to facilitate spontaneous speech acquisition and generalization to the natural environment (Charlop-Christy & LeBlanc, 1999) Consistent with the guidelines of Stokes and Baer (1977) and Stokes and Osnes (1989), these interventions incorporate several features designed to enhance generalization. Varied reinforcers and multiple exemplars are used throughout intervention and learning opportunities occur in natural play settings to create a teaching environment that is highly similar to the target performance environment (LeBlanc, Esch, Sidener, & Firth, 2006). These strategies also focus on development of functional relationships between spoken words and access to reinforcers

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(i.e., requests or mands) such that a spoken utterance results in access to something related to that utterance rather than an arbitrary preferred stimulus.

Koegel, O'Dell, and Koegel (1987) developed the natural language paradigm (NLP), a specific naturalistic teaching strategy, as an alternative to highly structured discrete-trial based language instruction for non-verbal children with autism. They compared experimenter-implemented NLP to an analogue, discrete-trial baseline condition and found notable increases with NLP in immediate and delayed imitative utterances, increases in spontaneous utterances and new words, and production of utterances outside of the clinic setting. A subsequent study by Laski, Charlop, and Schreibman (1988) investigated the effects of NLP when implemented by parents and found similar beneficial effects. Laski et al. taught parents to implement NLP by discussing the procedures, modeling for two sessions, and conducting in vivo training with immediate and then delayed feedback. All parents successfully learned to implement the procedure and found the procedure enjoyable. NLP was associated with a rapid increase in the number of intervals in which children produced vocalizations compared to a free play baseline. Recent studies have incorporated NLP into a broader-scope, multi-component empirically supported intervention referred to a Pivotal Response Training (PRT) without focusing specifically on the effects of NLP as a stand alone intervention (Koegel, Koegel, & Brookman, 2003; Koegel, Koegel, Harrower, & Carter, 1999; Koegel, Koegel, & McNerney, 2001).

The current study is a replication of Laski et al. (1988) investigating parent implementation of NLP. The effects on language are examined as well as the effects on appropriate play, which has not previously been reported in the literature. Additionally, a detailed examination of accuracy and error patterns of parents during training and implementation of NLP is presented.

1. Method

1.1. Participants and setting

The participants were three children with autism with little to no spontaneous language and their mothers. Diagnoses were conferred by independent evaluators and confirmed by local school systems and additional confirmatory support for diagnosis and language skills was obtained by having the parents complete the Gilliam Autism Rating Scale (GARS; Gilliam, 1995) and administration of the Peabody Picture Vocabulary Test, Third Edition (PPVT-III; Dunn & Dunn, 1997).

Caleb was a 5-year-old Caucasian boy with many clearly understandable words and the ability to imitate any word or simple phrase. He could ask for a small number of preferred items and name over 100 items or actions with prompts. He used some spontaneous language, however, this language was often delayed echolalia or exclusively about trains. His age equivalence score on the PPVT-III was 4 years 11 months indicating average receptive language functioning and his GARS score was 95 indicating characteristics similar to the average child with autism. NLP was used to expand play and verbal repertoires to toys other than trains. Caleb's mother was a 34-year-old, married, stay at home mom with a high school education.

Garrett was a 4-year-old Asian American boy who babbled frequently and spoke a few words. He could imitate 1–2 word phrases and spontaneously request 5–10 items. However, Garrett rarely spoke during play without prompting. He was untestable on the PPVT-III and his GARS score was 106, which is typical for a child with autism. Garrett's mother was a 38-year-old, married, university professor with a PhD.

Marcus was a 4-year-old African American boy who babbled with varied intonation and could imitate one-word phrases, but produced almost no spontaneous language. His GARS score was 103 and he was untestable on the PPVT-III. His mother was a 35-year-old, married, elementary school teacher with some graduate level education.

All sessions were videotaped using a portable camera. Three to six 10 min sessions were conducted during each visit and visits were conducted one to two times a week. Marcus' sessions occurred at a university in an 11′ by 12′ 4″ playroom containing a child-sized table, a puppet theater, a trampoline, and shelves filled with toys and books. Garrett's sessions were conducted in a playroom in his home containing a couch, a television, a computer, bookshelves, and toys. Caleb's sessions were conducted a university center in a room containing a computer, a child-sized table, bookshelves, and bins full of toys. Generalization probes occurred in a playroom at Caleb's home, which contained a couch, a bed, a basketball hoop, and bins full of toys.

1.2. Experimental design and procedures

Experimental control was demonstrated using a non-concurrent multiple baseline design across participants. Phase change decisions were made based on the stability of language measures.

1.2.1. Baseline

The baseline condition was similar to that described by Laski et al. (1988). The parent was asked to play with their child and to try to get him to talk as they normally would. A variety of toys were present but no specific instruction was given regarding the toys.

1.2.2. Parent training

Parents were trained to implement NLP as it is outlined in Koegel et al. (1987), Laski et al. (1988), and Charlop-Christy & LeBlanc, 1999. The parent sat on the floor facing the child with an assortment of toys and books. The parent placed three items in front of the child and asked him to choose one. The parent removed the items and prevented access to the chosen item while modeling an appropriate play activity (e.g., rolling a ball) for approximately 5 s to allow the opportunity for an unprompted/spontaneous vocalization. If no vocalization occurred, the parent provided a vocalization that described the action of the object (e.g. ‘‘ball’’) as a model. The parent waited for up to 5 s for the child to imitate the vocalization before modeling the phrase up to three times. Vocalizations that met the preset criterion resulted in immediate access to the item for approximately 30 s and a loose shaping criterion was used. The parent repeated the relevant phrase several times while the child played with the object. The parent then said, ‘‘my turn’’, retrieved the toy, and repeated the procedure using a different relevant vocalization (e.g., ‘‘red ball’’, ‘‘roll’’, ‘‘bounce’’). The parent presented new toys and allowed the child to select again after a few exchanges with the toy or if the child did not imitate.

Parents were given a rationale for NLP and instructed in the procedure with a presentation and a videotaped model of a psychologist (second author) implementing NLP with a child with autism (i.e., instructions and modeling). Next, the parent practiced each individual component with the experimenter with immediate feedback until she performed that component correctly on 9 of 10 NLP trials (i.e., rehearsal and feedback). When the parent could perform each component fluently, she conducted full-length NLP sessions with a confederate with delayed feedback provided on overall performance at the end of session until three sets of 10 NLP trials were completed with at least 90 percent of trials correctly implemented on every component. Parents were also trained in a simplified data collection procedure to allow data collection at home following completion of the study and to enhance discriminations for implementation and shaping. Parents were taught to score the training video until they could score two consecutive 10 trial blocks at 90 percent accuracy or higher.

1.2.3. Parent implemented NLP

Parents were instructed to play with their child and use NLP to try to get them to talk. The experimenter provided praise and feedback as appropriate at the end of a session.

1.2.4. Generalization

Generalization probes were conducted for Caleb at his home. Parents were instructed to play with their child and use NLP to try to get them to talk.

1.3. Dependent measures and interobserver agreement (IOA)

1.3.1. Child behaviors

The primary dependent variable was frequency of vocalizations (i.e., words or approximations meeting the individual operational definition). For Caleb, vocalizations were any recognizable word related to objects that were present and trains (i.e., object of obsession) were purposefully not present. Vocalizations occurring without a prior vocal model were coded as spontaneous and vocalizations occurring immediately after a parent's question or modeled vocalization were coded as prompted. Mean length of utterance (MLU; Leonard, Miller, & Brown, 1984) was calculated by computing the mean number of syllables produced per vocalization. Data were also collected on the percentage of intervals in which inappropriate and appropriate play occurred. Inappropriate play included aggressive or destructive use of an object and use of a toy in a stereotyped manner for which it was not intended (i.e., spinning or mouthing puzzles). Appropriate play was defined as using the toy in the manner in which it was intended.

1.3.2. Parent behaviors

The experimenter coded parent implementation of NLP to determine procedural integrity. For each trial, the experimenter coded each of the following behaviors: (a) providing three toys, (b) preventing access to items, (c) providing an action model for 5 s before modeling a vocalization, (d) reinforcing relevant responses, (e) presenting the item with a new model prompt, and (f) modeling during the play interval. If every step was coded correct, the trial was considered correct. Overall integrity was calculated by dividing the number of correctly implemented trials by the total number of trials conducted. A similar formula was used to calculate accuracy for each individual step of NLP.

A second independent trained observer scored parent and child behavior for 25 percent of sessions, distributed evenly across each phase. For parent behavior, a trial was scored as an agreement if both observers agreed on the coding of all steps. Agreement was calculated as the number of agreements divided by the number of agreements plus disagreements multiplied by 100 percent. IOA for parent behavior averaged 96 percent (range 80–100 percent). For child behavior, agreements were scored two different ways. Agreement for the rate of vocalizations measure was calculated using a frequency ratio such that the smaller number of vocalizations was divided by the larger number and multiplied by 100 percent. IOA on vocalization data was 100 percent across all sessions. For play, a trial was scored as an agreement if both observers agreed completely on both appropriate and inappropriate play scoring. Agreement was calculated as the number of agreements divided by the number of agreements plus disagreements multiplied by 100 percent. IOA on play data averaged 98 percent (range 90–100 percent).

A six-item social validity questionnaire was given to parents to return anonymously after the study was complete. Parents responded on a likert type scale about their opinions of the difficulty and usefulness of NLP and the effects of NLP on their children's language and play skills. The final question asked the parents to identify the step in the NLP procedure that they found most difficult.

2. Results

All three parents were able to learn the NLP procedure in the minimum number of sessions for the criteria with an average of 96 percent (range = 95–100 percent) presented accurately during training. All three parents' accuracy remained very high (M = 97.25 percent, range = 96–98 percent) during implementation of NLP. Analysis of error patterns for individual NLP steps indicated 96–100 percent accuracy for all steps except the 5 s delay, which was implemented correctly only 78 percent of the time. In fact, 73 percent of all errors that occurred involved provision of a sufficient delay during which the child might spontaneously emit a vocalization, though they still completed this step accurately for most trials. In the social validity questionnaire, parents reported that they did not have trouble with any particular step.

Fig. 1 depicts the rate of prompted and spontaneous vocalizations for each participant including any that occurred during access to the toy. During baseline, Caleb (top panel) emitted low rates ($<1\ \text{min}^{-1}$) of both spontaneous and prompted vocalizations. During NLP, spontaneous vocalizations increased to $3\ \text{min}^{-1}$ while prompted vocalizations remained very low. During baseline, Garrett's (middle panel) average rate of spontaneous vocalizations was $.35\ \text{min}^{-1}$ while prompted vocalizations were $2.6\ \text{min}^{-1}$ indicating a strong echoic repertoire. In the NLP phase, spontaneous vocalizations steadily increased to 8.5 vocalizations per minute in the final sessions with a concurrent decrease in prompted vocalizations to near zero levels. Marcus (bottom panel) emitted virtually no spontaneous or prompted vocalizations during baseline. During NLP sessions, prompted vocalizations increased to an average of 1.1 vocalizations per minute and spontaneous vocalizations increased slightly to an average of .13 vocalizations per minute with an increasing trend in the last three sessions.

The majority of NLP trials for Caleb and Garrett's were prompted in the first session with a switch to almost all spontaneous vocalizations for the remaining sessions and generalization probes. During baseline, Caleb emitted an average MLU of 2.47 increasing to 3.55 during NLP with an increasing trend in the final sessions. Garrett averaged an MLU of 1.4 during baseline, which increased only slightly to 1.7 during NLP sessions. Marcus responded to approximately 70 percent of trials with prompted vocalizations in the first two sessions and did not respond on the remaining 30 percent of trials. By the third NLP session, he responded to 100 percent of trials with prompted vocalizations and vocalized spontaneously during 10–20 percent of trials by the end of intervention. Marcus's average MLU during baseline was 2.1, which remained relatively stable during treatment sessions.

Fig. 2 depicts the play data for the three participants. Caleb (top panel) exhibited appropriate play during nearly 100 percent of intervals during baseline with no significant changes in the percentage of intervals with appropriate and inappropriate play during NLP. Garrett (middle

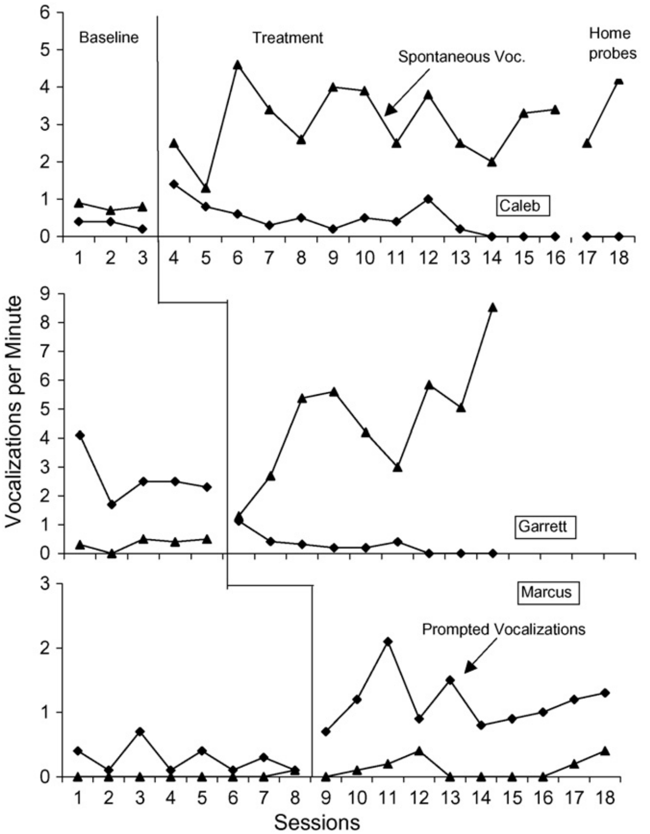

Fig. 1. Responses per minute emitted by Caleb, Garrett, and Marcus during a naturalistic play baseline and NLP sessions.

panel) played appropriately during an average of 50.5 percent of intervals in baseline increasing to an average of 84.1 percent of intervals throughout the NLP sessions and 92 percent of intervals during the last three treatment sessions. Inappropriate play occurred during only 10 percent of intervals during baseline and remained low in NLP (7.3 percent of intervals). Garrett did not play at all during an average of 45 percent of intervals in baseline, which decreased to 10 percent of intervals in NLP. During baseline, Marcus (bottom panel) exhibited appropriate play during 51 percent of intervals increasing to 72 percent of intervals in NLP and 81 percent of intervals in the last three treatment sessions. He exhibited inappropriate play during 11 percent of baseline intervals, which decreased to an average of 2.5 percent during NLP. Marcus did not play at all during 41 percent of intervals throughout baseline decreasing to 28 percent of intervals (19.5 percent of intervals for the last three treatment sessions). Thus, play improved for two of the three participants and a ceiling effect was observed for the third.

Two of the three parents returned the social validity questionnaire and both ranked the NLP treatment very highly in all categories. Both parents rated their participation in the study as ‘‘very useful’’ and the procedure as ‘‘very easy’’. Both parents stated they would continue the procedure at home ‘‘often’’ and that the intervention helped their child’s language skills ‘‘very much’’. One parent rated the helpfulness of the intervention in terms of their child’s play skills as ‘‘very helpful’’ and one parent ranked it as ‘‘somewhat helpful’’.

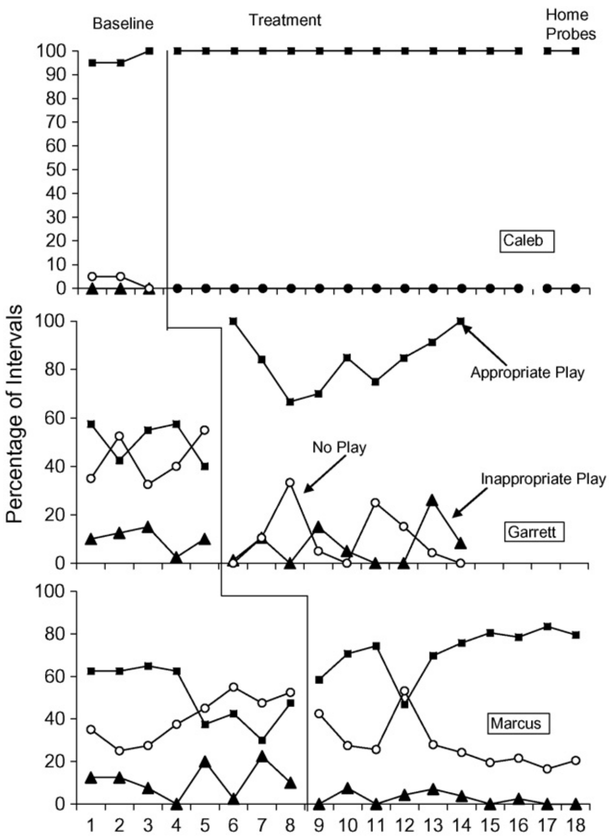

Fig. 2. Intervals with appropriate, inappropriate, or no play for Caleb, Garrett, and Marcus during a naturalistic play baseline and NLP sessions.

3. Discussion

Consistent with the findings of Laski et al. (1988), three parents readily acquired the skills necessary to accurately implement NLP resulting in increases in vocalizations and appropriate play by their children with autism. The specific training procedures in this study included a component of rehearsal and feedback with a research assistant prior to implementing the procedure with the child with autism. After only three brief rehearsal sessions, each parent implemented intervention with his or her child at a minimum of 90 percent accuracy and remained accurate throughout the entire intervention phase. The most difficult component for parents was providing a sufficient delay to allow spontaneous vocalizations, though they implemented this step accurately most of the time. Additionally, a social validity questionnaire indicated that parents generally enjoyed the procedure, found it easy to implement, felt it was beneficial for their child, and planned to use the procedure often in the future.

The impact of NLP on child language was consistent with previous studies (Koegel et al., 1987; Laski et al., 1988) and additional benefits were observed on child play skills. All three children experienced immediate increases in the frequency of vocalizations and continued to make gains throughout treatment. Caleb and Garrett, the two children with the most language during baseline, exhibited substantial increases in spontaneous vocalizations and in the mean length of utterance per vocalization. Caleb also increased the diversity of topics he would speak about expanding beyond his obsessive interest in trains. The third child (Marcus) made gains primarily in prompted vocalizations with slight increases in spontaneous vocalizations during the last few treatment sessions. Thus, language benefits were evident for all but the benefits varied slightly based on the initial child repertoire. Concurrent changes in play were observed for the two participants who began the study with limited appropriate play. The effects were strongest for Garrett who experienced an increase in appropriate play and a decrease in intervals with inappropriate play or no play.

Future studies might examine the specific types of language that result from NLP with respect to Skinner's (1957) analysis of verbal operants. During implementation of NLP, multiple antecedents might control responding and access to a toy is the primary consequence. Thus, child-produced vocalizations are probably under multiple control with elements of the echoic, tact, and mand (LeBlanc et al., 2006). Over time, social reinforcers in the play context may acquire value strengthening the tact component and children tend to produce vocalizations prior to vocal models eliminating the echoic component.

Although clear effects were observed during implementation of NLP, it is unclear whether substantial improvements occurred outside of the NLP sessions. Additionally, we have no long-term follow-up data for these children. However, these parents indicated that they intended to use the procedures in their homes when playing with their children as a supplement to the school and center-based intervention programs in which they participated. Future research might examine effects across the entire day and might also incorporate other intervention agents such as siblings. A substantial literature suggests peers and siblings can be effective intervention agents for diverse skills (e.g., Celiberti & Harris, 1993; Halle, Garbler-Halle, & Bemben, 1989; Kamps, Royer, & Kravitz, 2002), but no studies have experimentally examined whether siblings can effectively implement NLP. Additionally, future studies might examine whether parents who have been taught to implement NLP can subsequently train their relatives or care providers using a pyramidal training model.

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