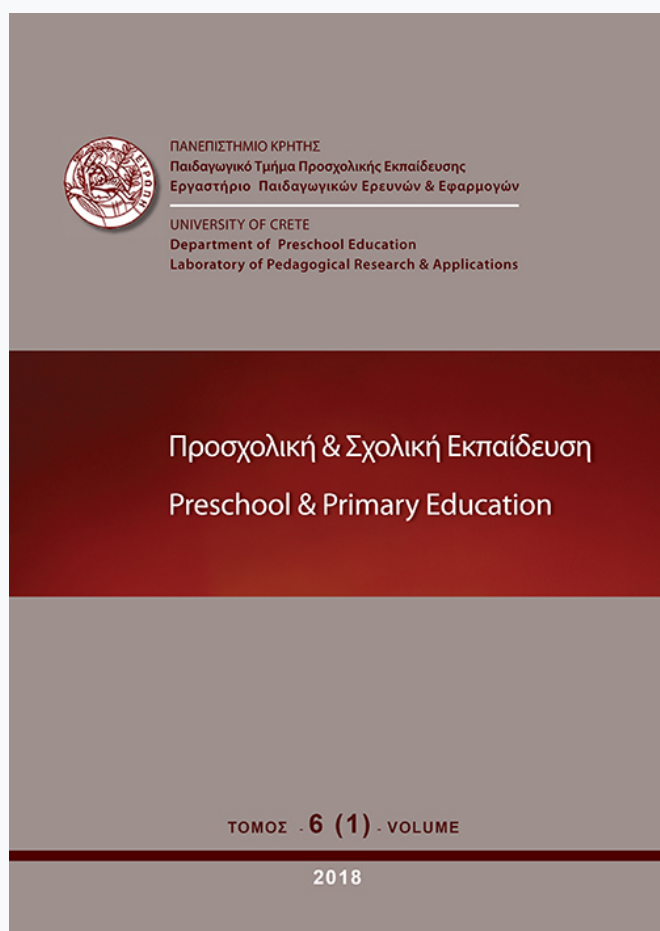


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Early view



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Playful interactions among twins with autism spectrum disorder, teachers and peers: a case study

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Summary. The purpose of this analytically structured empirical case study was to explore the interactions which twins display while playing with their teachers and peers in a Special Nursery Unit. Two 5.5-year-old twin brothers with Autism Spectrum Disorder (ASD) participated in this study, along with two teachers and seven non-typically developing peers. Non-participant observations were made over four full-time school days in four consecutive weeks. The frequency, initiations, and duration of the playful interactions were observed in a naturalistic context. Results derived from the analysis of video-recordings and documents from the school service records indicate that the twin brothers with autism took initiatives to become interactive partners in their dyadic play with their non-typically developing peers. However, when the twin brothers with ASD initiated interactions, they did not last longer than interactions initiated by their peers. In the twins' dyadic interactions with their teachers they never took the initiative for any playful interaction. There are also indications that the twin brothers were engaged in interactive rather than solitary play. Findings provide a starting point for a new approach for the twin situation and the extraordinary etiological heterogeneity of ASD in terms of Innate Intersubjectivity Theory.

Keywords: twins with autism spectrum disorder, playful interactions, interactions with teachers and peers, innate intersubjectivity

Introduction

Autism Spectrum Disorder (ASD) is a disorder which involves impairments in social communication and the presence of restricted and repetitive behaviors (American Psychiatric Association, 2013). More specifically, ASD is a severe lifelong disorder (Smyth & Bryson, 1994), where individuals have: a) social and communicative deficits (Grey, Bruton, Honan, McGuinness, & Daly, 2007; Hobson, 2007; Kasari et. al, 2016; Lohr & Tanguay, 2013) b) deficits in learning and symbolic play (Trevvarthen, Aitken, Papoudi, & Robarts, 1998); c) language problems and deficits in non-verbal exchange (Ellis Weismer, & Kover, 2015; Papakalodouka & Papailiou, 2015; Tager-Flussberg & Kasari, 2013; Vivanti, Nadig, Ozonoff, & Rogers, 2008); d) limited imitative ability (Leighton, Bird, Charman, & Heyes, 2008; Oberman et al., 2005; So, Wong, & Lam, 2016) and e) impairments in understanding facial expressions and emotions, and in joint attention (Soucy, 1997). Apart from the above studies which locate deficits in social exchange, Trevvarthen and Delafield-Butt (2013) found further that children with autism lack the ability to: a) create simple actions / movements; b) organise a series of actions; and c) simultaneously coordinate and integrate multiple action

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groups. Additionally, they consider ASD to be a disorder in intentional movement and affective engagement and a disorder of self-related motor-affected processes which control development of shared cognitive representations (Trevvarthen & Delafield-Butt, 2013).

Epidemiological studies have reported that the prevalence of ASD is higher than displayed the last two decades (Anagnostou et al., 2014; Baird et al., 2006; Chakrabarti, & Fombonne, 2005; Fombonne, 2005; Saracino, Noseworthy, Steiman, Reisinger, & Fombonne, 2010; Sealey et al., 2016). Most recently, research interests have turned to twin and family studies to test the hypothesis that ASD is due to inherited genetic defects (Geschwind, 2009). The increased rate of twins among affected sibling pairs with ASD confirms the implication of genetic factors in the etiology of ASD (Betancur, Leboyer, & Gillberg, 2002; Greenberg, Hodge, Sowinski, & Nicoll, 2001; Kean, 1975; Kotsopoulos, 1976; McQuaid, 1975; Rutter, 1967). However, which specific genes are associated with ASD have not yet been identified. Additionally, there are research findings derived from large twin-pair studies which confirm the equally important role of both environmental and genetic factors (Hallmayer et al., 2011) and highlight the fact that the inherited genetic origins in ASD are overestimated (Sealey et al., 2016). In general, ASD's etiology and implications have been investigated from diverse theoretical approaches. Some are based on neurocognitive explanatory theories of ASD, while others are based on brain morphophysiological and functional abnormalities (Huguet, & Bourgeron, 2016; Muhle, Sanders, Reed, & State, 2016; Peñagarikano, 2016; Silva, et al., 2013). However, a new approach to the etiology and implications of ASD in terms of innate intersubjectivity theory is suggested by Trevvarthen (in Kugiumutzakis, 2016; see also Delafield-Butt, & Trevvarthen, 2018)), who seeks the etiology of ASD in the function of the brainstem and more specifically in possible defects or malfunctions in the sub-cortical brain structures (see Kugiumutzakis, 2016; Torres & Dollennan, 2007-2015; Trevvarthen & Delafield-Butt, 2013/2015). Trevvarthen and Delafield-Butt (2013/2015) emphasize that neither a genetic nor a neurobiological or environmental factor has been identified as the sole cause of autism. Moreover, it is noteworthy that studying ASD in terms of innate intersubjectivity theory shifts the research interest from the study of single participants under experimental conditions to the study of dyadic interactions –a person with ASD and his/her communicative partner - in naturalistic contexts. This perspective named the *movement perspective* by Torres and Donnellan (2007-2015) highlights an innovative approach to studying and supporting people with ASD. According to the movement perspective, language and other cognitive systems are not weighed more than the role of motives, emotions, movements and communicative expressions in understanding the individual with ASD as a person who is, like all humans, a social being able to participate actively in all aspects of his/her life and learning.

Social interactions of children with Autism Spectrum Disorder

As mentioned above, deficits in communication and social interactions are profound in ASD. In contrast to typically developing children, those with ASD show eagerness to communicate mostly to express their needs and rarely reply to prompting for interpersonal communication (Downs & Smith, 2004; McGee, Feldman, & Morrier, 1997; Sealey et al., 2016; Sigman & Ruskin, 1999). Peers often misunderstand these deficiencies in social communication and socially isolate children with ASD (Bass & Mulick, 2007). Lord and Hopkins (1986) nevertheless found that children with ASD can engage in social interactions (i.e. time spent watching their peers, responsiveness to peers' initiations, proximity) with other children with ASD and typically developing partners. Stone and Caro-Martinez (1990) explored spontaneous initiations of communication by children with ASD (4-13 years) and showed that they produced initiations 3-4 times per hour in unstructured school activities. Interestingly, children with ASD were more likely to choose teachers as communication

partners than others (i.e. observer, peers) and their cognitive level was associated only with social initiations to peers and observers (Stone & Caro-Martinez, 1990). Other research data on spontaneous communication in the interactions of children with ASD with their peers and adults show low rates of initiation of communication by children with ASD (Loveland, Landry, Hughes, Hall, & McEvoy, 1988).

In two observational studies, Lord and MacGill-Evans (1995) explored peer interactions of high functioning children and adolescents with autism, children with behavioural disorders and typically developing children. In their first observational study it was found that children with autism engaged less time in peer interactions and had fewer interactions in any purposeful activity than the other children. In the second study, (observations of spontaneous initiations of interactions), children with autism were more likely to produce and receive fewer initiations than their peers did. Hauck, Fein, Waterhouse, and Feinstein (1995) found that children with ASD produced fewer initiations and were more likely to greet and inform others about something the other may not know, when compared with verbally matched children with intellectual developmental disorders in their interactions with peers (greeting and informing were coded as two positive initiations of social behaviour). Regarding the quality of initiations to teachers, children with ASD exhibited more 'ritualized' (Hauck et al. 1995, p. 579) behaviour and they were more likely to be in physical proximity with them. It has been shown that adults initiate contact with children with ASD, Down syndrome and other developmental delays more frequently than vice versa (Sigman & Ruskin, 1999) and that children with ASD are more engaged in interactions with their teachers than with their peers with ASD (McHale, Simeonsson, Marcus, & Olley, 1980). When adults initiate social interactions, playing with children with ASD, Down Syndrome and other developmental delays, it becomes even more difficult for children with ASD to be engaged in interactions with their peers (Sigman & Ruskin, 1999). What is certain is that engaging children with ASD in an interaction is a difficult matter even for the most socially competent adult. For children with ASD, initiation of social interaction with peers was found to be positively correlated with their cognitive level (Hauck et al. 1995). Free play was found to promote isolation and the possibility of this happening is even greater in preschool-aged children with ASD (Hauck et al. 1995). Children with ASD are actually interested in social interaction but their play partners are not supportive enough to give them a motive to make the interaction last longer (Sigman & Ruskin, 1999; Wolfberg & Schuler, 1999). They also maintain interactions for less time after a successful bid in comparison with other children and even children who frequently initiate social interactions fail to maintain them (Sigman & Ruskin, 1999). Familiarity among partners was found to be an important factor in children's with ASD engagement in social interactions (Sigman, Mundy, Sherman, & Ungerer 1986; Watteyn, Roeyers, & De Groote, 2005), although, in some cases, the developmental delay of children with ASD may be the reason for no differences in the way these children engage in social interactions with familiar or unfamiliar persons (Meirsschaut, Royers, & Warreyn, 2011).

The above research is focused on cognitive and social disorders observed after infancy. However, Trevarthen and Delafield-Butt (2013/2015) suggested that deficits in serial coordination and prospective control of movements affect the communicative ability of infants, toddlers and children with ASD in early infancy, before medical diagnosis. They showed that dysfunction in early cognitive and language abilities resulting from the dysfunction of sympathetic sharing, has a negative effect on parents as communicative partners. Parents are not fully emotionally invested in their intrapair interactions with their infants. Moreover, intersubjective communication between parents and children with ASD does not contribute in the best possible way either to a better quality of life or to happier and more creative relationships with important others for children with ASD (Kugiumutzakis, 2016). A few years ago it was found that developmental disorders in children's language

abilities in the crucial period from 1-4 years have a negative effect on the communicative paths parents follow to communicate with them (Oller et al., 2010). Trevarthen and Delafield-Butt (2013) suggest that the developmental disorder that affects children's communicative abilities and mutuality in parent-child interactions may be explained as a brainstem dysfunction, a failure of development in systems that programme timing, serial coordination and prospective control of movements. Findings on the dyadic interactions between mothers and their children with ASD in a naturalistic context confirm an inability to thoroughly communicate and cooperate in common activities when compared to children with developmental delays and typically developing children matched for their verbal skills, during their free dyadic play interactions with their mothers (Papoudi, 2016a, 2016b). It is also suggested that the way mothers of children with ASD communicate with them is affected by the communicative and mental abilities and the weaknesses of their children (Papoudi, 2016a). Furthermore, several case studies have shown that children with ASD are more engaged in their communication and they take more initiatives through a type of intervention based on intersubjectivity, "the intensive interaction", which enhances social and communicative abilities of children with ASD (Aitken, 2008; Kellett, 2000; Nind, 1996; Nind, Kellett, & Hopkins, 2001; Watson & Fisher, 1997) and also improves collaboration within the school (Jones & Howley, 2010). Recent findings on the use of intensive interaction during interactive play between a 6-year-old-boy with ASD and his teacher confirmed the effectiveness of this approach in an inclusive preschool class. This child's social interactions also improved in the post-training period while playing with a girl in the same inclusive preschool class with another developmental delay (Argyropoulou & Papoudi, 2012). Finally, in a number of studies on ASD play is used within intervention strategies. In a systematic review of play interventions for children with ASD in school settings Kossyvaki and Papoudi (2016) refer to a number of studies classified into behavioural/naturalistic and developmental/relationship-based. In both categories the role of play is underlined in designing effective interventions to develop play skills in children with ASD at school. They also suggest the importance of designing real world studies where play interventions focus on the interpersonal world of children with ASD and the derived positive emotions.

There may be scientific interest in seeking the motives, if any, in twins with ASD, in terms of the innate intersubjectivity theory. Twins share common genes and have each other as a permanent companion from their conception. Being a twin may make the social deficiencies of children with ASD milder. This is why it would be interesting to study the manner in which the twin relationship affects social engagement in twins with ASD. Twin children with ASD have been studied from a certain clinical perspective, as described in the following section.

Twin children with Autism Spectrum Disorder

Research focused on autism spectrum disorder in twins is either based on a population-based twin sample or takes the form of case studies. The pioneering studies of Folstein and Rutter (1977) changed the perspective in genetics of ASD. They studied a group of 21 same-sexed twin pairs ranging in age from 5 to 23 years, in each of which a child with ASD was included. Folstein and Rutter (1977) found that the hereditary influences are concerned with a variety of cognitive deficits and not just with ASD, and they also concluded that brain injury in the infancy period may be the cause of ASD on its own, or combined with a genetic predisposition. Until then an extensive body of literature, based on the notion that monozygotic twins (henceforth MZ) share 100% of their genetic material, while dizygotic (henceforth DZ) share 50% and they co-exist in the same environment in utero, documented higher rates of ASD in pairs of MZ than DZ twins, so that a genetic etiology was supported (Bailey, 1995; Rosenberg, 2009). However, a very recent study with a

large sample of twins showed the predominance of shared environment over genetic factors (Hallmayer et. al., 2011). Moreover, Ho, Todd and Constantino (2005) explored the development of autistic symptoms in relation to gender to find out whether twins are more likely to develop autistic traits than non-twins. They found that male twins may be more liable to be diagnosed on the autism spectrum than non-twins. Furthermore, Goldsmith, Lemery-Chalfant, Schmidt, Arneson, and Schmidt (2007) in a series of population-based longitudinal studies, attempted -among others- to detect all the twins aged 2–16 years who had been diagnosed with ASD. Results showed that 50% to 70% of MZ twins featured on the autism spectrum, whereas the figure for DZ twins was 15% to 25%. In another study, which was carried out on a population-based twin sample, Dworzynski, Ronald, Hayiou-Thomas, McEwan, Happe, Bolton and Plomin (2008) focused on the relationship between early language delay and ASD. The study found that 8-year-olds who showed extreme social and communication disorders had been below average in language development when they were 2–4 years old. Finally, a large sample study on the social engagement of children with ASD showed evidence of deficits in reciprocal behaviour in 219 pairs of school-aged male twins, which were substantially genetically irrespective of other domains of child psychopathology (Constantino, Hudziak, & Todd, 2003).

However, apart from population-based twin studies, case studies also contribute to the investigation of the role of some neuroanatomical structures that may be responsible for ASD in twins. Findings on the neuroanatomical and neuropsychological differences in a pair of 7.5-year-old MZ twin boys discordant for strictly defined autism indicate the existence of a dysfunction in the subcortical structure of the brainstem that makes them differ from a sample of age- and sex-matched peers (Kates et al., 1998). Although the unaffected twin did not fulfil the diagnostic criteria for ASD, he seemed to be under stress in his social interaction and play. These results suggest a dysfunction in two separate but overlapping neuroanatomical pathways that led twin brothers to differ from each other on the one hand and differ from their age- and sex-matched peers on the other (Kates et al., 1998).

Research has also focused on the appearance of the main symptoms in twins with ASD (Dworzynski, Happe, Bolton, & Ronald, 2009), and the overlap that might exist between symptoms of ASD and behaviour problems in twins and their non-twin siblings (Hoekstra, et al., 2007). An early such case study involving DZ twins of different gender (Sloan, 1978) showed that the appearance of symptoms of ASD might develop differently in twins, depending on other parameters. In this case, the first-born male twin's health condition was better than that of his sister who had suffered from perinatal anoxia. In a retrospective journal-based case study of an infant with ASD and his typically-developing female co-twin Rutherford (2005) described the development of the twin with ASD from the prenatal period up to the fourth year based on medical records and the mother's meticulously kept personal journals. This study showed differences between DZ twins regarding their development, their behaviour, and the habits they developed during different developmental stages and provided significant information about early symptoms of ASD. Another more recent case study of MZ twin brothers concordant for Asperger syndrome (Ishijima & Kurita, 2007) showed that, despite the similarities twins share due to their environment and genetic background, they also differ in comorbidity, IQ indicator and motor performance.

A scientific area where twin children with ASD were also studied was the intervention approaches. Zercher, Hunt, Schuler, and Webster (2001) used the integrated play group model to evaluate joint attention, symbolic play, and language use of two 6-year-old twin boys with ASD while playing with three typically developing girls, aged 5, 9 and 11 years. It was concluded that typically developing children can be trained to provide highly intensive social interventions for children with ASD and they are capable of maintaining the intervention at intensive levels, even when adults are not present. Finally, Thevarthen and

Daniel (2005) showed that in early infancy, before any medical diagnosis, a care-giver's sensitivity may be crucial for early intervention. Thevarthen and Daniel (2005) provided detailed evidence from a micro-analytic study of videos of monozygotic twin girls at 11 months, one of whom was diagnosed with ASD in the second year. During the micro-analysis Trevarthen and Daniel (2005) detected the later diagnosed twin's with ASD deficits in attention, motor tonus, initiative and emotion. These deficits reduced her prospective control of movements and her anticipations in awareness compared to her sister. As a result, the twin infant could not synchronize her social behaviour with that of her father who tried to engage her in social interactions. Emphasis on the "intersubjective therapies" (Trevarthen & Daniel, 2005, p. 31) and their achievements is given to increase the sensitivity of the care-giver to a child's motives and have a more effective interaction. Trevarthen and Daniel's study (2005) on that pair of twins was the first that took advantage of the twin situation for both the children's sake, the healthy twin and the twin with ASD, and focused on the core role of an "energetic" communicative partner. However, more systematic research needs to be carried out to fill the scientific gap described in the following section.

Limitations in current research

For over a century, so much controversy has surrounded the etiology of ASD that shifting research interest in the case of twins for their common shared genotype turned them into a tool of behavioural genetics, ignoring basic aspects of their development. The developmental trajectory of typically and non-typically developing twins is an innovative research field. Developmental studies on twins are of great interest for better understanding twin children as such, taking into account that from the beginning of their life twins co-develop with their co-twin, a developmental advantage that could be exploited at an intervention level. Previous studies have not investigated a very interesting aspect of twinship, the companionship in twins with ASD. Recent research examining the features of friendship in typically developing twin children (common or different friends or both) (Preedy, 1999) could be extended throughout the present study in twin children with ASD, examining their interactions with their peers and teachers in a school setting. Taking into account that there is an increased number of twins with ASD, (Betancur, et al., 2002; Ho et al., 2005) studying their playful interactions provides new information that can be used to develop effective intervention strategies and programmes that strengthen the social environment of these children and their interactions with others. Although great attention had been given to the deficiencies in social communicative relations among children with ASD in a naturalistic context almost 30 years ago (Volkmar, Hoder, & Cohen, 1985), there is still a lack of studies that explore playful interactions between DZ twins with ASD of preschool age and their peers and teachers in a naturalistic context. The present research fills this gap in the literature, with a focus on initiation which is considered pivotal (Cardon, 2007), as children who initiate interaction are more likely to get others' response and improve their language and communication skills (Koegel & Koegel, 1995). It is important to investigate twins with ASD interacting with typically developing peers or peers with ASD because, through the observation of the autistic traits of same-aged siblings combined with the twin situation, it becomes easier to identify the nature of the problem in twins' social interactions and more efficiently design support structures for twin children with ASD. These support structures could help them engage successfully in reciprocal peer interactions and participate in play-based early childhood programmes at school and also in their daily activities. More specifically, twin studies in school settings can improve educational outcomes for twin children with ASD, and positive aspects of being a twin such as familiarity and companionship, may shed light on the difficult situation of ASD. The findings of the present study will be discussed in terms of innate intersubjectivity theory. The underlying notion in this study is that ASD is a disorder in an interpersonal level which

prevents or hampers emotional coordination between children with ASD and their partners, and leads to dysfunction in communication (Hobson, 2005; Trevarthen, Aitken, Papoudi, & Robarts, 1998). Twins as children who grow up having a same-aged companionship from the beginning of their life, might turn their interpersonal relationship into a secure base for their social explorations, highlighting the developmental advantages of twinship.

Aim of the present study

The aim of the present study was to explore interactions which twins display while playing with their teachers and peers in a Special Nursery Unit. More specifically, we hypothesized that: 1) if twin brothers with ASD initiated play in dyadic social interactions with their non-typically developing peers, they were more likely to engage in interactive play than solitary play; 2) teachers were more likely to initiate playful interactions with the twin brothers with ASD than vice versa; and 3) dyadic interactions between the twin brothers with ASD and their non-typically developing peers would last longer when initiated by the twins. It is a naturalistic study as it was conducted in a real-life context. Moreover, it is an exploratory study, since as far as we know, there are no previous studies on initiatives for social engagement between twins with ASD and their teachers and peers within a naturalistic context.

Methods and Materials

Participants and Setting

A pair of DZ twin brothers with ASD, their teachers, and peers participated in the study. The twins were 65 months old at the time the research was conducted, and they had a younger brother, aged 13 months. The father was 35 years old and the mother 27 years old. They both had graduated high school. The father was self-employed and the mother was a stay-at-home mother. It was practically difficult for her to work because of the increased care needs of her children with ASD and her infant. They lived in a big city in western Crete, the biggest island in Greece. They belonged to a middle-class family. Twins' zygosity was established according to the Zygosity Questionnaire for Young Twins (Goldsmith, 1991). Prior to their enrolment in the Special Nursery, they had both received their first official diagnosis of autism based on an evaluation by the KEDDY¹ (official Centre responsible for the assessment of special educational needs in Greece). Problems in the twin children's development were not detected from early infancy. According to their mother, they did not have any older typically developing sibling for her to compare and note any deviations from the typical development. The mother did not mention any alarming comment from the paediatrician at any of the child wellness visits. The parents had disagreements regarding their twin children's health. The father did not give any support to his twin children and several times he had tried to persuade his wife to institutionalize them. The mother had to fight to keep the twins in the family, at home. This was very difficult because the fact that she could work meant that she had no money because her husband would not financially support her choices regarding the children's health improvement. Until the end of the research the father was not willing to support his wife and did not warm to his twin sons. The twin children with ASD were included in the study based on two conditions: they were DZ twins and they met the diagnostic criteria for ASD.

¹KEDDY: *Kentra Diaforodiagnosis Diagnosis kai Ypostirixis* (Centres for Differential Diagnosis, Diagnosis and Support).

Consent was obtained from the twin children's parents and classroom teachers for their participation in the study. More specifically, the special education teachers and parents were called on the phone and informed through correspondence; a personal meeting followed with teachers and the parents of the twins. Parents and teachers volunteered to provide personal information about the twins and allowed our access to the school records.

Teachers were specialized in Special Education and they offered a special curriculum for seven children of preschool age with a disability and/or special educational needs: one child with Down's syndrome, two boys and one girl with ASD, two hemiplegic girls, and one boy with epilepsy and cognitive delay. Each one of these seven children, apart from any other diagnosis from a public or private health service, was also diagnosed and therefore assigned to a special education class by KEDDY. Two teachers and occasionally undergraduate students were included in the classroom as volunteers. In addition to their formal education, the teachers received educational and psychological consultation from the authors oriented towards the twins after the research study. Trained undergraduate students involved in data collection frequently visited the classroom and were familiar to the children with special educational needs.

The twin children with ASD received special educational plans which entailed academic and physical skills, instrumental competencies and social skills, early socialization intervention, therapeutic horse riding, workshops for the development of time and space concepts or early writing skills etc. The research was conducted in the course of the special education classroom in an urban Special Nursery, which was located in Crete.

Research design

The present research project used an empirical-analytical case study design since it is focused on the restricted sample of a pair of DZ twin children with ASD. More specifically it is an analytically structured empirical case study that highlights the interactions between DZ twins with ASD and their educators and non-typically developing peers. Our case study database includes non-participant observation and documents from the school service records. According to Hayes (2006, p. 16), methods of data accumulation in analytical case studies include – among other methods – ‘observation of events’ and ‘inspection of relevant documentation’.

Observations of playful interactions: Social interactions between twins with ASD and their peers and teachers were videotaped in the school context. In order to assess twins' playful interactions and initiations, they were observed interacting with peers and teachers during school over four different days in four consecutive weeks. Video-recordings lasted the whole school day, specifically from 9:00am to 12:15pm. Therefore, the total duration of the recorded and analysed social interactions was 780 minutes. Playful interactions were recorded using two Sony Digital Video Camera Recorders, DCR-TRV22E, which focused on the twins and their communication partners. Trained undergraduate students served as research assistants and did not interact with the twins or their classmates or teachers (non-participant observations).

Coding of playful interactions: A Coding Protocol was designed to analyse the twins' playful interactions with peers and teachers based on the Observation Protocol of Semitekolou (2002) and Lieber & Beckman's (1991) coding of individual and dyadic play. The coding protocol entailed two parts, one with general information such as demographic data regarding the twins (age, sex, birth order, type of school etc.) and their parents (e.g. age, number of children, residence, profession), and a second part including details on the partners in each interaction [first born/second born (FB/SB from now on) twins, their peers

and teachers], who initiated each interaction, its duration in seconds, and the type of play and social behaviours during interactive play (Appendix A and B accordingly). The present study focuses on the following three particular groups of interaction coded data: a) the type of play (solitary/interactive); b) the initiator of the playful interaction; and c) the duration of the interaction. As mentioned above, the coding protocol was adapted to evaluate the subject (twin/peer/teacher) who initiated playful interactions, as well as the duration of the interactions. *Solitary play* (manipulative, relational, symbolic, stereotypical play) was coded when the twin partner or his peer played alone ignoring his partner, though one of them had already initiated an interaction that was no longer continued (see Appendix A). *Interactive play* was defined as a playful activity in which the twin with ASD and his peer or teacher were both participating and were both focused on it, exhibiting social behaviours for dyadic sessions as described by Lieber & Beckman (1991). These included simple socially directed behaviour, coordinated socially directed behaviour, new look, behaviour, elicited response, isolation and imitation (see Appendix B). A *social initiation* was defined as an entry in play interaction and in cases where interaction was *accepted by partners* (see also: Sigman & Ruskin, 1999, p. 68). The playful interaction ended when one or both of partners changed focus or communicative partners.

Results

In the 780 minutes of video-recordings, 20 out of 30 episodes of solitary/interactive play were initiated by the teachers, 7 were initiated by the twin brothers with ASD and 3 were initiated by peers. In the following sections there is a general commentary on observations of the episodes initiated by the teachers and an indicative description by observations of interactive play initiated either by the twin with ASD or his teachers and peers.

Qualitative data gathered by non-participant observations

Observations when teachers initiated playful interactions with a twin child with ASD

According to the analysis of the observational data, the twin brothers with ASD were more engaged in interactions with their teachers than with their non-typically developing peers. Teachers took the initiative to engage twins with ASD in a playful interaction more during the free-play periods than during the teaching periods. In outdoor activities, where the twins had more space and things to investigate, they were more prone to be detuned from the multi-sensory stimuli. When the twin brothers seemed to be self-absorbed, isolated even when other children were playing all around, and when they had no interest in anything, teachers came and got them to hang out. Teachers seemed to understand that children with ASD were more easily engaged in playful interactions when they were verbally elicited or instructed to play. Some indicative observations of interactive play are the following (the number of each observation refers to its number in the list of the indicative observations, not the total number of the observations made in the study):

Observation 1: During the third day of the data collection, FB was in the gym with his teacher. He was just moving around when the teacher invited him to get in a plastic hoop. He accepted the invitation with a smiley face. Then the teacher started moving the hoop once around him and once around her repeating “One for me, one for you” playing a turn-taking game which both seemed to enjoy. The interaction was ended by the teacher as she had to pay attention to the other children around them as well.

Observation 2: During the third day of the data collection, the SB twin was in the swimming pool with his teacher and some peers. Although he was surrounded by familiar

people, he was self-absorbed showing no interest in any activity or people. Actually he was almost ready to leave the pool when his teacher, right on the opposite side, realized his intention and started swimming fast to stop him. He turned SB's body towards the swimming pool again and asked him to make a circle with his arm on the water surface and tap his feet. The child with ASD followed the instruction and each time he stopped, the teacher repeated "I caught you, I caught you..." while they were both laughing. The playful interaction came to an end when the SB first and then teacher just after him got the wall on the opposite site of the swimming pool.

Observations when a twin with ASD initiated a playful interaction with a teacher

Observation 3: During the fourth day of the data collection, the FB was sitting at a table and had plastic cups of different size in front of him. He was trying to get the smaller cups into the bigger ones. He seemed to enjoy it and started saying loudly incomprehensible words that drew his teacher's attention. She asked him what he was trying to do and then she gave him the cups piece by piece. The FB took the cups one by one from her hands and put the smaller ones in the bigger ones. The game ended when the last cup was put in. The FB pushed the toy away and the teacher turned her face to the other child sitting next to her.

Observation 4: During the swimming lesson, on the third day of the data collection, the swim coach helped the SB mount a pool float toy in the water. As soon as SB mounted it, he started moving his legs as if riding a horse and produced the sound "baa" which in Greek language is the bleating of sheep. Then he opened his mouth and his lips shaped an "O" producing the sound "o". The coach imitated both his facial expression and the sound, so that a playful dialogue started with the following structure: "ooo" and laughter (the turn of the twin with ASD) - pause - "ooo" and laughter (coach's turn). The playful interaction ended after that simple structured imitation.

Observation when a twin with ASD initiated playful interaction with a peer

Observation 5: During the fourth day of the data collection, the FB was in the gym with his classmates running around when a girl invited him to ride on a plastic round mat. She had already ridden it and the FB sat behind her. The girl started moving her body and the FB did the same. In a while the girl dismounted and the FB also. He started running in the opposite direction.

Observation 6: Another playful interaction that also took place during the swimming lesson on the third day of the data collection was initiated by the SB twin when he had just got into the swimming pool. His peers were already in the water and one of them, a girl, gave the SB a plastic swimming board and he, with a somewhat questioning expression on his face that soon changed into smile, gave the swimming board back to the girl. That time a give-and-take game started which ended when the swim coach gave instructions for the next step of the lesson.

Qualitative data gathered by school records

As mentioned above, school records provided information about the twins with ASD; the authors elicited information on the following aspects among others: language, impairment in social interaction and communication and stereotyped patterns of behaviour. The FB understands verbal speech, but he does not use it functionally. Echolalia occurs frequently and the FB repeats verses from songs. He has intense fits of anger/falls in the floor and doesn't stand up or uses force. He doesn't maintain eye contact, he communicates and asks something only when he is interested in it. He has difficulties in participating actively in groups and team work/joint activities; with the teachers' encouragement he joins/stays in the company of peers and rarely seeks interaction and

communication with his peers. Concentration is confined to individual activities, during which he isolates himself and is interested only in specific objects (e.g. train, cards). However, music helps him concentrate and calm down. He imitates some movements and reproduces behaviours he has already seen. He has difficulty in imitating suggested movements, schemes and verbal expressions. His play is monotonous, without imagination and with stereotypical behaviour. As mentioned above, he has difficulties in playing with peers. He isolates himself and plays with specific objects and in a specific way. He often doesn't interact with his peers, except in cases when he becomes angry and expresses his anger physically. He cooperates with adults only within strict limits and after their encouragement. Generally, he has difficulties in cooperating and following instructions and rules especially in the classroom. He tends to cooperate better and comply with the trainer in individual sessions (team and social activities). In the context of the socialization program, he faces difficulties. When he is calm, he can cooperate and has physical contact with adults. He seems not to be interested in persons and situations around him. He needs limits in behaviour with a structured programme. In self-care activities he is almost independent; he eats alone and his diet is limited. Instead of eating with peers, he prefers eating alone or accompanied by adults. Additionally, he presents some peculiarities in the way he eats.

The SB has difficulties in understanding the meaning of instructions and only after consistent encouragement and by using examples does he perform simple instructions; he uses second and third singular (as it is used in Greek grammar) and understands the meaning of simple sentences. Echolalia appears sometimes and he has serious deficiencies in communication. The SB can describe a picture and imitate gestures and facial expressions. Expressive speech and articulation are at a satisfactory level. He has difficulties in separation from his mother, and most of the times he cries, a condition which leads to self-injury, but he manages to separate from her in the end. There are times during which these outbreaks are profound and constant. He demonstrates willingness to cooperate and understands orders when he is focused. His participation in dialogues is almost satisfactory and he responds to other's requests. He acts positively to individual intervention and often looks for his co-twin. He gives information on subjects he is interested in. His vocabulary is limited but the structure of sentences is correct. However, he needs time to adjust to a new condition. He shows his need to communicate with others. He easily comes close to other children and he is not aggressive towards peers, although he has difficulties in social interactions. When a teacher is nearby to instruct him, he participates in activities and follows his programme. He is independent in self-care. Results based on the quantitative data gathered by observation and the qualitative data gathered by school records were combined and compared to offer a fuller picture of the interactions between the twins and their teachers and peers.

Quantitative data gathered by observation

Fisher's exact test was used on contingency tables to find out possible relationships between two categorical variables, i.e. if the initiation of the play by the twin brothers with ASD with their non-typically developing peers increases the possibility for them to engage in interactive rather than solitary play. The Fisher's exact test is used when the sample size is small, where no asymptotic tests (i.e. the χ^2) can give accurate results on the examined relationships. The non-parametric Mann-Whitney test was used to find if there is any significant difference between the mean values of the two groups (peers and twins with ASD). As before, a non-parametric test was used due to the small sample size, since parametric statistical tests' assumptions are violated. According to the first research hypothesis of the present study, if the twin brothers with ASD initiated play in dyadic

social interactions with their non-typically developing peers they were more likely to engage in interactive play than solitary play. With regard to this hypothesis, Fisher's exact test on the respective contingency table is given in Table 1.

Table 1 Contingency Table between Type of Interaction and Who Initiates It

		Type of Interaction after Twins' Initiative		
		Solitary play	Interactive Play	Total
Peer as Initiator	f	2	1	3
	%	66,7%	33,3%	100,0%
Twin with ASD as Initiator	f	3	4	7
	%	42,9%	57,1%	100,0%
Total	f	5	5	10
	%	50,0%	50,0%	100,0%

The Chi-square test was equal to 0.476(df=1), with one sided exact p-value of the test equal to $0.5 > 0.05$, thus the null statistical hypothesis that there is no relationship between who initiates the play and the type of play (interactive play versus solitary play) is not rejected. Hence, the difference of the percentages is not statistically significant.

The second research hypothesis could not be examined using a statistical test, because all the 20 twin - teacher interactions were initiated by the teachers. Hence, it seems our second hypothesis is confirmed by the data, without the need to use an appropriate statistical test.

With regard to the third hypothesis, we used the non-parametric Mann Whitney test to examine if the mean duration of the episodes is higher when one of the twins initiates the episode, compared to the mean duration of the episodes initiated by a peer. The descriptive statistics are given in Table 2.

Table 2 Descriptive Statistics of the Duration of the Playful Interactions

	Mean duration	Std. Deviation	N
Peer as Initiator	63,67	61,81	3
Twin with ASD as Initiator	60,71	53,53	7
Total	61,70	52,55	10

The Mann-Whitney test was found to be equal to $U=8.5$, with an exact p value= $0.667 > 0.05$, hence the null statistical hypothesis that the two mean duration times are almost equal is not rejected. Therefore, the difference of the mean values was not statistically significant; there is no difference on the mean duration of the episode, whether the play is initiated by one of the twins or by a peer.

Discussion

The present case study is an empirical inquiry that explored initiatives for engagement in social activities within a real-life context. One general purpose of the present study was to detect the mechanism of motivating preschool-aged children on two axes, the autism spectrum disorder and the twin situation. A lengthy observation time (3 hours and 15 minutes over four days) was employed to obtain the twins' playful interactions with their teachers and non-typically developing peers in their daily school

activities. More specifically, the main purpose of the study was to document whether twin children with ASD take initiatives in social activities with their teachers and their non-typically developing peers, and when they do so what kind of play do they engage in. In addition, the frequency with which initiatives were taken by the interactive was examined, as well as the duration of these interactions in relation to who initiated them.

The most striking finding is that the twin brothers with ASD were able to take initiatives for social interaction. Even if we take for granted that the twins are familiar with multiple-person interactions and common rearing practices because of the twin situation and its increased demands (Feldman & Eidelman, 2004, 2005; Feldman, Eidelman, & Rotenberg, 2004; Gottesman, 2006; Markodimitraki & Kokkinaki, 2014; Sandbank, 1999), the deficits associated with ASD are supposed to pass twinship by and have a negative effect on the twins' social engagement. However, our study found that the twin brothers with ASD took more initiatives to become interactive partners in their dyadic play with their non-typically developing peers than vice versa. They were also the ones who mostly, albeit only slightly more, played interactively (see Table 1) despite their social deficits in comparison with their peers with disability and/or special educational needs (Down syndrome, ASD, hemiplegia, epilepsy and cognitive delay). It is worth mentioning the inconsistency among findings. Sigman and Ruskin (1999) found that when adults initiate social interactions while playing with children with ASD, Down Syndrome and other developmental delays, it becomes even more difficult for children with ASD to engage in interactions with their peers. What is the key element that makes children with ASD show more deficits in communication with teachers and non-typically developing peers, as shown in Sigman and Ruskin's study (1999), but show more engagement in interactions with teachers and peers when the children with ASD are also twins? It seems that the difference is rooted in the developmental advantage attached to being a twin and exposed by nature and nurture to multi-personal social contexts. Trevarthen and associates (1998, p. 1) revealed the following concerning the initiative taken by children with ASD in general:

"As preschoolers the children (with ASD) are not insensitive to others or unaffectionate, and they can show strong likes and dislikes for particular people. Sometimes they imitate or seek to interact but never in a free and easy way, and sometimes with a peculiar ritualistic insistence, and remarkable inattention to their effects on other people. Strange postures and movements and a need for sameness, combined with obsessive interest in certain objects and experiences, cut them off from others. At times they seem to be in a trance, "floating off", "looking" or listening" when nothing is there, often with strange flapping of the hands, or an enigmatic smile, and they only make unintelligible baby-like vocalizations".

It is possible that, in case of twins, the sensitivity to others or affection is even greater as twins co-exist since their conception, which makes them more familiar with being with others. Seeking interaction may not be such a problem for twin children, even when they are with ASD, as they always have an interactive partner around at home and school because of the twin situation and their similar health condition.

Our first hypothesis was that if twin brothers with ASD initiated play in dyadic social interactions with their non-typically developing peers, they were more likely to engage in interactive than solitary play. Indications, but no proof, that the twin brothers with ASD of the present study engaged in playful interactions are derived from the analysis of the kind of play they were engaged in. The willingness of children with ASD to initiate an interaction seems to depend on their peers' ability to adapt their communication in a way that is understandable to them. Also, there seems to be an innate motive for sharing, in intra-pair interactions as in typically developing young children (Trevarthen,

1979; 1998), which, however, in children with ASD, is not strong enough to make them continue the interaction without the necessary adaptations from their partner. Additionally, based on school records, the FB faces deficits in playing with peers and, although the SB shows a need for communication, he has difficulties in social interactions. The twins' weakness in continuing a playful interaction has its roots indisorder in intentional movement and affective engagement. We adopt Trevarthen's and Delafield-Butt's (2013/2015, p. 9) following suggestion:

"The subtle deficits in prospective motor control of children with ASD must be involved in the symptoms of social isolation and emotional distress that they show. They have difficulties in communicating their intention in gestural acts, and in sensing the dynamics of another's intentions from their movements".

Although seeking to interact, as Trevarthen and his associates (1998) mentioned above, children with ASD do not know how to achieve their goal. At this point teachers intervene to assist, which has to do with our second hypothesis. According to this, teachers were more likely to initiate the playful interactions with the twin brothers with ASD than vice versa. The teachers' initiative in all playful interactions with each of the twin brothers with ASD is one more key finding of the present study. The "obsessional interest in certain objects and experiences", (Trevarthen et al., 1998, p. 1) among children with ASD, which leads them being cut off from others, makes adult assistance necessary to restore their connection with the present reality and become able to communicate. In the certain context of the current study the potential partners are adults (teachers) and non-typically developing children (classmates). The more mature repertoire of the teachers proved to be more helpful for the twins' with ASD engagement in playful interactions. There is a substantial difference between the richer social repertoire of the teachers as adults and that of the children as communicative partners. This finding is also confirmed by McHale and associates' (1980) study on the interactions of children with ASD, both with their teachers and peers with ASD. This observation was derived by the analysis of the quantitative data gathered by observation and was also highlighted by qualitative data gathered by school records and the analysis of the videotaped records; observations mentioned that the FB cooperated with adults after their constant encouragement and that the SB participated in activities and followed the programme, only in cases where an adult, as a mature partner and specialized professional, was nearby to instruct him as a direct link between communication and behaviour. In these cases, it seems as if the teachers maximized the twins' with ASD developmental potential. This is something that children with ASD may vaguely understand and use the maturity of an adult partner as a scaffolding for interaction. This is why they let or expect adults, if we could say so, initiate interactions and engage them in social play. This finding is in line with previous research data which confirm that adults are more likely to initiate interaction with children with ASD, Down's syndrome and developmental delay than vice versa (Loveland, et al., 1988; Sigman & Ruskin, 1999; Stone & Caro-Martinez, 1990).

With regard to the duration of dyadic interactions, which is our third hypothesis, our results suggest that interactions do not last longer when the twin brothers with ASD are initiators compared with when their non-typically developing peers are. We hypothesized that the twin brothers' motive for communication, which is indicated by their initiation of playful interactions, would make their interactions last longer. Our third assumption was not confirmed. As similar results have been obtained by Sigman and Ruskin (1999), we would expect that the deficits in the communication of children with ASD should lead to substantial differences between the duration of interactions initiated by them and the duration of interactions initiated by their non-typically developing peers. However, the DZ twin children of the present study not only took initiatives and

communicated with their non-typically developing partners, but the mean duration of the playful interactions initiated by them was almost the same as that of their peers. The “intersubjective deficit” described by Papoudi (2015, p. 225) in case of ASD may not have such a negative effect on the playful interactions of twin children with autism and their non-typically developing peers compared to the playful interactions of non-twin children with ASD and their peers with other developmental delays. Differences in prospective motor timing (Trevarthen & Delafield-Butt, 2013/2015) seems to affect less the social expectation and understanding of twin rather than non-twin children with ASD. The twin brothers’ with ASD tendency to initiate interactions with their non-typically developing peers of almost the same duration as those initiated by their peers, indicates the existence of a rudimentary innate motive for communication in children with ASD. This motive may be greater because of the twin situation and the needs demanded by co-existence and co-development with a twin sibling.

At this point some of the limitations of the present study need to be discussed. The most important issue has to deal with the question of whether our findings can be generalized in a twin population with ASD. A limitation, common in case studies, is that results should be replicated with additional samples of twin children with ASD in a Special Nursery School setting. This is difficult as both twinning and autistic traits are not that common in a school setting. Additionally, we did not code the exact disability and/or special educational need of each of the peers who were interacting with the twin brothers with ASD during their free play (ASD, Down syndrome, hemiplegia, epilepsy and/or cognitive delay), in order to estimate the severity of symptoms and their own difficulties in communication.

Despite the limitations described above, the present data collected at the school setting highlight interesting aspects of the social interactions of children with ASD with their non-typically developing peers and teachers. The findings of the present study, although derived from a case study, are encouraging as they show that there are cases of twin children with ASD who are capable not only of being engaged in playful interactions with teachers and non-typically developing peers, but also of initiating them while interacting with peers. Moreover, it is during preschool that peer-related social behaviour typically appears. The sooner the weaknesses of children with ASD in interacting with peers are identified, the more effective will the intervention programmes designed for them be. Finally, the present study highlights the features of social interactions in children with ASD and more specially twins with ASD (familiar adults and peers, responsiveness, initiations and the setting in which the interaction occurs). The cognitive and social skills of twin preschoolers with ASD may be predicted by their initiations in intra-pair interactions or peer interactions. As Hauck and associates (1995, p. 593) underline, “for the autistic child ... active initiation may index progress in social development”.

The aforementioned limitations suggest possibilities for future research. Future play-based interventions with either structured classroom programmes or free play situations and naturalistic interventions for communication and social relationships should further be designed to increase the social interactions of children with ASD. As regards twins with ASD, the impact of each twin on his/her co-twin’s cognitive, emotional and social development is of great interest. Twinship is a very special situation where typically and non-typically developing twins share emotions, everyday life experiences, and their parents’ and teachers’ interest. It would be very useful to investigate autistic twins’ ability to share and the conditions under which they share. The omnipresence of a twin brother/sister auxiliary could operate as social stimulus from the early years and everyone involved in the upbringing of twins with ASD should take advantage of it. Further research should explore if an interactive twin partner better promotes the social development of his/her twin brother/sister with ASD than a non-typically developing

peer. Finally, intervention programmes should focus on teaching children with ASD not only to respond appropriately to the play initiations of peers and teachers, but also to initiate interaction, as both initiations and responses are components of social interaction.

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Appendix A

Types of Solitary Play

Types of Play

- a. *Manipulative*: It involves the handling of objects at any level of complexity (Lieber & Beckman, 1991).
- b. *Relational*: It involves the putting together of objects according to a criterion, e.g. building with blocks (Lieber & Beckman, 1991).
- c. *Symbolic*: It is pretend play, which can be further separated into 4 levels:
 level 1: The child is engaged in self-pretend, e.g. pretends to eat

- from an empty plate (Lieber & Beckman, 1991).
- el 2: The child pretends to do an activity referring to someone/something else, e.g. the child pretends to comb the hair of a doll (Lieber & Beckman, 1991).
 - el 3: The child pretends actions which run in a sequence, e.g. the child pours tea in a teacup and drinks (Lieber & Beckman, 1991).
 - el 4: This is an advanced level in which the child engages in planned and sequenced activities with present or absent objects, e.g. the child pushes a toy car, stops and searches for a toy motorway, assembles the motorway and resumes pushing the car on the lanes of the motorway (Lieber & Beckman, 1991).

d. Stereotypical: It involves aimless, repetitive, stereotypical, and uniform manipulation of objects.

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