The Development of Joint Attention and its Possible Role in Early Language Development

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Mentorica:

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Na temelju članka 42. Statuta Edukacijsko-rehabilitacijskog fakulteta Sveučilišta u Zagrebu, Fakultetsko vijeće Edukacijsko-rehabilitacijskog fakulteta na 4. redovitoj sjednici održanoj dana 27.12.2019 donijelo je odluku o imenovanju Povjerenstva za ocjenu specijalističkog rada u sastavu:

1. doc.dr.sc. Sanja Šimleša, predsjednica
2. izv.prof.dr.sc. Maja Cepanec, članica i
3. prof. emerita dr.sc. Marta Ljubešić, vanjska članica

Fakultetsko vijeće Edukacijsko-rehabilitacijskog fakulteta prihvatilo je pozitivno izvješće Povjerenstva za obranu specijalističkog rada studentice **Barbare Vogrinčič** pod **n**aslovom **„The Development of Joint Attention and its Possible Role in Early Language Development“** na 5. redovitoj sjednici održanoj dana 17.02.2020 te imenovalo Povjerenstvo za obranu specijalističkog rada u sastavu:

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Abstract

Early language development is built on many preverbal skills such as joint attention, vocalization, and characteristics of child`s play. Between these factors, joint attention stands out, since it enables sharing the same reference point between two subjects. The phenomenon of joint attention is still not fully understood despite many studies and research that addressed the question of the development of joint attention and causes of not fully established joint attention during the childhood. This led us to focus on the development of joint attention in typically developing children and also seek to address how joint attention is related to receptive and expressive language. Due to the recently increased number of children with autism spectrum disorder and preterm born children, concerns about specific development of joint attention and early language development have also arisen, that is why we included them in our study.

The Early Social Communication Scales was used as a measure of joint attention skills, Short-form version of the MacArthur Communicative Development Inventories was used as a measure of receptive and expressive vocabulary and the anamnestic questionnaire was used for collecting information about the children's early life. The study included 30 typically developing children aged 9, 12 and 18 months, six children with ASD and three preterm born infants.

Results in the typically developing group revealed changes due to maturing in the quality and quantity of different forms of joint attention. Language comprehension and language production show significant correlation with joint attention.

In the ASD group all of the children had severe impairments in joint attention, but language performance varies according to the age of a child. They all showed atypical joint attention and language performance.

Preterm children showed significant discrepancy between receptive and expressive language as well slower development of joint attention skills and language development.

Key words: joint attention, early language development, expressive language, receptive language, preterm born children, autism spectrum disorder, typically developing children

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1. INTRODUCTION

1.1. Joint attention

Humans are social creatures from the first day of their life. Starting at their births, babies have a natural attraction to faces. Around 2-3 months of age marks the beginning of a dyadic interaction between baby and caregiver (Bertenthal & Boyer, 2015). Face-to-face interaction gives the baby an opportunity to learn about turn-taking, reciprocity, and self-efficacy. After six months of age, they seem to lose interest in face-to-face interaction. They do not actually lose interest in other people, but they "upgrade" their interaction with caregivers by directing them to objects or events (Bertenthal & Boyer, 2015). The possession of an object coupled with face-to-face interaction with adults is simply more interesting (Shin, 2012).

During later stages of the infant's first year of life, the infant starts showing evidence of triadic interaction. Carpenter, Nagell and Tomasello (1998) found out, as in similar studies before, that joint-engagement episodes between mothers and typically developing (TD) infants between the age of 9 and 15 months start occuring and also increase in terms of complexity and quality. Nine months marks the beginning of the phenomenon called joint attention.

1.1.1. Development of joint attention

Joint attention is a skill that involves coordinating the attention of two individuals to a common point of interest and to each other. It is divided into two classes of behaviours: responding to joint attention (RJA) and initiating joint attention (IJA). RJA is related to behaviours where an individual respond to the eye-gaze shift and/or gesture of another person. When Individuals initiate eye-gaze and/or use gestures with the purpose of coordinating attention of others is called IJA (Carpenter et al., 1998). By nine months, infants begin to **share attention** to an entity with another person for a certain amount of time. It refers to the infant’s gaze alternation between an object, on which both are focused, and an adult. Infants share attention by directing their gaze at an object and then switching their eye gaze towards an adult and back to the object. This last step, where the infant is incorporating the adult into his attention

whilst engaging with an object, is very important. Without it, there would only be the switching of an eye gaze between the object and the adult.

Around 12 months of age, infants start to **follow the direction** of a social partner's gaze or pointing gesture (Carpenter, Nagell and Tomasello, 1998; Butterworth and Morissette, 1996). It is much more complex than "sharing attention" because it relates to the understanding of the social partner as an intentional agent. Between 12 to 15 months of age infants start to get more precise with their gaze following and moreover, they can locate their target more precisely. Infants can already **direct** their parent's attention in between 9 to 10 months of age and this behaviour starts manifesting more frequently between the age of 12 to 15 months. The pointing gesture develops from pointing and then turning to look at the adult (12 months) to pointing and then looking at the adult at the same time (14 months), followed by first looking towards the adult and then pointing to the desired object or event (16 months). Major early social-cognitive skills emerge between 9 and 15 months. At first joint attention episodes and communicative tools are simple in nature and emerge rarely, but will with time become more complex and constant (Carpenter et al., 1998).

Infants understand people as communicative partners who can perceive and respond to their communicative behaviour, meaning that infants direct signals toward another person and then alternate their gaze between the person and the entity (Carpenter et al., 1998). As written before, infants initially only respond to a few stimuli and at later stages infrequently initiate joint attention themselves. Joint attention involves a variety of different behaviors, such as eye contact, pointing gestures, showing gesture, reaching gesture and giving gesture, which will be discussed later. In the responding situations, the infant needs to manifest the ability to follow the adult's attention, and in initiating situations, he/she needs to form early nonverbal social-communicational behaviours to shift the attention of another person to his/her point of interest (Mundy et al., 2003).

There are two main well-known intentional communication acts, imperative and declarative. Imperative purpose of communication is when a child may desire an object or event. Declarative purpose means that the child obtains the adult's attention to share his perception due to experiencing an event in the environment (Bates, Camaioni and Volterra, 1975). Bates and co-workers are using the prefix "proto" as a preverbal effort of infants to get in touch with their social partner (proto-imperative and

proto-declarative). Bakeman and Adamson (1984) in their study of a mother and a child during free play found out that frequency, duration, and relative amount of time of joint attention increased with age, albeit rather slowly. In the 9-months age group, only one third of children engaged with their mother during a 10-minute play time, and the engagement rate was only 2% during the 10 minutes. However, every 18-months old child was observably engaged in joint attention with their mothers at least once during the 10-minute free play time, and the engagement rate was 26,6% of the time (Bakeman and Adamson, 1984).

At first, the child mainly communicates to obtain something or to get someone's attention and less so to "react" to an event. In later life, the purpose of communication becomes more declarative, meaning we mainly communicate with the desire to share an opinion with another, or we want to hear an opinion from others. Cochet, Jover, Oger & Vauclair (2014) wanted to distinguish between imperative and declarative pointing gestures. Their assumption was that whole-hand gestures characterize imperative pointing and index-finger gesture is associated with declarative pointing but their research on a small sample size proved to be inconclusive.

There are many variables which can enhance the joint attention interaction e.g. the mother's skill at identifying and manipulating the infant's focus of attention, the infant's engagement with the objects available, and the particular motivational predispositions of both on the same occasion (Carpenter et al., 1998). Extension of joint attention is also affected by basic cognitive processes as representation, memory, speed of information processing, learning and response inhibition (Mundy et al., 2007).

As stated before, joint attention is the main triadic ability. But what is the distinction between joint attention and shared gaze? Joint attention is the present comprehension of gaze shifting as a means of directing someone's attention to something with the purpose of communicating about it, whereas shared gaze is only a physical state, and it means simply following someone's gaze (Bertenthal & Boyer, 2015). Joint attention is a social cognition skill and is essential in developing and establishing various social communicative interactions with peers. Gaze following could be the basis for the development of social understanding (Shin, 2012).

1.1.2. Intersubjectivity

Intersubjectivity is the phenomenon which allows us to share experiences with one another (Carpenter et al., 1998) and it's connected with joint attention. The development of intersubjectivity starts with **mirroring**, occurring at birth, which has an innate role in the process of socialization. Humans have an inborn communicative competence, given by biological mechanisms which help us learn, recognize and think. We imitate others' behaviour which creates intersubjectivity. This basic mirror process probably corresponds to the innate social binding mechanisms. Because of imitation, mirroring and reciprocity, infants are probably able to develop intersubjectivity (Rochat, Passos-Ferreira and Salem, 2009). Around two months, imitation is taken to a higher level, where it becomes a source of selective and intentional transmission and learning. Dyadic exchange becomes reciprocal. This second level of intersubjectivity is called **primary intersubjectivity**. Around nine months, triadic interaction emerges, where infants include their surroundings into a dyadic relationship. Communication becomes intentional by developing joint attention (Rochat et al., 2009).

Joint attention, from the ontogenetically earlier phenomena of the infant's social interaction point of view is secondary intersubjectivity, which allows infants to fuse the third element (e.g. toy, person, event…) into their dyadic interaction with others. From the ontogenetically earlier phenomena, joint attention is the final stage of a long process which begins when infants start to interact with adults face-to-face in the process of primary intersubjectivity. But it is the starting point of intentional communication and language development during the second year of the infant's life (Carpenter et al., 1998).

In the **tertiary intersubjectivity**, which appears around 20 months of age, objects and situations are not just jointly attended to, but they develop into "jointly evaluated" where some kind of mutual concession is made. This happens with negotiation, which is a result of experiences gained over time, that manifest in the present, following the possibility of the child to project them into the future. After that, an **ethical stance** develops, where the child makes a decision based on their opinion on what is right and what is wrong starting at about four years of age (Rochat et al., 2009).

1.1.3. Neurobiology of joint attention

Joint attention involves a whole-brain system with nodes in the dorsal and medial frontal cortex, orbital frontal/insula cortex, anterior/posterior cingulate cortex superior temporal cortex, precuneus/parietal cortex, and amygdala, and striatum. This system processes information about self-attention/action, information about other's attention/action, and processing a desired referent in space (Mundy, 2017). Williams, Waiter, Perra, Perrett & Whiten (2005) reported that activation, specific to joint attention, is centered in the area associated with the theory of mind, which is located around the ventromedial frontal cortex. In addition, the cingulate gyrus and caudate nuclei, as structures involved in the regulation of attention, are activated during joint attention (Williams et al., 2005).

1.2. Early language development

An elemental idea of the importance of joint attention in the process of language development is the child's experimentations with language used by adults during their joint engagement. Joint engagement is a more basic process than language, but a very important one for acquiring language (Carpenter et al., 1998) in two ways. Firstly, because of the extended episodes of joint attention between child and adult, and secondly, because of adults talking about the child's attentional focus (Tomasello & Farrar, 1986).

Due to joint attention, infants can attend to social stimuli and are able to relate and engage with other people. Word learning prospers because of the adult's responsiveness to the infant's affinity to an object, event or person, by adults labelling the child's entity of interest (Carpenter et al., 1998). A predictor of early child language ability or development is maternal education and the frequency of story reading at home (Brooks & Meltzoff, 2008), the characteristics of child's play, joint attention and imitation (Toth, Munson, Meltzoff and Dawson, 2006), and also the child's temperament (Salley and Dixon, 2007). For preterm born children, mind-mindedness could help mothers widen their attention to an object or an event and furthermore promote language development. However, mind-mindedness would not have the same impact on language development of full term born infants as it has on preterm born infants (Constantini, Coppol, Fasolo and Cassibba, 2017). Distal family risk

factors such as poverty and maternal education (Vernon-Feagans, Garrett-Peters, Willoughby and Mills-Koonce, 2012) can also contribute to language development.

Brooks and Meltzoff (2008) studied the correlation between the duration of eye gaze and pointing. Infants who both pointed and looked longer at the correct target had the fastest vocabulary growth, corresponding to a study done by Bruner (1975), who also correlated early language acquisition and joint attention. Yu and Smith (2013) in their micro-analytic studies of children's eye gaze reported systematic, selective and sustained attentional shifts during word learning to be the critical factor for language development.

Brooks and Meltzoff (2005) in their study found out that gaze following as low-level behaviour with simultaneous vocalization predicts later vocabulary comprehension and gesture production but not vocabulary production. On the contrary, the findings of Vuksanovic and Bjekic (2013) suggest that high-level behaviours of joint attention have a strong positive correlation with language comprehension and also language production. However, both agreed that initially simple communication actions develop followed by more complex communication actions. In the early 80', Bakeman and Adamson (1984) also pointed towards the idea that less complex joint attention acts are necessary beginning stages of language development. Brooks and Meltzoff (2005) also went a step forward and figured out that 9-monts-olds are following adults head turning and body movement, whereas 10-months-olds and 11-monts-olds are following the direction of adults eyes.

Yet, word learning can occur without joint attention and vice versa, joint attention cannot be the main generator of the expansion of vocabulary (Akhtar & Gernsbacherm, 2007). The results of Scofield and Behrend study (2011) show that word learning can occur without joint attention, but in their research joint attention means solely establishing eye contact. Furthermore, they claim that only speaker, a word learner, and a shared target referent might be enough for word learning. However, there is no scientific proof yet of word learning with only those three minimal conditions. Joint attention could be very crucial for word learning for children younger than two years old. It could have an impact when it's present and no negative influence when it's missing. The impact of joint attention is bigger when combined with other social and language cues (Scofield and Behrend, 2011). Accordingly, it is still unknown how much impact joint attention has during the childhood on word learning and exactly when it has impact.

In the first years of life, the parent's role in vocabulary growth is important; the child's showing continuous visual attention and frequently looking at objects is not enough. Hence, encouraging the child to look at an object is strongly related to the child's productive vocabulary.

Accurate parental proposal is highly important for a child's vocabulary growth as is its appropriate response to it (Scott et al, 2013). Mundy (2006) also discovered the responding of children to be correlated with vocabulary development in TD children. Due to general child development, joint attention behaviours are mastered and become more complex.

Many researches found out that joint attention in TD children contributes not only to early language learning but also to more complex language abilities later on (Carpenter et al., 1998).

1.3. Communicative gestures

Gestures, like language, show us an index of a child's cognitive status. With the gestures, the infant obtains and sustains the adult's attention and can communicate with him. Iverson and co-workers (1994) distinguished between deictic (also performative) and representative gestures. The first gesture group consists of **showing**, **giving,** and **pointing,** which can be interpreted only in an extralinguistic context where communication appears (Iverson, Capirci and Caselli, 1994). Gestures occur in sequence written above from 10 months on (Capone and McGregor, 2004) and emerge and are fully developed before the onset of speech (Butterworth and Morissette, 1996). **Reaching** occurs before these three gestures, which is an early deictic gesture (Crais, Watson and Baranek, 2009). In this group are also **ritualized requests,** e.g. "give" (Capone and McGregor, 2004). Butterworth and Morissette (1996) found out that the emerging of the pointing gesture occurs at 11,3 months of age. Furthermore, results of Butterworth and Morissette's suggest that the onset of pointing can be correlated with language acquisition due to gestural and auditory-vocal route, meaning that vocalization often accompanied babies pointing. Moreover, they also found out that receptive vocabulary may develop at the same time as the production of pointing gestures. The pointing gesture also plays a very special role in the period of transitioning to two-word speech (Iverson et al., 1994).

Gestures can be divided into two groups despite the fact, if infants make contact with an adult or not. For example, a contact gesture occurs when the child gives his mother a toy, and a distance gesture occurs when a child points at the toy (Crais et al., 2009).

1.4. Language development and joint attention in autism spectrum disorder

Fundamental impairments of early social communication of children with ASD are impairments in joint attention (Mundy, Sigman, Ungerer and Sherman, 1986). Adamson, Bakeman, Suma & Robins (2017) found out that joint attention problems in children with ASD are pervasive. They imply that joint engagement between a child with ASD and their parents could be a predictor of expressive vocabulary. Moreover, joint attention is more negatively impacted when toddlers do not talk during the interaction, but their skills of joint attention rise remarkably when they begin to speak. Chawarska, Macari and Schic (2012) included 18 to 24 months old children with ASD in their study and compared them with their TD peers. Children with ASD showed low levels of attention towards the entire situation with adults and were only concentrating on toys or other objects. Furthermore, decreased responsivity to social bids and state of “readiness” for social interaction was observed. Yoder, Watson and Lambert (2015) suggested RJA to be a powerful predictor of receptive and expressive language in children with ASD. On the other hand, JA is a clear predictor of existing language in children with ASD, but its role is not fully understood during later stages of the child’s development (Toth, Munson, Meltzoff and Dawson, 2006).

Several studies suggest the amygdala plays a role in joint attention disturbance in children with ASD (Mundy, 2017). Also, the Peeva et al. (2013) study suggests individuals with ASD may have impaired supplementary motor area (SMA)- ventral premotor cortex connectivity (vPMC) in the left hemisphere. Furthermore, their findings suggest the possibility of impairment of the activity of mirror neurons[1] as a result of the impaired influence of SMA on vPMC (Peeva et al., 2013). Findings based on this research show that even when language development is normal in toddlers

[1] Cells in premotor cortical areas which respond during perception and production of an action. Mirror neurons for speech are in vPMC (Wilson, Saygin, Sereno, Iacoboni, 2004).

with ASD, speech production may differ from speech production of their TD peers (Chenausky and Tager-Flusberg, 2017).

Twenty percent of children with ASD do not develop the functional use of language (Chakrabarti, 2001). One-third do not develop speech (Bryson, 1996) but this number among those who received very early interventions falls to approximately 14–20% (Lord, Risi and Pickles, 2004). One third of children with ASD will never develop sufficient oral language ability (National Resource Council, 2002). There is also evidence for a delay in the development of RJA (Sullivan et al., 2007) and deficits in declarative pointing (Baron-Cohen, 1995). Children with ASD at three years of age respond less often to joint attention bids via eye gaze compared to TD children (Sullivan et al., 2007).

Language ability in children with ASD may vary from nonverbal to highly distinctive language with possible echolalia and unusual prosody. Likewise, evidently impaired is the abstract use of language. Problems appear on the receptive and expressive part of the language. In the early age, deficits are evident in joint attention, receptive language, and reduced vocal output. Some children with ASD may also have apraxia or oral-motor impairment besides impaired communication skills. (Mody and Belliveau, 2013). However, children with ASD can have intact articulation skills (Kjelgaard and Tager-Flusberg, 2001). Higher functioning children with ASD make a larger number of nondevelopmental syntax errors. Neologisms, unusual words and phrases are produced by almost all autistic speakers (Volden and Lord, 1991). There is an atypical pattern of language development. Davidson and Weismer (2017) proved significant differences between language production and comprehension at 30 months of age. Considerably, there is apparent relatively lower comprehension than production compared to age expectations. Moreover, this discrepancy is less likely to be a characteristic of ASD children during the later preschool years.

1.5. Language development and joint attention in preterm born children

The survival rate of prematurely born infants notably increased in the past years. Preterm birth is associated with less optimal development, which can contribute to long-term general difficulties (Allen, 2008), negatively affecting language amongst

others. Fundamentally, they are at risk of cognitive disorders (Bhutta, Cleves, Csay, Cradock and Anand, 2002).

Many studies confirmed that preborn children may have hearing impairments (Saigal & Doyle, 2009). The results of Jansson-Verkasalo et al. (2010) study reported that prematurely born children have delayed or atypical perceptual narrowing, which leads to slower language acquisition. Very low birth weight (<1500 g) can be associated with cognitive and language disorders as a consequence of anatomic abnormalities in brain development. Considering Sansavini et al. (2014) in their research of extremely low gestational age (<28 weeks) born children, these children might have a persistent delay in language, even when there is no neurological damage. A previous study suggested that one in three preterm born children indicate significant delay in language development at 3;6 years, shown as limitations in grammatical expression and slow lexical development (Sansavini et al, 2010). The author suggested the importance of early identification of risk of language impairments of preterm born children.

Jansson-Verkasalo et al. (2003) found a correlation between naming and difficulties in the central auditory processing of speech sounds and vice versa preborn children without naming issues also do not have abnormalities in pre-attentive speech sound discrimination. Preborn children respond to familiar language and unfamiliar the same way as term children (May, Byers-Heinlein, Garvain and Werker, 2011).

When preterm children without prenatal and postnatal medical complications were assessed, data showed no significant difference between preterm and term children in the use of gestures and pre-linguistic vocal production, and there is no difference in vocabulary size at 24 months of age. Possible slight differences in language and preverbal competence can be attributed to the premature birth developmental gap. Preterm children in this study obtained lower scores as their full-term counterparts but would eventually reach the same scores albeit at a later stage in their development. Thus, it can be said that language development is delayed and not atypical (Fasolo, Dodorico, Constantini and Cassibba, 2010).

Brosch-Fohraheim et al. (2019) also indicate significant differences in expressive communication but no differences in receptive communication and cognitive abilities in regard to full term born and preterm born. They concluded that their findings indicate preterm born children may catch up to their full term born peers in expressive

language. They suggested that external factors (education level, positive parental or carer support) might have an impact on language performance.

2. AIM

The aim of the present study is to determine:

1. Changes in features of joint attention in the period from 9 to 18 months in typically developing children.
2. The relation between joint attention and development of receptive vocabulary in typically developing children.
3. The relation between features of joint attention and development of expressive vocabulary of typically developing children.

Beside the main questions in our empirical study we also want to take a closer look at the potential relationship between joint attention and language development in a group of children at the risk for the acquisition of language disorders. In our study we include children with Autistic Spectrum Disorder and Preterm born children.

3. METHODOLOGY

3.1. Participants

The study included 30 typically developing (TD) monolingual children aged 9, 12 and 18 months, six children with ASD and three preterm born children (Table 1).

All participants had to exceed the following inclusion criteria:

1. **Typically developing children (TD)** – full-term born children whose parents did not report any developmental concerns and their paediatrician did not detect any developmental delays or developmental difficulties during systematic exams. They are from monolingual families.
2. **Clinical groups**:
    a.) **Children with autism spectrum disorder** (ASD) or with early signs of autism spectrum disorder. ASD children were 32–46 months old and four of them were enrolled in early intervention programs.
    b.) ***Preterm children*** (Preterm) - born in 36. weeks of gestation or before, and included in early intervention. They were 20 to 25 months old and two of them were enrolled in early intervention programs.

TABLE 1. Sample of participants of typically developing children (TD), preterm born children (Preterm) and children with autistic spectrum disorder (ASD).

age	N (total)	gender		group
		boys	girls	
9 months	10	2 (20%)	8 (80%)	
12 months	10	5 (50%)	5 (50%)	TD
18 months	10	5 (50%)	5 (50%)	
20–25 months	3	2 (67%)	1 (33%)	Preterm
32–64 months	6	4 (67%)	2 (33%)	ASD

In the TD (*M* = 39.5 week; *SD* = 1.14) and the ASD (*M* = 39.4; *SD* = 1.95) group, all participants were born on term. In the preterm group they were born on average in 32.3 weeks (*SD* = 3.7). 70% of the TD children were firstborn and 30% of them were second born. 80% of the ASD children were firstborn and 20% were second born. All of the preterm children were second born.

Mother's age and formal education in different groups of children were as follows:

- In the group of TD children, their mean age was 30;6 (*SD* = 4.8); in the preterm group 31;3 (*SD* = 3.7); in the ASD group 32;2 (*SD* = 7.1) years.
- In the TD group 3.3% of mothers finished primary school, 36.7% finished high school and 60% have an academic degree. In the preterm group 66.67% mothers finished high school and 33.33% have an academic degree. In the ASD group 80% of mothers finished high school and 20% have an academic degree.

In Slovenia children can start attending nursery by the age of 11 months. Nine (out of 30) TD children, one preterm (out of 3) and all six of ASD children were attending nursery at the time of our study.

3.2. Measuring instruments

In order to gather data on joint attention skills, we used the Early Social Communication Scale (ESCS) (Mundy, 2006). The short-form version of the MacArthur Communicative Development Inventories (CDIs) (Fenson et al., 2000) was used as a measure of receptive and expressive vocabulary. With the anamnestic questionnaire, we collected information about the children's early life, their development, and their family's socio-economic status.

3.2.1. Early Social Communication Scales (ESCS)

Early Social Communication Scales (ESCS; Mundy et al., 2003) is a videotaped structured observation measure of nonverbal communication skills which appear between 8. and 30. months of mental age. The videotape recordings of the ESCS enable observers to classify children's behaviours into one of three mutually exclusive categories of early social-communication behaviours: 1) Joint attention behaviours; 2) Behavioural requests; 3) Social interaction behaviours divided into the six following scales:

- Initiating Joint Attention (IJA)
- Responding to Joint Attention (RJA)
- Initiating Behavioural Requests (IBR)

- Responding to Behavioural Requests (RBR)
- Initiating Social Interaction (ISI)
- Responding to Social Interaction (RSI)

Initiating and Responding to Joint Attention scales measure a child's skills of displaying nonverbal behaviours to share the experience of objects or events with others or measure a child's skill in following another person's object or event of interest. The child may use eye contact, pointing and showing to initiate shared attention.

Initiating and Responding to Behavioural Requests scales indicate a child's skills in displaying nonverbal behaviours to obtain aid in reaching a desired object or event. The child can display eye contact, reaching or giving gesture and pointing to gain another person's help to obtain a desired object or event. Also, the ability to respond to another person's simple command to get an object or action from the child is measured.

Initiating and Responding to Social Interaction scales indicate the child's capacity to be a part of a playful and positive turn-taking interaction with another person. He may tease the adult during the turn-taking sequences but at first, he or she should have the skills to initiate those kinds of actions. In the responding part of the Social Interaction scale, the child should respond to turn-taking interactions initiated by another person with eye contact, gestures, and involvement in sequences (Mundy et al., 2003). All of the early social-communication behaviours are important while examining joint attention. ESCS can help us understand and see how the child is responding to communication bids of others, how he initiates communication and furthermore which tool he uses to achieve this.

Material for performing the ECSC protocol is standardised and includes toys (mechanical toys, hand-operated toys, plastic box, balloon, ball, car), a book and other daily used materials (hat, sunglasses, and comb) which can be seen in Picture 1. The toys and other materials used in the ESCS have been selected because of their potential to elicit social interaction, joint attention, and/or behavioural request. These materials give the child an opportunity to engage in social communication with the child's social partner, in this case with the examiner.

PICTURE 1. Material used for the ECSC protocol.

ESCS involves approximately 17 tasks. The time length of an ESCS examination is from 15 to 30 minutes for each infant. Every assessment was videotaped for the purpose of precise analysis. For analysis, we used the ESCS Coding Sheet. We gave points for each purposeful bid and response. Each task can contain more than one target behaviour of a child, which needs to be reported separately to the corresponding scale. On every scale, there can be different nonverbal behaviours in various quantities (the lowest score is 0, and the upper score limit does not exist).

3.2.2. MacArthur Communicative Development Inventories (CDIs)

The short version of the MacArthur Communication Development Inventories (Fenson et al., 2000) consist of two scales for assessing communicative skills in infants and toddlers. We used the Infant Short Form (Level 1), which can be used for 8- to 18- month old children. The checklist for vocabulary comprehension and production contains 88 words, 62% are nouns, 15% are verbs, 12% are adjectives and adverbs, and 11% are pronouns sound effects, and other parts of speech. The checklist was translated to the Slovenian language. All parents completed it. The lowest score on CDIs inventories is 0, and the highest is 88.

3.2.3. Anamnestic questionnaire

We collected information from parents about the children's early life, the development of communication, language, and speech, their family and pregnancy.

3.3. Procedure

Before the ESCS was performed, parents filled out the Anamnestic Questionnaire and CDIs checklist and signed the consent to participate in research in the waiting room of Community Health Centre Murska Sobota (Slovenia), where the entire procedure had taken place. Any misunderstandings due to the questionnaire or CDIs were solved immediately. After that, the ESCS protocol was performed in the fully adapted environment. In the middle of a room was an empty table. On each side of the table were two chairs; one for the examiner and one for the child. Parents of the child were seated behind him.

On the wall left and right from the child were pictures of interesting objects (Thomas and Friends and a Teddy bear). Pictures were also on the wall behind him (Masha and the Bear, Lego cars). Before the administration of the tasks, we explained the ESCS protocol to the parents and asked them to turn the focus of the infant to the toy or/and the examiner during the following 17 tasks. Parents were only observers and didn't have any vital role in the administration. However, bids of the child to his parents were also considered. Every protocol was videotaped.

For the analysis, we used the Coding Sheet and video. For every social communication behaviour, the child got one point. The points were divided into lower-level and upper-level behaviours and the bids of the child to his parents (see Table 2). We got a total score on each scale, and the total score of the entire ESCS.

TABLE 2. Examples of lower-level and higher-level behaviours on three ESCS scales.

ESCS Scale	lower-level behaviors	higher-level behaviors
Initiating Joint Attention (IJA)	eye contact, alternating gaze	pointing, showing, bid to caregiver
Responding to Joint Attention (RJA)	following, proximal point/touch	following line of regard
Initiating Behavioral Requests (IBR)	eye contact, reaching, appeal (eye contact + reaching)	pointing, giving, bid to caregiver

The CDI's checklist was also analysed. We got two total scores. One total score was for the number of words the infant understands (size of the receptive vocabulary)

and one total score for words the number of words the infant says (size of expressive vocabulary).

3.4. Data analysis

Data was coded using ESCS Coding Sheet (Mundy et al., 2003) and then analysed using SPSS software. Descriptive statistics were calculated. Differences between groups were calculated using the Kruskal Wallis test. Pearson's correlation coefficient was calculated as a measure of relation between joint attention scores and language measures.

4. RESULTS AND DISCUSSION

Joint attention was until now widely investigated, but due to its complexity there are still some open questions. The emerging age of joint attention in current literature is around nine months and the ability improves with the development of the child. Joint attention is fully developed at around 18 months of age. Firstly, this study aimed to determine changes in features of joint attention in the period from 9 to 18 months in TD children. Secondly, since joint attention could be a predictor of early language development (Yu & Smith, 2013; Brooks & Meltzoff, 2008; Bruner, 1975), the next aim of the study was to understand the potential relation between joint attention measures and language development (receptive and expressive vocabulary).

Besides the primary questions in our empirical study, we also explored the potential relationship between joint attention and language development in a group of children at the risk for acquisition of language disorders. In the clinical group were children with austim spectrum disorder (ASD) and preterm born children (Preterm).

4.1. Typically developing children

4.1.1. Developmental changes in joint attention in the period from 9 to 18 month.

We observed joint attention using the ESCS protocol. TD children show a constant pattern of getting higher scores on all ESCS scales and the ESCS Total Score (see Table 3). There were changes in the quality and quantity of different forms of joint attention. This points towards to the idea of Carpenter and her co-workers (1998), who found out that joint-engagement episodes between mother and child increase in both complexity and quality. The quantity of nonverbal behaviours increased by approximately 10% per age group, along with a change in the quality of different forms of joint behaviours from less complex to more complex. Nevertheless, there were notable differences between age groups.

TABLE 3. *Scores on ESCS scales in 9-, 12-, and 18-months old TD children.*

	9-months (N=10)		**12-months** (N=10)		**18-months** (N=10)		**Chi-Square**	**p**
	M	SD	M	SD	M	SD		
Initiating Joint Attention (IJA)	8	2.5	9.4	4.1	10.4	4.0	2.20	.333
Responding to Joint Attention (RJA)	9	3.0	10.8	2.1	11	2	2.62	.269
Initiating Behavioral Requests (IBR)	10.4	2.5	16.2	3.9	16.2	6.8	9.7	.008*
Responding to Behavioural Requests (RBR)	1.2	1.2	2.4	1.7	3.1	1.7	6.2	.046
Initiating Social Interaction (ISI)	1.6	1.0	1.9	0.3	2.1	0.9	4.1	.127
Responding to Social Interaction (RSI)	13.4	6.5	18.4	6.4	16.8	3.8	3.8	.151
ESCS Total	43.6	7.3	59.1	8.3	59.6	11.1	15.6	.000*

*$p < .05$

Although total scores for each scale systemically grows in every age group, group differences are statistically confirmed by the Kruskal Wallis test on the ESCS Total score and IBR scale. It is possible that differences are not clearly evident because different children tend to improve in different joint attention domains at different ages. This phenomenon is already described in prior joint attention studies. For instance, Mundy et al. (2007) pointed out that joint attention development is characterized by a significant cubic developmental pattern, and infants with different rates of cognitive development display different frequencies of joint attention acts at each age. This cubic developmental pattern can be seen when individual scores are taken into account. For instance, when examining RJA scores, in the 9 months group (n = 10), the lowest score was 4, and highest 12, on average 9 (SD = 3.02). In the 12 months group (n = 10), the lowest score was 7, and the highest 14, on average 10.80 (SD = 2.10). In the 18 months, group (n = 10), the lowest score was 8, and highest 14, on average 11.00 (SD = 2.00). When examining IJA scores, in the 9 months group (n = 10), the lowest score was 3 and highest 11, on average 8 (SD = 2.45). In the 12 months group (n = 10), the lowest score was 4 and the highest 16, on average 9.40 (SD = 4.14). In the 18 months group (n = 10), the lowest score was 3 and the highest 18, on average 10.40 (SD = 4.03).

As can be seen on Figure 1, there is a great overlap of scores in different age groups, which confirms the hypothesis on great individual differences seen in early phases of joint attention skills development.

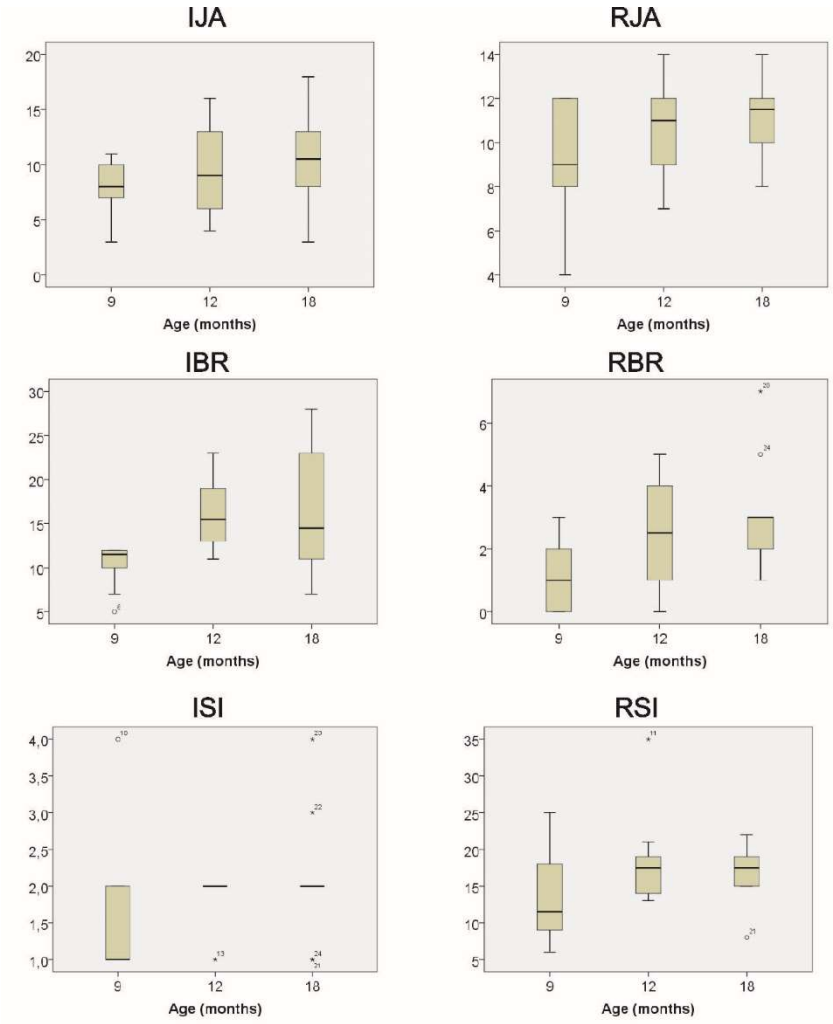

FIGURE 2: Boxplots Boxplots showing the range of individual differences on all 6 ESCS scales at three age groups (9, 12 and 18 months): Initiating Joint Attention (IJA), Responding to Joint Attention (RJA), Initiating Behavioural Requests (IBR), Responding to Behavioural Requests (RBR), Initiating Social Interaction (ISI), Responding to Social Interaction (RSI).

Subsequent analysis was done taking into account the individual behaviours children displayed during the ESCS task. These behaviours are categorized as low-level behaviours and high-levels behaviours, depending on the quality and complexity of the communicative means used. Figure 2 shows that older infants tend to use much more complex nonverbal behaviours than younger children which was also suggested by Brooks & Meltzoff (2005) and Bakeman & Adamson (1984). Great differences can be noticed on IBR tasks between the age of 9 and 12 months.

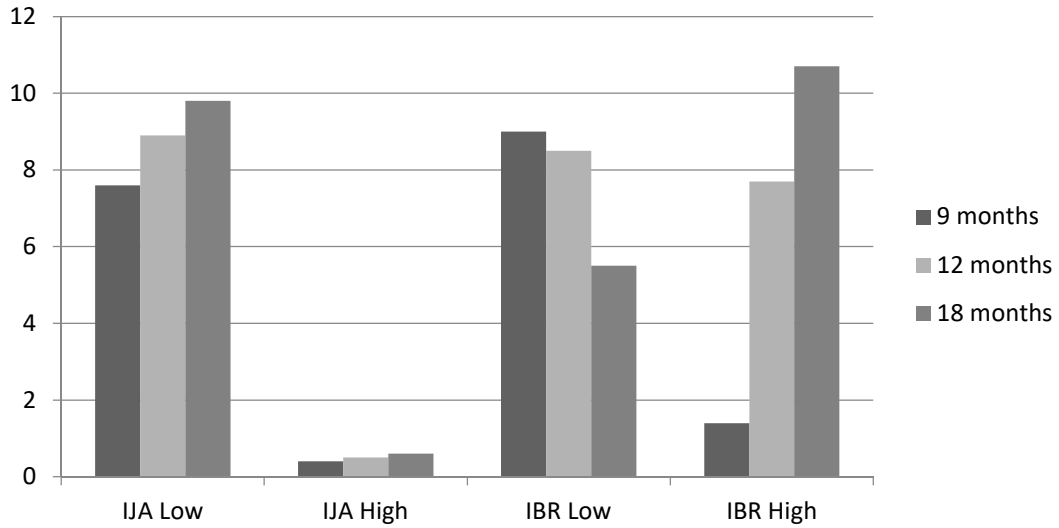

FIGURE 3. Summary of results of TD children on IJA and IBR scales, based on the complexity of the child`s behaviours. Older infants use much more complex nonverbal behaviours than children in 12 months group.

On the IJA scale, the 12 months group scored on average 8.9 lower-level points and 0.5 higher-level points. The 18 months group scored on average 9.8 points of lower-level behaviours and 0.6 points of higher-level behaviours. The differences between age groups were analysed using the Kruskal-Wallis H test. The differences in higher-level behaviours were not significant on IJA scales (p = .401 for IJA-Low and .865 for IJA-High) but were significant for Initiation of Behavioural Requests (p = .007 for IBR Low and p = .000 for IBR High). On the IBR scale, the 12 months group collected on average 8.5 lower-level points and 7.7 higher-level points. The 18 months group collected on average 5.5 lower-level points and 10.7 higher-level points.

4.1.2. The relation between joint attention and receptive vocabulary

The short version of the MacArthur Communication Development Inventories Level 1 (CDIs) were used as a measure of receptive vocabulary (the number of words which a child understands). Results are presented in Table 4.

TABLE 4. Descriptive statistics on receptive vocabulary, measured by short form of MacArthur Communicative Development Inventories (CDIs) (Fenson et al., 2000).

Age (months)	CDIs (receptive language)			
	min	max	M	SD
9 months	3	21	8.60	5.72
12 months	17	62	37.30	17.04
18 months	29	88	65.3	20.91

Correlations between receptive language score and joint attention measures were calculated and are presented in Table 5. Language comprehension shows highly significant ($p < .01$) correlation with ESCS Total Score and RBR scale and significant correlation with IBR. It seems that great developmental progress in IBR is strongly linked to language development. Our data lends support to the idea of joint attention being connected to the future development of comprehension (Brooks et al., 2005).

TABLE 5. Correlation between ESCS (six different scales and Total Score) and measure of receptive vocabulary (CDIs).

variable	CDIs	IJA	RJA	IBR	RBR	ISI	RSI	ESCS
CDIs (receptive)	1	.234	.192	.419*	.545**	.279	.255	.539**
IJA	.234	1	-.106	.165	.095	.184	.044	.418*
RJA	.192	-.106	1	-.042	.234	-.194	.022	.197
IBR	.419*	.165	-.042	1	.305	.084	.372*	.747**
RBR	.545**	.095	.234	.305	1	.024	.142	.445*
ISI	.279	.184	-.194	.084	.024	1	.512**	.387*
RSI	.255	.044	.022	.372*	.142	.512**	1	.757**
ESCS Total	.539**	.418*	.197	.747**	.445*	.387*	.757**	1

*. Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

4.1.3. The relation between joint attention and expressive vocabulary

Measure of expressive vocabulary was also taken from CDIs. Data is presented in Table 6.

TABLE 6. Descriptive statistics on expressive vocabulary, measured by short form of MacArthur Communicative Development Inventories (CDIs) (Fenson et al., 2000).

age	CDIs (expressive language)			
	min	max	M	SD
9 months	0	1	0.1	0.32
12 months	0	9	3.7	2.71
18 months	4	32	12.1	9.33

Correlation between language comprehension and language expression is significant ($r = .604$; $p < .01$). Correlation between expressive language score and joint attention measures were calculated and are presented in Table 7.

TABLE 7. Correlation between ESCS (six different scales and Total Score) and measure of language expression (CDIs).

variable	CDIs	IJA	RJA	IBR	RBR	ISI	RSI	ESCS
CDIs (expression)	1	.282	.245	.253	.429*	.150	.215	.473**
IJA	.282	1	-.106	.165	.095	.184	.044	.439*
RJA	.245	-.106	1	-.042	.234	-.194	.022	.208
IBR	.253	.165	-.042	1	.305	.084	.372*	.737**
RBR	.429*	.095	.234	.305	1	.024	.142	.429*
ISI	.150	.184	-.194	.084	.024	1	.512**	.401*
RSI	.215	.044	.022	.372*	.142	.512**	1	.746**
ESCS Total	.473**	.439*	.208	.737**	.429*	.401*	.746**	1

*. Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

There is a highly significant correlation between ESCS Total score and language expression score ($p < .01$), and there are significant correlations between RBR scale ($p < .05$). Our results are in line with the findings of Vuksanovic and Bjekic (2013) where the reported JA is highly connected with language production.

4.2. Clinical samples

4.2.1. Children with autism spectrum disorder (ASD)

Additionaly, we wanted to identify the specifics behind the development of joint attention and language development in children with autism spectrum disorder. Mundy and his co-workers in 1986 claimed that joint attention could be the fundamental impairment of early social communication in children with ASD.

We used the same testing inventory that was used for the TD children. Results from each child on the ESCS (Table 8) and the CDIs (Table 11) were compared with the average scores of the different age groups of TD children.

The average total score of the ASD group on the ESCS is less than the average total score on ESCS in TD children in the 12 months and 18 months group. Three boys (2, 5, 6) with ASD collected more than TD children in the 9 months group but less than the 12 months group. One girl (4) collected 19 points, which is more than 50 % less than the average of the 9 months group. One boy (1) and one girl (3) did not collect any points on the ESCS scale. In sum, all of the children in the ASD group had severe impairments in joint attention.

Our findings are in line with those of Adamson, Bakeman, Suma and Robins' (2017) study of pervasive joint attention problems in children with ASD. Mundy and his co-workers in 1986 claimed that joint attention could be the fundamental impairment of early social communication in children with ASD.

TABLE 8. Scores on ESCS scales in children with ASD.

No.	age (months)	gender	IJA	RJA	IBR	RBR	ISI	RSI	ESCS
1	32	boy	0	0	0	0	0	0	0
2	36	boy	5	14	5	4	2	18	48
3	38	girl	0	0	0	0	0	0	0
4	46	girl	0	0	8	2	2	7	19
5	63	boy	3	10	11	1	2	17	44
6	64	boy	3	14	6	3	2	19	47
M			1.8	6.3	5.0	1.7	1.3	10.2	26.3
SD			2.1	7.1	4.4	1.6	1.0	9.0	23.0

We took a closer look at the low-level behaviours and the high-level behaviours on the IJA and the IBR scale of children with ASD. Boys (2, 5, 6) displayed more high-level behaviours on both scales and each one of use words to communicate. Significant correlation ($p < .05$) is not only present with IBR high-level behaviours but also with IJA low-level behaviours (see Table 10). Girl (4) is not using any verbal communication tools yet. She displays a higher number of low-level behaviours on the IBR scale but displays no behaviour acts on the IJA scale (see Table 9).

In the TD group, children who already shows verbal communication demonstrated a higher number of high-level behaviours, which also occurred in the ASD group.

TABLE 9. Children with ASD on the IJA and the IBR scales, based on the complexity of the child`s behaviours. Children who use words as one of the communication tools display more high-level behaviours.

	age	**gender**	**verbal**	**IJA**		**IBR**	
No.	**(months)**		**communication**	**low**	**high**	**low**	**high**
1	32	boy	no	0	0	0	0
2	36	boy	yes	2	3	1	4
3	38	girl	no	0	0	0	0
4	46	girl	no	0	0	6	2
5	63	boy	yes	1	2	5	6
6	64	boy	yes	3	0	2	4

TABLE 10. Correlation between high- and low-level behaviours of the IJA and the IBR scales and measures of language production (CDIs).

variable	**IJA low-level**	**IJA high-level**	**IBR low-level**	**IBR high-level**	**CDIs (production)**
IJA low-level	1	.357	-.061	.653	.866*
IJA high-level	.357	1	.078	.663	.687
IBR low-level	-.061	.078	1	.533	.141
IBR high-level	.653	.533	.533	1	.905*
CDIs (production)	.866*	.687	.141	.905*	1

*. Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

Data shows that boys (5, 6) with the highest score on the ESCS in the ASD group scored all or almost all points on the CDIs, which is more than children in the 18 months group (*M* = 12.1, see Table 11). However, they scored a lower ESCS score compared to the average total score of the 12- and 18-months TD group. To sum it up, there is a big discrepancy between the language production and the level of joint attention. These phenomena were also addressed by Adamson, Bakeman, Suma & Robins (2017) in their study, where they concluded that joint attention problems are pervasive in children with ASD. Similarly, Weismer and Davidson (2017) summarize a significant discrepancy between language production and comprehension in earlier stages of language development. In accordance with all previous studies we suggest atypical language development in children with ASD.

It might also be that joint attention has a higher influence at the beginning stages of language development and loses influence during the advanced stages. This agrees with the findings of Akhtar & Gernsbacheern (2007) and Scofieled & Behrend (2011), who claimed that joint attention might not be the only and the most important factor contributing to the language development.

TABLE 11. Descriptive statistics on receptive and expressive vocabulary, measured by short form of MacArthur Communicative Development Inventories (CDIs) of children with ASD (Fenson et al., 2000).

No.	age (months)	gender	CDIs (comprehension)	CDIs (production)
1	32	boy	0	0
2	36	boy	59	23
3	38	girl	0	0
4	46	girl	36	0
5	63	boy	88	88
6	64	boy	86	86

Correlations between receptive language score, expressive language score and joint attention measures were calculated and are presented in Table 12. and Table 13. Language comprehension shows a highly significant correlation ($p < .01$) with the ESCS Total Score and with the RSI scale of ESCS. There is also a significant correlation ($p < .05$) with the RJA, IBR and ISI scales of ESCS (see Table 12). This

data is in line with the data of TD children which shows a significant correlation between ESCS Total score and CDIs receptive score.

TABLE 12. Correlations between receptive language and ESCS in children with ASD.

variable	CDI	IJA	RJA	IBR	RBR	ISI	RSI	ESCS
CDI (receptive)	1	.762	.860*	.825*	.637	.873*	.960**	.952**
IJA	.762	1	.955**	.449	.783	.665	.898*	.908*
RJA	.860*	.955**	1	.476	.772	.692	.948**	.943**
IBR	.825*	.449	.476	1	.419	.884*	.722	.730
RBR	.637	.783	.772	.419	1	.791	.796	.807
ISI	.873*	.665	.692	.884*	.791	1	.877*	.886*
RSI	.960**	.898*	.948**	.722	.796	.877*	1	.999**
ESCS Total	.952**	.908*	.943**	.730	.807	.886*	.999**	1

*. Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

There is no significant correlation between the ESCS Total Score or any specific individual ESCS scale and expressive language score (see Table 13).

TABLE 13. Correlations between expressive language and ESCS in children with ASD.

variable	CDI	IJA	RJA	IBR	RBR	ISI	RSI	ESCS
CDI (expressive)	1	.602	.762	.653	.313	.593	.801	.776
IJA	.602	1	.955**	.449	.783	.665	.898*	.908*
RJA	.762	.955**	1	.476	.772	.692	.948**	.943**
IBR	.653	.449	.476	1	.419	.884*	.722	.730
RBR	.313	.783	.772	.419	1	.791	.796	.807
ISI	.593	.665	.692	.884*	.791	1	.877*	.886*
RSI	.801	.898*	.948**	.722	.796	.877*	1	.999**
ESCS Total	.776	.908*	.943**	.730	.807	.886*	.999**	1

*. Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

In the group of TD children there is significant correlation between Total score on the ECSC and both receptive and expressive language. In the group of ASD children there is only a significant correlation between ESCS and receptive language.

4.2.2. Preterm children

Furthermore, we were interested in both joint attention and language development in preterm born children. Many hypotheses regarding joint attention and language acquisition in preterm children appear to be not well grounded, but Allen (2008) outlines that preterm birth is associated with less optimal development, which can contribute to the general difficulties long-term, including impaired language development. Sansavini with her co-workers (2010) also drew this conclusion. Fasolo, Dodorico, Constantini, and Cassibba (2010) on the other hand, concluded that the developmental gap due to premature birth might not be so large. There can be a slight difference in language and preverbal competence, but we cannot say that language development is atypical. Their theory is that language development in preterm birth children is delayed. In our study of preterm children's language and JA development, we used the same testing inventory as the one which was used for the TD and the ASD group. Results from each child on the ESCS (Table 14) and the CDIs (Table 16) were compared with the average scores of the age groups of TD children.

The average total score of the Preterm group on the ESCS is the same as the average total score on the ESCS in TD children in the 12 months group. Girl (2) scored the same amount of points as the child with the highest scores in 12 months group (81) and 18 months group (78). Two boys in the group scored more than the average total score of the 9 months group (*M* = 43.60) and less than the average total score of the 12 months group (*M* = 59.10).

TABLE 14. Scores on the ESCS scales in the group of Preterm children.

No.	age (months)	gender	IJA	RJA	IBR	RBR	ISI	RSI	ESCS
1	20	boy	13	10	5	2	2	12	44
2	20	girl	18	14	18	4	5	21	81
3	25	boy	9	7	10	3	5	18	55
M			13.3	10.3	11.0	3.0	4.0	17.0	58.7
SD			4.5	3.5	6.6	1.0	1.7	4.6	19.0

We took a closer look at the low-level behaviours and high-level behaviours on the IJA and the IBR scale of Preterm children. On the IJA scale boy (1) and girl (2) scored higher on low-level behaviours as compared to the average in the 18 months

group (*M* = 9.8). This specific girl also scored higher on high-level behaviours than the average in 18 months group (*M* = .6). Boy (3) scored more than the average in the 12 months group (*M* = 8.9), but less than the 18 months group. Boys didn't score any points towards high-level behaviours, which is less than the average of the 12 months group (*M* = .5). On the IBR scale the girl's results are comparable with the scores of the 12 months group, which has a higher score of low-level behaviours (*M* = 8.5) and lower score of high-level behaviours (*M* = 7.7). The girl is the only one who is using high-level behaviours on both scales and also uses verbal communication.

TABLE 15. Preterm children on the IJA and the IBR scales, based on the complexity of the child`s behaviours. All three of them have showed more of the low-level behaviours than the high-level behaviours.

	age	gender	verbal	IJA		IBR	
No.	**(months)**		**communication**	**low**	**high**	**low**	**high**
1	20	boy	no	13	0	5	0
2	20	girl	yes	17	1	9	9
3	25	boy	no	9	0	7	3

The girl in this group scored almost all points (87/88) on the CDIs receptive language category, which is more than children in the 18 months group (*M* = 65.30), and scored 10 points in CDIs expressive language category, which is more than children in the 12 months group (*M* = 3.70), but less than children in the 18 months group (*M* = 12.10).

The girl's joint attention was fully developed by the time she reached the age of 20 months. Furthermore, her receptive language is more developed than her 18-months peers. On the other hand, a girl develops her expressive language a bit slower. Moreover, there is a significant discrepancy between receptive and expressive language. The research of Brosch-Fohraheim and co-workers (2019) also indicated significant differences in expressive communication without any differences in receptive communication between of full term born and pre-term born infants. Their findings indicate preterm children may catch up their full-term peers in expressive language.

Two boys in the preterm group showed slower development in joint attention and in language. They scored lower in the CDIs receptive language category compared to

the average of the 12 months group (*M* = 37.30), but more than the average of the 9 months group (*M* = 8.60). Furthermore, they scored more points in the CDIs expressive language category compared to the average of the 9 months group, and less than the 12 months group. In summary, they scored better results on both the CDIs and the ESCS, compared to those in the group of nine-month olds but scored worse than those in the group of 12-month olds, although their development is impaired in every field equally. There is a strong possibility of their development of joint attention skills and language to happen slowly but not necessarily atypically. Nevertheless, we should be cautious with interpretation and monitor their language development. It might be that the two boys are late in their language development, but on the other hand we should bear in mind that their language development might show signs of being impaired at a later stage, i.e. at school when they learn to read or write. We can agree with Sanvini and her co-workers (2010) that it is very important to pay attention to the communication skills and language development of preterm born infants and not overlook them. Researchers still disagree on whether or not language and joint attention development of preterm infants can be atypical at all or instead just delayed. However, the implication of researchers as well as our study is the importance of early identification of possible joint attention and language impairments in preterm infants and the need to provide them with early intervention to maximize their language outcome.

TABLE 16. Descriptive statistics on receptive and expressive vocabulary, measured by short form of MacArthur Communicative Development Inventories (CDIs) of Preterm children (Fenson et al., 2000).

No.	age	gender	CDIs (comprehension)	CDIs (production)
1	20	boy	15	6
2	20	girl	87	10
3	25	boy	17	8

Correlations between receptive language score, expressive language score and joint attention measures were calculated and are presented in Table 17 and Table 18. There is no significant correlation between the ESCS Total Score or any specific individual ESCS scale and language comprehension (see Table 17).

TABLE 17. Correlations between receptive language and ESCS in Preterm children.

variable	CDI	IJA	RJA	IBR	RBR	ISI	RSI	ESCS
CDI (receptive)	1	.885	.894	.933	.878	.521	.772	.982
IJA	.885	1	1.000*	.659	.554	.064	.387	.782
RJA	.894	1.000*	1	.673	.569	.082	.404	.793
IBR	.933	.659	.673	1	.991	.792	.948	.984
RBR	.878	.554	.569	.991	1	.866	.982	.952
ISI	.521	.064	.082	.792	.866	1	.945	.672
RSI	.772	.387	.404	.948	.982	.945	1	.877
ESCS Total	.982	.782	.793	.984	.952	.672	.877	1

*. Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

Language production shows highly significant ($p < .01$) correlation with one of the ESCS scales (RBR) (see Table 18.).

TABLE 18. Correlations between expressive language and ESCS in Preterm born children.

variable	CDI	IJA	RJA	IBR	RBR	ISI	RSI	ESCS
CDI (expressive)	1	.554	.569	.991	1.000**	.866	.982	.952
IJA	.554	1	1.000*	.659	.554	.064	.387	.782
RJA	.569	1.000*	1	.673	.569	.082	.404	.793
IBR	.991	.659	.673	1	.991	.792	.948	.984
RBR	1.000**	.554	.569	.991	1	.866	.982	.952
ISI	.866	.064	.082	.792	.866	1	.945	.672
RSI	.982	.387	.404	.948	.982	.945	1	.877
ESCS Total	.952	.782	.793	.984	.952	.672	.877	1

*. Correlation is significant at the .05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

Once again, in the group of TD children there is significant correlation between the Total score on the ECSC and both receptive and expressive language. In the group of Preterm there is only a significant correlation between the ESCS scale (RBR) and expressive language.

5. LIMITATIONS OF THE STUDY

Limitations of the study should be considered. First, in the present study there is a very small sample of both the TD children group and the clinical group. The biggest problem might be with clinical group data. However, the individual data of each child's joint attention and language skills was reported in the clinical sample, which might present us additional insight into joint attention and language development. Prospective longitudinal data will be necessary to address the language impairments which can protrude later on in their life. Second, in our research we didn't consider some variables, such as the severity of ASD symptoms and female to male ratio. Third, we didn't have any data of the cognitive status of all subjects. Lastly, the clinical sample groups were too heterogeneous, for example in age and test results.

6. CONCLUSION

This study highlighted changes in joint attention and language skills in typically developing children aged 9 to 18 months, which provided information about joint attention and language acquisition development and allowed us to compare it with children with ASD and preterm children. When comparing typically developing children in different age groups, there were notable but not significant differences in joint attention skills between them. However, there was significant correlation between joint attention skills and language acquisition. Interestingly, there was also significant correlation between joint attention skills and language development in the clinical group. The most important finding was the atypical pattern of language development of children with ASD, which corresponds with previous studies. Given that our findings are based on a limited number of children at risk of language disorders, the results from such analyses should therefore be treated with considerable caution.

Results in this study imply a significant correlation between development of joint attention skills and language acquisition. It is important to consider other cognitive mechanisms and factors which can have an impact on language development, although they were not investigated in this study.

To summarize, our work leads us to being aware of the importance of joint attention skills, especially in the early stages of children's lives. It highlights the need to help develop said skills if needed, because they seem to play an important part in language development.

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8. APPENDICES

8.1. Letter of Ethical Approval

8.2. Anamnestic questionnaire

Sveučilište u Zagrebu
Edukacijsko-rehabilitacijski fakultet
Etičko povjerenstvo
Klasa: 602-04/19-42/22
Ur.broj: 251-74/19-01/2
Zagreb, 03.01.2020.

Barbara Vogrinčič
vogrincic.barbara@gmail.com

Predmet: Mišljenje Etičkog povjerenstva o provođenju projekta „The development of joint attention and its possible role in early language development"

Etičko povjerenstvo Edukacijsko-rehabilitacijskog fakulteta Sveučilišta u Zagrebu pregledalo je dokumentaciju priloženu uz zahtjev za davanjem mišljenja o usklađenosti projektnog prijedloga „**The development of joint attention and its possible role in early language development**" s Etičkim kodeksom Sveučilišta u Zagrebu. Voditeljica istraživanja Barbara Vogrinčič povjerenstvu dostavila je ispunjen Obrazac nacrta projekta/istraživanja.
Iz dostavljene dokumentacije razvidno je da se projekt:

- planira provesti sa svrhom kreiranja novih znanja važnih za dobrobit pojedinca i znanosti;
- planira provesti uz uvažavanje načela svjesnog i pisanog pristanka sudionika danog na temelju odgovarajuće obaviještenosti o svrsi, ciljevima i postupcima istraživanja te načinima zaštite privatnosti podataka i identiteta sudionika, odnosno odustajanja od sudjelovanja u istraživanju u bilo kojem trenutku;
- planira provesti uz uvažavanje prava i dostojanstva svih koji sudjeluju kao ispitanici i drugi sudionici u znanstvenom istraživanju;
- planira provesti uz informirani pristanak roditelja (sudionici istraživanja su mlađi od 14 godina);
- planira provesti uz prepoznavanje eventualnih rizika koji se mogu pojaviti tijekom provođenja istraživanja;
- planira provesti uz poštivanje načela tajnosti podataka prikupljenih istraživanjem;
- planira provesti sa predviđenim načinom informiranja sudionika o dobivenim rezultatima
- planira provesti nakon dobivanja suglasnosti institucije u kojoj će se istraživanje provesti.

Sukladno prethodno navedenom, Etičko povjerenstvo zaključuje kako je predloženi projektni prijedlog usklađen s Etičkim kodeksom Sveučilišta u Zagrebu te daje pozitivno mišljenje za njegovo provođenje.

Prof.dr.sc. Irma Kovčo Vukadin
Predsjednica Etičkog povjerenstva

IME IN PRIIMEK OTROKA: _____

NASLOV:_____

DATUM ROJSTVA:_____

STAROST:_____

SPOL: M Ž

MATERNI JEZIK:_____

OTROK OBISKUJE VRTEC: DA NE

OTROK JE V DOMAČEM VARSTVU: DA NE

(če je v domačem varstvu, otroka čuva _____)

1. **AMNESTIČNI PODATKI O DRUŽINI**

MATI **OČE**

_____ **IME IN PRIIMEK** _____

_____ **DATUM ROJSTVA** _____

_____ **IZOBRAZBA** _____

_____ **ZAPOSLITEV** _____

ŠTEVILO OTROK V DRUŽINI: _____

ŠTEVILO DRUŽINSKIH ČLANOV (koliko ljudi živi v hiši/stanovanju): _____

POLOŽAJ OTROKA GLEDE NA OSTALE SOROJENCE

PRVOROJENEC DRUGOROJENEC TRETJEROJENEC ČETRTOROJENEC

ENOJAJČNI DVOJEČK DVOJAJČNI DVOJČEK

GOVORNE MOTNJE V DRUŽINI (zapišite vse govorne in jezikovne motnje na vaši in partnerjevi strani)

_____

_____

2. NOSEČNOST IN POROD

NOSEČNOST _____

POROD _____

PORODNA DOLŽINA _____ TEDEN _____

PORODNA TEŽA _____

2. **OTROKOV JEZIKOVNI IN GOVORNI RAZVOJ PO MNENJU STARŠEV**

Kdaj je začel vaš otrok gruliti (ga, gu, ka..):_____

Kdaj je začel vaš otrok bebljati (ma ma, ba ba, pa pa, te te):_____

Kdaj se je po vašem mnenju pojavila prva beseda (prva beseda je kombinacija dveh zlogov s pomenom; otrok namerno uporabi besedo za določeni predmet oz. osebo): _____

Otrok ima _____ besed.

Ali otrok po vašem mnenju dobro sliši: DA NE