Journal of Autism and Developmental Disorders
https://doi.org/10.1007/s10803-022-05719-4

ORIGINAL PAPER

Applying a Parent Training Program in a Naturalistic Behavior Analytic Context to Improve Attachment in Children with ASD

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Accepted: 9 August 2022

Abstract

Infants develop attachment to their caregivers very early on. The quality of attachment is considered to be crucial for the emotional development of humans and animals alike. Despite its importance, very little is known about how attachment develops between children with Autism Spectrum Disorder (ASD) and their caregivers. The purpose of the present study was to assess the attachment patterns of two young children with ASD with their parents and to identify the means for promoting parent, child, and parent–child relational characteristics that may contribute to the development of secure attachment. The results replicated prior findings pertaining to attachment quality of children with ASD and demonstrated the effectiveness of a naturalistic, behavior-analytic intervention in improving the quality of their attachment.

Keywords Attachment · Autism spectrum disorder · Naturalistic behavior analytic intervention · Parent training

Introduction

Attachment theory provides a developmental model for the appraisal of the quality of early infant-caregiver interactions and their consequences on the infant's social, emotional, and cognitive development (Ainsworth et al., 1978; Bowlby, 1982). Infants are born with an inclination for proximity and attachment that becomes apparent through smiling, crying, vocalizing, and several other types of purposeful and reciprocal social behavior. Infants organize their behavior according to their experiences, in general, and particularly to experiences associated with caregivers. Early experiences are translated into mental representations of the self, of others, and of the infant's environment over all (Bowlby, 1982; Bretherton & Munholland, 2008; Bretherton & Waters, 1985). Bowlby referred to those mental representations as "internal working models" or "representation models" and highlighted the importance of those models for infants to develop a sense of safety which is critical for their welfare and important for the encouragement of their continuous exploration of their surroundings (Bowlby, 1973). The infant's representations, as well as the quality of the caregiver-infant bond, depend on both the infant's individual differences in cognitive and emotional development and in the selection of strategies that infants employ to regulate attachment needs (Dykas & Cassidy, 2011). Similarly, parental behavior that fosters proximity and safety, as well as several other contextual variables, are associated with the type of attachment that infants develop in relation to their caregivers (Bell & Ainsworth, 1972).

There are several studies that addresses the importance of the quality of the caregiver-infant attachment for child development, yet very little is known about the quality of attachment of both mothers and fathers who raise a child with Autism Spectrum Disorder (ASD) and how it may be improved upon (Grzadzinski et al., 2014). For example, caregivers of infants with ASD may have difficulties to attend to

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Published online: 27 August 2022

the needs and intentions of their child with ASD during play and are less likely than caregivers with typically developing children to be spontaneous and not overly directive (Crowell et al., 2019; Kasari et al., 1988; Keenan et al., 2016). In a context of naturalistic, non-directive interactions with their caregivers, infants become more inclined to share their experiences, whereas an overly directive parenting style discourages sharing (Kasari et al., 2010; Schreibman et al., 2015). To that end, the present study aims to: (1) investigate the attachment patterns of both mothers and fathers with their child with ASD, and (2) evaluate a parent training program, based on naturalistic behavior-analytic methodology that aims to improve the quality of the parent–child attachment.

Attachment Definition and Types

All infants become attached to their caregivers. Yet, not all attachment patterns are categorized as organized. Based on Ainsworth's et al. taxonomy (1978), attachment patterns may be characterized: as Insecure-Avoidant (A), Secure (B), or as Insecure-Ambivalent (C). Attachment responses that are not goal-oriented and cannot be assigned to Ainsworth's taxonomy are characterized as atypical and classified as Disorganized/Disoriented (D) (Main & Solomon, 1990). Atypical attachment patterns do not entail organized behavioral patterns of interaction toward the attachment figure and are characterized as ambiguous, odd, or inexplicable since they are difficult to interpret (Barnett & Vondra, 1999; Lyons-Ruth & Jacobvitz, 2016).

Attachment and ASD

Historically, children with ASD were considered to be incapable of developing organized attachment due to their social and communication deficits (American Psychiatric Association, 1987; Kanner, 1943; Rutter, 1978; Wing & Gould, 1979). Kanner (1943) emphasized the lack of social awareness and the restricted and repetitive behaviors of children with ASD and concluded that they were unable to interact with people and to contribute to the development of the parent–child relationship in a positive manner due to deficits attributed to biological factors. In the 1950s, the onset of autism was attributed to the "refrigerator mother"—characterized by lack of sensitivity, reciprocal communication, and emotional synchrony (Bettelheim, 1967). This assumption was unsubstantiated and therefore gradually discarded since the etiology of ASD is attributed to biological rather than psychological factors (Rutter, 2005).

Additionally, several studies pertaining to attachment and ASD demonstrated that children with ASD do indeed develop various types of attachment and are, therefore, in some cases capable of developing secure attachment with their caregivers (Capps et al., 1994; Dissanayake & Crossley, 1996; Grzadzinski et al., 2014; Keenan et al., 2016; McKenzie & Dallos, 2017; Rogers et al., 1993; Rutgers et al., 2004; Shapiro et al., 1987; Sigman & Ungerer, 1984; Siller et al., 2014; Van Ijzendoorn et al., 2007). Some of the most important outcomes include the following: (a) children with ASD show preference for their caregiver(s) over strangers and seek proximity to their caregiver during reunion episodes (Kasari et al., 1993; Rogers et al., 1991; Shapiro et al., 1987; Sigman & Mundy, 1989); (b) the presence of a stranger leads to the child's seeking for increased proximity to his/her caregiver and to reducing his/her explorative behavior (Dissanayake & Crossley, 1996, 1997; Sigman & Ungerer, 1984); (c) using the Strange Situation Procedure (SSP) to assess the quality of attachment of children with ASD to their caregivers (in studies that included all four categories of attachment), it was found that 47–53% of children with ASD developed secure attachment relationships (Capps et al., 1994; Esposito et al., 2014; Rogers et al., 1991; Rutgers et al., 2004; Teague et al., 2017). In addition, empirical studies, which address attachment and ASD, have demonstrated that children with ASD did not demonstrate lower rates of secure attachment than their neurotypical peers. Nevertheless, they were less responsive to their caregivers' emotional and communicative cues which is associated with increased arousal of parental stress (Grzadzinski et al., 2014; Hoffman et al., 2009; Keenan et al., 2016). Dissanayake & Crossley (1996) demonstrated that the attachment responses of children with ASD may be related to their social deficits and to limited demonstrations of joint attention attempts, rather than to stress-related behavior, such as staying away from their caregivers. Even though there are empirical data that shed light on the attachment patterns that children with ASD develop in relation to their caregivers, very little is known about the factors that may inhibit or foster the development of secure attachment.

According to McKenzie & Dallos (2017), who follow Ainsworth's taxonomy, children with ASD may develop: (a) secure attachment, (b) insecure attachment, and (c) attachment difficulties. Even though an association between a child's with ASD cognitive, social, and communication abilities and his/her attachment security has been empirically demonstrated, the findings are not consistent about an association between severity of autistic symptomatology and attachment security experienced by children with ASD (Naber et al., 2007; Oppenheim et al., 2009). Furthermore, aside from parental sensitivity and insightfulness, there is a scarcity of research pertaining to the possible associations between parental interactive behavior, and the development of attachment security in children with ASD.

In addition, based on the results of a metanalytic review that included 16 studies on attachment and ASD (Rutgers et al., 2004), it may be concluded that, even though some children with ASD form secure attachment with their

caregivers, they are at an increased risk for developing insecure and disorganized attachment relationships with them (Naber et al., 2007; Rutgers et al., 2004). In addition, their stereotypic and other types of atypical behavior may lead to a false characterization of their attachment style—namely, that of disorganized attachment (Capps et al., 1994; McKenzie & Dallos, 2017). Thus, researchers and clinicians, alike, face a challenge in their attempts to assess the quality of the attachment style of children with ASD due to the fact that autism shares a great number of symptoms with the type of attachment that is characterized as insecure and a variety of responses that may be interpreted as disorganized (Davidson et al., 2015; Pipp-Siegel et al., 1999; Sadiq et al., 2012). According to Moran (2010), there are symptoms that are common among both infants with ASD and infants with disorganized attachment, such as atypical play ("repetitive and routinised behaviours" p. 47), poor social interaction, deficits in social communication, deficits in emotional regulation, executive function difficulties, and sensory integration difficulties. Identifying, whether stereotypic behavior is attributed to either ASD or disorganized/disoriented attachment, may be difficult. Thus, when we interpret the attachment behavioral patterns of children with ASD, we may attribute their difficulties associated with autism to attachment difficulties and therefore run the risk of overclassifying them as having disorganized attachment (Capps et al., 1994). To avoid this overclassification, there is a common criterion that researchers adopt to assess attachment in children with ASD. This criterion dictates that stereotypic or other types of disorganized behavior is not attributed to a disorganized/disoriented attachment style unless it is displayed only in the presence of the caregivers but not in their absence (Atkinson et al., 1999; Hesse & Main, 2006; Pipp-Siegel et al., 1999). In the following section the factors associated with type of attachment will be reviewed as it is critical to understand child and parental characteristics that may be important in shaping their attachment.

Factors Associated with Type of Attachment

Bowlby (1982) was the first to highlight the importance of both child and caregiver characteristics for the quality of the child's attachment to the caregiver. Pertaining, specifically, to the quality of the attachment of children with ASD, there are several studies that investigate child and parental characteristics that may contribute to it. For example, both the language and the cognitive attributes of the child (Capps et al., 1994), as well as several characteristics of the parent–child interaction, have been identified as critical for the type of attachment that children with ASD develop with their caregivers (Crittenden et al., 2014; Rozga et al., 2018; Teague et al., 2017). In addition, parental characteristics and behavior may account for the quality of attachment. For example, parental behavior that contributes to the child's sense of security (Belsky, 1997; Belsky & Fearon, 2002; Bowlby, 1980; Cassidy, 2016; Solomon & George, 2016; Sroufe, 1983, 2005) was found to contribute to the development of secure attachment in both neurotypical children and in children with ASD (Mahler, 1967; Rutter, 1978). Below is a summary of the findings pertaining to both child characteristics and parental behavior that are associated to attachment.

Child Characteristics

Beginning with child characteristics, it has been demonstrated that cognitive milestones, such as those related to object permanence and to the ability of the child to generalize, are important for the organization of the attachment repertoire (Bowlby, 1980, 1982). Autistic symptomatology, as well as other types of neurodevelopmental deficits, create challenges that affect both the parent–child communication as well as the quality of the attachment children with ASD develop in relation to their parents. Therefore, such symptomatology, as well as behavioral problems, that children with ASD often present (Dabrowska & Pisula, 2010; Hoffman et al., 2009; Slade, 2009), have been associated with the development of insecure attachment (Cortina & Liotti, 2010; Teague et al., 2017; Van Ijzendoorn et al., 2007). In fact, it has been demonstrated that children with ASD, who develop appropriate communication skills, are more likely to develop secure attachment than those who lack such skills (Capps et al., 1994; Rogers et al., 1991, 1993). Similarly, developing joint attention and language (Baker et al., 2015; Capps et al., 1994; Siller & Sigman, 2002; Willemsen-Swinkels et al., 2000) were found to contribute to the establishment of secure attachment in children with ASD (Capps et al., 1994; Crowell et al., 2019; Siller & Sigman, 2008).

Parental Behavior

Bowlby also considered parental behavioral patterns, which may encourage proximity and a sense of safety, to be important for the development of an "attachment-caregiving social bond" (Bowlby, 1982). As far as the contribution of parental characteristics and practices to the quality of the attachment that develops between children with ASD and their caregivers, there are some important findings. Specifically, secure attachment has been associated with: (a) maternal insightfulness (Fonagy et al., 1991; Oppenheim et al., 2008, 2009, 2012), (b) caregiver's attunement during play (Naber et al., 2008), (c) caregiver's emotional availability, and responsiveness to the infant's needs (Dolev et al., 2009; Siller et al., 2014), (d) parental behavioral patterns that encourage proximity to the child and a sense of safety (Ainsworth et al., 1978; Cassidy, 2016; Poslawsky et al., 2015), (e) parents

adapting a more naturalistic interactive style during parent–child interactions and providing opportunities for joint attention episodes (Poslawsky et al., 2015), and (f) parents using reinforcement contingencies and providing the child with opportunities for interaction during play (Birmingham et al., 2017; Siller & Sigman, 2008; Siller et al., 2014; Teague et al., 2017). The benefits of those parental practices were not limited to improving attachment but were apparent across all developmental domains (Crowell et al., 2019; Patterson et al., 2014; Siller & Sigman, 2008). Insecure attachment, on the other hand, is attributed to several parental characteristics, such as increased stress levels (Dabrowska & Pisula, 2010; Hoffman et al., 2009; Slade, 2009) and a sense of limited competence in the parental role, which parents of children with ASD often report (Beurkens et al., 2013; Harker et al., 2016; Patterson et al., 2014; Solomon & George, 2016), as well as to poor parental practices, such as caregivers' difficulties to respond consistently to the child's emotional and communication needs and to develop reciprocal communication with the child (Crowell et al., 2019; McKenzie & Dallos, 2017).

Nevertheless, it is important to underline that the parents of children with ASD are not necessarily more prone to stress to begin with or less competent in the parental role. It is possible that elevated stress levels and other characteristics and practices of parents of children with ASD may be reactive to the stressors associated with raising a child on the autism spectrum. For example, the fact that parents of children with ASD tend to be more directive (Keenan et al., 2016) and less able to be consistently responsive to their child's needs may be attributed to the emotional and physical exhaustion that parents of children with ASD often experience. Even though parents may adopt a more directive style to facilitate their child's social behavior, a less directive style, such as following the child's lead, has been proven to be of greater benefit in engaging children with ASD during play with caregivers (Schreibman et al., 2015).

Parent Training Practices

Parent training practices are considered to be crucial in helping parents of children with ASD to alleviate psychological and physical distress and in increasing parental involvement. Parental involvement leads to providing more opportunities for the child with ASD to generalize and maintain acquired skills (Koegel et al., 1982), it enhances the children's communication and overall social skills (Kasari et al., 2010; Koegel et al., 1999; Laski et al., 1988; Minjarez et al., 2011; Vismara et al., 2019), and also leads to a decrease in problem behavior (Vismara et al., 2019). Parent training was also found to be of great benefit to parents themselves and especially to the mothers of children with ASD, since it contributes to decreased stress levels, to the strengthening of self-confidence, and to enhancing the sense of parental self-efficacy (Brookman-Frazee et al., 2006; Crowell et al., 2019; Estes et al., 2014; Kasari et al., 2010). Finally, parent training practices were found to be beneficial for the parent–child interaction (Kasari et al., 2010; Koegel et al., 1996).

Taking into consideration the child's and the parent's characteristics and the benefits of parent-training practices for the parent–child relationship, it was considered worth exploring its potential benefits for the quality of the parent–child attachment since attachment constitutes a transactional variable—a variable that requires both parental and child input. Furthermore, the development of secure attachment, for all children, is crucial for the advancement of the child in all developmental domains and across the lifespan. Specifically, for children with ASD, it has been demonstrated that, similarly to neurotypical children, secure attachment contributes to: (a) improved social competence and joint attention efforts during play interactions (Seskin et al., 2010), (b) reducing disruptive behavior (Baker et al., 2015), and (c) improving language skills (Siller & Sigman, 2002).

An important empirical question that needs to be addressed, other than the content of parent-training practices, is the methodology that needs to be adopted in order to promote optimal therapeutic outcomes. It has been demonstrated in many studies that behavior-analytic interventions applied in a naturalistic context, have great benefits for children with ASD in all aspects of their lives including social interaction, communicating effectively with others, and in language development and play interactions (Gillett & LeBlanc, 2007; Peters-Scheffer et al., 2011; Schreibman et al., 2015). Specifically, Naturalistic Developmental Behavioral Interventions (NDBI) combine behavior-analytic therapeutic technology with a developmental psychology approach that emphasizes the importance of creating interventions based on a developmental perspective; that is, selecting therapeutic and educational goals in a hierarchy that is consistent with the development of neurotypical children (Schreibman et al., 2015). In addition, NDBI emphasizes the importance of applying procedures associated with naturalistic teaching, such as incidental teaching or following the child's lead (Schreibman et al., 2015). The basic premises of NDBI are the following: (a) the child with ASD should be treated as an active learner, (b) there are plenty of learning opportunities in the child's natural settings, (c) therapists ought to follow the child's lead and preferences, and (d) when therapists use a variety of toys, activities, and other types of reinforcers, in a variety of settings and, at the same time, use naturalistic types of teaching, they promote stimulus and response generalization (Koegel et al., 1987; Schreibman et al., 2015). All of the aforementioned components are incorporated in the present study. Specifically: (a) incidental teaching methodology was used, (b) only social, no tangible reinforcement was

applied, (c) a non-directive style of interaction was adopted by parents, (d) joint attention was encouraged, (e) play accompanied by vocalizations was taught, (f) parent–child social interaction was systematically taught. The targeted response categories were selected based on their association with parent–child attachment.

The present study is the first in Greece, to our knowledge, that aims to assess the attachment patterns of children with ASD with both their mothers and fathers. In addition, it attempts to demonstrate that parent training practices, based on a naturalistic behavior-analytic methodology, while taking into consideration important developmental trajectories, may provide the means for an effective and efficient treatment context. In this context, the quality of the parent–child interaction, in general, and of attachment in particular, may be improved. We suppose that this type of intervention is effective and efficient because it approaches the family as a unified system rather than the child with ASD as the sole agent requiring training and therapy (Gena et al., 2016). This approach imposes systemic changes that effect improvements on the quality of life of the family and therefore in the quality of life of all its members (Gena et al., 2014). Specifically, the findings of the present study pertain to two families with children with ASD and the quality of attachment established between both the mothers and the fathers with their sons. The interaction challenges in each dyad were unique. Thus, the intervention was individualized for each parent–child dyad aiming to extend prior research findings pertaining to the attachment of infants with ASD to their parents. Specifically, the present study was not limited to an assessment of the attachment patterns of children with ASD to their mothers and fathers, but also aimed to ameliorate social communication difficulties in each dyad. A behavior-analytic methodology was adopted to study three types of variables associated with attachment: child behavior, parent behavior, and parent–child interaction, which are considered to be transactionally related. That is, changes in each type of variable are expected to lead to changes in all types of variables since they are all considered to be interrelated in the context of the family system. Furthermore, it was hypothesized that the treatment outcome would lead to an improvement in the parent–child attachment bond.

Method

Participants

Children

Two boys with Autism Spectrum Disorder – John and Alex – participated in the present study. Both participants were diagnosed by independent agencies using the diagnostic criteria of the DSM-IV-TR (American Psychiatric Association, 2000) and had been receiving behavioral intervention in a day treatment program for 15 and 25 h per week, respectively. At the beginning of the study, John was 2-years-olds, had no expressive language but was able to communicate his basic needs nonverbally, such as by pointing to preferred items. His receptive language included following simple commands and identifying objects and familiar people by name. He had no imitation skills, and his social skills were limited to responding to his name by making eye contact. He had no play skills and did not engage in joint attention with his parents or therapists. He had a short attention span and engaged in high rates of stereotypic behavior. John's IQ was 92 (Verbal: 92, Performance: 94) (WPPSI-III GR). Alex was 4-years-olds and had a Performance IQ of 70, his Verbal IQ could not be evaluated since he had not developed expressive language (WPPSI-III GR). He imitated a few sounds, but not words, and communicated with others using the Picture Exchange Communication System. His receptive language was limited to identifying objects, actions, some body parts, and shapes, and was also able to follow simple commands. He liked to play with puzzles and musical toys but had not developed functional or symbolic play skills. His social skills included inconsistent responding to his name by making infrequent eye contact with familiar people as well as interactive physical play with his father. He had a very short attention span and engaged in high rates of stereotypic behavior. He received anti-convulsant medication from the age of two because of suspicions for seizure disorder. The participants' characteristics and test scores are summarized in Table 1.

Parents

The mothers and the fathers of both children also participated in the study. Both couples were married, all parents had received higher education, were middle class, and their ages ranged from 37 to 39. Parental characteristics are summarized in Table 2.

Standardized and Other Assessment Instruments

The following scales were administrated to the children who participated in the study: (a) the Greek version of the Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WPPSI-III GR; Sideridis & Antoniou, 2015); (b) the Childhood Autism Rating Scale (CARS; Schopler et al., 1986); and (c) the Vineland Adaptive Behavior Scales-Survey Form, Interview Edition (VABS; Sparrow et al., 1984). The CARS and the VABS were completed by the mothers of the participants and by one of their therapists. The Greek versions of the following standardized scales were used at the beginning and at the end of the study to assess possible

Table 1 Participant's characteristics and test scores

Child	Age	WPPSI-III (Performance IQ)	CARS	VABS					ABA Therapy prior to study (h/per week)
				Comm	Daily skills	Social	Motor	COMP	
John	2	94	37.5	61	28	44	50	42	15
Alex	4	70	36	59	51	53	100	60	25

Table 2 Parental characteristics

Child	Parent	Age	Educ. Status	Employment
John's	Mother	39	Higher Educ	Self -employed
	Father	39	Higher Educ	Self-employed
Alex's	Mother	37	Higher Educ	Public sector
	Father	38	Higher Educ	Private sector

changes in the participating parents: (a) the State-Trait Anxiety Inventory (Form Y-1) (STAI-Y; Spielberger et al., 1983); and (b) the Parenting Styles and Dimensions Questionnaire (PSDQ; Robinson et al., 2001). Each parent's and each family's demographic characteristics were obtained through a self-administered questionnaire that was developed for the purposes of the present study.

The Strange Situation Procedure (SSP) was also used. SSP is used with infants around the age of 12 months and includes a series of eight episodes lasting approximately 3 min each, whereby a caregiver, an infant, and a stranger are introduced, separated, and reunited. Specifically, (a) Caregiver, infant, and experimenter: The experimenter enters the experimental room with mother and infant and asks the mother to interact with the infant as usual and then to take a seat; (b) caregiver and infant are left alone in the room; (c) a stranger joins the caregiver and the infant; (d) caregiver departs, leaving the infant alone with the stranger; (e) caregiver returns and stranger leaves the room; (f) caregiver leaves the room and the infant is left all alone; (g) stranger returns; (h) caregiver returns and stranger leaves. Classification of the child's security is based on "interactive behaviors" toward the caregiver in the two reunion episodes. Child's reactions to reunions are rated per reunion episode on a seven-point scale for the following responses: Proximity- and Contact-Seeking Behavior, Contact-Maintaining Behavior, Avoidance Behavior and Contact, and Resistance Behavior. Proximity- and Contact-Seeking Behavior describes the intensity and persistence of the infant's efforts to achieve contact and proximity to the parent, with the highest score marked for both very active efforts for contact and initiatives in achieving it. Contact Maintaining Behavior describes infant's activity and persistence to maintain contact with the parent, with the highest score regarding infant's very active and persistent efforts to maintain contact. Avoidant Behavior describes the intensity, persistence, duration, and promptness of the infant's ignorance or avoidance of proximity and interaction with the parent, with the highest score referring to very persistent avoidance. Resistance Behavior describes the intensity and frequency or duration of the infant's resistance to parent, who interacts (or tries to) with the infant, with the highest score showing very intense and persistent resistance. Yet, scoring is somewhat differentiated for children with ASD. Namely, stereotypic

behavior upon reunion with caretaker is associated with disorganized/disoriented attachment for typically developing children, which is not the case for children with ASD since stereotypies, such as rocking, spinning, or hand flapping are part of their typical repertoire. The assessment of attachment for children with ASD is further complicated because of the difficulty to differentiate between their tendency to be socially distant and the insecure attachment patterns (Avoidant, Anxious-Ambivalent, Disorganized) that are associated with inflexibility, lack of social responsiveness, etc.

Despite challenges associated with the diagnosis of ASD, this study assessed the attachment of children with ASD to their parents using the SSP's coding system and the Disorganized/Disoriented Classification Scheme.[1] Thus, stereotypic and disorganized types of behavior were not coded as such unless they interrupted the child's approach to the caregiver upon reunion.

Each child's attachment pattern was ultimately classified according to Ainsworth's typology for attachment. Namely, avoidant (A), secure (B), and resistant (C). They were, then, sub-classified using indices for disorganization/disoriented attachment. The session of SSP of each participating dyad was videotaped and was scored by a doctoral candidate who had received training for the Strange Situation (ABC) at the University of Minnesota and for the Disorganized/Disoriented Classification Scheme (D) at the University of Cambridge. An experienced coder of SSP from the University of Minnesota served as an independent coder for inter-observer agreement purposes.

Setting, Research Materials, Researchers, and Therapists

All research sessions were conducted in a specially arranged classroom at the Institute of Systemic Behavior Analysis, a non-for-profit day-treatment therapeutic center specializing in early intensive behavior-analytic intervention, which is located in Athens, Greece. The classroom was 12 m^2 was quiet, spacious, and equipped with age-appropriate toys that were used for the purposes of this study (e.g., plastic balls, musical toys, play corners, puzzles, etc.). There was an area with a carpet, placed at the center of the classroom, where the participants often engaged in play activities. The same toys were used for both participants.

Each parent was trained in three response categories. At the beginning of each session during which training of a new response category was introduced to the parent, the researcher provided the parent with a written set of instructions including the operational definition of the variable that was going to be trained as well as several examples from that response category. For examples of operational definitions for each response category see Table 3.

A data collection sheet was used to record occurrences, non-occurrences, and frequencies of the target responses (see Table 4). All sessions were videotaped using a Sony DCR-SX65 camera.

Three researchers were responsible for collecting and analysing the data for inter-observer agreement purposes: the lead researcher, who was a doctoral candidate with a masters degree in Special Education and with 11 years of teaching and clinical experience, and two other researchers—a psychologist and a special educator, both holding a doctoral degree. The therapists who conducted the parent training sessions had undergraduate and graduate degrees in psychology and secondary education and several years of experience in behavior-analytic intervention. During research sessions, apart from the parent and the child with ASD, both the therapist who conducted the sessions and the lead researcher were always present.

Dependent Variables

The dependent variables of this study were clustered in three categories: those depicting child behavior, parent behavior, and parent–child interaction. Those response categories have been used in prior research aiming to improve the parent–child interaction for children with ASD (Gena et al., 2014, 2016; Vismara et al., 2009). For each parent–child dyad, the targeted categories were different and individualized to the specific difficulties demonstrated during the interaction of that particular dyad. Table 5 depicts the targeted categories for each parent–child dyad.

Experimental Design and Conditions

A multiple-baseline-across-response-categories experimental design was implemented to assess the efficacy of the intervention. The experimental conditions included the following phases: baseline, intervention, generalization, and a one-month follow-up at the day-treatment center. The average duration of the study was three weeks for baseline and six months for treatment per dyad, including the follow up session. One to two sessions per dyad were carried out per week.

Procedure

General Procedure

Both parents of each participant were informed about the purposes of the present study, its procedures, its approximate duration, and its anticipated benefits for the child and

[1] A classification based on seven indices associated with disorganization and disorientation in the SSP (Main & Solomon, 1990).

Table 3 Examples of operational definitions of the response categories

Response category: Child behavior Declarative joint attention	Joint Attention involves sharing a common interest on an object or event with someone else and includes: gaze following, alternating gaze and directing the attention by using gestures, vocalizations. There are two types of joint attention: imperative joint attention and declarative joint attention. In the latter case the child shares an experience or the awareness of an event/situation with a communication purpose. The child and the adult share a common interest, an emotion (e.g. The parent is singing and stops. The child looks at his parent and uses both a gesture and a vocalization delivering the message: "Keep singing, I really enjoy it!")
Response category: Parent- child interaction On-task behavior with interaction	On-task behavior with interaction includes verbal or nonverbal interaction between the child and the parent during a sharing play activity with or without toys. For example, turn taking games or sharing toys 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
Response category: Parent behavior Naturalistic style of interaction	Naturalistic style of interaction was defined as the style of interaction characterized by spontaneity and absence of rigid structure. Interaction aimed at conditions that changed loosely (e.g., changes in tone and intensity of parent's voice, the way in which stimuli were presented, objects' position in the room, child's and parent's position during interaction). Parents could alter the activity at any time, by presenting different toys or introducing novel activities, while using a variety of discriminative stimuli to teach target responses. The parent engaged the child in the activities introduced. Specifically: (a) the child was allowed to choose a new activity; (b) the activity could be altered or even terminated upon the child's communicative initiation; (c) the child was allowed to alter the target behavior; (d) toys were used in a functional or symbolic way, alternately, by the parent and the child (turn taking); (e) the child was encouraged to make choices. The parent created conditions that enabled the child to make efforts for communicative purposes (e.g., placing objects, that the child wanted to have at inaccessible places, holding or using child's favorite toys, commenting on an activity, etc.) Parent responded to child's communicative efforts and tried to expand on the child's utterances as a means of providing more complex language models. Prompting was used, mainly, in the form of in-vivo modeling. Plenty of opportunities and time were given to the child to imitate the desired behavior. Commands, guiding questions, and any other form of prompting that was characterized as directive style of interaction was avoided. Preferably, the activity itself and the toys used served as reinforcing contingencies. In addition, parents provided praise contingently upon appropriate responding. All children's efforts were reinforced no matter how successful they were, if they had some relevance to the target behavior
Response category: Parent behavior Positive reinforcement	Positive reinforcement refers to delivery of reinforcement contingently upon target responses in the form of praise with an enthusiastic tone of voice (e.g., Well done, you finished the puzzle) or other types of social reinforcement such as hugs and kisses. Reinforcement had to be delivered within 5 s of the emission of the target response
Response category: Child behavior Vocalization with play	Vocalization with play refers to functional or symbolic play accompanied by relevant vocalizations in the absence of disruptive or stereotypic behavior. The vocalizations could be: (a) sounds e.g., the sound of a car, while playing with a car, (b) approximate words related to the toys used, (c) words or phrases related to the toys used Play without vocalizations was defined as either play that was either not accompanied by verbal utterances or accompanied by utterances that matched parental vocal models

the family. Before baseline, the Strange Situation Procedure was used to assess each child's attachment to his mother and father. The parents signed written consent for their child's participation in the study. Throughout the study, parents were instructed to use the toys available for the study rather than to bring their own.

Baseline

Baseline sessions had a 10- to 15-min duration. The parent was asked to play with his/her child as they normally do and was informed that he/she could use the toys available in the classroom and was urged to change toys frequently as a means of capturing the child's interest. No further instructions were provided. The researcher was available to answer the parents' questions concerning procedural issues without providing information about the response categories in which the parent was going to receive training. During and at the end of each session, parents were praised for their efforts to play with their child, but no behavior-specific praise or corrective feedback was provided. Data were collected for each participant on the same five response categories.

Intervention

Intervention sessions were approximately 30 min long and training was individualized for each parent–child dyad.

Table 4 Data collection sheet

Video	Child	Parents	Coder	Date	Session	Session number	Location
		Mother Father			Baseline Intervention Generalization		ISBA Home

Time	On-task behavior with interaction		Style of interaction		
	(Y = yes)	(N=no)	(N = naturalistic)	(D = directive)	N = neutral)
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
	Y	N	N	D	N
Total %					

	Frequencies	Total
Vocalization with play		
Positive reinforcement		
Declarative joint attention		

Table 5 Targeted categories for each parent–child dyad

John-mother	John-father
Trained categories	
1. Declarative joint attention	1. Declarative joint attention
2. Naturalistic style	2. Naturalistic style
3. Positive reinforcement	3. Positive reinforcement
Untrained categories	
1. On-task behavior	1. On-task behavior
2. Vocalization with play	2. Vocalization with play
Alex-mother	**Alex-father**
Trained categories	
1. Naturalistic style	1. On-task behavior
2. Declarative joint attention	2. Declarative joint attention
3. Vocalization with play	3. Naturalistic style
Untrained categories	
None	1. Vocalization with play

Among the five response categories for which data were collected during baseline, the three with the lowest percentages or frequencies of occurrences were selected to be trained for each dyad. Before the beginning of each treatment session, the researcher reviewed the main purpose of that session with the parent. Namely, she described the response category to be trained in that session in simple terms, offered two to three examples of that variable, and answered questions that the parent might have. The session started with the therapist reviewing the operational definition of the target response category for that session and then, for 5 min, she engaged in interactive play with the child providing several models of the target response category while engaging the child. Following the 5 min interaction, the therapist asked the parent to start playing with the child for 15 min taking into consideration the training instructions provided by both the researcher and the therapist. During the session, every time the parent emitted the target behavior, the therapist provided contingent praise. Failure to emit the target response was followed by a verbal reminder to engage in that response. Incorrect responding was followed by (a) verbal prompting, such as, "make sure that ____ (child's name) looks at you while he invites you to join him in a play activity", and (b) in-vivo modelling of the target response. The number of verbal prompts provided per session ranged from one to twenty-six with an average of nine prompts per session. Yet, as the study progressed, fewer and fewer prompts were required per session. At the two final sessions, no more than four prompts were used. In addition, at the beginning of each session, parents were reminded which other skills they had already received training for and were urged to continue to use them during the session. Nevertheless, no other reminders, reinforcement, or correction were provided contingently upon those other skills. At the end of each session, and for approximately 5–10 min, the researcher and the therapist provided verbal feedback to the parent about his/her overall performance during the session. In addition, the written set of instructions, described in the "Settings, Research Materials, Researcher, and Therapists" section, was given to the parent only at the initial treatment sessions in which a new target response was introduced. Those written sets of instructions included the response definition (for operational definitions see Table 3) of the new target response as well as several concrete examples for the parent to use. For example, for the response category of interaction style engaging in turn taking games or starting the play interaction with favorite toys were suggested to the parents. Thus, the purpose of the parent training procedure was for the target responses emitted by the parents to come under the stimulus control of the 5 min training that proceeded each intervention session. Verbal reminders were prompts that were systematically faded as parents became increasingly proficient in following the therapist's instructions.

Generalization and Follow Up

During generalization and follow-up sessions, the same procedure was followed as in baseline. Generalization across settings was assessed in the participants' homes. One follow-up session per participant was conducted at the day-treatment center one month after completion of the intervention.

Data Collection Procedure and Statistical Analysis

Data were collected for all sessions (see Table 4). Two data collection procedures were used: The first procedure was

a momentary time-sampling procedure used to assess the child's on-task behavior with interaction and the parent's naturalistic style of interaction. Sessions were divided into 1-min intervals and occurrences or non-occurrences of the target responses were scored for the final 10 s of each interval. On-task behavior with interaction occurrences were scored as "Y" and non-occurrences as "N". For Parental Style of Interaction, naturalistic style was scored as "N", directive as "D" neutral as "O", and "NA" was scored for non-applicable (corresponding to intervals during which the parent was receiving training by the therapist). To calculate the percentage of the target responses, the total number of intervals during which each target response occurred was divided by the total number of intervals scored, excluding the intervals with "NA" scoring, and the quotient was multiplied by one hundred. The second data collection procedure was a frequency-count recording procedure used to measure the total number of play engagements accompanied by verbal utterances, delivery of reinforcement, and declarative joint attention throughout the session.

In addition to the visual analysis of the data represented in graphs, a statistical analysis was contacted to estimate the magnitude of change between baseline and intervention. For that purpose, the Tau-U index was computed using an online calculator (singlecaseresearch.org) developed by Vannest and her colleagues (Vannest et al., 2016). Tau-U is a non-parametric, non-overlap effect size measure, with strong statistical power that controls for baseline trend (Parker & Vannest, 2012; Parker et al., 2011). Values between 0 and 0.31 correspond to a minimal effect, values between 0.32 and 0.84 to a moderate effect and values between 0.85 and 1 to a strong effect (Parker & Vannest, 2009; Qi et al., 2018).

Inter-observer Agreement

To assess the reliability of the data, inter-observer agreement was calculated for 50% of the sessions. A point-by-point agreement ratio was calculated for the variables assessed with a momentary time-sampling procedure and for declarative joint attention. The ratio of the total frequency of occurrences divided by agreements was used for play accompanied by verbal behavior and for reinforcement delivery. Inter-observer agreement of the dependent measures for all phases ranged from 80 to 100% with an average of 90% agreement.

Social Validity

At the end of the study, a four-point Likert scale questionnaire was completed by both parents of each participant to assess the degree to which the intervention was found to be useful for the child and the parents. In addition, they were asked to describe changes in the behavior of the child that they attributed to the intervention.

Results

As seen in Table 6 the two children with ASD who participated in this study showed different types of attachment to their mothers and fathers in the Strange Situation Procedure. Both children with ASD were classified according to Ainsworth's classification system (A, B, C)—as described in the Standardized and Other Assessment Instruments Section and then all the disorganized or disoriented behaviors were sub-classified according to Main & Solomon Disorganized/Disoriented Classification Scheme—as described in the Standardized and Other Assessment Instruments Section. If the child's disorganized behavior was not goal oriented, was not attributed to fear of the caregiver or was not apparent under either condition—in the presence and in the absence of the caregiver—it was assigned to the D Classification. Specifically, John's attachment was classified as secure (B) with both of his parents, yet he demonstrated responses such as stereotypic use of toys, spinning, and wandering aimlessly, which may be classified as disorganized (D). Alex's attachment was highly atypical. Specifically, he clearly showed preference for his parents over an unfamiliar adult but, since he neither initiated nor responded reciprocally to his parents' social initiations, the quality of his attachment to his parents could not have been assessed as often anticipated for children with ASD and Intellectual Disability (Barnett & Vondra, 1999). Despite the reliability of the scoring, for the case of Alex it may not be ascertained whether the disorganization/disorientation is attributed to fear (explained by disorganized attachment scheme), or to the presence of neurological deficits beyond those attributed to ASD. For example, Alex's proximity behavior was at the lowest point. When the parent entered the room he did not reach out for the parent, nor did he responded to parental attempts for contact. At the same time, he neither avoided nor resisted parental attempts for contact. Overall, he maintained a rather passive position during reunion episodes. Therefore, Alex's lack of initiative to interact with caregivers did not permit an evaluation on any of the parameters associated with type of attachment: frequency, intensity, duration. Finally, since all disorganized behaviors that Alex emitted were occurring equally, during both the presence and the absence of caregivers, that leads us to refrain from classifying his attachment behavior as

Table 6 Type of attachment between participants and their parents

	Mother	Father
John	Secure (B)	Secure (B)
Alex	Unclassified	Unclassified

Table 7 Parental anxiety levels before and after the intervention

Alex	Before intervention		After intervention	
	Mother	Father	Mother	Father
State-Trait Anxiety Inventory-STAI	50/80 (right now feel) 51/80 (general feel)	43/80 (right now feel) 40/80 (general feel)	44/80 (right now feel) 48/80 (general feel)	36/80 (right now feel) 35/80 (general feel)
John				
	Mother	Father	Mother	Father
State-Trait Anxiety Inventory-STAI	53/80 (right now feel) 50/80 (general feel)	29/80 (right now feel) 37/80 (general feel)	23/80 (right now feel) 40/80 (general feel)	44/80 (right now feel) 52/80 (general feel)

Disorganized/Disoriented (D) according to Main's & Solomon's classification scheme (Main & Solomon, 1990).

Pertaining to the results of the State-Trait Anxiety Inventory (STAI) that was administered to the participating parents, some systematic differences were noted between initial scores and scores obtained after the intervention. Specifically, as depicted in Table 7, there was a slight decrease in scores following intervention which is indicative of decreased anxiety levels, yet John's father's stress levels were increased after intervention.

To assess the social validity of the study, a four-point Likert scale was completed by both parents of each participant. The outcome of the questionnaires revealed that all participants were satisfied with the results of the intervention for the following reasons: (a) the improvement of the quality of their attachment with their child (e.g., starting to follow the child's lead, improved parent–child synchronicity); (b) the changes in the child's involvement (e.g., exploring the environment and toys more actively and improving quality of play, social engagement with parent, and attention span); and (c) their improved understanding of their children's social needs and desires. All four parents reported that were eager to suggest the training to other parents.

Baseline, treatment, generalization, and follow up data are presented in Figs. 1,2, 3, 4, 5, 6, 7. Figure 1 depicts the percentages and frequencies of John's and his mother's responding for trained categories. The vertical dashed lines indicate the starting points of the intervention per response category, the points represented by squares are the generalization-across-setting data and follow up data are depicted by triangles. During baseline, there were no occurrences of declarative joint attention, but increased to an average two per session (range: one to five) following the introduction of intervention and to one occurrence during the follow up. There were zero occurrences, however, during the generalization-to-the home-setting session.

Pertaining to the naturalistic style of interaction of John's mother, on the average, the percentage of naturalistic interactions increased from 35% during baseline to 53%, following the introduction to treatment, to 53% during generalization to the home setting, and to 67% during the follow up session.

Finally, the frequency of positive reinforcement delivered by John's mother was one per session, on the average, during baseline, and increased to eleven, during treatment and generalization, and to twenty during the follow up session.

Figure 2 depicts the percentages and frequencies of John's and his mother's responses to novel response categories—categories for which no training was received. The dashed lines demonstrate the starting point at which intervention was initiated for: (a) declarative joint attention, (b) naturalistic style of interaction, and (c) reinforcement. During baseline, the percentage of intervals scored for on-task behavior with interaction was 32%, on average and increased to 37% during intervention, to 60% during generalization, and to 80% during follow up. As far as the frequency of play accompanied by vocalizations in baseline was two per session, on average, and increased to six during treatment, to four during generalization across settings, and to three during follow up.

Figures 3 and 4 depict the data collected during John's sessions with his father. Figure 3 depicts frequencies and percentages of responding for trained categories. Specifically, during baseline, there were no occurrences of declarative joint attention. During treatment, the frequency of declarative joint attention increased to five on average, and during generalization and follow up to two.

Pertaining to the responding of John's father, during baseline, a naturalistic style of interaction was scored for 26% of time intervals, on average, which increased to 50% during intervention, to 67% during generalization to the home setting, and to 87% during follow up. In addition, the frequencies of positive reinforcement provided by John's father increased, from an average of one per session in baseline,

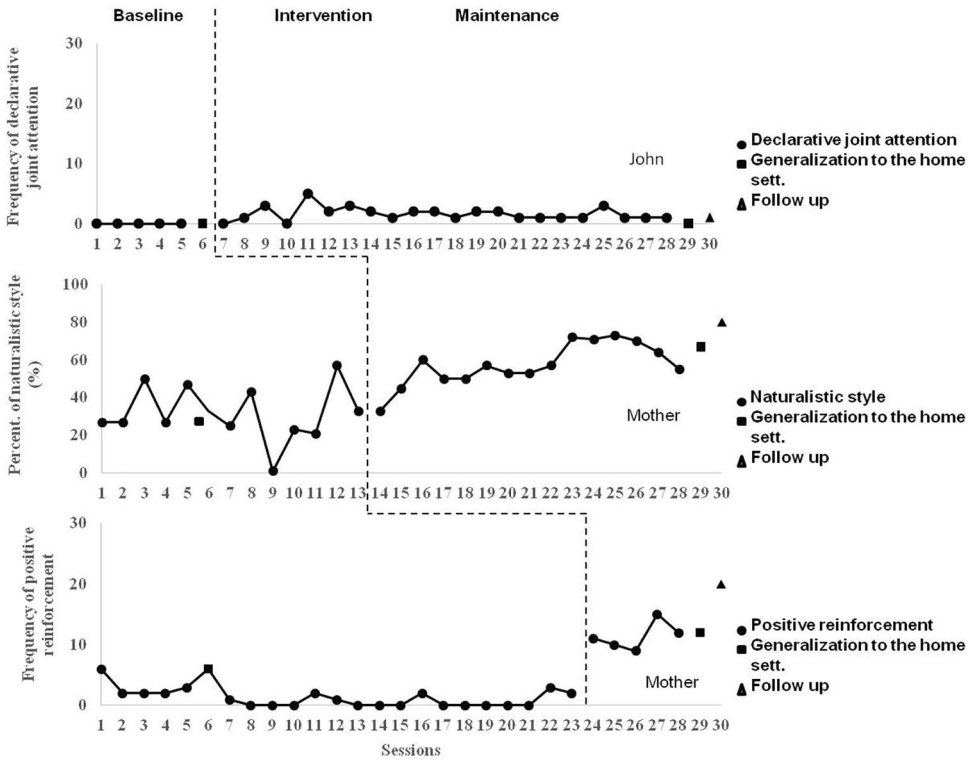

Fig. 1 Percentages and frequencies of appropriate responding for trained categories—John-mother dyad

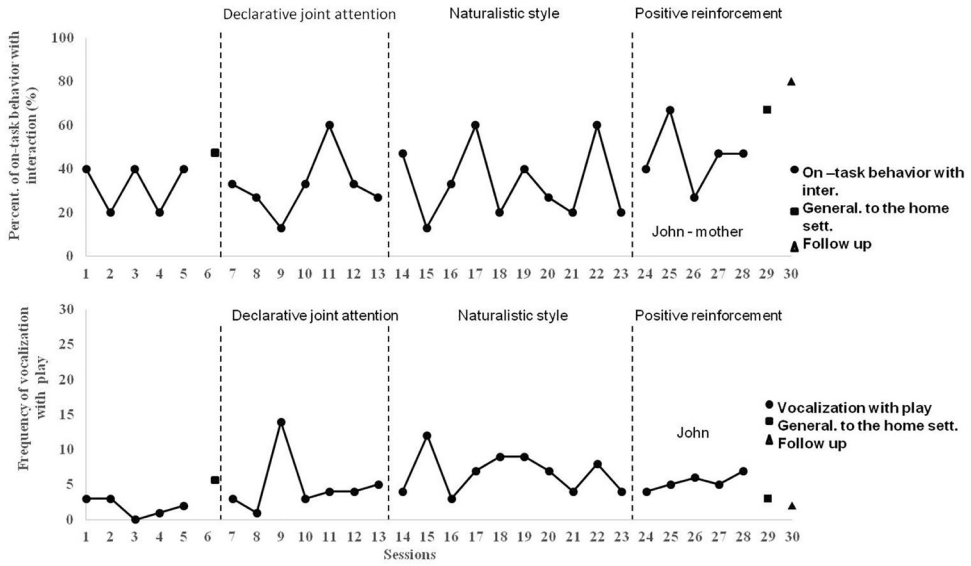

Fig. 2 Percentages and frequencies of appropriate responding for untrained categories—John-mother dyad

to seven in treatment. During generalization, the frequency of reinforcement was two, and it increased to five during follow-up.

Figure 4 depicts the percentages and the frequencies of John's and his father's responding for untrained categories. The dashed lines indicate the starting point at which intervention was initiated for: (a) declarative joint attention, (b) naturalistic style of interaction, and (c) reinforcement. During baseline, the percentage of intervals scored for on-task behavior was 45%, on average, and decreased to 31% during intervention, but finally increased to 47% during generalization and to 73% during follow up. Pertaining to play accompanied by vocalizations, the frequency was one, on the average, and, after intervention was introduced for trained categories, it increased to five, decreased to one during the generalization and increased to ten in follow-up session.

Pertaining to Alex's data, Fig. 5 depicts percentages and frequencies of Alex's and his mother's appropriate

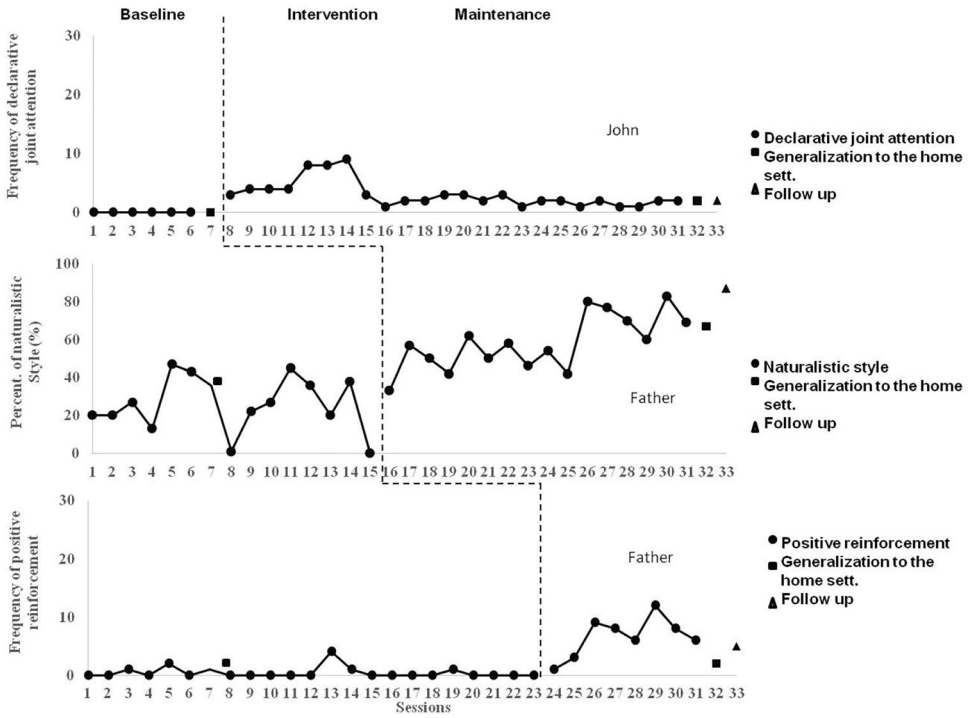

Fig. 3 Percentages and frequencies of appropriate responding for trained categories—John-father dyad

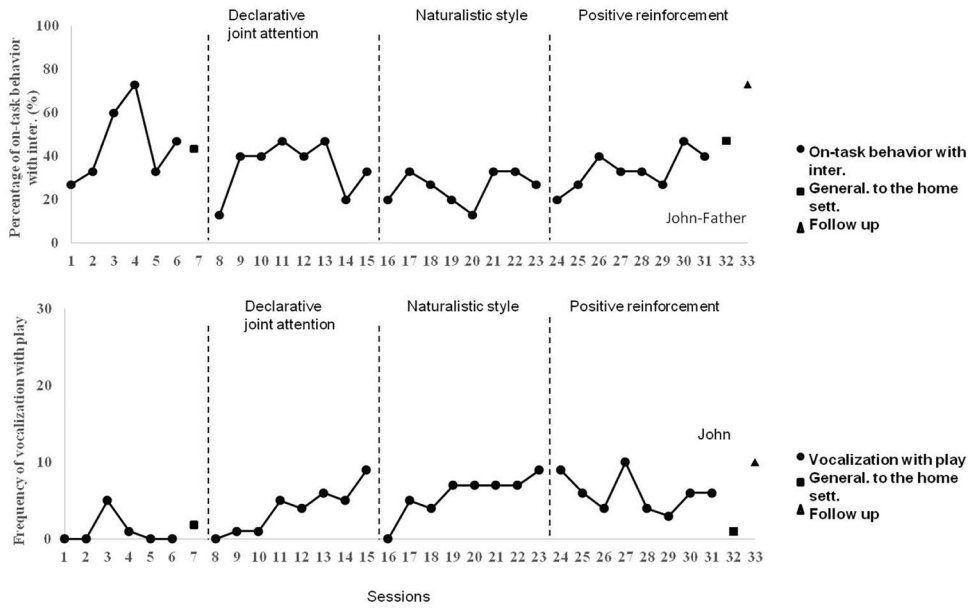

Fig. 4 Percentages and frequencies of appropriate responding for untrained categories—John-father dyad

responding for trained categories. Starting with the naturalistic style of interaction of Alex's mother, during baseline, the average percentage of intervals scored for naturalistic style was 22% which increased to an average of 50% during treatment, to 67% during generalization, and to 60% during follow up. The next variable for which training was introduced was declarative joint attention. During baseline, there were no occurrences of declarative joint attention, but, during treatment, the average occurrences increased to five per session. Nevertheless, during generalization and follow up, the occurrences decreased to the averages of one and zero, respectively. Furthermore, the average frequencies of play accompanied by vocalization were four in baseline and increased to eighteen during treatment, to eight during generalization, and to five during follow up.

Figure 6 depicts percentages and frequencies of Alex's and his father's responding for trained categories. During baseline, the average percentage of intervals scored for

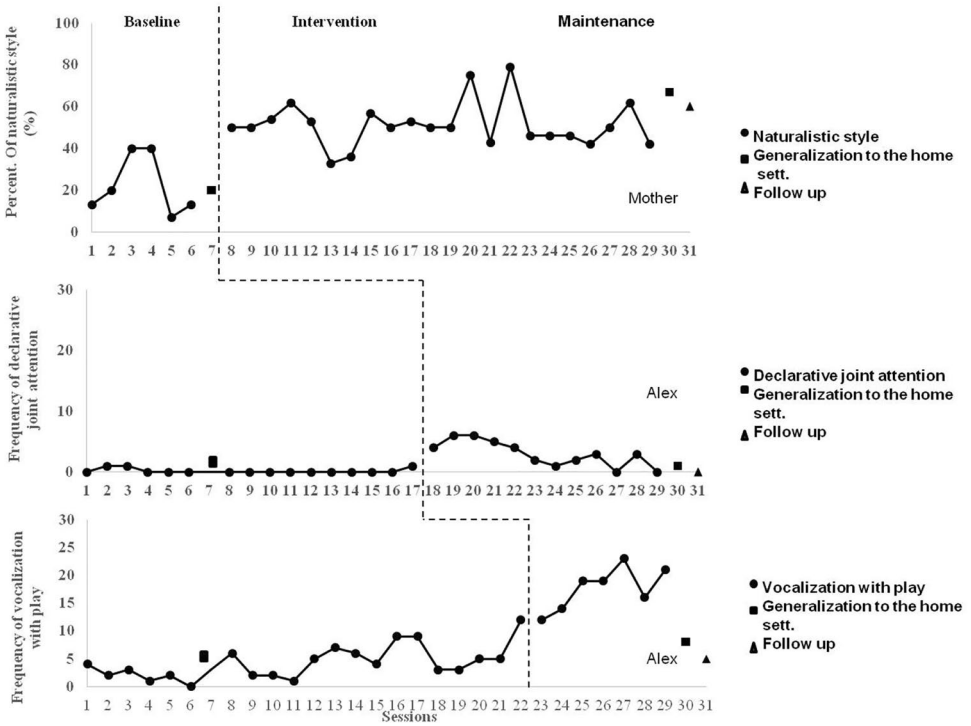

Fig. 5 Percentages and frequencies of appropriate responding for trained categories—Alex-mother dyad

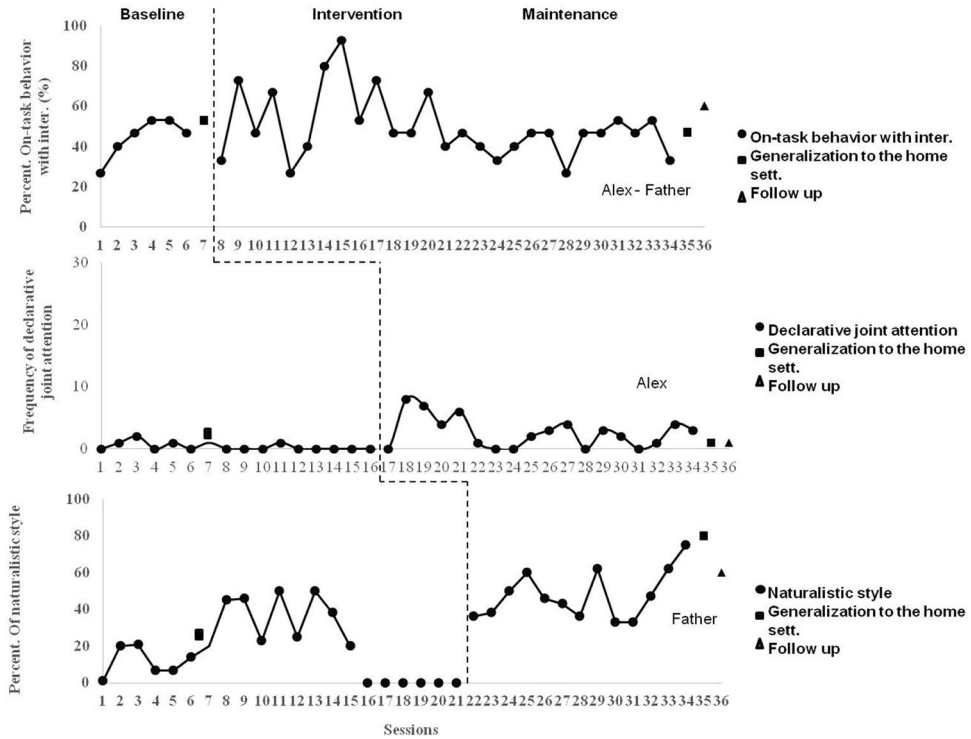

Fig. 6 Percentages and frequencies of appropriate responding for trained categories—Alex-father dyad

on-task behavior with interaction was 45% which increased to 59% during treatment but decreased to 47% during generalization and increased to 60% during follow up. The second variable for which treatment was introduced was declarative joint attention. During baseline, there were no occurrences of joint attention. During treatment, however, an average of six joint attention episodes were scored per session, one during generalization and one during follow-up. This outcome was generalized and maintained. The naturalistic style of interaction of Alex's father was the next trained variable.

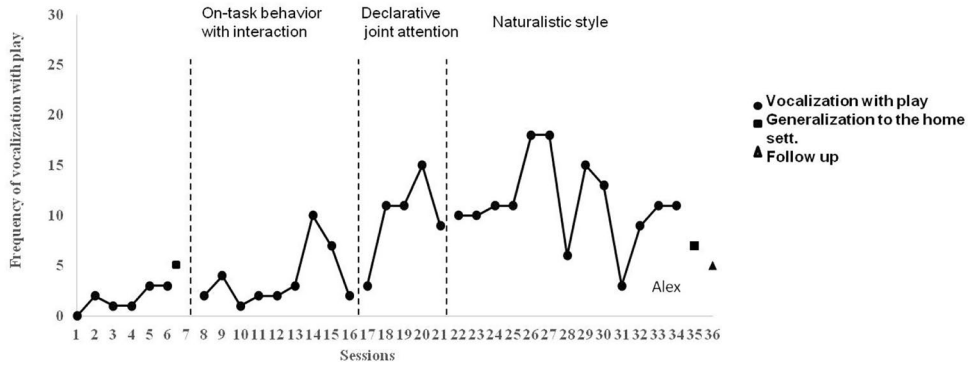

Fig. 7 Percentages and frequencies of appropriate responding for untrained category—Alex-father dyad

During baseline, the average percentage of intervals scored for naturalistic interactions was 18%, which increased to 48% during treatment, to 80% during generalization, and decreased to 60% during follow up.

Figure 7 depicts the frequencies of Alex's and his father's responses for untrained categories. The dashed lines demonstrate the starting point at which intervention was introduced for: (a) on-task behavior, (b) declarative joint attention, and (c) naturalistic style of interaction. During baseline, the frequency of play accompanied by vocalization was two on average and increased to nine during treatment, decreased to seven during generalization, and to five during follow up.

Statistical analysis of the data indicates statistically significant changes following the introduction of treatment ($p < 0.001$) and strong effect sizes for three out of the four dyads. Specifically, the Tau-U were: for John and his mother 0.90, 90% CI (0.65, 1), for John and his father 0.94, 90% CI (0.72, 1), for Alex and his mother 0.90, 90% CI (0.62, 1) and for Alex and his father 0.50, 90% CI (0.28, 0.72) which corresponds to moderate effect size.

Discussion

The present study is the first in Greece, to our knowledge, that addresses the attachment of children with ASD. Its purpose was twofold: to examine the attachment patterns of children with ASD with both their mothers and fathers and to assess the effectiveness of a parent training program that aimed to improve the parent–child interaction in parameters associated with attachment. Pertaining to the assessment of attachment, the four participating dyads (Alex with his mother, Alex with his father, John with his mother, John with his father) showed attachment responses that resembled those of typically developing children, such as searching for their mothers and fathers during separation and demonstrating preference for their parents over a stranger, during reunion. Pertaining to the efficacy of the parent training intervention—which was based on behavior-analytic methodology and applied in a naturalistic context, following a developmental perspective as far as the selection of the targeted behaviour—the results were very encouraging since they indicate that the treatment package was effective in improving the quality of the parent–child interaction in dimensions associated with attachment, for each one of the parent–child dyads who participated in the present study. Specifically, the following improvements were noted: *parents* (a) adopted a more naturalistic style or interaction during play in the sense that they became less directive and more attuned to their child's preferences, (b) learned to reinforce their child's efforts to communicate and interact in a functional way during parent–child play and to encourage the child's on-task behavior during play; *children* (a) increased on-task behavior while interacting with their parents, (b) increased their vocalizations during play activities and improved play skills, such as turn taking or sharing toys without engaging in stereotypic behavior or diverting their attention from play activities; *the parent–child interaction* variables improved since (a) interactions were more frequent during play activities and (b) there were more episodes of declarative joint attention initiated by the child. Both response and stimulus generalization were attained. Namely, treatment outcomes generalized to untrained response categories related to attachment, such as emitting vocalizations during play activities (response generalization) and to the home setting (stimulus generalization) and were maintained across time. It is important to note that three types of response categories were targeted through parent training: (a) parental behavior, (b) child behavior, (c) and parent–child interactions since they are considered to be transactional in obtaining improved outcomes in social-interactive behavior. In addition to visual inspection of the data, a statistical analysis was conducted according to which statistically significant improvements were obtained, following the introduction of treatment, with moderate to strong effect sizes in all the trained categories.

Finally, measures of parental stress, as assessed by the State-Trait Anxiety Inventory (Form Y-1) (STAI-Y; Spielberger et al., 1983), indicated that, following intervention, three out of four parents, who participated in the present

study, had slightly lower stress levels than before the intervention. Yet, in the case of John's father, stress levels were slightly increased which may be attributed to life events signifying important changes in his family life (e.g., his wife's pregnancy etc.).

Indirect measures of social validity led to social validation of the treatment outcomes. Specifically, parents reported that they: (1) adopted a more naturalistic style of interaction during play their child, (2) could evaluate their child's communicative needs and preferences and were more responsive to them, (3) shared positive emotions, such as enthusiasm, more often during play interactions, and (4) noticed several improvements in their child's behavior after the intervention, such as sharing, showing preference, smiling, and engaging in joint attention throughout the day.

The aforementioned results coincide with prior research findings in terms of demonstrating that, when parents of children with ASD: (a) follow their child's lead and synchronize their efforts to his/her preferences, during play interactions, children's communication and language skills improve (Bang & Nadiq, 2015; Siller & Sigman, 2002) and (b) are less directive when interacting with their child, the child's play and on-task behavior improve (Bottema-Beutel et al., 2018; Parlade et al., 2020). In addition, we replicated prior research findings that demonstrated that children with ASD may be categorized as securely attached, insecurely attached, or with attachment difficulties (Grzadzinski et al., 2014; McKenzie & Dallos, 2017). The present study also revealed, as prior research did, that there is a variability in the attachment patterns of the two participating children. Namely, John developed secure attachment (type B) with both his parents, yet some of his behaviors could be classified as disorganized. Alex seemed to recognize and prefer his parents over a stranger, yet there was no recognizable pattern of attachment behavior (during either separation or reunion episodes). This finding was consistent with prior outcomes that attribute differences in attachment style to individual differences in cognitive, social, and language development as well to the severity of autistic symptomatology (Grzadzinski et al., 2014; McKenzie & Dallos, 2017; Van Ijzendoorn et al., 2007). For example, if children with ASD do not communicate their needs to their caregivers, effectively, or do not realize the reciprocal character of the interaction with their caregivers, it is very much likely that the quality of their attachment will be affected (Crowel et al., 2019; Fusaroli et al., 2019; Keenan et al., 2016; Parladé et al., 2020; Rozga et al., 2018; Siller et al., 2014). Finally, the present study, similar to prior research, demonstrated that parental behavior may be crucial for the improvement of the quality of the parent–child attachment (Siller & Sigman, 2008).

Overall, the present study contributes to a body of research concerning the needs of children with ASD and their families with regard to attachment, by emphasizing the need for systemic and systematic interventions that aim to ameliorate attachment difficulties (Keenan et al., 2016; Poslawsky et al., 2015; Siller et al., 2014). When parents are trained to interact reciprocally and effectively with their children with ASD, attachment difficulties may be resolved. The present study demonstrates the effectiveness of behavior-analytic procedures, used in the context of naturalistic play activities, in improving the quality of the attachment of children with ASD to their parents. Thus, aligned with prior research, we may ascertain, based on the findings of the present study, that parent-training interventions foster outcomes in crucial areas for child development that generalize and maintain and therefore contribute to the quality of life of the entire family (Althoff et al., 2019; Karst & Van Hecke, 2012; O' Cathain et al., 2013; Oono et al., 2013).

The present study has a few strengths: it verifies several prior research findings and contributes to the growing literature that aims to enhance our understanding of the attachment patterns that children with ASD form with their mothers and fathers. Namely, it replicates prior findings about the variability in the attachment patterns of children with ASD. They may be securely attached or may have attachment difficulties. In addition, it was demonstrated that attachment may be treated as operant behavior. Thus, it may improve considerably with properly implemented contingencies. In the present study, the environmental contingencies, such as a naturalistic style of interaction or reinforcement for on-task behavior, were the by-product of a parent training program. We may consider parental skills obtained through parent training likely to maintain since they may come under natural reinforcement contingencies—the child's improved social responding. Finally, treatment gains were obtained on various systemic levels—parental behavior, child behavior, and parent–child interaction.

Nevertheless, the present study has several limitations as well. First, only two children with ASD participated and the selection of children was not random but convenient. Thus, the study's findings have limited external validity. A replication should be considered with a larger sample of representative children. Moreover, the design of the present study and the size of its sample do not allow for an evaluation of a possible association between severity of ASD and the development of disorganized patterns of attachment. It would be very interesting for future research to experimentally investigate this empirical question. In addition, variability was noted in Alex's performance while interacting with his father. This variability in two of the three targeted responses may be attributed to several factors, yet none was experimentally investigated. For example, the factors that may have contributed to a decrease in interactions, during generalization, may be associated with Alex's overall behavioral regression during that period which also led to changes in his medication. It is important to underline

that the newly acquired skills were generalized to the home setting and maintained one month after cessation of treatment. Nevertheless, declarative joint attention was not generalized and both participants maintained low rates of this response category across time, which may be attributed to the fact that declarative joint attention is a quite challenging response for young children with ASD and thus, to obtain its generalization across time, may require overtraining (a prolonged period of teaching even after reaching optimal levels of occurrence), use of more powerful reinforcement contingencies rather than social praise alone, or systematic training of the participants for eye contact since this is a particularly challenging behavior for children with ASD and lack of eye contact with a parent was the reason why several joint attention episodes were not scored as occurring. Finally, only indirect measures of social validity were used in the present study. Future research could employ direct measures for validating treatment outcomes, such as having independent evaluators to compare baseline and treatment performance of the participating parents and children.

In summary, the present study aimed to contribute to the existing literature on the attachment patterns of children with ASD in several ways. It replicated prior research findings, such as the potential of children with ASD to establish secure attachment with their parents and to improve upon attachment-related social-interactive skills. In addition, a naturalistic behavior-analytic intervention, informed by a developmental perspective as far as the selection of target response categories, appears to be an appropriate context for the enhancement of attachment-related interactive exchanges between children with ASD and their parents and for reducing parental stress. The generalization, maintenance, and social validation of the treatment outcomes accentuate the value of the results for the quality of life of families of children with ASD.

Acknowledgments The present work was co-funded by the European Union and Greek national funds through the Operational Program "Human Resources Development, Education and Lifelong Learning" (NSRF 2014-2020), under the call “Supporting Researchers with an Emphasis on Young Researchers—Cycle B” (MIS: 5048140).

Author Contributions All authors contributed to the study conception and design. AS wrote the manuscript, collected the data, conducted all statistical analyses and the graphics, GG analysed the data for interobserver agreement purposes and conducted the tables, AG was the major supervisor of the manuscript, conducted writing-review, editing and had the project administration and SV had an oversight responsibility for the research activity planning. All authors read and approved the final manuscript.

Funding The present work was co-funded by the European Union and Greek national funds through the Operational Program "Human Resources Development, Education and Lifelong Learning" (NSRF 2014-2020), under the call “Supporting Researchers with an Emphasis on Young Researchers -Cycle B” (MIS: 5048140).

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