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**Generalized imitation and response class formation in children
with autism**

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City University of New York, 1994

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Generalized Imitation and Response Class Formation
In Children with Autism

by

Jill M. Young

A dissertation submitted to the Graduate Faculty in Psychology
in partial fulfillment of the requirements for the degree of
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Abstract

GENERALIZED IMITATION AND RESPONSE CLASS FORMATION IN
CHILDREN WITH AUTISM

by

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An experimental analysis of imitation was conducted to examine the influence of response topography on generalization of imitation across three response types. Four children with autism were presented with both reinforced training trials and nonreinforced probe trials of models from vocal, toy-play, and pantomime response types. The probe trials were used to examine generalization within each response type. A multiple-baseline design was used to analyze percentage of matching and non-matching responses to models across response types. This study, the first to analyze imitative response classes in children with autism showed that imitation generalized from reinforced training models to nonreinforced probe models within a response type, but it did not generalize across response types. Thus, functional response classes determined by topographical boundaries were exhibited within generalized imitation.

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Introduction

During typical development, children acquire many complex responses by observing and imitating the behavior of others. Consider the cumbersome task facing parents and teachers if direct shaping through successive approximations were required to teach each social, recreational, and language skill. Thus, the ability to acquire behavior through observation allows us to efficiently develop much of the vast repertoire of behavior needed to function appropriately within society. Children who exhibit deficits in imitation, however, often fail to acquire important behavior through observing others in their environment (Lovaas, 1981). Children with autism are a case in point.

Although there is no universally accepted definition of autism, the Diagnostic and Statistical Manual III - Revised definition is widely considered the best available (Autism Task Force, 1988). Included in the criteria of this definition is the "absence or impaired ability to imitate (e.g. does not wave bye-bye; does not copy mother's domestic activities; mechanical imitation of others' actions out of context)" (p. 6). Imitation training is, therefore, a crucial element in education programs for children with autism (Lovaas, 1986) and the generalization of imitation is of particular concern to the applied practitioner.

Imitation refers to a class of responses that

temporally follow and are topographically similar to behavior modelled by another person. Because of its possible role in social behavior and language development, imitation has received considerable attention in the research literature. Experimental analyses of imitation have been conducted with typically developing children and infants (Baer & Deguchi, 1985; Baer & Sherman, 1964; Brigham & Sherman, 1968; Poulson & Kymissis, 1988; Poulson, Kymissis, Reeve, Andreatos, & Reeve, 1991; Steinman, 1970a), and developmentally delayed children (Baer, Peterson, & Sherman, 1967; Garcia, Baer, & Firestone, 1971; Lovaas, Berberich, Perloff, & Schaeffer, 1966).

Baer and Deguchi (1985) reviewed the research on imitation and described it as a functional response class. Imitative responses, that are never directly reinforced, can be maintained as long as other imitative responses are reinforced (Baer et al., 1967; Lovaas et al., 1966). This generalization of imitative responding to nonreinforced models is termed generalized imitation. In addition, imitative responses that are not directly reinforced decrease in frequency when reinforcement is no longer contingent on other imitative responses within the same response class. Subsequently, increases in responding occur again with the reinstatement of reinforcement for other imitative responses. Furthermore, nonreinforced imitative responses do not decrease in occurrence even following

continual differential reinforcement of other imitative responses (Baer et al., 1967; Steinman, 1970a, 1970b). This finding indicates that responding to nonreinforced models is not a transitory effect related to factors such as a failure to discriminate reinforcement contingencies. These covariations between reinforced and nonreinforced imitative responses define imitation as a functional response class.

Subsequent research (Garcia, Baer, & Firestone, 1971) has suggested that generalized imitation does not constitute one large response class. Instead, imitation may be comprised of distinct imitative response sub-classes that are defined by the topography of the imitative responses reinforced. Garcia, et al. (1971) examined potential sub-classes of generalized imitative responses using a multiple-baseline design across four response types: short vocal, long vocal, small motor, and gross motor. Four developmentally delayed children (8- to 14-years-old) were successively trained to imitate three of these different response types. Some modelled responses were presented as nonreinforced probes to assess generalization within each response type. The results of the Garcia, et al. (1971) study showed that when reinforcement was delivered for the three response types, imitative responding increased, but generalization was contained within that response type. Imitative responding did not generalize across the response types. In other words, the imitator may learn "say what the

model says" or "move the way the model moves," as opposed to a general rule of "make the response the model makes." That is, the generalization of imitation may be restricted to the type of responses for which imitation has been reinforced.

Similar results with normally developing infants between 12 and 14 months old were obtained by Poulson, Kyparissos, Andreatos, Kymissis, and Parnes (1993). In their study, infants were presented with reinforced training models and nonreinforced probe models across three response types: vocal, motor-without-object, and motor-with-toy. Reinforcement was introduced using a multiple-baseline design for correct matching responses across response types. The results of this study showed that imitative responding generalized to probe models within a response type but failed to generalize across response types.

The results of studies such as Garcia et al. (1971) suggest that generalized imitation may be restricted to the type of responses for which imitative behavior has been reinforced and not to all responses modelled by the experimenter. The current study examined potential response topographies that may form generalized imitative sub-classes in children with autism. The children were presented with models of three different response types: vocal, toy-play, and pantomime. These responses were selected because each type represents typical deficits in the repertoires of children with autism. A multiple-baseline design was used

to analyze percentage of matching and non-matching responses to models across response types. Generalized, nonreinforced imitative responding was measured within each response type during the presentation of nonreinforced probe models.

Method

Subjects

Four children, 3 boys and 1 girl, participated as subjects for this study. Each child met the DSM-III-R (1987) criteria for autism according to an independent agency. On the first day of baseline David was 4 years and 5 months old, Neal was 4 years and 5 months old, Seth was 4 years and 0 months old, and Heidi was 2 years and 11 months old. At the conclusion of the study, David, Neal, Seth, and Heidi were 5 years and 0 months old, 5 years and 0 months old, 4 years and 8 months old, and 3 years and 7 months old, respectively.

All four children were enrolled in the Princeton Child Development Institute or PCDI education program. Three children showed no evidence of imitative behavior when they entered the program. One boy, David, showed some echolalic responding. The three boys attended the PCDI program for approximately 1 year prior to participation in this research and received preliminary training in vocal imitation. The girl was enrolled in the PCDI program at the beginning of the school year and began vocal-imitation training in her day-treatment program concurrently with the start of this

investigation. Each of the children displayed some perseverative behavior with objects, such as spinning, rubbing, and squeezing, and/or some perseverative behavior without objects, such as stereotypic finger and eye movement, and low volume vocalizations.

The Peabody Picture Vocabulary Test (PPVT) and Vineland Adaptive Behavior Scales (VABS) were administered to each child in October and December of the 1991 school year. David achieved a mental age score of 2.5 on the PPVT and an adaptive behavior age equivalent of 1.11 on the VABS. Neal achieved a mental age score of 2.1 on the PPVT and an adaptive behavior age equivalent of 2.0 on the VABS. Seth achieved a mental age score of 2.1 on the PPVT and an adaptive behavior age equivalent of 1.5 on the VABS. Heidi achieved a mental age score of 2.0 on the PPVT and an adaptive behavior age equivalent of 1.5 on the VABS.

Setting and Apparatus

The study was conducted in a small classroom used for the children's regularly scheduled one-to-one sessions. The classroom was carpeted and contained two 46 X 66 cm tables, two 71 X 76 cm chairs, and, a General Electric VHS-HQ camcorder was used for all sessions. Experimenter and child sat facing each other across the corner of one table. The camcorder was mounted so the table, the front of the child, and the side of experimenter were clearly visible.

Modelling Stimuli

Vocal responses. All the vocal models were selected individually for each child. Vocal models included a combination of words already in the child's repertoire with words not present in the repertoire (See Appendix A for complete vocal response definitions). For example, if the word "bubble" was in a child's repertoire, but the word "blow" was not, a vocal model for that child might have been "blow bubble." The words in the child's repertoire were determined during approximately 6, 20-minute pre-baseline observational sessions conducted in the child's classroom. The experimenter evoked the child's verbal behavior through physical contact such as, tickling, bouncing the child on her knee, or lifting the child in the air, and presenting and asking questions about toys such as, blowing bubbles, pointing to objects in books, spinning tops.

Vocal-with-toy responses. Because David was echolalic the vocal response models for this child were changed to a "vocal-with-toy" response type. The vocal-with-toy models consisted of a simple toy-play response such as, lifting a toy plane up to eye level, combined with a vocalization such as, "whee" (See Appendix B for complete definitions).

Toy-play responses. Forty-five different toys, each with a specific motor response, were used in the study (See Appendix C for complete definitions). For example, a toy-play model might have been to make a pouring movement with a

toy teapot over a cup, and then lift the cup to the lips.

For Neal, the "rubber stamp" toy was replaced with the "He-man" toy following the first day of baseline because he emitted a match on the first presentation of the toy. The "shaving kit" toy was replaced with the "cutter" toy for Heidi because of gender inappropriateness.

Pantomime responses. Pantomime responses included motor movements that resemble activities performed with objects, or movements of the body that have social meaning (See Appendix D for complete definitions). For example, pantomime models might have included blowing a kiss or placing hands around one eye to form a "telescope."

For Heidi and David, the approximation definition for each pantomime response was modified to require the child to produce fewer components (i.e. motor responses) of the model (See Appendix E for revised definitions). This was done to compensate for these children's under-developed fine motor skills as observed during baseline.

For Neal, 4 pantomime models (i.e. thumbs up, blow kiss, entwined fingers, violin) were replaced following the first day of baseline because he emitted matches following first presentation of each model.

Stimulus Sets

Within each response type (i.e. vocal, vocal-with-toy, toy-play, and pantomime), two-thirds of the models were training (reinforced) models and one-third of the models

were probe (nonreinforced) models. Training and probe models of each response type contained approximately the same number of movements or words.

There were 20 stimulus sets (See Appendix F for each stimulus set) that each consisted of 27 trials (9 vocal models, 9 pantomime models, and 9 toy-play models). One stimulus set was used for each session. Stimulus sets were constructed to ensure that probe models and models from the same response type were never presented more than twice in succession and to ensure that a session did not begin or end with a probe model. Otherwise, presentation was randomized across stimulus sets.

Response Categories

Following the presentation of each model, responses emitted by the child were recorded as matches or non-matches. Matching responses for toy-play and pantomime models included exact matches and approximations. Exact matches contained all the movements of the model and approximations contained a pre-determined number of movements of the model. For example, if a model involved placing a toy person in a toy car, pushing the car up a ramp, and then rolling it back down the ramp, a match may have been recorded if the child emitted each of the movements or approximated the model by emitting all the movements except rolling the car back down the ramp. It was difficult to determine individual vocal approximations.

Therefore, for vocal models, a match was scored only if all vocal components were present.

Non-matching responses were defined by response type. For vocal models, non-matching responses were any vocal response that did not match the model. Vocal non-matches also included repetitions of components of the vocal model. Vocal repetitions were included as non-matches because perseverative vocal behavior is clinically undesirable in children with autism. Therefore, for example, a vocal response "Hi mommy, mommy" following the model "Hi mommy" would be scored as a match for "Hi mommy" and a non-match for the extra "mommy."

For vocal-with-toy models, a non-match was scored if either the vocal or the toy-play component was absent or did not match the model. For toy-play models, non-matching responses included all motor interactions with the toy that did not match the model. For pantomime models, non-matching responses included any motor response that did not match the model.

During the interval following each model, a child could have emitted both a matching and a non-matching response. Both response categories would then be recorded as having occurred. Nevertheless, because a child could fail to emit any of the above responses, percentages of matches and non-matches did not sum to 100% of all responses measured. It was important to record non-matching responses to assess

whether increases in matching with the introduction of treatment was an increase in imitation rather than a more general increase in all responding.

Data Analysis and Experimental Design

Data were obtained from videotapes taken of each session. The dependent measures were the percentages of matching and non-matching responses emitted within 6 s following the model of each type of response during a session. The experimenter's behavior was monitored for the correctness of model presentation, number of models presented, instruction presentation, correct placement of toy items, correct order of models presented according to stimulus set, contingent delivery of reinforcers within 2 s of a matching response, and withholding of reinforcers during probe trials. A multiple-baseline-across-responses experimental design (Baer, Wolf, & Risley, 1968) was used to assess generalization of imitation across and within response types.

Interobserver agreement

The experimenter served as the primary observer for all experimental sessions. Four instructors at the Princeton Child Development Institute and one undergraduate intern rotated participation as secondary observers for the purpose of interobserver-agreement data collection. Secondary observers were trained to a criterion of 90% agreement on each response type before scoring experimental sessions.

Observers were allowed to view any segment of the session tape up to three times to score responses.

Interobserver-agreement data were obtained for approximately 33% of each child's sessions with baseline and treatment conditions equally represented in the agreement data. Interobserver agreement between independent observers was calculated using a point-by-point analysis (Kazdin, 1982). Occurrence agreement was calculated by dividing the sum of the number of agreements by the total number of agreements plus disagreements, and multiplying by 100.

Across all children, the percentage of interobserver agreement for vocal/vocal-with-toy responses during the model-alone condition for training models was 100% for both matches and non-matches (See Appendix G for mean interobserver agreement for individual children). No child made a matching response following the probe models during baseline, and therefore, there was no opportunity to score interobserver agreement on those items. Percentage of interobserver agreement for non-matches during baseline was 100%. During treatment the percentage of interobserver agreement for vocal/vocal-with-toy matches on training models was 99.2% (range = 98.9 - 100%) and on probe models was 99.6% (range = 98.4 - 100%). Interobserver agreement for non-matches on training trials was 99.6% (range = 98.6 - 100%) and on probe trials was 100%.

The percentage of interobserver agreement for toy-play

responses during baseline on training models was 99.6% (range = 98.5 - 100%) for matches and on probe models 100% for matches. Agreement for non-matches, during baseline, was 97.5% (range = 90 - 100%) on training models and 100% on probe models. During treatment, agreement for matches was 99.6% (range = 98.6 - 100%) on training trials and 100% on probe trails. Agreement for non-matches was 100% on both training and probe trials.

The percentage of interobserver agreement for pantomime responses during baseline for matches was 99.6% (range = 98.5 - 100%) on training models and 100% on probe models. Agreement for non-matches was 100% on both training and probe models. During treatment, agreement for matches was 99.5% (range = 98.2 - 100%) on training trials and 100% on probe trials. Agreement for non-matches was 100% on both training and probe trials.

During all experimental conditions, the percentage of interobserver agreement was 100% on correct toy placement. Agreement on whether the instruction "ready" was given was 100%. Agreement on whether the experimenter modelled the response correctly was 100%. Agreement on whether the experimenter presented reinforcement following a match was 100%. Agreement on the number of times a model was present during a trial was 100%. Finally, agreement on the correct order of stimulus presentation was 100%.

Monitored Experimenter Behavior

Across all children, toys were placed correctly in front of the child during 100% of the toy-play trials for each child. Correct instructions were given during 100% of the trials in each session. For each response type, models were presented correctly during 100% of the trials in each session. Reinforcement was presented within 2 s following 100% of the matching responses emitted during all treatment sessions. Reinforcement was never presented following pantomime non-matches during treatment; nevertheless, 4 of 2,246 vocal non-matches and 1 of 3,297 toy-play non-matches emitted during treatment were inadvertently reinforced. Reinforcement was never present following vocal, vocal-with-toy, toy-play or pantomime matches during probe trials. The modelling stimuli were presented in the correct order during 99.1% of the 475 sessions.

Procedure

The children attended experimental sessions at a regularly scheduled time each day as part of their daily education program. The experimenter seated the child at the table and then sat across from the child so each modelled response could be clearly seen. Sessions began following two successful, reinforced trials of the following sequence of responses: the experimenter said "look at me;" the child looked at the experimenter; the experimenter held up her hand with her palm facing the child; the child sat quietly

and looked at the experimenter for 2 s. Behavior specific praise for "good behavior" such as sitting in the chair with hands down and feet on the floor was occasionally delivered during these two trials.

Model-alone condition. Prior to presenting a model, the experimenter said, "look at me." When the child was quiet and looking at the experimenter, the experimenter held up her hand with her palm facing the child and paused for 2 s. Following this 2-s pause, the experimenter brought her hand down, said "ready," and presented the model. Following the completion of each model presentation, the experimenter waited 6 s before modelling the next response. During the model-alone condition, no reinforcement was given for responding by the child during this 6-s interval. The 6-s interval length was determined by previous infant studies of imitation (Poulson, et al., 1993)

Model-and-praise condition. During the model-and-praise condition, models were presented in the same manner that they were in the model-alone condition. During treatment, however, when a child produced a response that matched the model within 6 s, verbal praise was given. Praise was always accompanied by an edible reinforcer (e.g. a piece of pretzel or chip, a sip of juice) and/or physical contact (e.g. a pat on knee/arm, a tickle, a hug). Reinforcers were delivered for matching responses only during training trials, matching responses during probe

trials did not produce reinforcement.

Prompts for matching, for example, manual guidance, were not provided if a matching response did not occur within 6 s of a model. Once introduced, prompts would have had to be faded and it was unknown how the prompting and fading procedures would interact with response class formation.

For Seth, an additional procedure was implemented during treatment conditions because he showed only slight increases in his matching. Included for this child was an instruction-following procedure (Mace, 1988; 1990) consisting of two models for which there was a high probability of compliance. One of these models was a motor response (clap hands) and the other was a verbal response ("Hi"). These models were presented in the same manner as were training and probe models during the model-alone condition. Matching responses that followed instruction-following models did not produce reinforcement, but were immediately followed by presentation of the regular training trial model. The instruction-following procedure was implemented only prior to the training models.

Generalization probes. Throughout the study, probe models were presented in the manner that they were in the model-alone condition. During probe model presentations, the experimenter modelled the response and waited 6 s before modeling the next response. Reinforcers were not delivered

during this 6-s interval.

Results

Figure 1 shows the percentage of matches (filled triangles) and non-matches (open diamonds) emitted by Neal during training trials (top graph) and probe trials (bottom graph) on consecutive sessions. During training trials, Neal's vocal matching showed steady increases to 100%. Toy-play matches increased above baseline levels but reached 100% during only one session. Pantomime matching showed a delayed increase but improved to a consistent level of 83%. Non-matching systematically decreased during training trials for each response type as matching increased. During vocal and pantomime trials, the relationship between matching and non-matching responding reversed.

During probe trials, Neal's vocal matching also reached a consistent level of 100%. Toy-play probe matching showed an increase when the model-and-praise treatment was implemented for training trials and reached a consistent level of 100% matching. Pantomime matching regularly reached 67% and reached 100% during one session. Non-matching across each response type did not systematically increase and decreased late in the treatment phase.

Figure 2 shows the percentage of matches (filled triangles) and non-matches (open diamonds) emitted by David during training trials (top graph) and probe trials (bottom

graph) across consecutive sessions. David's baseline for vocal-with-toy models was too short (5 sessions) to unequivocally show an increase with the implementation of treatment. Nevertheless, during training trials, vocal-with-toy matches did increase by the seventh session of treatment. Following session 31 of treatment, vocal-with-toy responding increased to a consistent level of 83% matching compared to a level of 16% matching in baseline. Furthermore, David's vocal-with-toy matching increased while baselines for toy-play and pantomime remained stable. In addition, matching for toy-play and pantomime increased systematically with the introduction of treatment. Non-matching systematically decreased for each response type with the introduction of treatment. As with Neal's data, the relationship between David's matching and non-matching responding during vocal-with-toy and pantomime training trials reversed.

During probe trials, David's response patterns mirrored those in his training data. The increases in matching during probe trials, however, did not reach the levels of performance displayed during training trials. Matching systematically increased across each of the three response types with the introduction of treatment for training trials. Matching responding following vocal-with-toy and pantomime models reached 100% matching. Non-matching during probe trials did not systematically increase.

Figure 3 shows the percentage of matches (filled triangles) and non-matches (open diamonds) emitted by Heidi during training trials (top graph) and probe trials (bottom graph) across consecutive sessions. Heidi's training data show a systematic and rapid increase in matches over baseline on training trials with the introduction of model-and-praise for vocal and pantomime response types. Vocal training trials reached consistent 100% matching. Heidi's data for toy-play matches on training trials show a very slight increase in matches over baseline with the introduction of treatment. This increase was very gradual and was not fully apparent until the final 30 treatment sessions. Although matches on toy-play probe models were emitted more consistently with the implementation of treatment on toy-play training trials, only one session showed an increase over baseline. Heidi's matching during vocal and pantomime training trials systematically increased following the introduction of treatment. Although Heidi's toy-play matching increased only during the final 30 experimental sessions, it did in fact increase. Non-matching during vocal and pantomime training trials decreased as matching increased. As with Neal's and David's non-matching data, the relationship between matching and non-matching reversed during vocal and pantomime trials. Non-matching during toy-play trials did not increase.

During probe trials, Heidi's matching showed a systematic increase for vocal and pantomime models. Her performance on toy-play probe models mirrored that of training trials, showing only a slight and inconsistent increase in matching. Non-matching responding also mirrored that during training trials. The relationship between matching and non-matching responding reversed during vocal and pantomime probe trials. Non-matching did not increase during toy-play probe trials.

Figure 4 shows the percentage of matches (filled triangles) and non-matches (open diamonds) emitted by Seth during training trials (top graph) and probe trials (bottom graph) across consecutive sessions. When treatment was introduced for Seth during vocal training trials, we did get an increase in matching by the fourteenth treatment session. This increase was only slight and was not as high as the percentage of matches emitted by the other children. Furthermore, matching during vocal probe trials remained at 0% and it reached a high of 33% in only 3 out of 40 sessions. Therefore, we did not introduce the same procedure for toy-play and pantomime models. Instead, the primary intervention was changed to include the instruction-following procedure described above.

With that added instruction-following procedure, Seth's matching systematically increased across all three response types during training trials. Vocal matching responding

showed an increase from baseline and reached 100% on 3 sessions. Toy-play matching responding increased only slightly and remained variable. Pantomime matches on training trials showed a clear increase over a baseline of 106 sessions within 4 session of treatment. Treatment in this response type had to be terminated, however, with the conclusion of the school year.

Seth's non-matching during training trials decreased during vocal and pantomime training trials. As with the other children's data, non-matching and matching responding reversed during vocal training trials. Pantomime non-matching responses on training trials showed variability early in baseline, but began to consistently range from 64% to 100% following session 55 of baseline. Following the introduction of instructions-model-and-praise, pantomime non-matches showed a clear decrease from the second half of baseline sessions (sessions 55 - 106) within 9 sessions. Non-matching during toy-play training trials did not increase.

Seth's probe data mirrored his training data to a great extent, probe matching showed a systematic increase across each of the response types with the introduction of treatment for training trials. Matches following probe vocal models reached 100% during this phase. He did not, however, maintain high rates of matching during toy-play probe trials nor did his matching during pantomime probe

trials reach the level of performance displayed during training trials. Matches following pantomime probe models were, however, emitted more consistently with the introduction of instructions-model-and-praise for pantomime training models. Non-matching did not systematically increase.

In summary, Neal's matching during both training and probe trials for each response type increased systematically with the introduction of treatment. Although David's vocal-with-toy matching did not increase within the number of sessions he experienced during his initial baseline period, matching did increase while baselines for toy-play and pantomime remained stable. In addition, matching for toy-play and pantomime increased systematically when treatment was introduced. These response patterns were mirrored in David's probe data. Although Heidi's toy-play matching increased only during the final 30 experimental sessions, it did in fact increase. Otherwise, her matching during vocal and pantomime responding increased immediately following the introduction of treatment. In general, Heidi's probe data mirrored her training data with the exception that matching during vocal probe trials showed a more gradual increase than did matching during training vocal trials. Seth's probe data mirrored his training data to a great extent, although he did not maintain high rates of matching during toy-play probe trials nor did his matching during pantomime

probe trials reach the level of performance displayed during training trials.

Overall, these results show increases in matching within each response type with the introduction of treatment. More importantly, there was a corresponding increase in nonreinforced probe matching for all children in at least two response types. Matching did not, however, generalize to the training or probe models across the response types. Non-matching responding did not increase with the introduction of treatment during training or probe trials, and decreased on 19 of 24 occasions with the introduction of treatment.

Discussion

The present study demonstrated that generalized imitation may be limited by the topographical boundaries of response type. In general, the children emitted nonreinforced matches more frequently following probe models that were topographically similar to training models for which matches were reinforced. Imitation generalized within each response type, but failed to generalize across response types. Furthermore, because non-matching responding did not systematically increase with the introduction of treatment during training or probe trials, we can conclude that the systematic increase in matching is an increase in imitation, rather than a more general increase in all responding.

A consistent finding was that the toy-play response

class was the most slowly acquired. Several studies have shown a negative correlation between perseverative behavior and appropriate toy-play in children with autism (Tryon & Keane, 1986; Koegel, Firestone, Kramme, & Dunlap, 1974). In the present study the perseverative behavior included rubbing, spinning, and squeezing the toys. It is likely that these responses interfered with imitation. We also found that toys that required movements bringing them off the table (e.g. raising airplane above eye level) or imaginative responding (e.g. "pouring" into a teacup & bringing it to the lips) were the most difficult for the children to match. This may reflect the training priorities for young children with autism. For example, difficulty in bringing toys appropriately off the table may have been the result of over-training to the instruction "hands down" and keeping materials on the table. Both of these directions are often first steps in training programs for children with autism. Likewise, imaginative toy-play is simply not in most of these children's repertoire and is seldom a training priority in children in this age group. At this age, toilet-training, language acquisition training and social skills training are of higher priority.

It is also interesting that the addition of the high-probability instructions procedure was sufficient to produce generalized imitation by Seth. This procedure involved presenting two instruction models (i.e. "Hi," and clap

hands) that had been taught to Seth at the Institute prior to the study. These findings are consistent with those of Mace (1988; 1990), who has shown that the interspersal of high-probability-of-compliance commands among commands with a lower probability of compliance can increase instructional control in general. The fact that a high rate of compliance to the instruction models had been established and that this compliance generalized to the training models that immediately followed the presentation of the instruction models suggests that imitation might best be viewed as a sub-class of instructional control. Seth engaged in perseverative behavior (e.g. stereotypic finger and eye movement, and low volume vocalization) more frequently than did the other children. Therefore, it is likely that the added instructions were more successful at gaining his attention and compliance prior to the presentation of the model than were the hand-up and "ready" instructions alone.

Several investigators (Baer, Peterson, & Sherman, 1967; Baer & Sherman, 1964, Parrish, et al., 1986) have asserted that similar contingencies may control the formation of imitative and instruction-following response classes. For both, the model's or instructor's behavior sets the occasion for reinforcement and serves as both a discriminative stimulus and conditioned reinforcer. Response class relationships observed in instruction-following behavior have, in fact, shown similarities to those obtained in

imitative behavior. Neef, Shafer, Egel, Cataldo, and Parrish (1983) investigated generalized compliance to "do" and "don't" instructions both within and between these response classes. Their results showed that compliance generalized to untrained probe requests within the class of instructions for which compliance to training requests was reinforced. The effects of training on one class of instructions, however, failed to generalize to the other class of instructions.

In a subsequent study, Parrish et al. (1986) found an inverse relationship between compliant and non-compliant behavior. When compliance to requests was reinforced, the authors observed an increase in compliant responding and a corresponding decrease in other non-compliant responding for which no consequences were experimentally arranged. Similarly, in the present study, no corrective or preventive procedures were implemented to decrease non-matching. A child might have emitted a non-matching response as well as a matching response during the same trial. Nevertheless, in several cases there was a corresponding decrease in non-matching as reinforced matching responding increased.

In addition, the number of separate, topographically-defined response classes trained before imitative behavior generalizes to all models regardless of topography, is still unknown. Haring (1985) and Haring et al. (1989) investigated the training of multiple-sets of stimuli to

produce between-class responding. They postulated that multiple-class training may control between-class generalization in the same manner that multiple-exemplar training might control generalization within a response class. Their results indicated that the occurrence of between-class generalization required training across a range of 3 to 5 distinct classes. In this study, David had a pre-existing vocal imitative response class, then vocal-with-toy and toy-play response classes were established through reinforcement. Nevertheless, his imitative responding did not generalize to pantomime models. Only three imitative classes were systematically trained for each child in the present study, however. Therefore, the effects of multiple-class training on generalization to other imitative classes cannot be assessed. Future investigations of imitative response class interactions that address these issues should be a productive area.

Figure 1

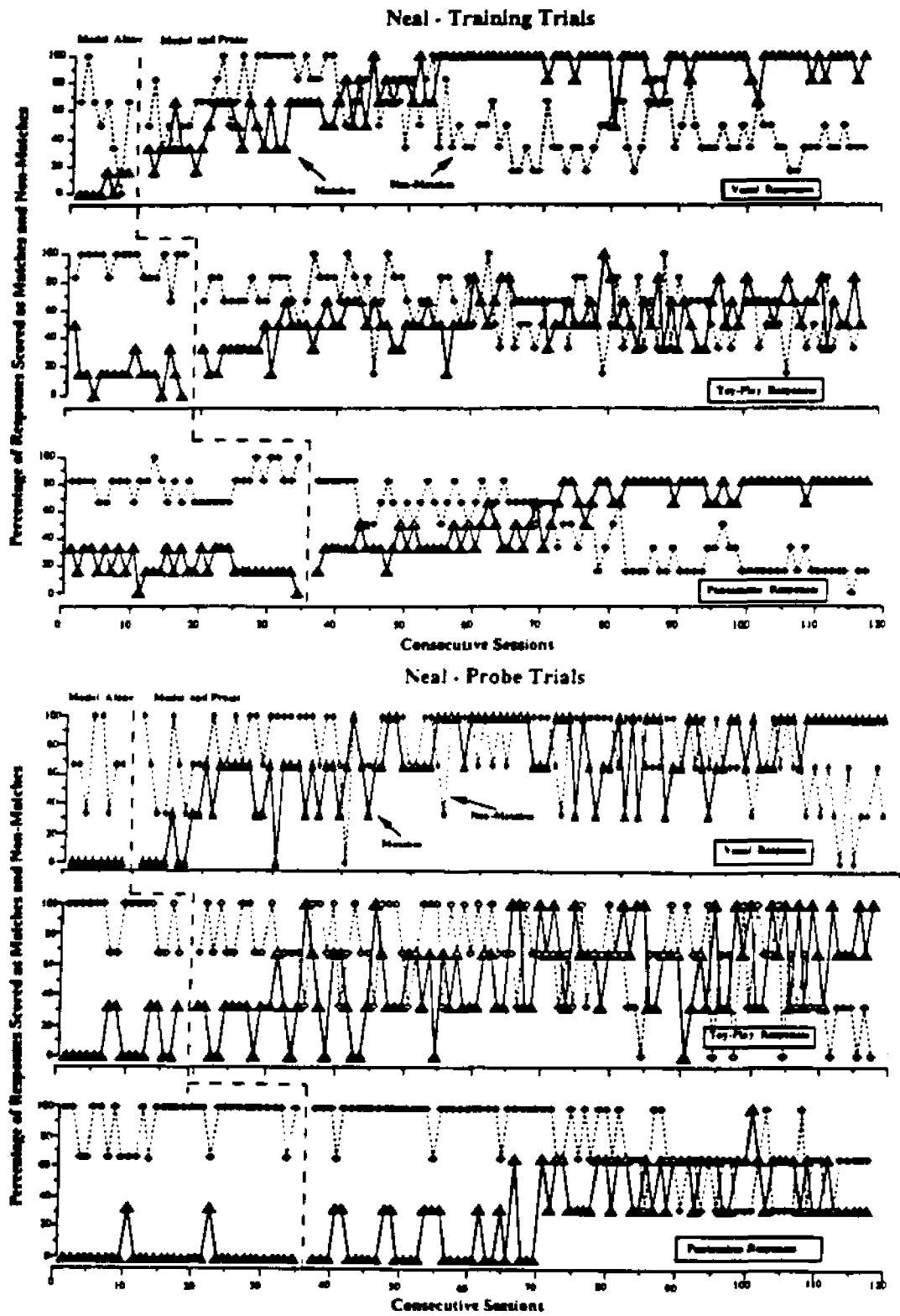


Figure 2

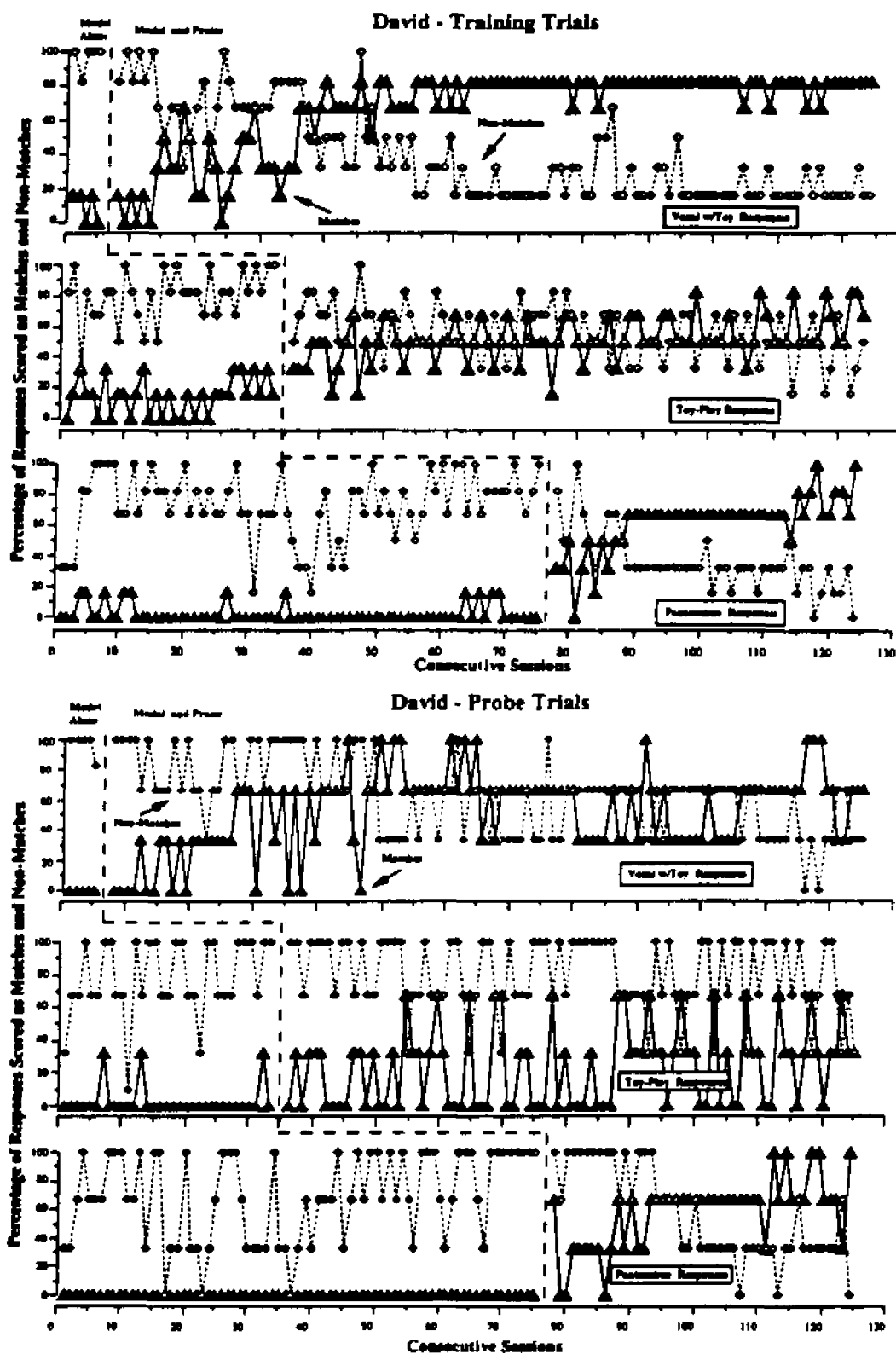


Figure 3

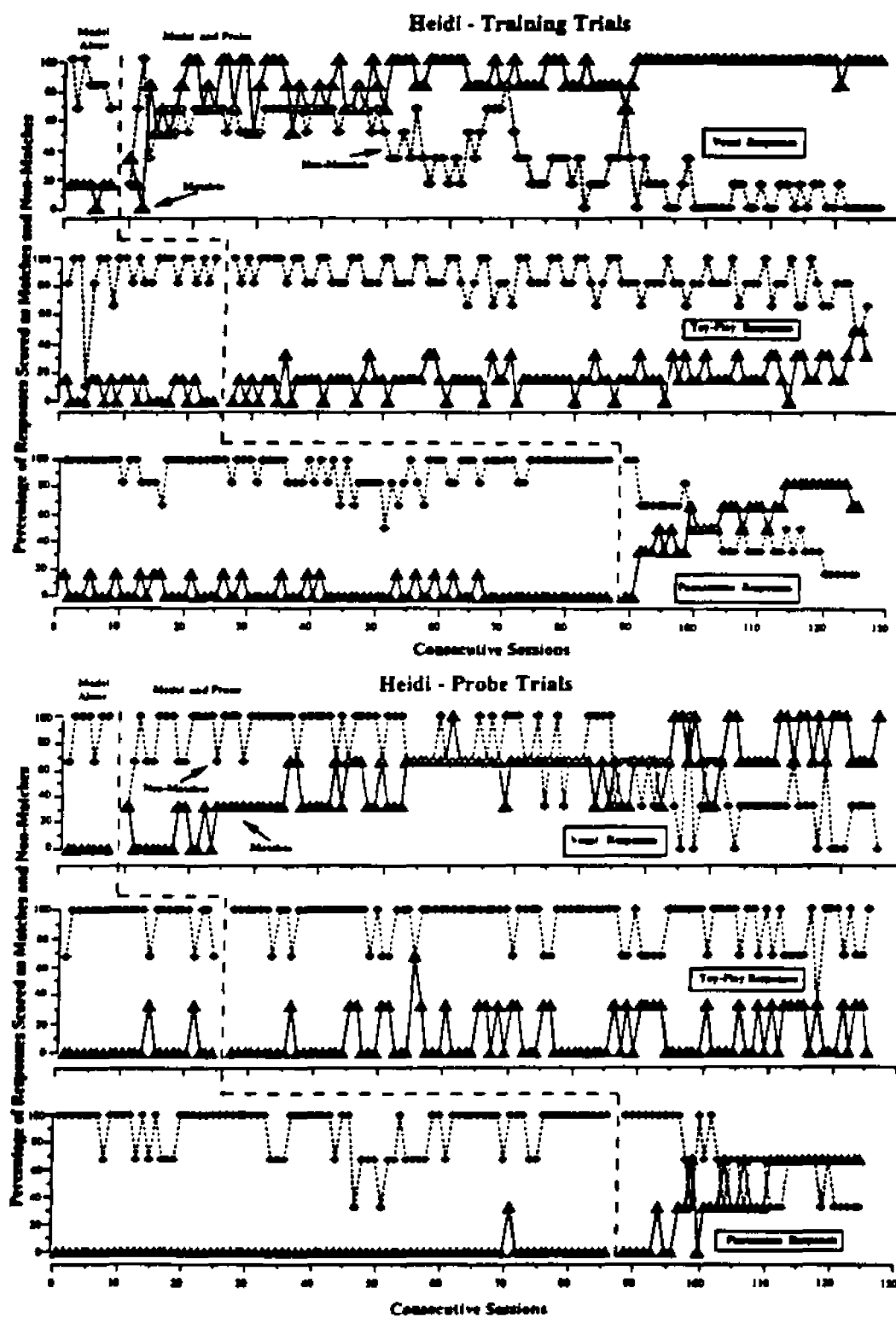
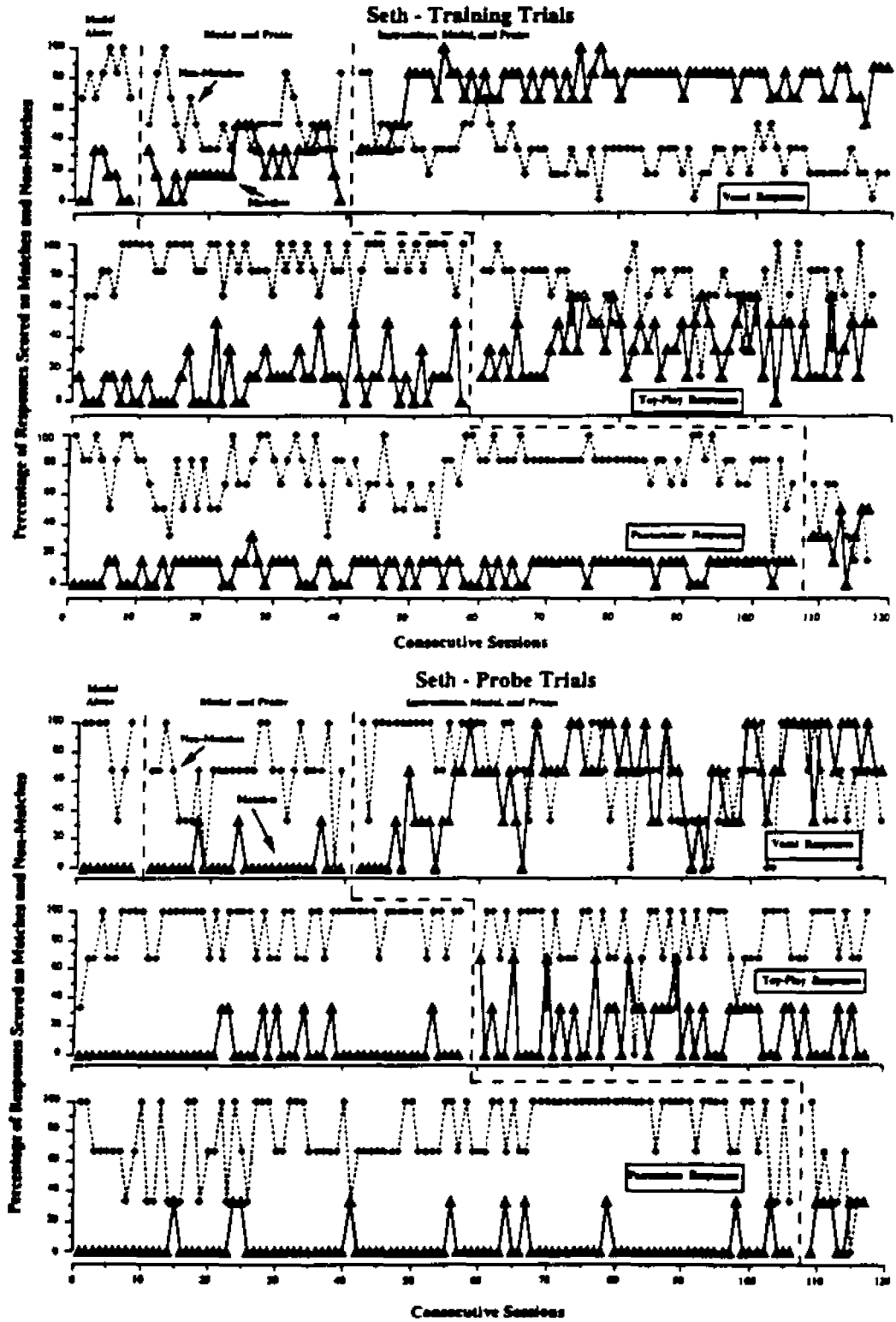


Figure 4



Appendix A
Vocal Models and Response Definitions

Appendix A

Vocal Models and Response Definitions

NEAL

Training Models**My cookie**

Mah cook(a), Meh
cook(a)

Read a book

Read /ah, eh, oh, uh,
uu, ih, ay/ book(a)

You help me

Uu (h)elp me

Tie a shoe

(T)ie /ah, eh, oh, uh,
uu, ih, ay/ (sh)oe

Ride a bike

Ride /ah, eh, ay, oh,
uh, uu, ih/ bik(a)

Happy day

(H)appy dey, (H)appy
deh, (H)appy dee

Probe Models**You hug me**

Uu (h)ug me

A good boy

Ah, eh, oh, uh, uu, ih,
ay/goo(d) boy

Do a puzzle

Do /ah, eh, ay, oh, uh,
uu, ih/ puzzle

Vocal Models and Response Definitions for Individual Children

SETH

Training Models

I ride a bike

I ride /ah, eh, ay, ih,
oh, uu, uh/ bike

I run

I wun

You hug me

Ou (hug) me

Happy day

(H)appy deh

Do a puzzle

Do /ah, eh, ay, ih, oh,
uu, uh/ pu(dd)le

May I

(M)ay I, Meh I, Mee I

Probe Models

I love Mommy

I lo(ve) Mahmy/Mee

My daddy Eric

Meh (d)addy Erwic

Blow a bubble

(B)low, Boo /ah, eh, ih,
oh, uu, ay, uh/ bu(dd)le

Vocal Models and Response Definitions for Individual Children

HEIDI

Training Models

Hi Mommy

(H)i Mommy, (H)i Mahmy

Happy Girl

(H)appy Gi, (H)appy Gr

Eat Cookie

EE Cookee, EE Cooka

Ball Up

(B)all oop, (B)all upa,

Help Me

(H)elp Mee

Quack Quack

Quacka Quacka

Probe Models

My Baby Doll

(M)y Baby (c)all

May I

Mee I, Meh I, Mah I

Blow Bubble

Boo Bubble, Oh Bubble

Appendix B

Vocal-with-toy Models and Response Definitions

Appendix B

Vocal-with-toy Models and Response DefinitionsTraining Models

Matches	Approximations
<p>CAT - "Meow" Cat face up, legs facing child. Pick-up cat in one hand, w/other pet its head, saying "Meow". (Meo, Mee, Eow)</p>	<p>Pick-up cat, need not stroke head. Saying "Meow". (Meo, Mee, Eow)</p>
<p>LIZARD - "Boing" Lizard parallel to edge of table. Hold by tail and hop across table, saying "Boing" each time lizard hits table. (Oing, Boin)</p>	<p>Hold anywhere on lizard's body, and hop it up and down, need not be across table. Say "Boing", "Oing", or, "Boin."</p>
<p>CARS - "Crash" Cars facing each other, parallel to edge of table. Hold one car in each hand, roll towards each other until their front ends touch, say "Crash" (Cras, Rash).</p>	<p>Hold at least one car, bring cars together so they touch on any part, say "Crash, Rash, or, Cras).</p>
<p>TWIRLER - "Happy" Twirler flat on table, handle up. Pick-up by handle, hold flat part upright, twirl around, say "Happy" (Appy).</p>	<p>Hold by handle, need not hold upright, twirl around, say "Happy or Appy."</p>
<p>STAR - "Twinkle, Twinkle" Star upright on table. Hold by top, turn star around 2xs saying "Twinkle" w/each turn. (Winkle, Tinkle)</p>	<p>Hold star anywhere, turn in circle, need remain upright. Say "twinkle, twinkle" (Winkle, Tinkle).</p>
<p>CUTTERS - "Cut, Cut" Toy lying flat on table. Pick-up by holding each handle back and forth, say "Cut, Cut" (Cu, Ut)</p>	<p>Pick-up by any part. Push men back and forth, need not be with handles, say "cut, cut" (Cu, Ut)</p>

Probe Models

Matches

DINOSAUR - "Ow, Ow"
 Dinosaur upright on table. Pick-up dinosaur, wrap its arms around index finger say "Ow, Ow."

TRUCK - "Honk, Honk"
 Truck upright, parallel to table edge. Hold by hitch, push across table, saying "Honk, Honk" (Onk, Onk).

AIRPLANE - "Whee"
 Airplane parallel to table edge. Hold by tail, bring up to eye level, saying "Whee" (Eee).

Approximations

Pick-up dinosaur, touch anywhere to other hand, say "Ow, Ow."

Hold anywhere on truck, push across table, saying "honk, honk" (onk, onk)

Hold anywhere on airplane, bring to chest level, say "whee" (Eee).

Appendix C

Toy-play Models and Response Definitions

Appendix C

Toy-Play Models and Response Definitions**Matches****Approximations****1. Tea set - drinking**

Teapot and cut arranged side-by-side on table. Lift teapot by handle and make "pouring" motion into cup. Place teapot on table and lift cup by handle to lips.

Lift teapot, need not be by handle and make "pouring" motion into or near cup. Lift cup, need not be by handle, to any facial area below the nose.

2. Marbleworks

Marble placed on the base piece. Tube piece placed beside the base on table. Secure tube onto top of the base. Pick-up marble and drop it through the top so that it descends down through both pieces onto the base.

Attempt to secure tube to base. Puts marble through tube that is not attached to base.

3. Stuffed animal - hug

Stuff animal placed face down perpendicular to table edge. Pick-up animal and face it towards chest. Hug animal with both arms into chest and twist torso back and forth.

Pick-up animal, need not face chest, and hug to chest with at least one arm. May or may not twist back and forth.

4. Helicopter

Helicopter set on table so that side is facing table edge. Man placed beside helicopter between helicopter and table edge. Place man in hole of helicopter. Holding helicopter by tail, bring it up into air at least chest level.

Place man in hole of helicopter. Bring helicopter up so all parts are off the table.

5. Doll - clap hands

Doll placed face-up on table, feet pointing toward table edge. Bring doll to sitting position. Grasp both arms and clap hands together.

Bring doll to sitting position. Clap together any two extremities.

6. String pull

Toy placed on table so that stacking parts and string form a line perpendicular with the table edge. Grasp ring and pull so that pieces of toy stack one on top of the other. Maintain for at least one second and then release tension on string so that toy pieces fall to the table.

Grasp ring and pull so that the pieces of toy stack one on top of the other. Need not release tension on string.

7. Form board

Board flat on table, bottom edge facing table edge. Man placed on the bottom right corner with feet off board. Pick-up man and place so that his feet and bottom half of body are on the rug. Man's head is pointing to top of the board.

Pick-up man, place anywhere on the rug.

8. Clown snap

Clown lying flat on table, head facing edge of table. Grasp leg with shoe snap and bring it over body. Fasten snap and return leg to table top.

Grasp leg with shoe snap, need not pull across body. Turn so that snap can be reached, touch snaps together. Need not return leg to original position.

9. Blocks - stack

Place rectangular block so that longer side is perpendicular to edge of table, square block placed beside one short end of longer block. Pick-up rectangular block and stand upright on one short side. Place square block flat on top of rectangular block. Release hands from blocks.

Pick-up rectangular block and set it upright on one short end. Place square block on top of rectangular block. Need not release blocks.

10. Car and man - up ramp

Place car facing ramp so that both are perpendicular to edge of the table. Place man beside car between car and table edge. Put man in hole of car. Push car on to top of the ramp and then off.

Place man in the hole of car. Push car to the top of the ramp. Need not push car back off ramp.

11. Fold paper

Place 5 1/2" x 8 1/2" sheet of paper flat on table longer side perpendicular to edge. Grasp one short edge of paper and fold paper in half. Use one hand to run along folded edge of page to flatten the crease.

Grasp one short edge of paper and fold over, need not be in half. Need not make a definite crease.

12. Ring bell

Bell placed upright on table. Pick-up bell by handle and ring. Place bell back to original position.

Pick-up bell by handle and ring. Need not place bell back to original position.

13. Thread bead

Thread placed beside bead on table. Pick-up unknotted end of thread in one hand and bead in the other. Push thread through hole of bead and pull all the way through so that bead rests on knot of thread.

Pick-up unknotted end of thread in one hand and bead in the other. Push thread through hole of bead and pull through. Bead need not be threaded all the way to the knot.

14. Kushball - drop

Kushball placed on table top. Pick-up kushball with one hand, lift chin level, and drop to tabletop.

Pick-up kushball, may use both hands, lift at least chest level, and drop to tabletop.

15. Telephone

Phone placed sideways on table so that side of the phone is facing table edge. Pick-up receiver and hold to side of the head so that mouthpiece is at mouth and receiver covers ear. With other hand, index finger dials one number.

Pick-up receiver and hold to side of the head, mouth piece facing downwards (need not be at mouth) and receiver pointing towards ear. With any finger of the other hand, dial one number.

16. Hour-glass - turn over

Place hour-glass upright on table. Grasp sides of hour-glass in each hand and turn it towards body 180 degrees, so rests on table upside down relative to original position.

Grasp sides of hour-glass and turn it 180 degrees towards body, need not rest on table.

17. Troll - brush hair

Troll placed upright on table facing table edge. Brush lying bristles up beside troll, handle facing table edge. Hold troll in one hand, with the other pick-up brush and stroke troll's hair from top to bottom with bristles.

Hold troll with one hand. Pick-up brush with other hand and touch to troll's hair, need not stroke.

18. Tool set

Stand set upright on table facing table edge, screw unscrewed upright in hole. Screwdriver lying beside stand, handle pointing toward table edge. Pick-up screwdriver and screw screw one revolution.

Pick-up screwdriver and screw at least 1/4 revolution.

19. Kermit - vest

Frog set upright on table, front facing table edge, vest lying beside frog. Pick-up vest and place arms of frog through armholes. Fasten velcro on front of vest.

Place at least one arm through vest armhole. May or may not fasten velcro.

20. Giraffe - push down

Giraffe set upright on table, front facing table edge. Grasp stand and push down so that giraffe falls to table. Release pressure, but maintain grasp, on stand so that giraffe returns to upright position.

May or may not pick-up giraffe from table. Push stand (may be held in hand) so that giraffe falls. May or may not release pressure so giraffe returns to upright position.

21. Pocket Camera

Camera set parallel to table edge so that lens faces away from table edge. Pick-up camera with hand on each side, bring up to face. Push button so that flashbulb makes one 90 degree turn.

Pick-up camera and bring to chest level. Push button so that flashbulb makes one 90 degree turn.

22. Watering Can & Flowerpot

Flowerpot set on table beside watering can. Watering can set so that spout faces pot and handle points away from pot. Pick-up watering can by the handle and "pour" into flowerpot. Place watering can back onto table top.

Pick-up watering can, need not be by handle. Tilt watering can over flowerpot so that spout points towards flower. May or may not return watering can to table top.

23. Finger Puppets

Finger puppets set upright on table, front facing table edge. Pick-up puppet and place one on index finger and the other on middle finger. Face puppet away from body and wiggle fingers.

Pick-up finger puppets and place on any fingers. Need not face puppet away from body or wiggle finger.

24. Mailbox

Mailbox set upright on table, front facing table edge. Two letters set one-on-top-of-the- other beside mailbox. Drop the letters, one at a time, into mail slot. Open door and take out letters.

Drop at least one letter into mail slot. Open door and remove letter.

25. Farmer and Barn

Barn set upright on table, silo facing table edge. Farmer set beside barn. Pick-up farmer and place into silo. Open silo door and take out farmer after he slides down.

Pick-up farmer and place into silo. May or may not open and remove farmer.

26. Mr. Potato Head

Mr. Potato Head set upright on table, front facing table edge, hat and pipe set beside him. Put hat on Mr. Potato Head's head and place pipe into mouth.

Place either the hat or pipe onto Mr. Potato Head. Touch or pick-up other item, need not place onto Potato Head.

27. Dog collar

Dog set on table in sitting position, front facing table edge, leash beside dog. Pick-up plastic collar and loop around dog's neck. Push pompom through loop.

Pick-up collar and loop around dog's neck. Touch pompom to plastic loop, may or may not push through.

28. Rubber Stamp

Ink pad open on table beside rubber stamp. Sheet of white paper placed beside pad and stamp. Pick-up stamp and press onto ink pad. Stamp onto paper so that image appears when rubber stamp is lifted.

Pick-up stamp and press onto ink pad. Place onto paper, may or may not leave an image.

29. Skateboarder

Skateboard upright on table, skateman lying on back beside skateboard. Pick-up man and fasten feet onto skateboard. Push skateboard and man across table.

Pick-up man and touch to skateboard, need not fasten feet to board. Push either man or board across table.

30. Spool and Beanbag Toss

Spools set side-by-side parallel to table edge, beanbag 4-5 inches away from spools. Stack one spool on top of the other, pick-up beanbag and toss or place onto spools.

Touch one spool to the other, need not stack. Pick-up beanbag and place onto spools, may or may not knock one or more over.

31. Bike Horn

Bike horn lying on side on table, open end facing table edge. Pick-up horn, hold open side pointing towards ceiling, press bulb so that horn sounds. Return to table upright, open end on table.

Pick-up horn, need not point towards ceiling. Press bulb so that horn sounds, need not return to table.

32. Cymbals

Cymbals set face down, side-by-side on table. Pick-up cymbal in each hand by handles. Slide cymbals together (one up/one down) then reverse motion.

Pick-up cymbals in each hand, need not be by handles. Slide cymbals together and apart. Need not reverse motion.

35. Card Turnover

Football cards set side-by-side, face down on table. Turn each card face up consecutively. Maintain cards on table surface.

Turn at least two cards face up. May or may not maintain cards on table surface.

36. Snake-in-Grass

Nest, grass, and snake set side-by-side on table. Place grass into nest then set snake in so that all parts are inside nest.

Place grass and snake in nest in any order. All parts of snake and/or grass may or may not be in nest.

37. Spatula and Bowl

Spatula set beside bowl, bottom of handle facing table edge. Pick-up spatula by handle. Place rubber top into bowl and stir around sides of bowl.

Pick-up spatula, need not be by handle, and place one end into bowl. Stir around sides of bowl.

38. Wrist Twister

Twister set on table parallel to edge. Place wrist in middle of twister, fold up sides around wrist and twist ends. Lift up arm from table.

Place wrist on twister or bring twister to wrist. Fold around wrist, may or may not twist ends together.

39. Baby and bottle

Basket, doll, and bottle set side-by-side on table. Place doll in basket and touch bottle to doll's face.

Place doll into basket, may or may not remove. Touch bottle anywhere to doll's head.

40. Magic Slate

Slate face up on table, opening edge pointing towards table edge, pencil on top of slate. Pick-up pencil and make a scribble on slate. Lift plastic so that scribble disappears.

Pick-up pencil and make scribble mark on slate. Touch open edge of plastic, may or may not lift.

41. Twisting Cup

Collapsed cup set upright on table. Pick-up cup and turn upside down. Grasp open end and twist, turn upright so that cup maintains form.

Pick-up cup and turn upside down. Touch open end, need not twist. May or may not turn cup upright (need not hold its form).

42. Whistle

Whistle lying on table, mouthpiece facing table edge. Pick-up whistle with both hands (one in front of the other) and bring to mouth. Blow so that a sound is audible.

Pick-up whistle with at least one hand. Bring to mouth, may or may not blow.

43. Shaving set

Shaver in bag (unzipped) on table. Remove shaver and bring to face. Holding shaver by handle, "shave" one cheek and then the other.

Remove shaver from bag. Bring shaver to face, need not hold by handle, and touch to at least one cheek.

44. Tractor & Trailer

Tractor in front of trailer, both parallel to table edge. Sheep standing between trailer and table edge. Connect trailer to tractor, place sheep in trailer and pull across table.

May or may not connect trailer to tractor, place sheep in trailer. Pull tractor or trailer across table.

45. Soap and Washcloth

Soap and washcloth in soapbox on table. Open box, remove soap and washcloth. Rub washcloth on soap and then rub washcloth around face.

Open box, remove soap and washcloth. May or may not touch washcloth to soap, touch any portion of head with washcloth.

46. He-man

He-man lying on back, feet facing table edge, helmet and shield beside He-man. Pick-up He-man, place helmet on head and shield on arm.

Pick-up He-man, either place helmet on head or shield onto arm.

47. Chalkboard

Chalkboard lying on table face up, chalk and eraser lying between bottom of chalkboard and table edge. Pick-up chalk and mark board. Pick-up eraser and rub over board.

Pick-up chalk and mark board. Pick-up eraser, may or may not rub over chalkmark.

Appendix D
Pantomime Models and Response Definitions

Appendix D

Pantomime Models and Response Definitions

Matches

Approximations

Flying

Thumbs tucked into armpits with elbows bent and extended at a right angle to the side of the torso. Flap elbows up and down.

Elbows bent and extended at right angles to the sides of the torso, thumbs need not be tucked into armpits. Flap elbows up and down.

Eating

One hand open with palm facing upward. Other hand positioned as if holding a fork. Forked hand scoops down towards open palm as if picking up food from a plate. Forked hand then comes up and touches lips.

One hand open with palm facing upward. Other hand may be held in fist or open with the tips of at least two fingers touching. Fisted hand scoops down towards open palm, need not make contact. Fisted hand then comes up and touches any portion of the face below the nose.

Playing Violin

One arm extended at right angle to the front of body, elbow bent slightly downward, hand close-fisted. Other arm moves back and forth between fist and shoulder of extended arm, elbow bent and held perpendicular to body.

One arm extended out from the front of the body, so that hand is at least chest level. Elbow bent slightly downward, hand need not be close-fisted. Other arm moves back and forth between hand and shoulder of extended arm, elbow bent but need not be held perpendicular to body.

Telescope

Hands positioned as if wrapped around a tube, thumb and index finger of one hand touching pinky finger of other. Bring hands up together to one eye so that the index finger and thumb of the hand touching face circle the eye.

Hands may be held in fists, thumb and pinky fingers of one hand in line with pinky finger of other fist, but fists need not touch. Bring hands up so that front fist touches face anywhere between nose and forehead.

Walking Fingers

One hand held close-fisted above table top. Extend index and middle fingers, tips touching table top. Alternating fingers "walk" across table top.

One hand held above table top, need not be close-fisted. Extend any two fingers, tips touching table top. Alternating fingers "walk" across table top.

Fist and scissors

One hand open, extended out from front of body, palm facing toward ceiling. Other hand close-fisted, pinky finger facing open palm. Touch fisted to palm twice and then extend index and middle finger of fisted hand outward to form "scissors".

One hand open, extended out from body, palm facing toward ceiling. Other hand close-fisted. Any portion of fisted hand touches open palm at least once and then at least one finger extends out from fist.

Entwined fingers and steeple

Elbows resting on table top, forearms extended upward. Fingers entwined, extend index fingers upward so that tips of the two fingers touch.

Elbows need not rest on table top, forearms extended upward. Fingers entwined, any two fingers (one of each hand) extend outward. Fingers extended outward touching but, need not be only the tips.

Blow kiss

One hand brought up to lips, lips touch palm of hand. Fingers of hand come downward such that fingers are at right angle to forearm facing away from lips and heel of hand touches chin. Lips pucker and blow.

One hand comes up to lips, palm facing lips but lips need not touch palm. Fingers come downward away from lips, need not at right angle to forearm, heel of hand pointed toward chin but need not touch. Lips purse, but need not blow.

Thumbs up signal

Both hands held chest level above the table top, closed-fisted. Extend thumbs upward toward ceiling.

Both hands held above table top, need not be at chest level, close-fisted. Extend thumbs out from fists, need not be towards ceiling.

Replacement Models for Neal:**Head on hands**

Elbows placed on table top, forearms extended upward. Palms facing table top, tips of fingers of each hand touching tips of corresponding fingers of the other hand. Rest chin on top of hands.

Elbows above table top, but need not touch top, forearms extended upward. Hands open, palms facing towards table top, fingers may entwine or overlap. Bring chin down to within 1 inch from fingers.

Throwing

One arm brought up so that hand is at least 1 inch behind the corresponding shoulder. Move hand forward, as if throwing a baseball overhand, so that arm is fully extended perpendicular to the front of the chest.

One arm brought up so that hand is at least shoulder level. Move hand forward so that forearm and biceps are at least at an angle greater than 90 degrees.

Wheels-on-the-bus

Hold arms out from the front of the body, elbows bent at right angles to forearm. Biceps held perpendicular to chest and forearms parallel to chest. Move forearms so that they circle around each other.

Bullwinkle ears

Place hands, palms facing forward on each side of the head, fingers extended upward. Thumbs extended at right angle to the side of hand, tips touching head between crown and ears. Wiggle fingers back and forth.

Hold arms out from the front of the body, elbows bent (need not be at right angle). Move forearms or hands so that they circle each other.

Place hands, palms facing forward, on each side of the head. Fingers extended upward, thumbs need not be at right angle to hand. Thumb side of hands touching side of the head between crown and cheeks. Wiggle fingers back and forth.

Appendix E

Pantomime Models and Revised Approximation Definitions

Appendix E

Pantomime Models and Revised Approximation Definitions

Match	Approximation
Walking Fingers	
One hand held close-fist above table top. Extend index and middle fingers, tips touching table top. Alternating fingers "walk" across table top.	One or more finger tips touch top of table. Hand moves across table surface.
Eating	
One hand open with palm facing upward. Other hand positioned as if holding a fork. Forked hand scoops down towards open palm as if picking up food from a plate. Forked hand then comes up and touches lips.	One hand comes to mouth, tips of fingers touch lips. Hand need not first touch palm of other hand.
Playing Violin	
One arm extended at right angle to the front of body, elbow bent slightly downward, hand close-fist. Other arm moves back and forth between fist and shoulder of extended arm, elbow bent and held perpendicular to body.	One arm held perpendicular to front of chest, elbow bent. Arm moves back and forth across chest. Other arm may or may not be outstretched.

Fist and scissors

One hand open, extended out from front of body, palm facing toward ceiling. Other hand close-fist, pinky finger facing open palm. Touch fist to palm twice and then extend index and middle finger of fist hand outward to form "scissors".

One hand close-fist, held chest level extend one or two fingers, thumb may also be extended. Fist hand may or may not first touch open palm of other hand.

Blow kiss

One hand brought up to lips, lips touch palm of hand. Fingers of hand come downward such that fingers are at right angle to forearm facing away from lips and heel of hand touches chin. Lips pucker and blow.

Hand comes to mouth, fingers extend toward ceiling, lips touch palm. May or may not bring fingers down and purse lips.

Entwined fingers and steeple

Elbows resting on table top, forearms extended upward. Fingers entwine, extend index fingers upward so that tips of the two fingers touch.

Hands brought together and clasped. Fingers of each hand need not entwine or index finger tips touch.

Flying

Thumbs tucked into armpits with elbows bent and extended at a right angle to the side of the torso. Flap elbows up and down.

Hands held at or above stomach level, elbows bent and held out from sides of body. Elbows need not flap up and down.

Thumbs up signal

Both hands held chest level above the table top, closed-fist. Extend thumbs upward toward ceiling.

Hands held chest level, thumbs extend up towards ceiling. Hands need not be held in fists.

Telescope

Hands positioned as if wrapped around a tube, thumb and index finger of one hand touching pinky finger of other. Bring hands up together to one eye so that the index finger and thumb of the hand touching face circle the eye.

Both hands brought to face, one hand covers an eye, other hand held with at least some portion touching hand covering eye.

Appendix F
Stimulus Sets

STIMULUS SET 1

T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (ANIMAL-HUG)
P-PANTOMIME MODEL (THUMBS UP)
T-PANTOMIME MODEL (EATING)
T-TOY-PLAY MODEL (SPATULA & BOWL)
P-TOY-PLAY MODEL (CLOWN SNAP)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (PLAYING VIOLIN)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (TEA SET)
T-TOY-PLAY MODEL (FORM BOARD)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FIST & SCISSORS)
P-PANTOMIME MODEL (BLOW KISS)
T-TOY-PLAY MODEL (MARBLEWORKS)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (WALKING FINGERS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (POCKET CAMERA)
T-PANTOMIME MODEL (FLYING)
T-TOY-PLAY MODEL (MAILBOX)
P-PANTOMIME MODEL (TELESCOPE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
T-TOY-PLAY MODEL (GIRAFFE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL

T = Training Trial; P = Probe Trial

STIMULUS SET 2

T-TOY-PLAY MODEL (DOG COLLAR)
T-PANTOMIME MODEL (FIST & SCISSORS)
P-TOY-PLAY MODEL (FOLD PAPER)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (THUMBS UP)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (GLASSES)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)
P-PANTOMIME MODEL (BLOW KISS)
T-TOY-PLAY MODEL (BIKE HORN)
T-PANTOMIME MODEL (PLAYING VIOLIN)
P-TOY-PLAY MODEL (HELICOPTER)
T-TOY-PLAY MODEL (CHALKBOARD)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (STRING PULL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (TROLL)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (WALKING FINGERS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (TELESCOPE)
T-PANTOMIME MODEL (FLYING)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
TOY-PLAY MODEL (BLOCKS)

STIMULUS SET 3

T-PANTOMIME MODEL (EATING)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (HOURGLASS)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (THREAD BEAD)
P-PANTOMIME MODEL (TELESCOPE)
T-PANTOMIME MODEL (FIST & SCISSORS)
T-TOY-PLAY MODEL (CAR/RAMP/MAN)
P-TOY-PLAY MODEL (MR POTATO HEAD)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (TELEPHONE)
T-PANTOMIME MODEL (PLAYING VIOLIN)
T-PANTOMIME MODEL (WALKING FINGERS)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (FINGER PUPPETS)
P-TOY-PLAY MODEL (KERMIT)
T-PANTOMIME MODEL (FLYING)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (THUMBS UP)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
P-PANTOMIME MODEL (BLOW KISS)
T-TOY-PLAY MODEL (TOOL SET)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (KUSHBALL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL

STIMULUS SET 4

T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (PLAYING VIOLIN)
P-PANTOMIME MODEL (BLOW KISS)
T-TOY-PLAY MODEL (CYMBAL)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (SKATEBOARDER)
P-TOY-PLAY MODEL (SPOOL & BEANBAG)
T-PANTOMIME MODEL (FIST & SCISSORS)
P-PANTOMIME MODEL (TELESCOPE)
T-TOY-PLAY MODEL (RUBBER STAMP)
T-PANTOMIME MODEL (EATING)
P-TOY-PLAY MODEL (FARMER/BARN)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (TWISTING CUP)
P-TOY-PLAY MODEL (SNAKE-IN-GRASS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (MAGIC SLATE)
T-PANTOMIME MODEL (FLYING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (WALKING FINGERS)
P-PANTOMIME MODEL (THUMBS UP)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (CARD TURNOVER)

STIMULUS SET 5

T-TOY-PLAY MODEL (TRACTOR PULL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (WASH CLOTH)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (BLOW KISS)
T-PANTOMIME MODEL (PLAYING VIOLIN)
T-TOY-PLAY MODEL (DOLL)
P-PANTOMIME MODEL (TELESCOPE)
T-TOY-PLAY MODEL (BABY/BOTTLE)
P-PANTOMIME MODEL (THUMBS UP)
T-TOY-PLAY MODEL (WHISTLE)
T-PANTOMIME MODEL (EATING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (RING BELL)
T-PANTOMIME MODEL (FIST & SCISSORS)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (WRIST TWISTER)
T-PANTOMIME MODEL (FLYING)
P-TOY-PLAY MODEL (WATERING CAN/FLOWER)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (SHAVING KIT)
T-PANTOMIME MODEL (WALKING FINGERS)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL

STIMULUS SET 6

T-PANTOMIME MODEL (PLAYING VIOLIN)
T-TOY-PLAY MODEL (SPATULA/BOWL)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (FORM BOARD)
T-PANTOMIME MODEL (EATING)
P-PANTOMIME MODEL (BLOW KISS)
T-TOY-PLAY MODEL (Giraffe)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FIST & SCISSORS)
P-PANTOMIME MODEL (TELESCOPE)
T-TOY-PLAY MODEL (ANIMAL/HUG)
T-TOY-PLAY MODEL (TEA SET)
P-PANTOMIME MODEL (THUMBS UP)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FLYING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (MAILBOX)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (CLOWN SNAP)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (MARBLEWORKS)
P-TOY-PLAY MODEL (POCKET CAMERA)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (WALKING FINGER)
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)

STIMULUS SET 7

T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FIST/SCISSORS)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (DOG COLLAR)
P-PANTOMIME MODEL (BLOW KISS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (FOLD PAPER)
T-PANTOMIME MODEL (VIOLIN)
T-TOY-PLAY MODEL (BIKE HORN)
P-PANTOMIME MODEL (WALKING FINGERS)
T-TOY-PLAY MODEL (GLASSES)
T-TOY-PLAY MODEL (BLOCKS)
P-PANTOMIME MODEL (TELESCOPE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (STRING PULL)
T-PANTOMIME MODEL (ENTWINED FINGERS/STEEPLE)
T-TOY-PLAY MODEL (CHALKBOARD)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (TROLL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (HELICOPTER)
T-PANTOMIME MODEL (FLYING)
T-PANTOMIME MODEL (THUMBS UP)

STIMULUS SET 8

T-TOY-PLAY MODEL (THREAD BEAD)
T-TOY-PLAY MODEL (CAR/RAMP/MAN)
T-PANTOMIME MODEL (VIOLIN)
P-PANTOMIME MODEL (TELEPHONE)
P-TOY-PLAY MODEL (KERMIT)
T-PANTOMIME MODEL (FIST/SCISSOR)
T-PANTOMIME MODEL (EATING)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (HOURGLASS)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (KUSHBALL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (THUMBS UP)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINED FINGERS/STEEPLE)
P-PANTOMIME MODEL (TELESCOPE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (BLOW KISS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (FINGER PUPPETS)
P-PANTOMIME MODEL (WALKING FINGERS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (MR. POTATO HEAD)
T-TOY-PLAY MODEL (TOOL SET)
T-PANTOMIME MODEL (FLYING)

STIMULUS SET 9

T-PANTOMIME MODEL (FIST/SCISSORS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (RUBBER STAMP)
P-PANTOMIME MODEL (WALKING FINGERS)
T-PANTOMIME MODEL (VIOLIN)
P-TOY-PLAY MODEL (SNAKE-IN-GRASS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (SKATEBOARDER)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)
P-TOY-PLAY MODEL (SPOOL/BEANBAG)
T-TOY-PLAY MODEL (CYMBALS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (FARMER/BARN)
T-TOY-PLAY MODEL (CARDS)
T-PANTOMIME MODEL (THUMBS UP)
P-PANTOMIME MODEL (BLOW KISS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINE FINGERS & STEEPLE)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FLYING)
P-PANTOMIME MODEL (TELESCOPE)
T-TOY-PLAY MODEL (MAGIC SLATE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (TWISTING CUP)

STIMULUS SET 10

T-TOY-PLAY MODEL (DOLL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (THUMBS UP)
T-TOY-PLAY MODEL (WRIST TWISTER)
P-TOY-PLAY MODEL (WATERING CAN/FLOWER)
T-PANTOMIME MODEL (FLYING)
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (WASH CLOTH)
T-PANTOMIME MODEL (WALKING FINGERS)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (RING BELL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (BLOW KISS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)
P-TOY-PLAY MODEL (SHAVING KIT)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (TRACTOR PULL)
P-PANTOMIME MODEL (TELESCOPE)
T-TOY-PLAY MODEL (WHISTLE)
T-PANTOMIME MODEL (PLAYING VIOLIN)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (BABY/BOTTLE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FIST & SCISSORS)

STIMULUS SET 11

T-PANTOMIME MODEL (FLYING)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (POCKET CAMERA)
T-TOY-PLAY MODEL (GIRAFFE)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (FORM BOARD)
P-PANTOMIME MODEL (THUMBS UP)
T-TOY-PLAY MODEL (MAILBOX)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (BLOW KISS)
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
P-TOY-PLAY MODEL (CLOWN SNAP)
T-PANTOMIME MODEL (WALKING FINGERS)
T-TOY-PLAY MODEL (SPATULA/BOWL)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (PLAYING VIOLIN)
T-TOY-PLAY MODEL (MARBLEWORKS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FIST & SCISSORS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (TELESCOPE)
T-TOY-PLAY MODEL (TEA SET)
T-TOY-PLAY MODEL (ANIMAL/HUG)

STIMULUS SET 12

T-PANTOMIME MODEL (WALKING FINGERS)
T-PANTOMIME MODEL (FLYING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (TELESCOPE)
T-TOY-PLAY MODEL (TROLL)
P-TOY-PLAY MODEL (STRING PULL)
T-PANTOMIME MODEL (ENTWINED FINGERS/STEEPLE)
T-TOY-PLAY MODEL (CHALKBOARD)
P-TOY-PLAY MODEL (HELICOPTER)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (BIKE HORN)
T-TOY-PLAY MODEL (BLOCKS)
P-PANTOMIME MODEL (THUMBS UP)
T-PANTOMIME MODEL (VIOLIN)
T-TOY-PLAY MODEL (GLASSES)
P-TOY-PLAY MODEL (FOLD PAPER)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (BLOW KISS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FIST/SCISSORS)
T-PANTOMIME MODEL (EATING)
T-TOY-PLAY MODEL (DOG COLLAR)

STIMULUS SET 13

T-PANTOMIME MODEL (ENTWINED FINGERS/STEEPLE)
T-PANTOMIME MODEL (WALKING FINGERS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (BLOW KISS)
T-TOY-PLAY MODEL (TOOL SET)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (FINGER PUPPETS)
P-TOY-PLAY MODEL (KERMIT)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (KUSHBALL)
P-PANTOMIME MODEL (TELESCOPE)
T-PANTOMIME MODEL (FLYING)
T-TOY-PLAY MODEL (CAR/RAMP/MAN)
P-TOY-PLAY MODEL (MR. POTATO HEAD)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (THREAD BEAD)
P-TOY-PLAY MODEL (TELEPHONE)
T-PANTOMIME MODEL (FIST/SCISSOR)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (THUMBS UP)
T-TOY-PLAY MODEL (HOURGLASS)
T-PANTOMIME MODEL (VIOLIN)

STIMULUS SET 14

T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINE FINGERS & STEEPLE)
P-TOY-PLAY MODEL (FARMER/BARN)
T-PANTOMIME MODEL (WALKING FINGERS)
P-PANTOMIME MODEL (BLOW KISS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (TELESCOPE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (CARDS)
P-PANTOMIME MODEL (THUMBS UP)
T-TOY-PLAY MODEL (MAGIC SLATE)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (TWISTING CUP)
T-PANTOMIME MODEL (FLYING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (SNAKE-IN-GRASS)
T-TOY-PLAY MODEL (RUBBER STAMP)
T-PANTOMIME MODEL (FIST/SCISSORS)
P-TOY-PLAY MODEL (SPOOL/BEANBAG)
T-PANTOMIME MODEL (VIOLIN)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (CYMBALS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (SKATEBOARDER)

STIMULUS SET 15

T-TOY-PLAY MODEL (RING BELL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (BLOW KISS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (WASH CLOTH)
T-PANTOMIME MODEL (WALKING FINGERS)
T-PANTOMIME MODEL (FLYING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (WRIST TWISTER)
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (TELESCOPE)
T-TOY-PLAY MODEL (DOLL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (THUMBS UP)
T-TOY-PLAY MODEL (TRACTOR PULL)
T-PANTOMIME MODEL (EATING)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (BABY/BOTTLE)
T-PANTOMIME MODEL (FIST & SCISSORS)
P-TOY-PLAY MODEL (WATERING CAN/FLOWER)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (WHISTLE)
P-TOY-PLAY MODEL (SHAVING KIT)
T-PANTOMIME MODEL (PLAYING VIOLIN)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL

STIMULUS SET 16

T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (MAILBOX)
T-TOY-PLAY MODEL (MARBLEWORKS)
P-PANTOMIME MODEL (TELESCOPE)
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (SPATULA/BOWL)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (WALKING FINGERS)
T-PANTOMIME MODEL (FLYING)
P-TOY-PLAY MODEL (POCKET CAMERA)
T-TOY-PLAY MODEL (GIRAFFE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (THUMBS UP)
T-PANTOMIME MODEL (PLAYING VIOLIN)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (BLOW KISS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (TEA SET)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FIST & SCISSORS)
T-TOY-PLAY MODEL (ANIMAL/HUG)
P-TOY-PLAY MODEL (FORM BOARD)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (CLOWN SNAP)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)

STIMULUS SET 17

T-TOY-PLAY MODEL (BLOCKS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (HELICOPTER)
T-PANTOMIME MODEL (FLYING)
P-TOY-PLAY MODEL (FOLD PAPER)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (WALKING FINGERS)
T-TOY-PLAY MODEL (TROLL)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (CHALKBOARD)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINED FINGERS/STEEPLE)
P-TOY-PLAY MODEL (TELESCOPE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (PLAYING VIOLIN)
P-PANTOMIME MODEL (BLOW KISS)
T-TOY-PLAY MODEL (BIKE HORN)
T-PANTOMIME MODEL (EATING)
P-PANTOMIME MODEL (THUMBS UP)
T-TOY-PLAY MODEL (GLASSES)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (STRING PULL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FIST/SCISSORS)
T-TOY-PLAY MODEL (DOG COLLAR)

STIMULUS SET 18

T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (FINGER PUPPETS)
T-PANTOMIME MODEL (ENTWINED FINGERS/STEEPLE)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (THUMBS UP)
T-TOY-PLAY MODEL (KUSHBALL)
P-TOY-PLAY MODEL (TELEPHONE)
T-PANTOMIME MODEL (FLYING)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (WALKING FINGERS)
P-TOY-PLAY MODEL (KERMIT)
T-TOY-PLAY MODEL (TOOL SET)
T-PANTOMIME MODEL (FIST/SCISSOR)
P-TOY-PLAY MODEL (MR. POTATO HEAD)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (CAR/RAMP/MAN)
P-PANTOMIME MODEL (TELESCOPE)
T-PANTOMIME MODEL (PLAYING VIOLIN)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (HOURGLASS)
T-PANTOMIME MODEL (EATING)
P-PANTOMIME MODEL (BLOW KISS)
T-TOY-PLAY MODEL (THREAD BEAD)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL

STIMULUS SET 19

T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (SKATEBOARDER)
P-PANTOMIME MODEL (TELESCOPE)
T-PANTOMIME MODEL (BULLWINKLE EARS)
T-TOY-PLAY MODEL (CYMBALS)
P-TOY-PLAY MODEL (SPOOL/BEANBAG)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (FIST/SCISSORS)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (RUBBER STAMP)
P-TOY-PLAY MODEL (SNAKE-IN-GRASS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)
P-PANTOMIME MODEL (THUMBS UP)
T-TOY-PLAY MODEL (TWISTING CUP)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (VIOLIN)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (FARMER/BARN)
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
T-TOY-PLAY MODEL (CARDS)
P-PANTOMIME MODEL (BLOW KISS)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (WALKING FINGERS)
T-TOY-PLAY MODEL (MAGIC SLATE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL

STIMULUS SET 20

T-TOY-PLAY MODEL (WHISTLE)
T-PANTOMIME MODEL (FIST & SCISSORS)
P-TOY-PLAY MODEL (SHAVING KIT)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-PANTOMIME MODEL (THUMBS UP)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (BABY/BOTTLE)
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (EATING)
P-PANTOMIME MODEL (BLOW KISS)
T-TOY-PLAY MODEL (TRACTOR PULL)
T-PANTOMIME MODEL (PLAYING VIOLIN)
P-TOY-PLAY MODEL (WATERING CAN/FLOWER)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (ENTWINED FINGERS & STEEPLE)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-TOY-PLAY MODEL (WASH CLOTH)
T-TOY-PLAY MODEL (RING BELL)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
P-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-PANTOMIME MODEL (WALKING FINGERS)
T-TOY-PLAY MODEL (DOLL)
P-PANTOMIME MODEL (TELESCOPE)
T-PANTOMIME MODEL (FLYING)
T-VOCAL MODEL/VOCAL-WITH-TOY MODEL
T-TOY-PLAY MODEL (WRIST TWISTER)

Appendix G
Mean Percentage of Interobserver Agreement for Individual
Children

Appendix G

Mean percentage of interobserver agreement for individual children

	Heidi	David	Neal	Seth
Match/Other	Match/Other	Match/Other	Match/Other	Match/Other
<u>Vocal/Vocal-</u>				
<u>with-toy</u>				
Baseline:				
Training	100/100	100/100	100/100	1) 100/100* 2) 100/100*
Probe	-/100	-/100	-/100	1) -/100 2) 100/100
Treatment:				
Training	99/98.6	99/100	98.9/100	100/100
Probe	100/100	100/100	98.4/100	100/100
<hr/>				
<u>Toy-Play</u>				
Baseline:				
Training	100/100	100/90	100/100	98.5/100
Probe	100/100	100/100	100/100	100/100
Treatment:				
Training	100/100	98.6/100	100/100	100/100
Probe	100/100	100/100	100/100	100/100

Mean percentage of interobserver agreement for individual children (cont.)

	Heidi	David	Neal	Seth
	Match/Other	Match/Other	Match/Other	Match/Other
<u>Pantomime</u>				
Baseline:				
Training	100/100	100/100	100/100	98.5/100
Probe	100/100	-/100	100/100	100/100
Treatment:				
Training	100/100	98.2/100	100/100	100/100
Probe	100/100	100/100	100/100	100/100
<hr/>				
% of sessions scored for IOA	34	34	33	31
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Other = non-matches

- = no opportunities to score

* = 1) model alone 2) model and praise

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