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Parent Training for Families With a Child With ASD: A Naturalistic Systemic Behavior Analytic Model

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Abstract

The great challenges that the treatment of children with Autism Spectrum Disorder (ASD) present to therapists and to parents, alike, arise not only from the severity of this disability, but also from two other factors: the continuously increasing prevalence of ASD and the serious financial restraints imposed by the recent economic hardships that the Western World faces. Thus, the need for parent-training practices is more prevalent than ever. The purpose of the present study was to identify parent-training practices that encompass child-related, parent-related and parent-child-interaction related variables as a means of addressing the difficulties that arise during parent-child interactions in a systemic and systematic way. Complex phenomena, such as the parent-child interaction, need to be treated with multi-focused interventions that produce generalized, systemic outcomes that are of clinical or social significance. The changes achieved in this intervention, which was conducted within a naturalistic context, were multiple and systemic since they involve child-related (e.g., on task behavior), parent-related (e.g., provision of reinforcement), and parent-child-interaction related variables (e.g., joint attention). Those changes were obtained through the use of behavior analytic techniques, such as modeling and systematic, direct parent training. Most importantly, those changes were spread to response categories for which training was not provided, generalized to novel settings and maintained through time. We may conclude that the combination of systemic and behavior-analytic approaches and methodologies may provide a highly beneficial perspective toward designing parent-training research protocols that may also lead to improved clinical practices.

Keywords: ASD, naturalistic systemic behavior-analytic intervention, parent training

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Introduction

The treatment of children with Autism Spectrum Disorder (ASD) continues to be a great challenge that often transcends the therapeutic technology that is available within one epistemological paradigm (Schreibman et al., 2015). There is ample evidence that behavior analytic interventions continue to provide the most effective and efficient means of intervening directly with the child with ASD (Koegel, Koegel, & Camarata, 2010; Smith, Klorman, & Mruzek, 2015). Yet, we do not have all the answers pertaining to optimal treatment practices (Fein et al., 2013), especially those associated with parental training, support, guidance and counseling (Gena, Galanis, Alai-Rosales, & Michalopoulou, 2014). Thus, there is a great need for models that attain to a systemic view of the needs of children with ASD and their families (Klin et al., 2015).

Parent-training practices are considered to be an essential part of therapeutic interventions for children with ASD (National Research Council, 2001) for several reasons: (a) Parents exert a powerful influence on their children

since they have both great proximity and a life-time commitment to them. (b) Parents provide unlimited resources that facilitate child progress, such as numerous opportunities for generalization and maintenance of acquired skills, which is very difficult to achieve without parental involvement (Gillett & LeBlanc, 2007; Koegel, Schreibman, Britten, Burke, & O'Neill, 1982). (c) Parent training is a cost-effective intervention which is very important given two factors, the continuously increasing prevalence of ASD (e.g., Autism and Developmental Disabilities Monitoring Network Surveillance Year 2008 Principal Investigators, 2012), as well as the paucity in funding in the fields of special education and mental health, especially in countries that undergo financial hardship as is the case of Greece (Economou et al., 2014; Economou, Madianos, Peppou, Theleritis, & Stefanis, 2010). (d) Parent training can be very useful while children with ASD are on a waiting list for treatment. As indicated, the waiting lists for effective interventions such as EIBI (Early Intensive Behavioral Interventions) are very long (Coolican, Smith, & Bryson, 2010). (e) The absence of parent training practices limits the therapeutic benefits to the child with ASD (Maurice, Green, & Luce, 1996).

In addition to the aforementioned reasons that underline the importance of parent-training practices for parents of children with ASD, the most substantial evidence about its importance comes from studies that point out the multiple benefits of such practices. In an attempt to classify those benefits, we may say that there are three types of benefits, which are, of course, interrelated: the benefits associated with the advances made by the child with ASD, the benefits to the parents, and the benefits to the parent-child relationship.

Starting with the benefits to the child with ASD, numerous gains are made across the board: communicative behavior, both non-verbal (Anderson & Romanczyk, 1999; Koegel, Koegel, Harrower, & Carter, 1999) as well as verbal, such as taking an initiative to talk to their parents (Laski, Charlop, & Schreibman, 1988; McGee, Morrier, & Daly, 1999; Stahmer & Gist, 2001); in play skills and other social skills (Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Stahmer, 1995; Vismara, Colombi, & Rogers, 2009); in fostering independence (Krantz, MacDuff, & McClannahan, 1993); and in managing inappropriate behavior, such as aggression (Koegel, Koegel, & Surratt, 1992; Vismara et al., 2009). It is apparent that the benefits of parent-training for children with ASD are noted in all areas of functioning: adaptive, intellectual, emotional, social and behavioral (Anan, Warner, McGillivary, Chong, & Hines, 2008; Baker-Ericzén, Stahmer, & Burns, 2007; Boettcher Minjarez, Williams, Mercier, & Hardan, 2011; Solomon, Ono, Timmer, & Goodlin-Jones, 2008). It is important to point out that when parents receive training and begin to use effectively behavior-analytic therapeutic methods, their children with ASD achieve significantly higher IQ scores and their autistic symptomatology decreases significantly as well (e.g., Bibby, Eikeseth, Martin, Mudford, & Reeves, 2002; Harris & Handleman, 2000; Schreibman & Ingersoll, 2005; Schreibman & Winter, 2003).

There are innumerous benefits of parent-training on parental wellbeing and especially for mothers of children with ASD which has been demonstrated by a great number of studies (Estes et al., 2014; Rellini & Cecconi, 2007). Some examples of those benefits include: reduction of anxiety or stress and depression, improved adjustment, enhancement of confidence and self-efficacy, improvement in parents' ability to use effective strategies while interacting with their child, learning to organize family life more efficiently, being more active in the community, feeling more self-assured as a parent, and being more optimistic and with higher expectations from their offspring (Brookman-Frazee, 2004; Cunningham & Davis, 1985; Estes et al., 2014; Koegel, Schreibman, O'Neill, & Burke 1983; Moes, Koegel, Schreibman, & Loos, 1992).

There are also some studies that demonstrate improvement in the parent-child relationship following parent-training interventions (Kasari et al., 2010; Koegel, Bimbela, & Schreibman, 1996; Mahoney & Perales, 2003,

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2005). Yet, we also need to take into consideration idiosyncratic parameters of the family. It was found that even when the same intervention was followed, there were qualitative differences in the mother-child interaction that were associated with the ways in which mothers try to engage their child with ASD (Kasari et al., 2010).

Providing treatment for the child with ASD without considering the needs of the family, entails two serious disadvantages: Firstly, it limits the child's ability to generalize and maintain acquired skills (Vismara et al., 2009) and to take maximum advantage of opportunities to learn throughout the day, and secondly, it does not address the issue of family climate that has proven to be a critical factor for the advancement of people with severe disabilities or serious mental health problems (Falloon, 2003). Family climate refers to all those variables that impact on the relationships established among family members, such as whether family members communicate effectively or provide more positive than corrective feedback to one another. Parent training practices have been considered very important since they enhance the ability of family members to communicate amongst themselves effectively which improves family climate and prevents regression or relapses of the family member that carries a diagnosis (Eldevik, Eikeseth, Jahr, & Smith, 2006; Falloon, 2003; Moes & Frea, 2002; Siller & Sigman, 2002).

Since the multiple benefits of parent-training for all the members of families with a child with ASD have been unequivocally demonstrated, the next question that arises has to do with best practices for parent training. Despite the highly-satisfactory effects of structured behavioral-analytic interventions, directive approaches entail numerous disadvantages for promoting social engagement and interaction, spontaneous speech, play activities, as well as generalization and maintenance of acquired behavior (Gillett & LeBlanc, 2007; Schreibman & Ingersoll, 2005). This realization led to an inquiry for naturalistic approaches that may alleviate those difficulties. From the early 1980's until nowadays, a great number of studies have been conducted that demonstrated the effectiveness of behavior analytic techniques that can be used in a naturalistic context, such as incidental teaching (McGee, Krantz, & McClannahan, 1985; McGee et al., 1999) or systematic withdrawal of partial assistance through time-delay (Laski et al., 1988), as well as naturalistic models for teaching (e.g., Gillett & LeBlanc, 2007; Koegel, Koegel, & Surratt, 1992; Koegel et al., 1999; Rogers & Dawson, 2010) that draw from a wealth of experimentally-validated methods in the context of Applied Behavior Analysis and other empirically-validated approaches, and promote spontaneous speech as well as stimulus and response generalization (Schreibman et al., 2015). These approaches use behavior analytic principles in a naturalistic perspective which means that: (a) the therapist follows the child's lead and (b) expands upon initial child responses in order to help him/her acquire advanced skills. Among the basic characteristics of naturalistic approaches are the following: using a variety of reinforcers, and of discriminative stimuli to teach desired responses, offering opportunities for learning within naturalistic conditions, such as play activities, providing reinforcement contingently upon attempts for desired responses, such as communicative attempts of children with ASD, and following the child's lead instead of being directive (Koegel, O'Dell, & Koegel, 1987). The term "Naturalistic Developmental Behavioral Interventions (NDBI)" has been recently coined in order to provide a more parsimonious way of referring to these naturalistic approaches (Schreibman et al., 2015).

Since, to our knowledge, no research attempts have been conducted in Greece on parent-training practices with families of children with ASD (as indicated by our search on the four peer-reviewed Greek journals pertaining to psychological interventions), we started out with a hybrid study that drew from both the behavior analytic and the general systems theory paradigms and aimed to explore how, within the ecology of the family, the parent-child naturalistic interactions may change in ways that lead to improvement on both the child and the parent-child relationship (Gena, Galanis, Alai-Rosales, & Michalopoulou, 2014). This hybrid study was empirical, yet, exploratory, aiming to identify as many variables as possible that can make the parent-child interaction more naturalistic than

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directive and more reinforcing than corrective. It entailed both an assessment of the parent-child interactions (for mothers and fathers) as well as an attempt to ameliorate the identified difficulties. It also provided the basis for designing the present study with two toddlers and their parents (Michalopoulou, Gena, & Galanis, 2014; Sarafidou, Gena, & Galanis, 2014). The purpose of the present study was to address parent training practices as a means of enhancing the parents' ability to comprehend and address effectively the difficulties that arise during their interaction with their child with ASD and to maximize the benefits of naturally-occurring events by providing learning opportunities for their child. For example, as parents of children with ASD, they learn to interact with their child as therapists, but they may fail to take advantage of opportunities to teach their child through naturally occurring events – talk to them while they play rather than pose questions, wait for the child to select toys or activities rather than take the first step themselves in initiating an interaction, etc. Ultimately, parents were provided with training on how to provide opportunities for the child to learn under naturalistic conditions and throughout the day rather than limiting learning opportunities to a therapeutic or school setting. In addition, through the process of parent training, parents are empowered, which results to great improvements in the family climate (Tsiouri, Gena, & Mouzas, 2013).

Specifically, the present study aimed to systematically assess the individual needs of two families of children with ASD and to improve the quality of the parent-child interaction through the use of behavior analytic methodology. In order to fulfill this purpose, we addressed three types of variables: child-related, parent-related variables, as well as variables related to parent-child interaction within a naturalistic context of interaction. The major novelty of this study lies on its theoretical underpinnings which draws from two paradigms: the Experimental Analysis of Behavior (EAB) and General Systems Theory (GST) (Gena et al., 2014). Those two models were considered complementary since they provide us with different perspectives for the analysis of behavior and its interaction with environmental variables. EAB emphasizes the systematic study of small units of behavior and its shaping longitudinally, whereas, GST emphasizes the interrelations of a great number of variables interacting within complex systems, such as the family system. Thus, we were interested in investigating the effects of our intervention in a variety of very specific response classes and at the same time a great number of possible emergent changes that are not necessarily predictable, but are very important especially for the population of children with ASD that present serious difficulties in response generalization. Such changes are not necessarily explained through linear causality, but rather through the cyclical causality attributed to dynamically inter-related variables (for example, changes in the parent-child-interaction variables may not be attributed to child or parent behavior, but to a dynamic interaction between the two).

Method

Participants

Two toddlers with Autism Spectrum Disorder (ASD), diagnosed by independent public agencies, according to the DSM-IV classification criteria, and their parents participated in the present study. At the beginning of the study, "Nick" was 3 years 8 months old and "Helen" was 3 years 5 months old. Throughout the study, they were both receiving one-on-one behavior analytic intervention in a private, not-for-profit day center that provides therapeutic intervention for children with ASD.

Nick had limited social and language skills, did not respond to his name or make eye contact, didn't pursue joint attention, had no communicative speech, was able to imitate a few sounds, but not words. Nick made communic-

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ative attempts by pointing to preferred items or by taking his parents or therapists by hand to lead them to an area where he could engage in preferred activities. Helen had not developed functional communicative speech and was using the Picture Exchange Communication System, instead. She had limited imitation and play skills and her affect was not always contextually appropriate. The participants' characteristics are summarized on Tables 1 and 2.

Table 1

Children's Characteristics

			VABS[b]					
Child	**Age**	**CARS[a]**	**Comm**	**Daily**	**Social**	**Motor**	**COMP**	**ABA therapy prior to study**
Nick	3.8	42	41	36	51	46	40	4 Months, 10h/ Week, one-on-one Intervention
Helen	3.5	35	59	61	63	64	48	11 Months, 15h/ Week, one-on-one Intervention

[a]"Childhood Autism Rating Scale" (Schopler, Reichler, & Renner, 1986).

[b]"Vineland Adaptive Behavior Scales" (Sparrow, Balla, & Cicchetti, 1984).

Table 2

Parents' characteristics

Child	**Parent**	**Age**	**Education status**	**Employment**
Nick's	Father	50	High-school	Self-employed
	Mother	41	Higher education	Private sector
Helen's	Father	41	Higher education	Self-employed
	Mother	34	Higher education	Stay-at-home

Setting and Therapists

The study was conducted in a specially-arranged classroom of the therapeutic day center that the participants attended – the Institute of Systemic Behavior Analysis – located in Athens, Greece. All sessions were videotaped. The classroom was quiet, comfortable, and well equipped with age-appropriate toys and activity corners. The arrangement of the furniture allowed for moving around the room comfortably, as well as for parent-child close physical proximity. Specifically, there was able room for moving around at the center of the room and four play "corners" arranged with different toys for the child to play with. The participants were sitting and playing on the floor for most of the session. For generalization purposes, data were also collected in the participants' homes. Specifically, the sessions were conducted in the living room of the homes with arranged play corners similar to those arranged in the day center.

Parent training was conducted by two psychologists with several years of experience in behavior analytic interventions. They were both employees of the therapeutic day center that the participants attended. Videotaping and data collection were conducted by a psychologist and a high-school teacher who were graduate students. They were both trained and supervised by a therapist with a doctoral degree in special education. During research

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sessions, at least one parent, the child with ASD, the parent trainer, and one observer/data collector were always present.

Response Definitions

There were three categories of dependent variables: those associated with child behavior, those associated with parental behavior, and those that involved parent-child interaction. Child behavior measures included: (a) on-task behavior, (b) functional and symbolic play, (c) child-initiated verbalizations, and (d) play accompanied by child-initiated verbalizations. Parental behavior measures included: (a) naturalistic, non-directive style of interaction, (b) provision of reinforcement, and (c) corrective feedback and reprimands to the child. Parent-child interaction measures included: (a) child on-task behavior while interacting with parent, (b) imperative and declarative joint attention, (c) motor, vocal, and combined motor with vocal imitation. For each parent-child dyad, the targeted categories were individualized to ensure that we targeted those that were problematic for each one dyad.

Due to the large number of variables used in this investigation, we considered appropriate to provide two representative examples of operational definitions of the dependent measures. On-task behavior included all types of activity that the child engaged in which involved appropriate manipulation of environmental stimuli, such as toys or appropriate engagement with others. Examples of on-task behavior are the following: eye-gazing toward the parent or the objects that were used in an activity, appropriate use of the play materials that were provided, and waiting between activities without engaging in disruptive or stereotypic behavior. Off-task behavior was defined as either abstaining from any type of activity, engaging in disruptive or stereotypic behavior or not attending either to the parent or the play materials. Examples of off-task behavior included, engaging in stereotypic behavior (e.g., tactile, vocal, etc.), engaging in disruptive behavior (e.g., aggressive behavior) not attending to assigned activities, not attending to parent commands, or attempting to avoid engaging in play activities.

Joint attention was defined as “coordinating attention between interactive social partners with respect to objects or events in order to share awareness of the objects or events” (Mundy, Sigman, Ungerer, & Sherman, 1986, p. 657). Joint attention has been described as triadic attention that includes: gaze following, alternating eye gaze, and directing the attention of others through the use of comments and gestures. Responding to joint attention involves the child responding to his/her partner’s pointing by shifting his/her attention toward the direction of the pointing. Initiating joint attention refers to the child’s attempt to direct the interaction partner’s attention toward an object or activity by pointing at it, shifting his/her gaze toward it, or by talking about it – excluding requests for the object or for engagement in the activity. Joint attention, depending on the function that it serves, may take two forms. In the case of imperative joint attention, the child initiates joint attention in order to request help or to obtain a desired object. For example, the child alternates gaze between the partner and the object and points to an object, delivering the message “Give me that thing over there”. In that case, the reinforcer is tangible, not social. In the case of declarative joint attention, the child shares an experience or the awareness of an event/situation with a communicative intent. For example, the child alternates gaze between the partner and the object and points to an object delivering the message: “Hey, look at that interesting thing over there!” In this case, reinforcement takes the form of social interaction as the child and the adult share a common interest.

Experimental Design and Procedure

A multiple baseline design across responses was implemented to evaluate the efficacy of the intervention. The experimental procedure included a baseline, an intervention, a follow-up condition, and a generalization phase in the home setting. The duration of the baseline and treatment phases was 13 months for Nick and 12 for Helen.

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Prior to baseline, the parent trainer met with the parents and provided an extensive rationale for the purposes of the study and the potential benefits to the child and the family. After ensuring that the parents understood this rationale, several examples of types of naturalistic interactions were provided for the parents to have a clear understanding of the targets of the study and thus provide informed consent for participation.

During baseline, each parent was asked to play with his/her child as he/she normally does, without providing any other instructions. There were plenty of toys available in the room and the parents were encouraged to alternate toys frequently in order to reinforce the child's interest for engagement. If they posed questions to the parent trainer, she would answer them as long as they were not related to the purposes of the intervention. The parents were praised for trying their best, but no behavior-specific praise was provided.

During the intervention phase, each parent received training separately to ensure that an individualized intervention would be applied according to the needs of each parent-child dyad. Table 3 depicts the response categories that were assessed for each parent separately.

Intervention sessions started by the parent trainer reviewing the response definitions of the dependent variable that was targeted at that point in time and by offering 2 to 3 examples pertaining to that variable. For example, when the dependent variable targeted was to adopt a "naturalistic, non-directive style of interaction", the trainer would ask the parent to do the following: (a) use affirmative language, (b) avoid giving commands and posing questions during play, (c) allow the child to select play activities rather than directing him/her to play activities and, generally, follow the child's lead, and (d) use a variety of toys rather than the same ones repeatedly. Or when the variable targeted was motor imitation skills, the trainer would ask the parent to do the following: (a) provide plenty of motor models during the session, such as play actions with animal figures, (b) provide the motor model and count to 3 as he/she waited for the child to respond, (c) provide each model once rather than repeatedly and use a variety of models, in general, (d) avoid using the same object for more than 3 actions, try to use a variety of objects, and (e) avoid using commands, try to invite the child to play activities, instead (e.g., "Would you like to join me?" rather than, "Come play with the airplane").

After providing those instructions, the parent trainer asked the parent to start playing with the child, taking into consideration the training instructions that had been offered so far. To achieve the training goals, several behavior-analytic techniques were used. When parents applied the instructions, pertaining to the targeted variable correctly, the parent trainer offered reinforcement in the form of social praise, such as, "you are following the instructions precisely, you are doing a good job getting _____ (child's name) to interact with you". The correction procedure used by the parent trainer involved the following: (a) in vivo modeling, (b) verbal prompting, such as, "make sure that ____ (child's name) looks at you while she invites you to join her in a play activity", (c) verbal reminders to engage in the target response. The number of verbal prompts provided per 15-min sessions ranged from 1-24, depending on parental compliance with the treatment goals. No immediate feedback was provided for parental errors in goals that had already been acquired. Yet, parents were reminded of those goals in the beginning of each session. At the end of each session, the therapist offered feedback to the parent pertaining to his/her progress. In addition, only for those sessions that a new variable was introduced, the trainer gave the parent a friendly-written set of instructions which included a description of the newly-introduced goals and examples of how to reach those goals. Parents were also encouraged to use what they learned, during intervention, in everyday activities with their child.

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Table 3

Categories of the Dependent Measures

Category	Nick's Parents	Helen's Mother	Helen's Father
Target Responses related to Child's Behavior			
On task Behavior	+	-	-
Functional and symbolic Play	-	-	-
Child initiated Verbalizations	-	-	-
Play accompanied by Verbalizations	-	N/A	N/A
Target Responses related to Parent's Behavior			
Naturalistic Style of Interaction	+	+	+
Reinforcement	+	-	-
Corrective Feedback	-	-	-
Reprimands	-	-	-
Target Responses related to Parent-Child Interaction			
Child's on-task Behavior while interacting with Parent	+	+	+
Imperative Joint Attention	-	+	+
Declarative Joint Attention	-	+	-
Motor Imitation	+	-	+
Vocal Imitation	+	-	-
Combined Motor with Vocal Imitation	+	N/A	N/A

Note. + = Variable for which direct training was provided. - = Variable that was not trained. N/A = Variables that were not selected for Helen's parents.

Once training was initiated for each new response category, treatment ceased to be provided for the previous response category (ies) that were trained. Yet, data continued to be collected on trained response categories to assess whether acquired skills would maintain across time.

Response and Setting Generalization

Response generalization was assessed across categories of responses for which training was not provided throughout the study. Those categories are depicted on Table 3. Furthermore, generalization across settings was assessed for both children in the home setting. The parents did not receive training in the home setting but were asked to interact with their child applying what they had learned in the clinical setting.

Follow-up

Following completion of the intervention, a 1-month follow-up session was conducted for Nick's mother only, since the father was not available. In follow-up sessions no treatment procedures were used. Instead, the procedure used was the same as in baseline. Follow-up sessions were run under the same conditions for Helen except for their timing. The initial and the final follow-up sessions were run 3 and 8 months following the completion of intervention, respectively.

Data Collection

All sessions were videotaped and data were collected on 100% of the sessions. Two to four sessions per month were run with each parent. A momentary time-sampling procedure was used to measure the child's on-task behavior with or without interaction, functional and symbolic play, and parent's naturalistic style of interaction. Each 15-minute session was divided to 15 1-minute intervals. The researcher observed the participants' behavior for

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the final 5 seconds of each interval and recorded occurrences and non-occurrences of the dependent measures. On-task behavior with or without interaction was recorded using “Y” for occurrences and “N” for non-occurrences. The play skills of children with ASD were scored as “F” for functional, “S” for symbolic, while “N” was recorded when children didn’t play appropriately during the last 5 seconds of the interval. Parental style of interaction was scored as “N” for naturalistic, as “D” for directive, and as “0” when it was neither naturalistic nor directive. To calculate the percentage of intervals in each session scored for the above responses, the number of intervals that each response occurred was divided by the total numbers of intervals (15) and the quotient was multiplied by 100. To measure occurrences of the rest of the dependent variables, we used a frequency count recording procedure (tally marks were used to record occurrences). Thus, to calculate the frequency (total number of occurrences per session) of child-initiated verbalizations, play accompanied by verbalizations, reinforcement, correction, reprimands, declarative and imperative joint attention, and motor, vocal and combined motor with vocal imitation, we summed occurrences per measure per session. The data-collection sheet is presented in Figure 1.

Datasheet

Child: ..... Parent: ..... Observer: ..... Date: ..... No of session: .....

Time	On task	On task with inter.	Play	Style of interact.	Time	On task	On task with inter.	Play	Style of interact.
1′					9′				
2′					10′				
3′					11′				
4′					12′				
5′					13′				
6′					14′				
7′					15′				
8′					%				

Responses	Occurrences	SUM
Child initiated verbalizations		
Child’s play accompanied by verbalizations		
Child’s motor imitation		
Child’s vocal imitation		
Child’s combined motor with vocal imitation		
Reinforcement provided by parents		
Corrective feedback provided by parents		
Reprimands provided by parents		
Imperative joint attention		
Declarative joint attention		

Figure 1. Data-collection sheet.

Inter-Observer Agreement

Three observers served as independent raters for inter-observer agreement purposes. Inter-observer agreement was calculated for all of Nick’s sessions and for 35% of Helen’s. A point-by-point agreement ratio was calculated for variables measured using momentary time-sampling. To calculate percentages of occurrences, the number of agreements was divided by the number of agreements plus disagreements and the quotient was multiplied by 100. The frequency ratio agreement method was used for the remaining variables, where the smaller total number of recorded responses was divided by the larger total number of recorded responses and the quotient was multiplied

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by 100 (Kazdin, 1982). Inter-observer agreement across all observations of the dependent measures ranged from 86 to 100% with an average of 93% agreement.

Social Validity

The social validity of the intervention outcomes were assessed only for Helen. A questionnaire was administered to her parents prior to and after the intervention. Helen's father and mother were asked to respond to the questionnaire separately by indicating whether they considered the parent-training program to be useful for their family and by describing its benefits for Helen and for themselves.

Results

Treatment, generalization, and follow-up data are depicted on Figures 2-9. Starting with Nick's data, Figure 2 depicts percentages of frequencies of Nick's and his mother's appropriate responding for trained categories. The vertical dashed lines indicate the point at which intervention was initiated for each response category. During baseline, the percentage of intervals scored for on-task behavior with and without interaction were 25% and 37%, respectively. Following intervention, those responses increased to 40 and 60%, respectively. Systematic increases for on-task behavior were also noted during the maintenance phase, during follow-up, as well as in the generalization setting (Nick's home).

Pertaining to Nick's mother's naturalistic style of interaction, during baseline, the average percentages of intervals scored for naturalistic interactions were 38% and 35% for directive interactions. Following treatment, naturalistic interactions increased to 72%, on average, and directive interactions decreased, as expected, to 13%. Similar outcomes were noted during maintenance and follow up as well as in the generalization setting. Finally, systematic improvement was also achieved in the frequency of positive reinforcement provided by Nick's mother. From an average of 6 in baseline, the frequency of reinforcement increased to 16 in treatment. Similar increases were achieved during maintenance and the final follow-up session as well as in the generalization setting.

Motor, vocal, and combined imitative responding were all variables from the category of parent-child interaction that were targeted for Nick. During baseline, the frequency of Nick's imitative responding was invariable 0 for all three types of imitative responses. Following his mother's training, there was a slight increase in motor, vocal and combined motor with vocal imitation to, an average of 3, 4, and 3 imitations per session, respectively. Slight increases were also obtained during, maintenance, during the follow-up session, as well as during generalization to the home setting.

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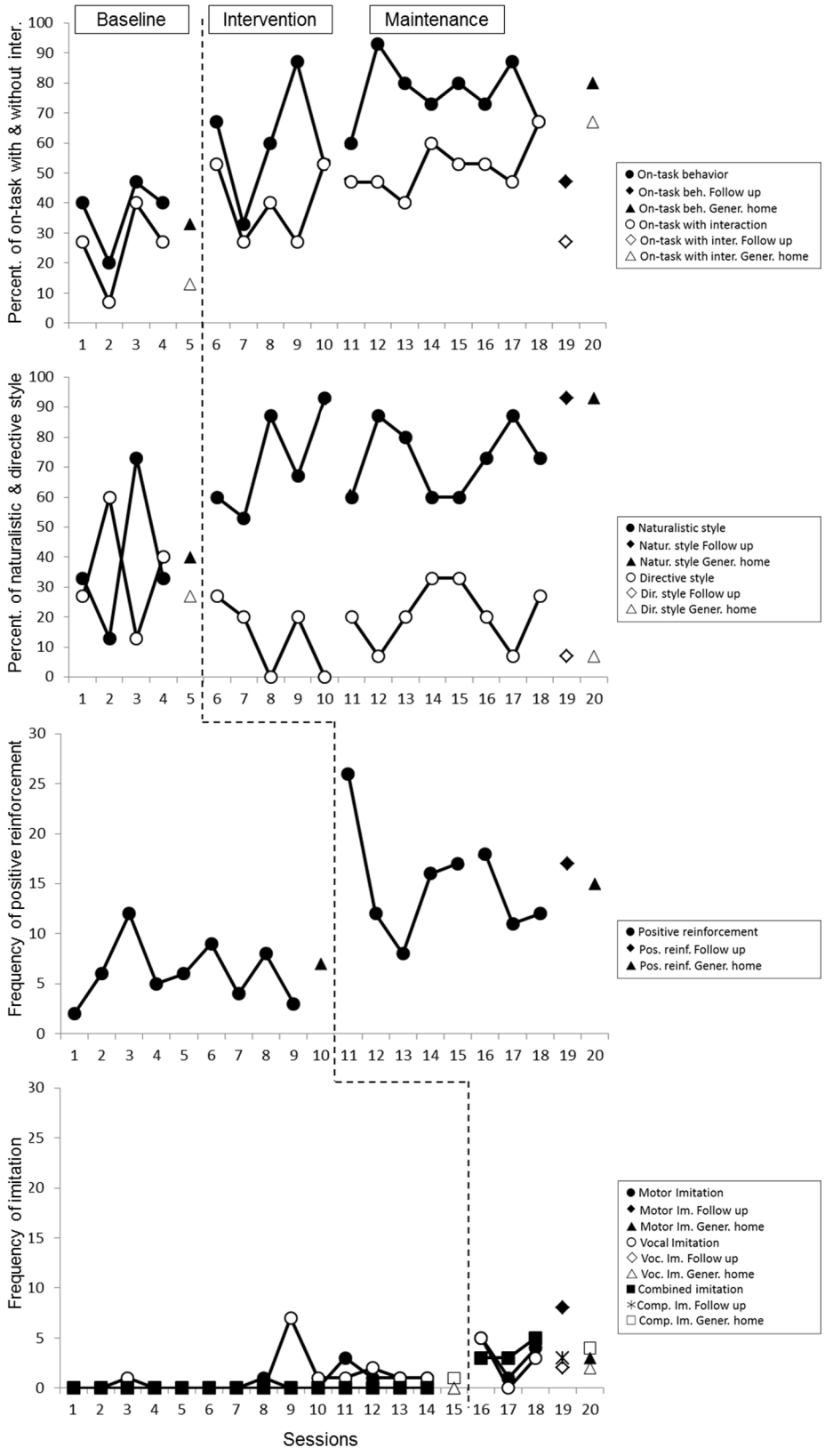

Figure 2. Percentages and frequencies of Nick's and of mother's appropriate responding for trained categories.

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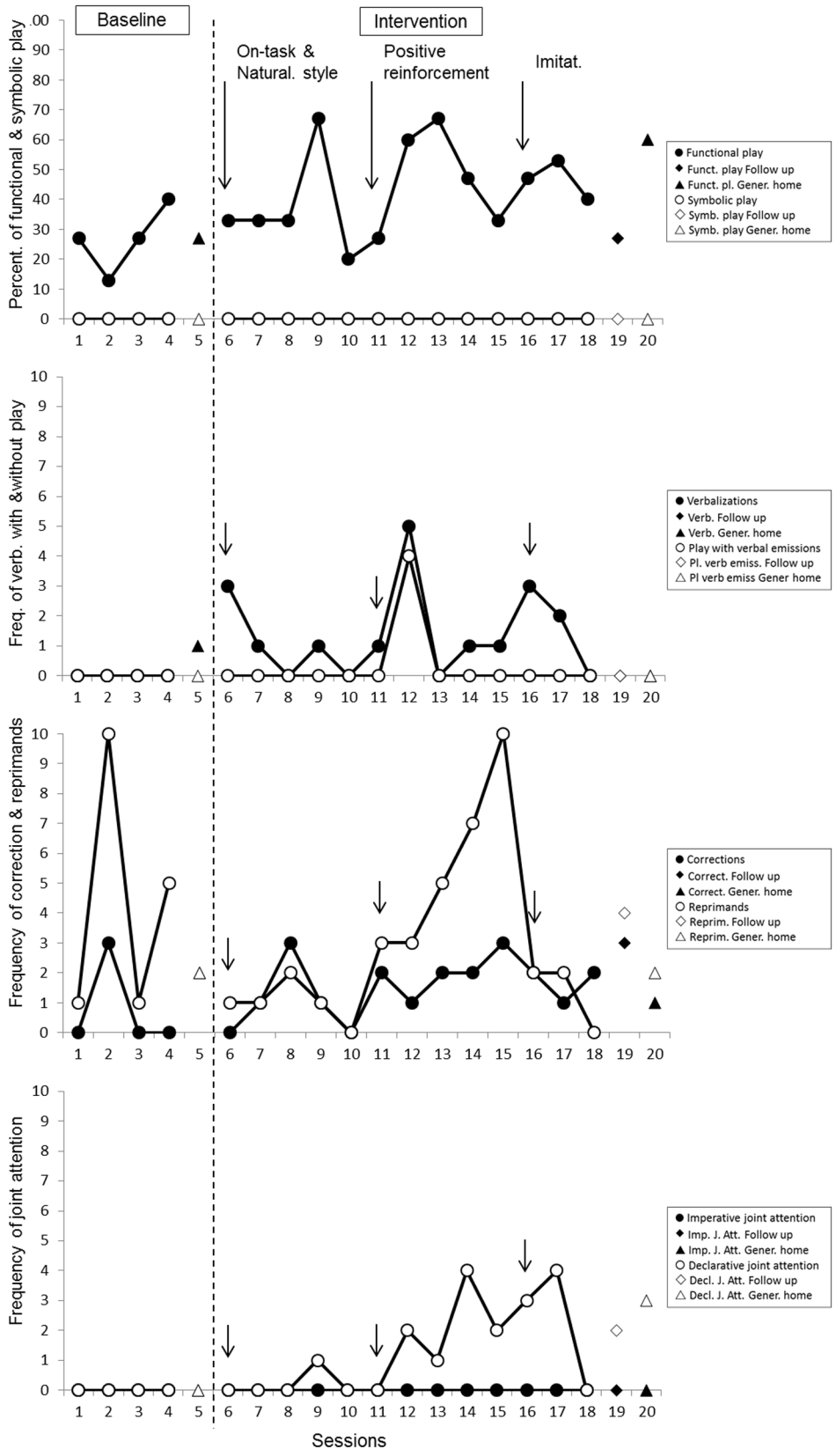

Figure 3. Percentages and frequencies of Nick's and of mother's responses for untrained categories.

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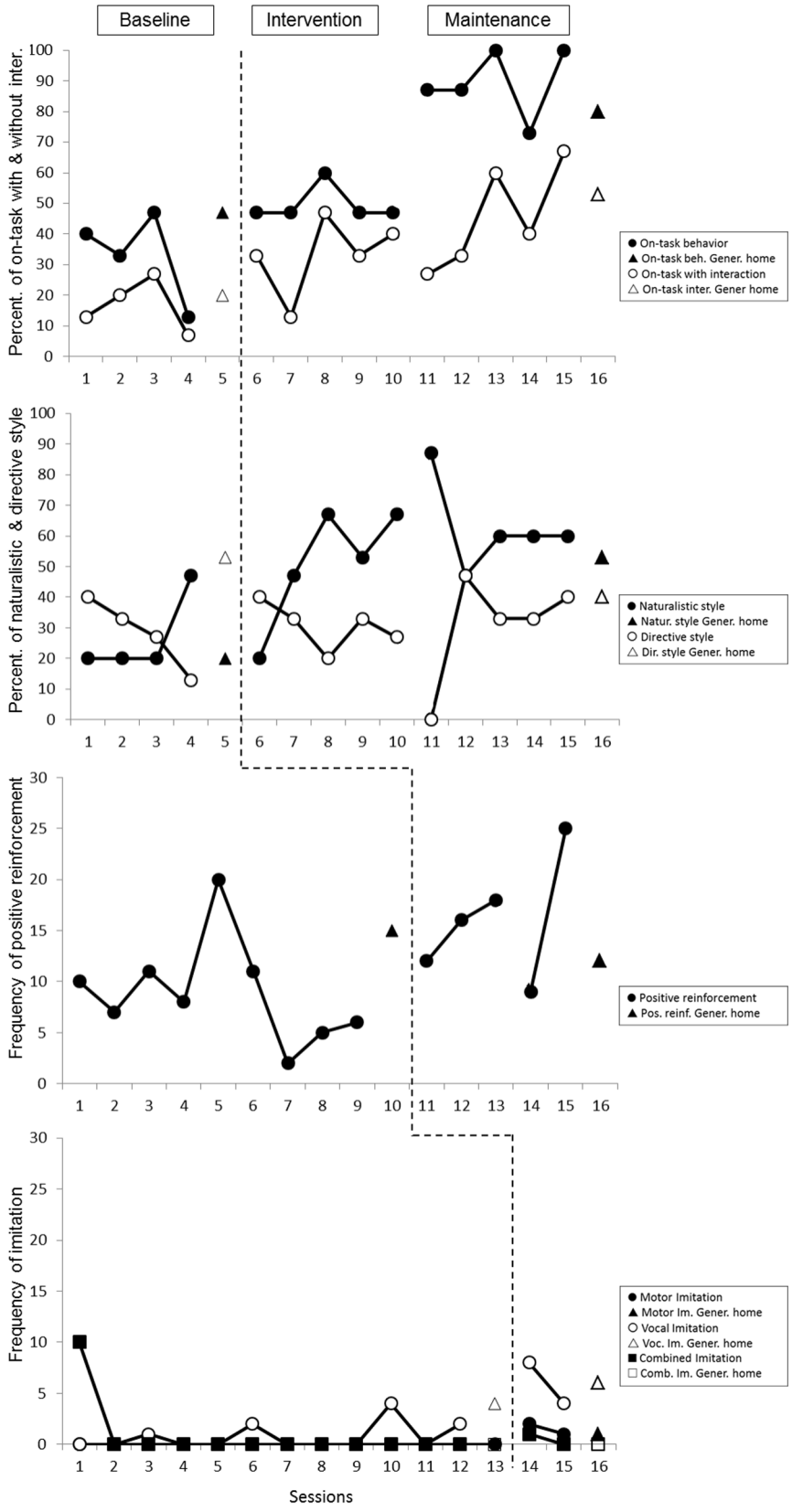

Figure 4. Percentages and frequencies of Nick's and of his father's appropriate responding for trained categories.

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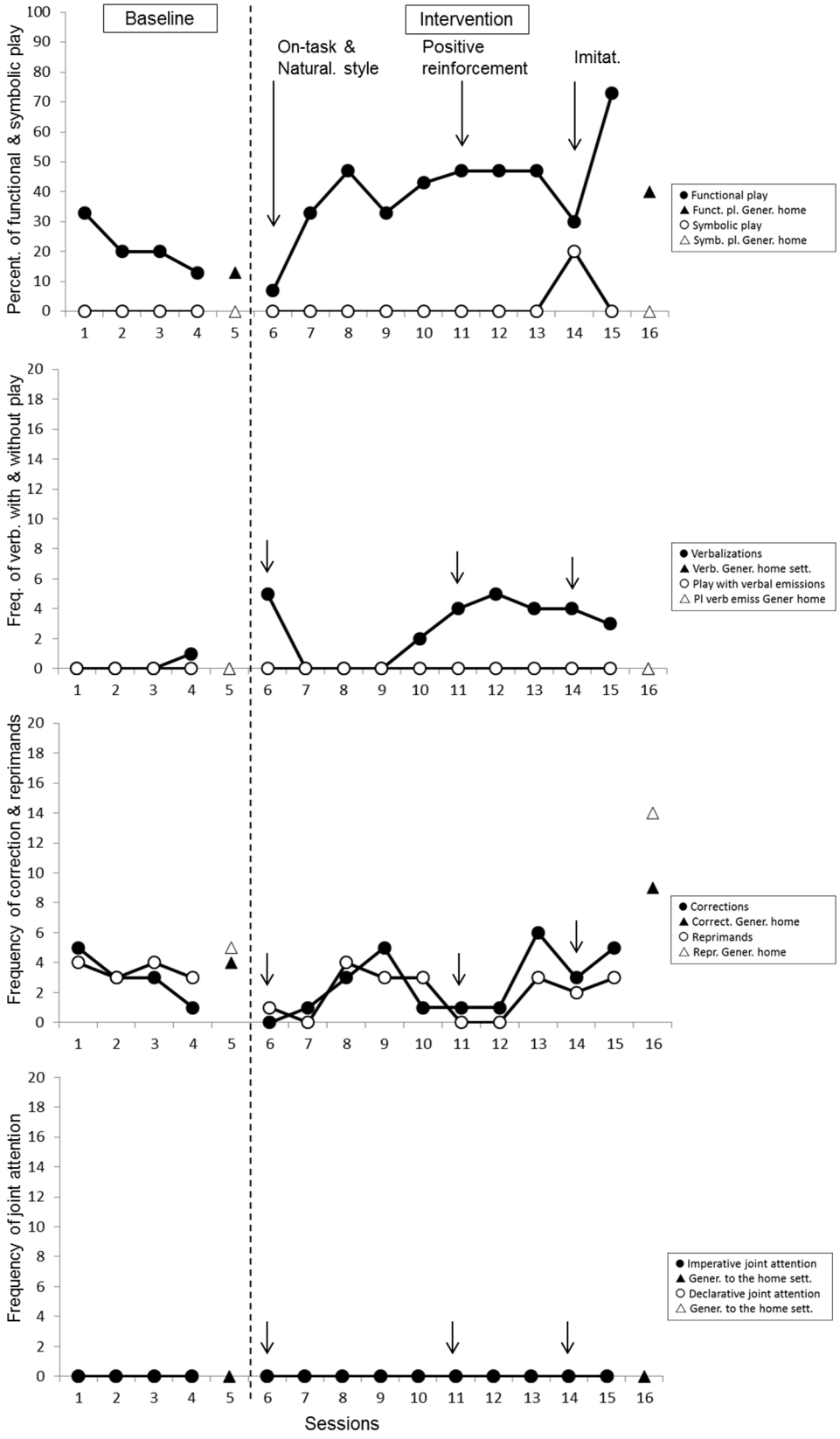

Figure 5. Percentages and frequencies of Nick's and of father's responses for untrained categories.

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Figure 3 depicts the percentages and frequencies of Nick's and his mother's responses for untrained categories. The arrows indicate the points at which the intervention was initiated for: (a) on-task behavior with and without interaction, naturalistic style of interaction, (b) positive reinforcement, (c) motor, vocal, and combined motor with vocal imitation. During baseline, the percentage of intervals scored for Nick's functional play ranged, on average, 27% and 43%, after the intervention was introduced for the trained dependent measures. During follow up, the percentage of the functional play decreased to baseline levels, 27% on average, but increased to 60% during generalization to the home setting. Nick's symbolic play remained at zero levels throughout the study. As far as verbalizations, Nick did not produce any during baseline, but produced an average of 1 verbalization per session after intervention was introduced. Verbalizations neither maintained during follow up nor generalized to the home setting. No play- accompanied- by- verbalization responses occurred throughout the study with the exception of one session following treatment.

Response generalization was assessed on two parent-related variables: corrective feedback and reprimands. During baseline, per session, Nick's mother provided corrective feedback once and 4 reprimands, on average. Following intervention, there were no essential differences. Per session, corrective feedback was provided twice and 2 reprimands. Similar frequencies were noted in follow-up and generalization sessions.

Pertaining to imperative joint attention, it remained at zero levels throughout the study. There were also no occurrences of declarative joint attention, during baseline, but when treatment was introduced for trained variables, the average occurrences per session increased to 1 during treatment, to 2 during follow up, and to 3 during generalization to the home setting.

Figure 4 depicts percentages and frequencies of Nick's and his father's appropriate responding for trained categories. During baseline, the percentage of intervals scored for on-task behavior with and without interaction were 17% and 13%, respectively. Following intervention, those responses increased to 33% and 50%, respectively. Further systematic increases for on-task behavior were also noted during the maintenance phase, during follow-up, as well as in the generalization setting.

Pertaining to Nick's father's naturalistic style of interaction, during baseline, the average percentage of intervals scored for naturalistic interactions was 27%, and 28% for directive interactions. Following treatment, naturalistic interactions increased to 51%, on average, and directive interactions remained at similar levels: 31% on average. Similar outcomes were noted during maintenance and follow up as well as in the generalization setting. Finally, systematic improvement was also achieved in the frequency of positive reinforcement provided by Nick's father. From an average of 9 in baseline, the frequency of reinforcement increased to 15 in treatment. Similar increases were achieved during maintenance and the final follow-up session as well as in the generalization setting.

Motor, vocal, and combined imitative responding were all variables from the category of parent-child interaction that were targeted for Nick. During baseline, the frequency of Nick's imitative responding ranged, on average, from 0-0.8 imitations per session for all three types of imitative responses. Following his father's training, there was a slight increase in motor, vocal, and combined motor with vocal imitation to an average of 1.5, 6, and 0.5 imitations per session, respectively. Slight increases were also obtained during generalization to the home setting.

Figure 5 depicts the percentages and frequencies of Nick's and his mother's responses for untrained categories. The arrows indicate the points at which the intervention was initiated for: (a) on-task behavior with and without interaction, naturalistic style of interaction, (b) positive reinforcement, (c) motor, vocal, and combined motor with

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vocal imitation. During baseline, the percentage of intervals scored for Nick's functional play was, on average, 22% and increased to 41%, after the intervention was introduced for the trained dependent measures. During generalization to the home setting, the percentage of functional play increased to 40% on average. Nick's symbolic play remained at zero levels throughout the study with the exception of one session (it reached 20%). As far as verbalizations, Nick did not produce but one during baseline, but produced an average of 2.7 verbalizations per session after intervention was introduced. Verbalizations did not generalize to the home setting. No play accompanied by verbalization responses occurred throughout the study.

Response generalization was assessed on two parent-related variables: corrective feedback and reprimands. During baseline, per session, Nick's father provided corrective feedback 3 times per session, and 3.5 reprimands, on average. Following intervention, there were slight decreases. Per session, corrective feedback on average was provided 2.6 times and 1.9 reprimands were given. Increased frequencies were noted for both types of responses in the generalization session.

Pertaining to both imperative and declarative joint attention, they remained at zero levels throughout the study.

Pertaining to Helen's data, Figure 6 depicts percentages of frequencies of Helen's and her mother's appropriate responding for trained categories. Starting with Helen's mother's naturalistic style of interaction, during baseline, the average percentage of intervals scored for naturalistic interactions was 18%, on average, and 70% for directive interactions. Following treatment, dramatic changes were obtained. Naturalistic interactions increased to 92%, on average, and directive interactions decreased, as expected, to 4%. Similar outcomes were noted during maintenance and follow up as well as in the generalization setting. The second variable for which treatment was applied was on-task behavior with interaction. During baseline, the percentage of intervals scored for on-task behavior with interaction was 64%. Following intervention, those responses remained at similar levels - 65%, but increased to 70% during maintenance and to 80% in the generalization setting (Helen's home). The average responding during the 2 follow-up sessions was 60% per session. Pertaining to declarative joint attention, during baseline, the average occurrences were 0.8% per session which increased to 14.2% during treatment, to 18% in generalization and 12%, on average, during the 2 follow-up sessions. Similar outcomes were obtained for imperative joint attention, with the exception of follow up data that dropped to 4% of occurrences, on average, in the 2 follow-up sessions.

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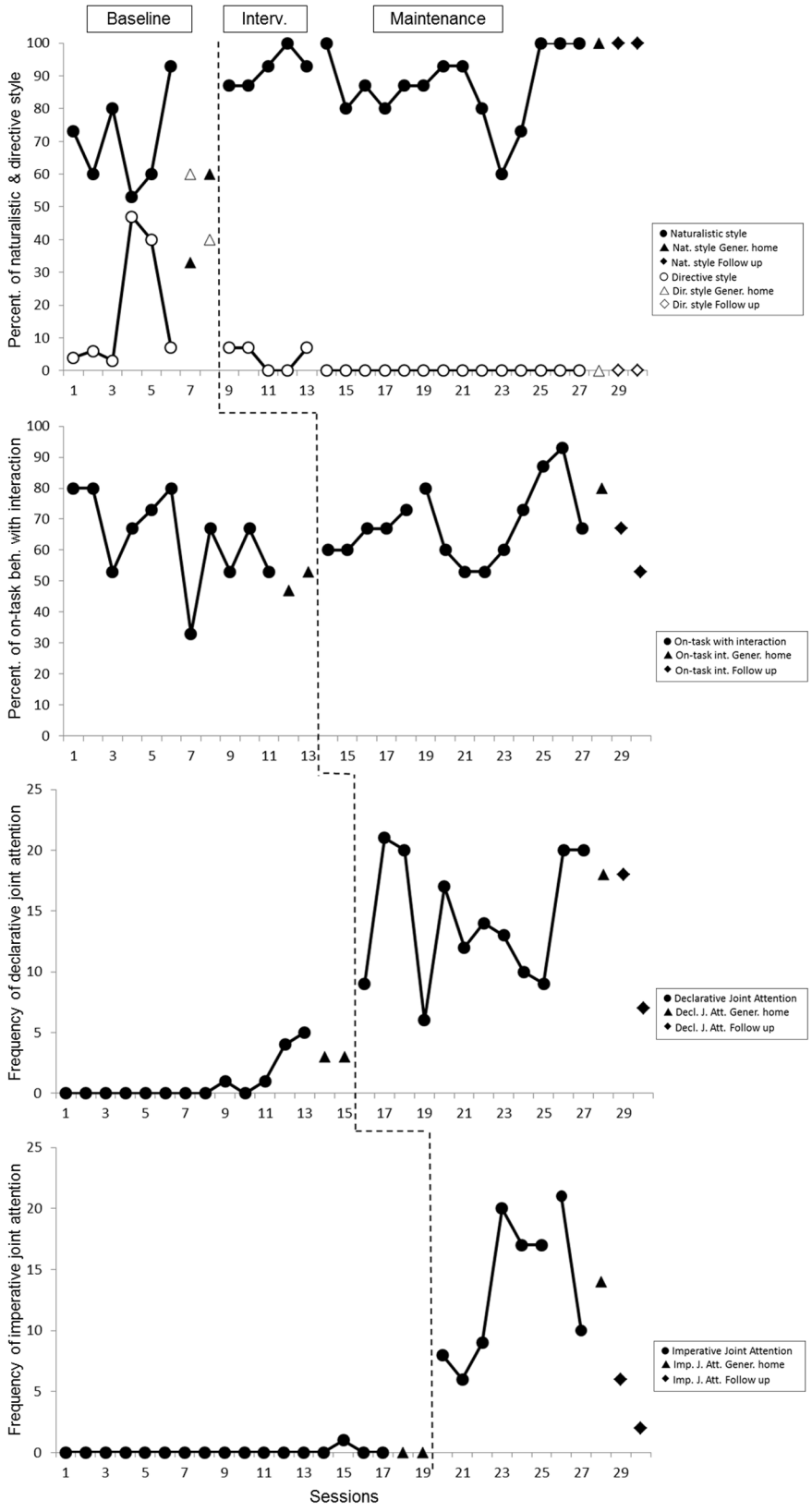

Figure 6. Percentages and frequencies of Helen's and her mother's appropriate responding for trained categories.

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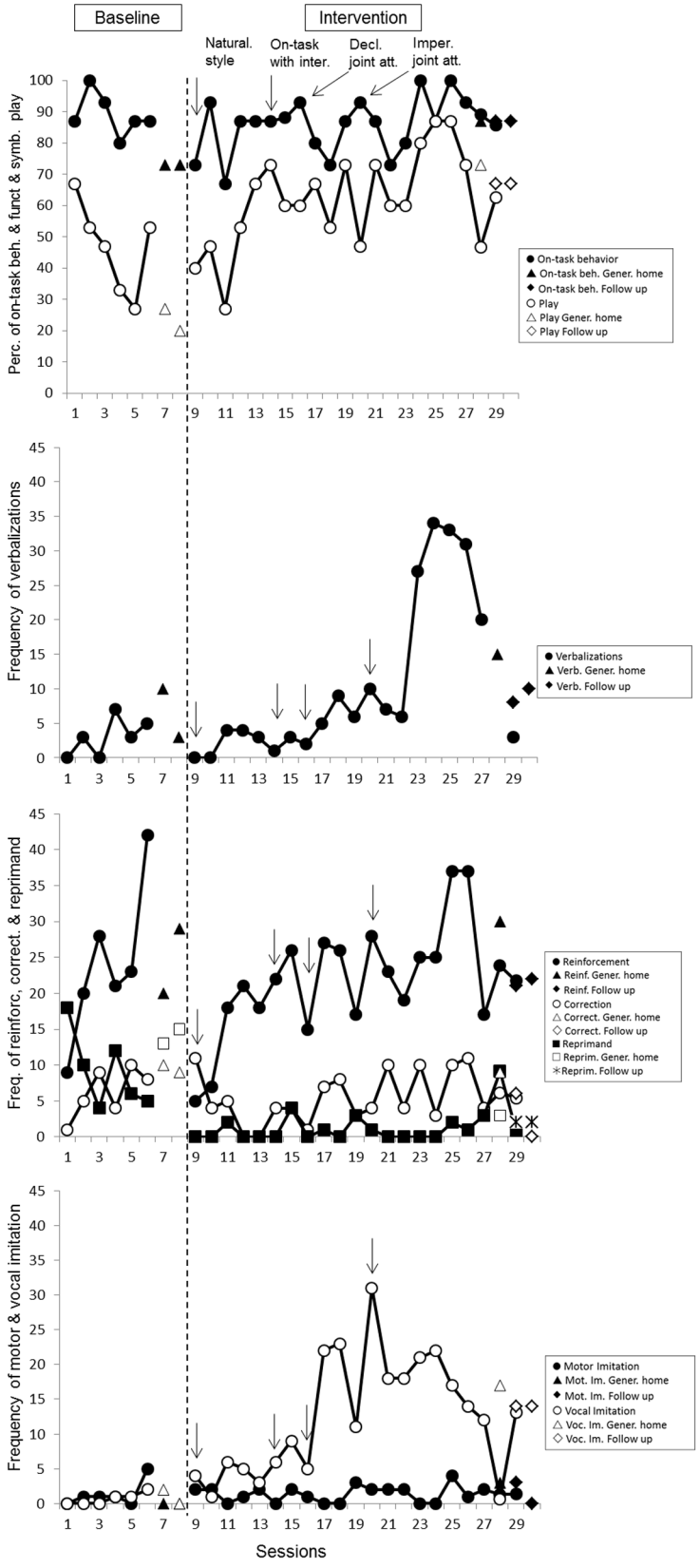

Figure 7. Percentages and frequencies of Helen's and of her mother's responses for untrained categories.

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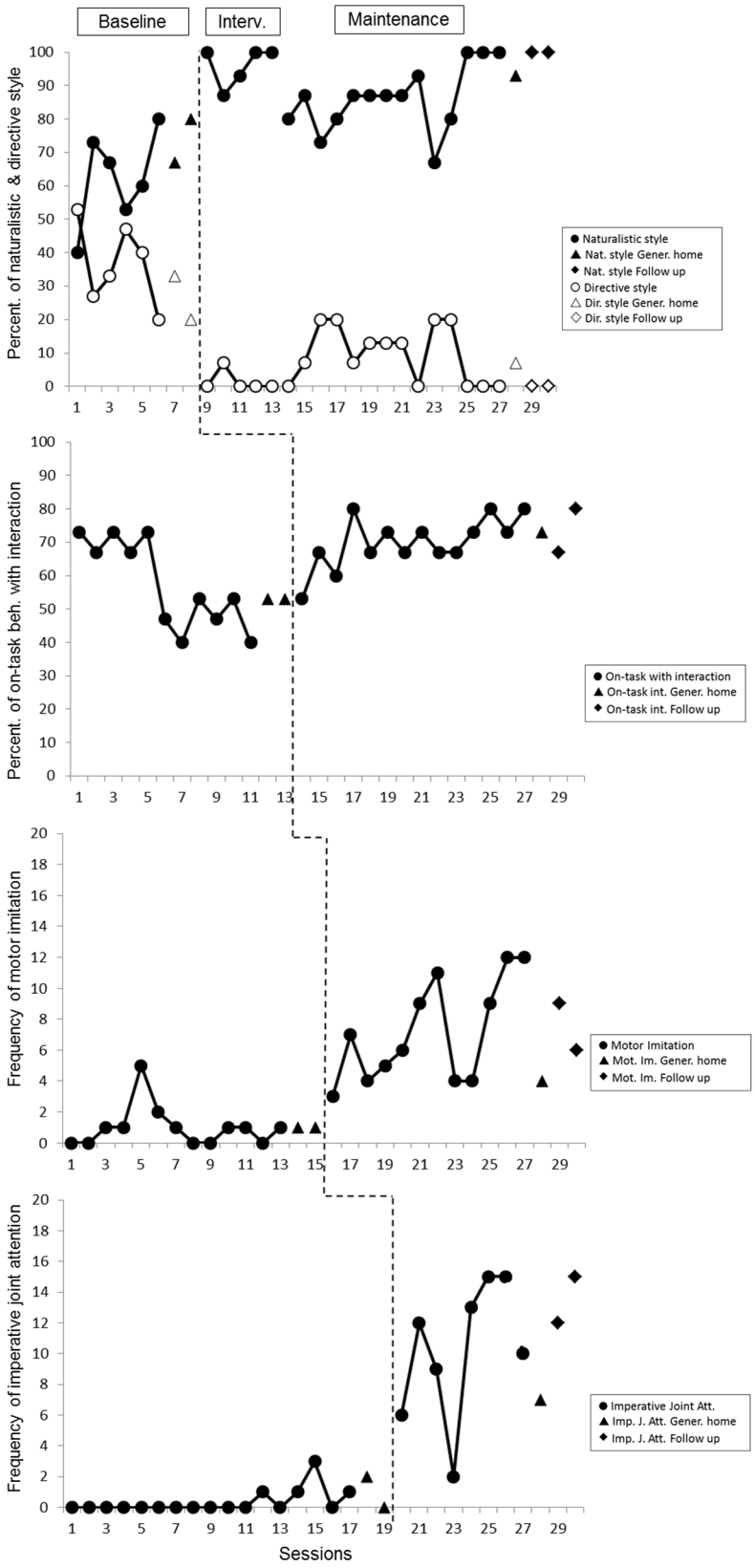

Figure 8. Percentages and frequencies of Helen's and her father's appropriate responding for trained categories.

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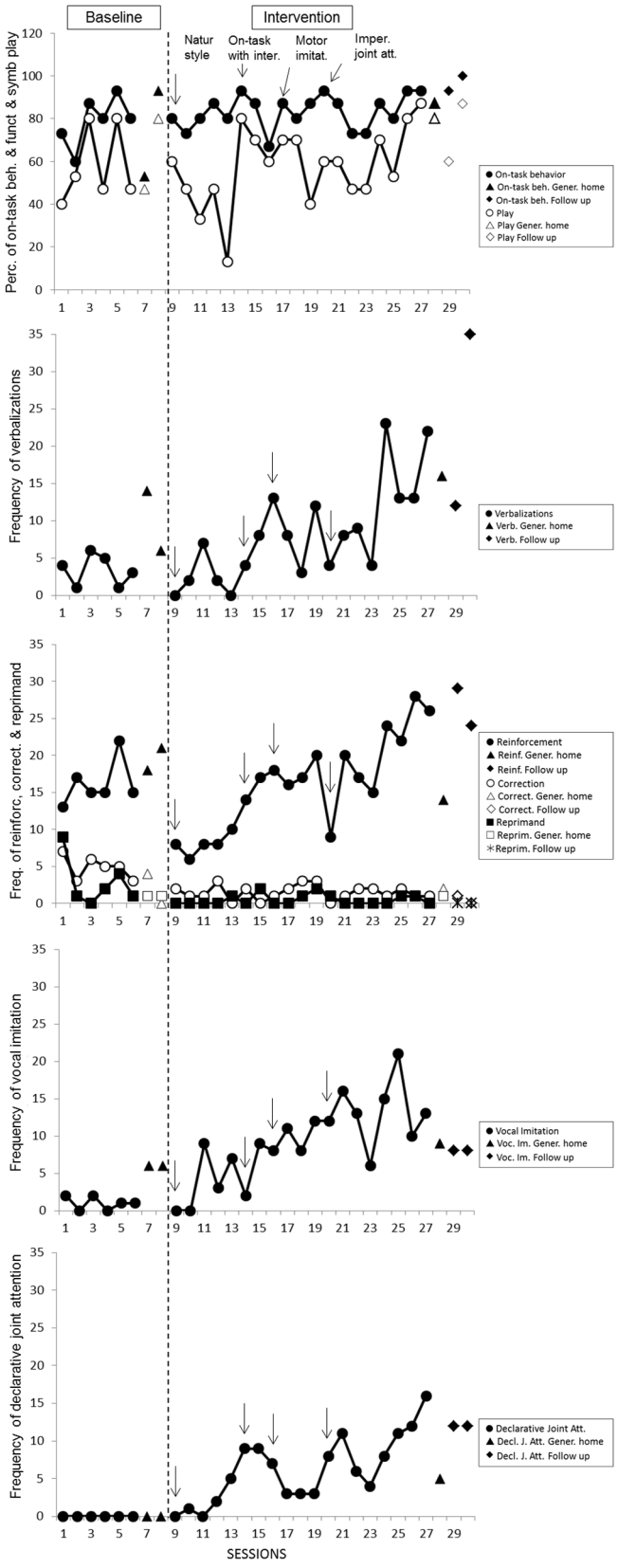

Figure 9. Percentages and frequencies of Helen's and of her father's responses for untrained categories.

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Figure 7 depicts the percentages and frequencies of Helen's and her mother's responses for untrained categories. During baseline, the percentages of intervals scored for Helen's functional and symbolic play was, on average, 47% and 62%, after the intervention was introduced for other dependent measures. During generalization to the home setting and follow ups, occurrences remained at similarly high levels. Data were also collected for on-task behavior which was very high throughout the study. As far as verbalizations, Helen produced an average of 3 per session during baseline, and an average of 10.7 during the intervention. Verbalizations generalized to the home setting and were maintained during follow-up sessions.

Response generalization was assessed on three parent-related variables: reinforcement, corrective feedback, and reprimands. During baseline, per session, Helen's mother provided reinforcement 23.8 times per session, and in treatment 21.7 times, on average. No systematic differences were observed on frequencies of corrective feedback across experimental sessions, with the exception of the final follow-up session, during which it dropped to the frequency of 0. As far as reprimands, 9.1 were given per session on average, in baseline, which dropped, as expected, following treatment to an average of 0.9. Those low frequencies were generalized and maintained.

Motor, and vocal imitative responding were the variables assessed from the category of parent-child interaction that were targeted for Helen. Motor imitative responding was stable low throughout the study, whereas, for vocal imitative responding a great increase was obtained: from a low of 0.6 responses per session in baseline, vocal imitative responses increased to 13, on average. Those increases generalized to the home setting, and maintained across time.

Figure 8 depicts percentages and frequencies of Helen's and her father's appropriate responding for trained categories. Starting with Helen's father's naturalistic and directive style of interaction, during baseline, the average percentage of intervals scored for naturalistic interactions was 62%, on average, and 37% for directive interactions. Following treatment, dramatic changes were obtained. Naturalistic interactions increased to 96%, on average, and directive interactions decreased, as expected, to 1%. Similar outcomes were noted during maintenance and follow-up sessions, as well as in the generalization setting. The second variable for which treatment was applied was on-task behavior with interaction. During baseline, the percentage of intervals scored for on-task behavior with interaction was 58%. Following intervention, on-task behavior with interaction increased to 70%. This outcome both generalized to the home setting and maintained across time. As far as Motor imitative responding, during baseline, its frequency was 1 response per session, on average, which increased to 7.1 during the intervention. This increase generalized to the home setting, and maintained across time. Finally, occurrences of imperative joint attention averaged at 0.3 in baseline and increased dramatically to 10.2, per session, during the intervention. This outcome generalized and was maintained during follow-up.

Figure 9 depicts the percentages and frequencies of Helen's and her father's responses for untrained categories. During baseline and treatment, the percentages of intervals scored for Helen's functional and symbolic play, remained at approximately the same high rates (about 58% per session). During generalization to the home setting and follow-up sessions, occurrences remained at similarly high levels with the exception of the final follow-up session when the rate increased to 87%. Data were also collected for on-task behavior which was very high throughout the study. As far as verbalizations, Helen produced an average of 3.3, per session, during baseline, and an average of 8.1 during the intervention. Verbalizations increased dramatically to an average of 16, per session, in the home setting and to 35 during follow-up sessions.

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Response generalization was assessed on three parent-related variables: reinforcement, corrective feedback, and reprimands. Reinforcement remained stable during baseline, treatment, and generalization to the home setting, but increased dramatically during follow-up sessions. The low rates of corrective feedback and reprimands, during baseline, decreased further during intervention and remained low during generalization and follow-up sessions. Vocal imitative responding was the variable assessed from the category of parent-child interaction. On average, during baseline, the rate of vocal imitations was 1 per session which increased to 9.2 during the intervention. Those increases generalized to the home setting, and maintained across time. Pertaining to declarative joint attention, during baseline, the average occurrences were 0% per session which increased to 6.2% during treatment, to 5% in generalization and 12%, on average, during the 2 follow-up sessions.

Discussion

The increasing number of children diagnosed with ASD, the long waiting lists of EIBI (Coolican et al., 2010); the needs for intervention for children with ASD that by far exceed the services provided (Boettcher Minjarez et al., 2011); the high cost of one-on-one, intensive, behavior-analytic interventions; but most of all the right to treatment that leads to optimal outcome for all children with ASD, make the need for effective parent-training practices more imperative than ever.

In the present study, though a hybrid one, since it involves only two families of young children with ASD, it was demonstrated that a naturalistic, systemic behavior analytic approach to parent training may be most effective in imposing change across a host of variables that pertain to child-related, parent-related, as well as to parent-child interaction-related variables. Improvements were accomplished on all variables for which training was provided and that was the case for both participants. Most importantly, however, the intervention led to changes that generalized across novel responses and across novel stimulus parameters. Changes that maintained across time, in the absence of intervention. Specifically, it was demonstrated that teaching parents novel ways of interacting with their child with ASD, such as adopting a more naturalistic style of interaction, providing models (vocal and motor) that offer the child opportunities for imitation, engaging in joint attention, etc, results in multiple benefits that become apparent by improvements in the child's behavior as well as in the parent-child relationship. For example, when Nick's mother received training on several response categories, such as encouraging the child's on-task behavior and adopting a naturalistic style of interaction, that led to an improvement not only on the trained responses, but also on several other responses for which training was not provided, such as functional play and declarative joint attention. Similarly, when Helen's father received training on various skills, such as how to encourage on-task behavior or adapting a naturalistic style of interaction, there were dramatic shifts in all types of responses that were monitored but not trained: the father's responses (e.g., decrease in corrective feedback and reprimands) and responses that reflect Helen's interaction with her father (i.e., vocal imitations and declarative joint attention). It is also important to note that treatment outcomes did not lead to generalization across all response categories that were assessed. Nick did not demonstrate neither symbolic play nor imperative joint attention with his mother throughout the study. Similarly, the frequency of Helen's motor imitative responses with her father did not change throughout the study.

The novelty of the present study relies on the fact that it is an initial attempt to address a host of issues pertaining to parent training, in a rather complex way, which may be considered suitable and important when dealing with complex phenomena such as the parent-child interaction. From a "general-systems-theory" perspective, the study

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of complexity calls for interventions at multiple levels, with multiple focus rather than investigating single, linear cause-and-effect relations. Thus, when we consider the causal relations that explain the effectiveness of the parent-training protocol that we followed, we may not point to a single variable that produced linear changes, but we may conclude that we expect important, clinically and socially validated, generalized improvements that maintain across time, when we adopt a multi-component, multi-focused treatment protocol. Specifically, when we intervene on several variables (at the three aforementioned levels: parent, child, and parent-child interaction), when both parents are involved in training, when the training lasts for several months (an average of 8 months), and when it involves children who receive EIBI (Early Intensive Behavioral Intervention). This multi-focus approach does not limit the value of the intervention, but emphasizes the need to address complex variables, such as the parent-child interaction, at multiple levels in order to produce lasting, generalized and clinically meaningful outcomes. Demonstrating the effects of a single variable on a single response may by compatible with demonstrating tight experimental control, but does not address the complexity of psychological phenomena nor is it, usually, sufficient in producing holistic and meaningful psychological changes. Pertaining specifically to the parent-child relation, we take the stance that it is a complex, psychological phenomenon that calls for complex, multi-level multi-focus interventions. A paradigm that addresses parent-training practices with an outlook of linear causality, with brief intervention protocols that address a single or a small number of variables may not do justice to the complexity imposed by parent-child relations.

In the 1970's the realization that generalization and maintenance of treatment gains were not obtained without parental involvement, prompted the investigation for procedures that would facilitate active participation of parents in treatment (Lovaas, Koegel, Simmons, & Long, 1973). The initial attempts to incorporate parent-training components in the treatment protocols used methods that were appropriate for highly-structured treatment settings (e.g., Koegel et al., 1983; Lovaas et al., 1973) which was very useful on one hand, but on the other hand was ineffective in facilitating transfer of treatment gains to the child's home and to community settings. Despite the great number of studies conducted since then, there is still a great number of experimental questions, pertaining to the development of parent-training practices that lead to optimal, generalized, and long-lasting outcomes, for which we do not have the answers. Yet, since the 1970's, we have come a long way with parent-training research and practices. For example, the "Naturalistic Developmental Behavioral Interventions (NDBI)" provides a very interesting example of combining two paradigms that may lead to optimal outcomes for children with ASD (Schreibman et al., 2015). We suggest that considering the incorporation of the general-systems-theory epistemological tradition into the parent-training practices that we currently use, may help us address the complexity of the issues that arise in this context more comprehensively.

Several limitations may be attributed to the present study. First of all, the results need to be replicated with more subjects in order to enhance the external validity of the findings. In addition, as we didn't evaluate the attribution of each of the independent variables, separately, we may not identify which of the components of the intervention were more critical or effective in producing the treatment outcome. Another point of consideration has to do with the lack of standardized psychometric batteries with the Greek population which does not permit for a more precise and objective evaluation of the intellectual functioning and other important parameters relating to the functioning of the participants. Among the limitations of the present study is also the fact that procedural reliability of the study was not assessed since no interobserver agreement data were collected for the independent measures.

Provided that the present study is only a preliminary one, it is not possible to draw definitive conclusions about the findings. Rather, it gives us a starting point that helps us design future studies that may focus with greater

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precision on patterns that emerge from these preliminary data. Specifically, it would be interesting to investigate whether we may obtain more dramatic changes with emerging skills rather than skills that are not at all in the child's repertoire. Another issue worth investigating would be possible systematic differences across children depending on their overall level of functioning. It is worth noting that Helen was higher functioning than Nick and demonstrated more dramatic improvements than Nick. Finally, it would also be interesting to investigate parent-related variables that may attribute to treatment outcomes.

The issue of the generality of our findings is a major limitation of this pilot study, yet, aside from this limitation, the positive outcomes of the study underline the need for a synthesis of what we have learned from a wealth of theoretical, epistemological advancements as well as therapeutic and educational practices in order to come up with models that are compatible with the complexity that characterizes the needs of children with ASD and their families. Specifically, the way in which the present study addressed such complexity was by: (a) Intervening in a large number of variables including those that adhere to the parent-child relation, (b) assessing the possible effects of the intervention on categories of responses for which no intervention was provided, (c) involving both parents and the child with ASD in the training procedure as a means of providing maximum support to the entire family system, (d) providing training for several months rather than a brief period of time, and (e) assessing generalization of treatment outcomes to the home setting.

There is a host of questions that arise from the present study that future research could address. Yet, for both research and clinical purposes, we consider questions pertaining to complexity and emergence (what unpredictable changes may occur following intervention) to be the most interesting ones for future research on parent-child interactions for children with ASD. The answers to such questions may bring us closer to optimal parent-training practices.

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Competing Interests

The authors have declared that no competing interests exist.

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