

**TRAINING OF EARLY SOCIAL-COMMUNICATIVE SKILLS IN YOUNG CHILDREN WITH
AUTISM SPECTRUM DISORDER**

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Training of early social-communicative skills in young children with autism spectrum disorder

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CHAPTER **1**

GENERAL INTRODUCTION

This first chapter starts with a definition of autism spectrum disorder (ASD). Next, the importance of imitation, joint attention and play as intervention targets for children with this disorder is discussed. We provide an overview of typical development, deficits in children with ASD and intervention for each of these social-communicative abilities. In addition, different intervention methods for children with ASD are discussed. Finally, the objectives of this dissertation are formulated and an overview of the different chapters is provided.

DEFINITION OF AUTISM SPECTRUM DISORDER

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and social interaction across multiple contexts and patterns of repetitive behaviour, interests or activities (American Psychiatric Association [APA], 2013). According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; APA, 2013, p. 50) the deficit in social communication and social interaction is expressed in problems with social-emotional reciprocity, a lack of nonverbal communication, and deficits in developing, maintaining and understanding relationships. These symptoms are supplemented with repetitive behaviour, interests or activities, such as stereotyped movements or speech, insisting on following the same routines, fixated interests of an unusual intensity or topic, or unusual sensory interests (APA, 2013, p. 50). The DSM-5 specifies that symptoms should be present early in development, but that their manifestation can be influenced by the amount of social demands and coping strategies of the individual with ASD. The prevalence of ASD is usually estimated at 60-70 per 10,000 children, which implicates that it is one of the most prevalent childhood neurodevelopmental disorders (Elsabbagh et al., 2012; Fombonne, 2009). There is an overrepresentation of autism in males with four times as many cases of ASD than in females (Elsabbagh et al., 2012; Fombonne, 2003). A reliable diagnosis of ASD is possible from the age of two onwards (Chawarska, Klin, Paul, Macari, & Volkmar, 2009). However, on average children are at least three years old by the time they receive a diagnosis (Barbaro & Dissanayake, 2009).

GOALS OF EARLY INTERVENTION

It has become generally accepted that intervention should start as soon as possible after a child has received a diagnosis, since the age at the start of the intervention is an important predictor for the outcome (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009). There is a growing consensus that the intervention should aim to stimulate social-communicative abilities (Ingersoll & Schreibman, 2006; National Research council, 2001;

Wetherby & Woods, 2006; Whalen, Schreibman, & Ingersoll, 2006). Especially for imitation, joint attention and play there is substantial evidence that these are important treatment goals in children with ASD, as will be discussed below.

Imitation

Imitation is the ability to repeat another person's actions, gestures or language. Typically developing children are capable of both immediate and deferred imitation, within the first year of life (Kuhl & Meltzoff, 1996; Patel, Gaylord, & Fagen, 2013). Imitation is an important learning mechanism: by observing and imitating the behaviour of the people around them, children learn abstract rules, strategies and cultural rituals (Meltzoff & Williamson, 2013). To imitate, infants need to see the similarity between the actions of themselves and others, which leads to a realization of deeper similarities in goals, intentions, perceptions and emotions (Meltzoff & Brooks, 2008). Through the interaction and mutual imitation with others that are viewed as "like me" a Theory of Mind (ToM) – the capacity to understand mental states of others, like feelings, thoughts and intentions – develops (Meltzoff & Williamson, 2013). Early imitation abilities are also predictive of later expressive language abilities (Charman et al., 2000; Young et al. 2011).

Deficits in imitation – of gestures and facial movements (bodily imitation) and of actions with objects (procedural imitation) – are extensively documented in children with ASD (Vanvuchelen, Roeyers, & De Weerd, 2011). Since imitation is an important learning mechanism, these deficits can cause subsequent delays in other areas of development. Several studies have shown that early imitation abilities of children with ASD are predictive of later language development (Charman et al., 2003; Luyster, Kadlec, Carter, & Tager-Flusberg, 2008; Stone & Yoder, 2001; Thurm, Lord, Lee, & Newschaffer, 2007). Moreover, both concurrent and longitudinal associations between imitation and play have been documented (Ingersoll & Meyer, 2011; Stone, Ousley, & Littleford, 1997). Besides a learning function, imitation also has an important social function, given that reciprocal imitation supports the development of parent-child as well as peer relationships (Ingersoll, 2008).

It has been shown that imitation abilities of children with ASD can improve with intervention (Ganz, Bourgeois, Flores, & Campos, 2008; Ingersoll, 2010a; Ingersoll & Lalonde, 2010; Ingersoll & Schreibman, 2006; Walton & Ingersoll, 2012; Warreyn & Roeyers, 2013). A method that takes into account both the learning and the social function of imitation, is *reciprocal imitation training*. When using this method, the therapist shifts between imitating the child and modelling new behaviours. The child is first given the opportunity to imitate the behaviour of the therapist spontaneously. Only when this does not happen the therapist will *prompt* (direct the behaviour of the child, help the child to perform the desired behaviour) the child to imitate. By rewarding the child's imitation (attempts) the behaviour is further stimulated. In this way children with ASD do not only learn to imitate, but also show progress in their social and language abilities (Ingersoll & Schreibman, 2006).

Joint attention

A second ability in which children with ASD show deficits from early on, is joint attention (e.g. Dereu et al., 2010). It is the triadic coordination of attention between the child, another person and an object or activity, with both interaction partners aware of the joint focus (Tomasello & Farrar, 1986). Joint attention can have two functions: a declarative function, which means the child wants to share interest with another person; and an imperative or requesting function, when the child wants to obtain something from another person. Additionally, a distinction is made between initiating and following joint attention (Mundy, Sigman, & Kasari, 1993). Typically developing children learn to follow joint attention between the ages of 7 and 12 months and start to initiate joint attention, first with an imperative and then with a declarative purpose, in the beginning of their second year of life (Kristen, Sodian, Thoermer, & Perst, 2011). Joint attention is said to be important in language learning, because children need social cues like the eye gaze of a social partner to map new words to objects (Baldwin, 2000). Research has shown that joint attention abilities are indeed predictive of later language abilities (Charman et al., 2000). Moreover, early joint attention abilities also show associations with later ToM (Charman et al., 2000; Colonnese, Rieffe, Koops, & Perucchini, 2008; Kristen et al., 2011).

Children with ASD show difficulties with both following and initiating joint attention and are generally more impaired in declarative than imperative joint attention (Bruinsma, Koegel, & Koegel, 2004). In children with autism declarative joint attention – both initiating and following – is associated with concurrent and future language abilities (Luyster et al., 2008; Schietecatte, Roeyers, & Warreyn, 2012; Thurm et al., 2007). Furthermore, associations between early joint attention and later social and communicative symptoms have also been shown (Charman et al., 2003).

A recent review (White et al., 2011) of both studies that directly targeted joint attention and studies that merely looked at joint attention as an outcome variable in children with ASD, concluded that the majority of those studies reported positive effects on joint attention. Joint attention is mostly taught in a play context, using a combination of some developmental (e.g. following the child's lead, imitating the child, expanding on the child's words and actions) and predominantly behavioural (prompting and rewarding new behaviour) techniques (White et al., 2011). Response to joint attention is usually stimulated by prompting the child to respond to increasingly difficult bids for joint attention and gradually diminishing prompts (*prompt fading*) until the child spontaneously shows the behaviour (e.g. Martins & Harris, 2006; Rocha, Schreibman, & Stahmer, 2007; Whalen & Schreibman, 2003). Initiating declarative joint attention should be taught with social rewards instead of access to a preferred item, to ensure that the child is truly using joint attention for a declarative and not an imperative purpose (Meindl & Cannella-Malone, 2011).

Teaching joint attention to children with ASD does not only promote the behaviours directly targeted, but also produces collateral changes in language, positive affect and play (Gulsrud, Kasari, Freeman, & Paparella, 2007; Jones, Carr, & Feeley, 2006; Kasari, Paparella, Freeman, & Jahromi, 2008; Naoi, Tsuchiya, Yamamoto, & Nakamura, 2008). This confirms the *pivotal* nature of joint attention in development.

Play

In the first years of life children develop increasingly complex play skills. Infants mainly explore the sensory characteristics of objects and develop more precise forms of object manipulation between the ages of 6 and 12 months (Ruff, 1984). In the last

quarter of the first year of life the ability to relate two or more objects emerges (Fenson, Kagan, Kearsley, & Zelazo, 1976). Examples of this type of play, called relational or combinational play, are putting one object in another or stacking objects. Functional play appears when the child is about 14 months old. At that age, the child can use (miniature) objects the way they were intended (such as pushing a toy car). The first examples of symbolic play abilities are seen around the age of 18 months and develop further during infancy and childhood (McCune-Nicolich, 1981). Symbolic play is defined as either: a) using an object as if it is something else; b) attributing imaginary properties to an object; or c) reference to an absent object (Leslie, 1987). Children spend a large part of their time engaged in play. During play they learn to solve problems, to cooperate and resolve conflicts and practice their language and social cognitive abilities (Lewis, Boucher, Lupton, & Watson, 2000; Pepler & Ross, 1981; Schwebel, Rosen, & Singer, 1999).

Children with ASD show deficits even in the most basic forms of play. Research has found atypical patterns of exploration (e.g. spending a long time visually inspecting only a part of an object) and a general developmental delay in exploratory play (Williams, 2003). Moreover, their functional play shows less variation and complexity than the play of typically developing children (Williams, Reddy, & Costall, 2001). However, the most extensively documented impairments are found in symbolic play, especially in spontaneous and unstructured situations (Jarrold, 2003). Like imitation and joint attention, also play fulfils an important function in the development of children with ASD, as is shown by the association between language and communication and pretend play (Weismer, Lord, & Esler, 2010).

Functional and more basic play abilities of children with ASD can improve with intervention. (Gillett & LeBlanc, 2007; Nuzzolo-Gomez, Leonard, Ortiz, Rivera, & Greer, 2002; Van Berckelaer-Onnes, 2003). An even larger number of studies showed the positive effect of training symbolic play abilities in these children (Dauphin, Kinney, & Stromer, 2004; Ingersoll & Schreibman, 2006; Kasari, Freeman, & Paparella, 2006; MacDonald, Clark, Garrigan, & Vangala, 2005; Morrison, Sainato, Benchaaban, & Endo, 2002; Stahmer, Ingersoll, & Carter, 2003). A recent review concluded that the majority of the interventions targeting play employ a behavioural approach within a natural

context where the interests of the child are followed (Jung & Sainato, 2013). However, also more therapist-directed methods can be just as effective to improve play skills of children with ASD (Bernard-Opitz, Ing, & Kong, 2004). The most common components of play interventions are modelling, systematic prompting, contingent reinforcement and naturalistic instruction (Lang et al., 2009). In several recently developed social communication intervention programmes for children with ASD, play is one of the main targets (e.g. Ingersoll & Wainer, 2013).

INTERVENTION METHODS

Applied Behaviour Analysis

Of all the different treatment methods, Applied Behaviour Analysis (ABA) is the most widely studied. Because of the numerous studies that demonstrated its efficacy, this intervention is considered the treatment of choice in children with ASD (Eikeseth, 2009; Reichow, Barton, Boyd, & Hume, 2012; Vismara & Rogers, 2010). Although many variations of the original treatment method – described by Lovaas (1977) – exist, they all use operant conditioning to gradually teach increasingly complex behaviours. This is done by creating learning opportunities for the child, who is prompted to behave in a certain way and rewarded for good attempts of the behaviour. Research has shown that children with ASD who receive intensive ABA make significantly more progress in cognitive abilities, language and adaptive behaviour than children who receive an eclectic treatment (Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Remington et al., 2007; Sallows & Graupner, 2005; Smith, Groen, & Wynn, 2000). However, a few remarks should be added to these positive results. First, almost all studies that proved ABA to be superior to other interventions, looked at the effect of intensive programmes, usually of 20-40 hours a week. In many European countries – also in Belgium – children with ASD receive only a couple of hours of intervention a week (Salomone et al., 2013). It is not clear whether ABA is also superior to other treatments, when it is provided much less intensive. Second, while the effect on language, adaptive and cognitive abilities has been replicated by multiple studies (Howard, Sparkman, Cohen, Green, &

Stanislaw, 2005; Remington et al., 2007; Sallows & Graupner, 2005; Smith, Groen, & Wynn, 2000), the effect of the traditional ABA on the core symptoms of ASD, social communication deficits, has hardly received any attention. Third, traditional ABA is very directive, leaving little chance for spontaneous behaviour of the child. This could cause *prompt dependency* in children, which means that they might learn to wait for a prompt of an adult and do not learn to use the instructed behaviours spontaneously (Clark & Green, 2004). For all these reasons, the traditional ABA evolved into a method that incorporated principles of its counterpart, the developmental intervention.

Developmental intervention¹

The developmental intervention originated from the developmental psychology of Piaget, psychoanalysis and the social-pragmatic model of language acquisition (Ingersoll, 2010b). The most known developmental intervention programme is the Developmental Individual Differences/Floortime model (Wieder & Greenspan, 2003). Contrary to ABA, the developmental approach is more child-focussed and teaches new abilities in an indirect way. Typical development guides the sequence of behaviours that are targeted (Prizant, Wetherby, Rubin, & Laurent, 2003). The relationship between the child and the therapist is seen as a means to promote development of the child (Mahoney & Perales, 2005). The core technique of this approach is following the child's lead and waiting for the child to initiate interaction. In addition facilitative strategies that are associated with a responsive interaction style are used, including imitating the child, using animated facial and vocal expression, modelling language in accordance with the child's focus of interest, and playfully obstructing the child to elicit communication (Greenspan & Wieder, 1999; Mahoney & Perales, 2005; Solomon, Necheles, Ferch, & Bruckman, 2007). A limited number of studies reported gains in language, cognitive development, communication skills and less symptoms of ASD following intervention with the developmental approach (Mahoney & Perales, 2005; Pajareya & Nopmaneejumrulers, 2011; Rogers & Lewis, 1989; Solomon et al., 2007). However, the majority of these studies have methodological shortcomings, such as the lack of a control group, sole

¹ Also referred to as social-pragmatic or relationship-based approach

reliance on parent report measures to assess progress and small sample sizes. In comparison to ABA, this method has been studied much less. Further research with a better methodology seems necessary to evaluate the benefits of this intervention.

Naturalistic Behavioural treatment

While traditional interventions were mainly situated on one end of the continuum between ABA and developmental interventions, nowadays the majority of intervention programmes for children with ASD uses techniques of both approaches. The naturalistic behavioural treatment originated from ABA, but is less directive. The aim to increase generalisation and spontaneous use of abilities by teaching them in the natural environment is common to several similar intervention models (Ingersoll, 2010b) such as incidental teaching (Hart & Risley, 1968) milieu teaching (Alpert & Kaiser, 1992) and pivotal response training (Koegel, O'Dell, & Koegel, 1987). These intervention models share the technique of following the child's lead with the developmental approach. However, the child's motivation is used to explicitly teach new behaviour by using prompts and rewards, which is the ABA component of these models. The main targets of naturalistic behavioural interventions are social-communicative abilities, since these are considered to be pivotal areas of development, which will cause further improvement in other developmental domains (Koegel, Koegel, Harrower, & Carter, 1999). It has been shown that these interventions can effectively improve social-communicative abilities – such as imitation, joint attention and play – in children with ASD (e.g. Hwang & Hughes, 2000; Ingersoll & Schreibman, 2006; Ingersoll & Wainer, 2013; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010). Naturalistic behavioural interventions are even more effective than traditional ABA to teach language to children with ASD (Delprato, 2001). One of the most known programmes implementing a naturalistic behavioural approach is the Early Start Denver Model (ESDM; Dawson et al., 2010). Research has shown that toddlers with ASD who received intervention for 2 years with this programme showed more progress on language, cognitive and adaptive abilities and a bigger decrease in ASD symptoms than children receiving treatment as usual. Moreover these children showed normalized brain activation in response to viewing faces, which was not found in the control group (Dawson, Jones, et al., 2012).

CONCLUSION AND RESEARCH GOALS

Social-communicative abilities have been proposed to be important intervention targets for preschoolers with ASD because: a) Children with ASD show clear deficits in these abilities, from early on (Dereu et al., 2010; Wetherby et al., 2004); b) These abilities are associated with later social, social-cognitive and language development (Charman, 2003; Poon, Watson, Baranek, & Poe, 2012); and c) Research revealed that these abilities can be taught successfully with specific trainings and have collateral effects on related abilities (Kasari et al., 2008; Whalen et al., 2006). Training programmes targeting social-communicative abilities often use behavioural intervention principles. In general, ABA is considered the treatment of choice for children with ASD (Eikeseth, 2009; Reichow, Barton, Boyd, & Hume, 2012; Vismara & Rogers, 2010). Traditional ABA evolved from an adult-directed and very structured method to the naturalistic behavioural intervention, which aims to increase generalisation and spontaneous use of abilities.

The main aim of this dissertation was to extend the current knowledge on the promotion of social-communicative abilities in children with ASD. This general goal was translated in several more specific research questions, which are described below.

Importance of social-communicative abilities as intervention targets

The first aim of this dissertation was to confirm the importance of social-communicative abilities as intervention targets for children with ASD. This was done by replicating previous studies that showed marked impairments in these abilities from early on (Bruinsma, Koegel, & Koegel, 2004; Jarrold, 2003; Vanvuchelen, Roeyers, & De Weerdt, 2011) and studies that showed the possibility to stimulate these abilities with intervention (e.g. Ingersoll & Schreibman, 2006; Kasari, Freeman, & Paparella, 2006; Warreyn & Roeyers, 2013). The pivotal nature of imitation, joint attention and pretend play was examined further by exploring concurrent associations with language. We chose to focus on language because this is – together with cognitive abilities – the most important predictor of later outcome (Howlin & Moss, 2012). Previous studies that looked at the relative contribution of imitation, joint attention and pretend play to

language development, controlling for the effect of the other social-communicative abilities, were often contradictory (Charman et al., 2003; Luyster et al., 2008; Stone & Yoder, 2001; Thurm et al., 2007; Weismer et al., 2010). We aimed to address several limitations of those studies, such as a small sample size, lack of fine-grained measurement of the social-communicative abilities and lack of taking into account the language age of the children.

How to stimulate social-communicative abilities in children with ASD

Although intervention for young children with ASD has received a lot of attention from researchers, most studies took place in research settings under controlled circumstances. Little is known about the effect of community interventions. It is important to look at the effect of interventions when they are being used in clinical practice, because clinicians tend to adapt evidence-based programs to characteristics of the child or setting (Stahmer, Collings, & Palinkas, 2005). Moreover, community interventions are often provided at a low intensity, which is a factor that could lead to less favourable outcomes than with intensive interventions (Granpeesheh et al., 2009). Because of these reasons, we aimed to compare the effect of several intervention methods in community settings on the social-communicative abilities of children with ASD. Besides an evaluation of current practices, we also wanted to look for ways to improve intervention services for children with ASD in Flanders. An alternative to intensive 1:1 intervention provided by a therapist was evaluated: training parents to stimulate the social-communicative abilities of their child in daily routines.

Heterogeneity in intervention success

While most studies only look at group averages, it is also important to take into account the variability in the outcome of interventions. Differential response to treatment was already noted in the first study on the effect of ABA, which showed clear improvement in cognitive abilities and education placement in only half of the children (Lovaas, 1987). However, this heterogeneity in progress has not received much attention until recently. Studies that tried to explain the variability in outcome found that especially treatment intensity, age, severity of autism and cognitive functioning are

related to the success of an intervention (Mazurek, Kanne, & Miles, 2012; Perry et al., 2011; Virues-Ortega, Rodriguez, & Yu, 2013; Zachor & Ben Itzchak, 2010). However, still a large part of the variance in treatment success remains unexplained. Because of this an overarching goal of the different chapters was to explore the variability in outcome and predictors of the amount of progress in early intervention.

Mechanisms of change

Although ABA is widely accepted as a well-established treatment, the effect of variations in implementation and factors contributing to the variability in outcome are not well understood. By studying moment-to-moment interactions of children with ASD and their therapist during intervention we aimed to obtain more insight in factors contributing to the efficacy.

OVERVIEW OF THE CHAPTERS

Chapter 2

Social-communicative abilities are central to this dissertation. For this reason, we included a study on the importance of imitation, joint attention and pretend play in the development of children with ASD. We looked at the associations between these abilities and language and tested whether the language age of the children could have an effect on the relationships between their social-communicative abilities and language.

Chapter 3

In Chapter 3 the same sample of children was followed up to look at the effect of the intervention they received on their social-communicative abilities. Intervention based on ABA was compared with a more specific intervention programme targeting imitation and joint attention and with treatment as usual in community settings. Besides an evaluation

at the group-level, this chapter describes the variability in the progress children make in a period of 6 months of low-intensive intervention.

Chapter 4

Parent training appears to be a cost-effective and more generally applicable alternative for intensive 1:1 intervention. Parents can use techniques in daily routines, which increases intervention intensity and facilitates skill generalization. This study investigated the effect of Project ImPACT (Ingersoll & Dvortcsak, 2010), a comprehensive parent-implemented intervention programme to stimulate social-communicative abilities in preschoolers with ASD with a multiple baseline design. This approach has the benefit that it gives more detailed information on how children progress during the course of an intervention programme than group-based studies.

Chapter 5

In this last chapter we conducted a micro-analysis of how therapists stimulate social-communicative behaviour during an ABA intervention session. We provide a descriptive analysis of the prompts and rewards used by therapists and analyse the individual variability in the interaction between therapists and children. Additionally, the study focused on the extent to which these observational data predict the progress which children make during 6 months of intervention.

It should be noted that this dissertation consists of several research papers, which are submitted for publication, are currently under review, or have been published. Since each of the manuscripts should be able to stand on its own, their contents may partially overlap.

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**SOCIAL-COMMUNICATIVE ABILITIES AND
LANGUAGE IN PRESCHOOLERS WITH
AUTISM SPECTRUM DISORDERS:
ASSOCIATIONS DIFFER DEPENDING ON
LANGUAGE AGE¹****ABSTRACT**

The aim of this study was to look at the unique contributions of imitation, pretend play and joint attention to differences in receptive and expressive language. Associations between social-communicative and language abilities were assessed thoroughly in a large sample ($N = 83$) of preschoolers with ASD. We hypothesized that these associations are dependent of language age. Therefore the sample was divided in two subsamples based on either the receptive or expressive language age for each of the analyses. Results revealed that imitation, pretend play, response to joint attention and imperative and declarative joint attention, were all uniquely associated with language. However, these relationships were different for receptive and expressive language and they also differed depending on the language age of the children. While imitation and pretend play showed unique associations with language in children with a language age under 2 years old and children with a language age above 2 years old, joint attention abilities were only uniquely associated with language in children with the youngest language age. These findings lend support to the idea that social-communicative abilities are important intervention targets for children with ASD.

¹ Based on Van der Paelt, S., Warreyn, P., & Roeyers, H. (2014). Social-communicative abilities and language in preschoolers with autism spectrum disorders: Associations differ depending on language age. *Research in Autism Spectrum Disorders*, 8(5), 518-528. doi:10.1016/j.rasd.2014.01.010

INTRODUCTION

Autism spectrum disorder (ASD) is a heterogeneous disorder with great variability in outcome (Magiati, Moss, Charman, & Howlin, 2011). Despite the pervasive nature of ASD the development of children with this disorder can be influenced by intervention (Warren et al., 2011). Because a stable diagnosis is possible in 2-year-olds (Chawarska, Klin, Paul, Macari, & Volkmar, 2009), there is recently a greater emphasis on early intervention (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009). Early social-communicative abilities such as imitation, joint attention and pretend play are seen as important intervention targets, given the clear deficits observed in young children with ASD and the pivotal role these skills play in development (Lam & Yeung, 2012; Paparella, Goods, Freeman, & Kasari, 2011; Vanvuchelen, Roeyers, & De Weerd, 2011b). Especially the association of these abilities with language has been studied extensively (e.g., Luyster, Kadlec, Carter, & Tager-Flusberg, 2008; Poon, Watson, Baranek, & Poe, 2012). The present study aims to investigate this association in a large sample of preschoolers with ASD with a more rigorous measurement of the social-communicative abilities than in previous research.

Studying language in children with ASD is important, considering it is one of the variables most significantly associated with later outcome (Anderson, Oti, Lord, & Welch, 2009). Moreover a language delay is one of the first symptoms that raises parental concern (Wetherby et al., 2004). Imitation, joint attention and pretend play all play a role in language development. Children learn their first words by imitating their parents, which makes a relationship between imitation and language obvious. This expected association has been confirmed both in typical children (McEwen et al., 2007) and in children with ASD (Ingersoll & Meyer, 2011). Joint attention is said to be important in language learning, because children need social cues like the eye gaze of a social partner to map new words to objects (Baldwin, 2000). Research has found concurrent and longitudinal associations between joint attention and language in typical children (Mundy et al., 2007) and children with ASD (Charman, 2003; Schietecatte, Roeyers, & Warreyn, 2012). Pretend play and language are theoretically associated because they both rely on a symbolic representation ability (Lewis, 2003). Moreover the

age at which pretend play begins to develop coincides with the age at which expressive language starts to develop. Even the onset of combinations in language and play are associated (Mccune, 1995). Although the association between pretend play and language is well established in typical development, this relationship is less clear in children with ASD (Lewis, 2003). Interventions targeting imitation, joint attention or pretend play have an impact on language ability (e.g. Ingersoll & Lalonde, 2010; Kasari, Paparella, Freeman, & Jahromi, 2008), providing indirect evidence for the link between these skills and language.

Because imitation, joint attention and pretend play are interrelated (Toth, Munson, Meltzoff, & Dawson, 2006) it is important to consider their relative contribution to language development, controlling for the effect of the other social-communicative abilities. Studies that have looked at the concurrent link between social-communicative abilities and language yielded mixed results. Some studies have found a unique association between imitation and expressive language (Luyster et al., 2008) whereas others have concluded that imitation does not explain any variance when pretend play or joint attention are already accounted for (Charman et al., 2000; Weismer, Lord, & Esler, 2010). Longitudinal studies pointed more consistently to imitation as an important predictor, especially with respect to expressive language (Charman et al., 2003; Stone & Yoder, 2001; Thurm, Lord, Lee, & Newschaffer, 2007). This was also found in typically developing children (Charman et al., 2000). However, some studies found that other variables, such as joint attention are equally associated with language (Toth et al., 2006). The differential age of the participants could be responsible for the contradictory findings.

Another replicated finding is that response to joint attention is uniquely associated with receptive language both concurrently (Luyster et al., 2008) and longitudinally (Thurm et al., 2007). Pretend play seems to show the least unique contribution to the prediction of language. However, a possible explanation for this is that it is mostly measured with very broad scales (e.g. ADOS), which could make it more difficult to discover a relationship with language. Another possible explanation can be deduced from the study by Toth et al. (2006). These authors show that although there is no unique association between pretend play and language concurrently or longitudinally,

pretend play ability is predictive for the rate of communication development from age 4 to 6.5 years. Other studies did not look at the rate of language or communication development, and therefore possibly fail to unravel the relation between pretend play and language.

The present study aims to further investigate the concurrent link between social-communicative abilities and language. Although several studies have replicated this connection, most of them lack a sufficient sample size to explore these relationships in more depth. Moreover the studies with a larger sample size often do not use fine-grained measurement of the social-communicative abilities (Thurm et al., 2007; Weismer et al., 2010). In order to study children with ASD at a very young age some studies (e.g. Weismer et al., 2010) have recruited siblings of children with ASD, because they are a high risk population. This has the disadvantage that it makes the sample less representative, because those children have an older sibling with ASD, which can affect their social-communicative abilities and language.

The present study describes a large sample of preschoolers with ASD, exploring imitation, joint attention and pretend play in relation to language abilities, with a thorough assessment. Because the association between social-communicative abilities and language has rarely been studied with this level of detail in such a large sample, this study can contribute significantly to the understanding of language development in children with ASD. Since findings from previous studies were often contradictory, we hypothesized that the language age of the children could have an effect on the relationships between their social-communicative abilities and language. Typically developing children reach an important milestone in language development on average around their second birthday. While in the second year of life the mapping of words to objects is central, by the end of that year 2-word-sentences start to emerge. With this new level of complexity different social-communicative abilities could play a role in language development.

METHOD

Participants

Ninety-two children with either an official ($n = 81$) or working diagnosis (preliminary diagnosis; Charman & Baird, 2002; $n = 11$) of ASD were recruited for this study, that was part of a larger study, in which children were followed up to look at the effect of the intervention they received (Van der Paelt, Warreyn & Roeyers, 2014). The participants were recruited from 16 treatment centres, serving children with developmental delays. Parents gave their written consent for participation. The Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore & Risi, 1999) was used to confirm diagnoses. Nine children scoring clearly below the cut-off for ASD (severity score 1 or 2) were excluded from further analysis. Because all children received intervention, which might have positively influenced their symptoms (Pellicano, 2012), children with a severity score of 3 were included ($n = 6$). The remaining 83 children (67 boys) were between 22 and 75 months old, 49 months on average ($SD = 14$ months) at the time of the assessment. Their cognitive level was assessed before the start of the study by the treatment centre with the Dutch version of one of the following tests: Bayley Scales of Infant Development, second edition (BSID-II-NL; Van der Meulen, Rutter, Spelberg & Smrkovsky, 2000; $n = 43$), Wechsler Preschool and Primary Scale of Intelligence, third edition (WPPSI-III; Hendriksen & Hurks, 2009; $n = 10$), Wechsler Preschool and Primary Scale of Intelligence – Revised (WPPSI-R NL; Vander Steene & Bos, 1997; used because the WPPSI-III was not yet available in Dutch in all treatment centres at the time of the assessment; $n = 13$), Snijders-Oomen Non-verbal Intelligence Test – Revised (Tellegen, Winkel, Wijnberg-Williams & Laros, 1998; $n = 14$), Psychoeducational profile – Revised (PEP-R; Pameijer & van Beukering, 1997; $n = 1$) and McCarthy Developmental Scales (MOS; Van der Meulen & Smrkovsky, 1986; $n = 2$). Forty-five children were firstborns, 38 had at least one older sibling. The sample was divided into subgroups based on the language level of the children. Because we expected different associations for receptive and expressive language, we used both receptive and expressive language age (age equivalent scores) separately to divide the sample. To study the associations between social-communicative abilities and receptive language the sample was divided in a

subgroup of children with a receptive language age of less than 2 years old and a subgroup of children with a receptive language age of 2 and above. For the associations with expressive language, a subgroup with an expressive language age of less than 2 was compared to a subgroup with an expressive language age of 2 and above. Tables 1 and 2 present the participant characteristics in the different subgroups based on receptive and expressive language level.

Table 1

Participant characteristics for the subgroups based on receptive and expressive language level

Characteristic	Receptive language age		Expressive language age	
	< 2 yrs	≥ 2 yrs	< 2 yrs	≥ 2 yrs
<i>N</i>	32	51	38	45
Mean age (<i>SD</i>) ^a	39.19 (12.01)	55.36 (10.43)	39.48 (11.49)	57.27 (9.11)
No. of boys	22	45	27	40

^a in months

Table 2

IQ distribution for the subgroups based on receptive and expressive language level

IQ category	Receptive language age		Expressive language age	
	< 2	≥ 2	< 2	≥ 2
	(<i>n</i> = 32)	(<i>n</i> = 51)	(<i>n</i> = 38)	(<i>n</i> = 45)
IQ < 55	20	7	21	6
IQ 55-70	7	11	9	9
IQ 71-85	4	15	7	12
IQ 86-115	1	17	1	17
IQ > 115	0	1	0	1

Measures

Preschool Imitation and Praxis Scale (PIPS; Vanvuchelen, Roeyers, & De Weerd, 2011a). The PIPS was used to measure motor imitation. The PIPS consists of 30 items, of which 21 items measure bodily imitation (gestural and facial imitation) and 9 procedural imitation. The bodily imitation scale comprises meaningful (e.g. wave good-bye) and non-meaningful (e.g. place one fist on top of the other) actions. The procedural scale encompasses goal directed (e.g. raise a toy bear by pulling a cord) and non-goal directed (e.g. open a box, turn it upside down and put a block on the bottom of the box) actions.

Test of Pretend Play (ToPP; Lewis & Boucher, 1997). The structured version of the ToPP was used to assess three main types of pretend play: object substitution, property attribution and reference to an absent object. The test assesses the child's ability to use him/herself as the object of pretend play as well as the ability to use a doll or teddy bear as agent. Moreover the ability to combine play acts into a script is tested. A nonverbal version, in which actions were modelled, was used in children with a language comprehension level of less than 3 years old. In children with a better language comprehension we used the verbal version, in which next to modelled actions, also verbal instructions were used. Every item consists of a part where the child can produce original play and a part where the child is asked to copy a modelled action (e.g. using an ambiguous object as a hat for a doll) or to follow an instruction ("show me the bear is sad"). Only the spontaneous pretend play (not the instructed or imitated pretend play) was used to compute a total score (which is a variant described in the manual of the test). This was done to avoid overlap with the imitation scores.

Early Social Communication Scales (ESCS; Mundy et al., 2003). The abridged version of the ESCS was used to measure initiation of joint attention (IJA), initiating behaviour request (IBR) and response to joint attention (RJA). Four different mechanical toys (3 wind-up toys and a pop-up puppet) were activated in sight of the children. The experimenter gave each toy to the child when he or she requested it. The child could play with the toy for 30 seconds, after which the experimenter requested the toy back and activated it again. This procedure was repeated with each toy three times. Two of the toys were first placed in a box that the child could not open by himself and were given to the child in the box in order to elicit requesting to open it. In order to assess RJA

four pictures (A4 size) of Winnie the Pooh and friends were placed on the walls right and left of the child, two in their visual field (at approximately 60 degrees from the child's midline) and two behind the child (at approximately 150 degrees from the child's midline). After gaining the child's attention, the experimenter gazed at each of the four posters and said the name of the child three times before looking back to the child. If the child did not follow the gaze of the experimenter to the first two posters, a pointing gesture was added for the last two posters. Children received a score from 0 to 4, depending on the number of posters they followed the gaze and/or point to.

The coding of the ESCS was done with the Observer XT, version 9.0 (Noldus, 2009) by four independent coders. Scores for IJA and IBR are based on frequency counts of nonverbal and verbal communication during the whole observation. Verbal communication was included because we tested children up to 6 years old in our sample. It can be expected that the older children become, the more they will use language as a means for sharing attention. Yoder, Stone, Walden, and Malesa (2009) also used the ESCS to count the frequency of nonverbal and verbal joint attention, (called *unweighted triadic communication*).

The following nonverbal IJA behaviours were observed: (a) making eye contact with the experimenter to share interest, (b) alternating eye contact between an active/moving toy and the experimenter, (c) proximal or distal pointing with or without eye contact to share interest, (d) showing an object to the experimenter with eye contact. Verbal IJA was defined as using one or more words to share interest with the experimenter. The number of words per utterance was coded (vocalization or non-word, one word, two words, three words, more than three words). The following nonverbal IBR behaviours were coded: (a) making eye contact with the experimenter to request something, (b) reaching for a toy, with and without eye contact, (c) proximal or distal pointing with and without eye contact to request, (d) giving an object to the experimenter. Verbal IBR was defined as using one or more words to request something, with a distinction between the number of words, in the same way as the verbal IJA score. Nonverbal and verbal scores for IJA and IBR were combined in a total IJA score and a total IBR score. Interrater reliability was determined with single measures intraclass correlations (ICCs) by double coding of 25% of the observations. The ICCs were

.94 for nonverbal IJA, .96 for verbal IJA, .87 for nonverbal IBR, .91 for verbal IBR and .84 for RJA.

Reynell Developmental Language Scales – Dutch version (RTOS; Schaerlaekens, Zink, & Van Ommeslaeghe, 2003). The RTOS was used to assess expressive and receptive language. Age equivalent scores, based on a sample of Dutch speaking children, were available.

Procedure

The tests were administered in the treatment centres of the children, on two separate days, with approximately one week in between. The first assessment started with the ADOS, after which the PIPS was administered. The second assessment consisted of the ESCS, ToPP and RTOS, in this order. Both assessments took approximately 60 to 90 minutes. We chose to start both assessments with the tests with the most liberal instructions to let the children warm up and get used to the test administrator. Since the tests were playful and provided enough variation of tasks and materials, children were able to remain engaged throughout the administration of the tests, with minimal signs of fatigue. The assessment was videotaped and all the tests were scored afterwards from the video. The study design was prospectively reviewed and approved by the Ethics Committee of the Faculty of Psychology and Educational Sciences of Ghent University, where the study was conducted.

RESULTS

Relationships among social-communicative abilities and language

Table 3 presents mean scores (*M*), standard deviations (*SD*) and ranges for the social-communicative abilities and language measures. Raw scores were used in all analyses because some children had bottom scores on the age equivalent scores. Pearson correlations between social-communicative abilities and receptive and expressive

language differed depending on the receptive or expressive language level of the children (see Table 4 and 5).

Table 3

Descriptive statistics for social-communicative and language abilities

Ability		Receptive language age		Expressive language age	
		< 2 (<i>n</i> = 32)	≥ 2 (<i>n</i> = 51)	< 2 (<i>n</i> = 38)	≥ 2 (<i>n</i> = 45)
Procedural imitation ^a	<i>M</i> (<i>SD</i>)	4.63 (5.19)	15.57 (5.44)	5.26 (5.73)	16.49 (4.41)
	Range	0-21	0-21	0-21	0-21
Bodily imitation ^a	<i>M</i> (<i>SD</i>)	4.34 (8.29)	29.86 (13.97)	5.84 (9.86)	32.00 (12.62)
	Range	0-28	0-57	0-34	0-57
Total imitation ^b	<i>M</i> (<i>SD</i>)	8.94 (12.58)	45.43 (18.61)	11.08 (14.83)	48.49 (16.13)
	Range	0-49	0-78	0-54	0-78
Pretend play ^a	<i>M</i> (<i>SD</i>)	2.44 (3.16)	9.04 (7.10)	2.26 (2.95)	10.07 (6.93)
	Range	0-14	0-26	0-14	0-26
IJA ^c	<i>M</i> (<i>SD</i>)	1.37 (1.22)	3.29 (1.61)	1.37 (1.03)	3.54 (1.59)
	Range	0-5.11	0.27-9.67	0-3.47	0.27-9.67
IBR ^d	<i>M</i> (<i>SD</i>)	1.30 (.81)	2.51 (1.25)	1.53 (1.16)	2.48 (1.16)
	Range	0-3.07	0.32-5.66	0-5.66	0.32-5.51
RJA ^e	<i>M</i> (<i>SD</i>)	.31 (.25)	.64 (.28)	.32 (.25)	.68 (.27)
	Range	0-1	0-1	0-1	0-1
Expressive language ^a	<i>M</i> (<i>SD</i>)	2.69 (6.51)	42.35 (19.44)	3.53 (4.91)	46.93 (16.12)
	Range	0-35	6-75	0-16	18-75
Receptive language ^a	<i>M</i> (<i>SD</i>)	5.06 (5.79)	43.00 (14.96)	9.24 (11.36)	44.53 (15.14)
	Range	0-17	18-69	0-40	17-69

^a Raw score. ^b Sum of procedural and gestural imitation. ^c Rate per minute of initiating joint attention. ^d Rate per minute of initiating behavioural request. ^e Proportion of responding to joint attention

Table 4

Correlations between receptive language and predictor variables

Receptive language level	Age	Bodily im.	Procedural im.	Total im.	Pretend play	IJA	IBR	RJA
< 2 yrs	.25	.56**	.57**	.60**	.69**	.72**	.60**	.41**
≥ 2 yrs	.49**	.58**	.47**	.57**	.61**	.12	-.19	.15

Note. im. = imitation; IJA = initiating joint attention; IBR = initiating behavioural request; RJA = responding to joint attention.

** $p < .01$.

Table 5

Correlations between expressive language and predictor variables

Expressive language level	Age	Bodily im.	Procedural im.	Total im.	Pretend play	IJA	IBR	RJA
< 2 yrs	.22	.41*	.29	.38**	.28*	.38*	.63**	.18
≥ 2 yrs	.44**	.63**	.57**	.64**	.58**	.06	-.12	.04

Note. im. = imitation; IJA = initiating joint attention; IBR = initiating behavioural request; RJA = responding to joint attention.

* $p < .05$. ** $p < .01$.

The joint attention variables only correlated significantly with language in the children with the lowest language level. IJA and IBR showed associations with receptive and expressive language, whereas RJA was only associated with receptive language. Pretend play and imitation showed significant correlations with both language variables in all children. Age correlated significantly with language (only in children with a

receptive or expressive language level above 2 years old) and was therefore used as a control predictor variable in the subsequent regression analyses. Procedural and bodily imitation were highly correlated in all language subgroups ($r = .73-.80$). To avoid multicollinearity the total imitation score was used in subsequent regression analyses. Correlations between the different social-communicative abilities were low to moderate in all groups. Multicollinearity diagnostics indicated adequate tolerance levels.

Predicting language

Multiple hierarchical regression analyses were conducted for receptive and expressive language separately. Because the dependent variables in the regression analyses were receptive and expressive language, it was not possible to include receptive and expressive language age and the interaction between language age and the other predictors directly into the regression models as predictors. Therefore regression analyses were also performed separately in each receptive and expressive language age group. This implies that in total four regression analyses were performed. In each analysis age was entered in the first step, to control for its effect on the language level. The predictors imitation, pretend play, IJA, IBR and RJA were entered together in the second step, to control simultaneously for the other predictors in the model.

Receptive language < 2 years. A model with age alone could not significantly predict receptive language in the group of children with a receptive language age of less than 2 years old, $F(1, 30) = 2.06, p = .16$. The model with the social-communicative abilities explained 73 percent of the variance in receptive language, $F(6, 25) = 11.03, p < .001$. Standardized betas revealed that pretend play and IJA explained unique variance. See Table 6.

Receptive language age \geq 2 years. A model with age explained 24 percent of the variance in receptive language in children with a receptive language age of 2 and above, $F(1, 49) = 15.12, p < .001$. The social-communicative abilities added significant variance to that, $F(5, 44) = 3.92, p = .005$. The combined model explained 47 percent of the variance. Only pretend play was a unique contributor to the variance in receptive language. See Table 6.

Table 6

Hierarchical regression for receptive language

Receptive language level	Step	B (SE)	β	R^2	ΔR^2
< 2 yrs	1 (constant)	0.28 (3.48)		.06	
	Age	0.12 (0.09)	.25		
	2 (constant)	-0.89 (2.07)		.73**	.67**
	Age	0.01 (0.06)	.02		
	Imitation	0.10 (0.07)	.22		
	Pretend play	0.74 (0.25)	.41**		
	IJA	1.89 (0.69)	.40*		
	IBR	1.23 (1.03)	.17		
	RJA	-3.96 (3.24)	-.17		
\geq 2 yrs	1 (constant)	4.43 (10.09)		.24**	
	Age	0.70 (0.18)	.49**		
	2 (constant)	12.49 (11.02)		.47**	.24**
	Age	0.29 (0.21)	.20		
	Imitation	0.18 (0.15)	.22		
	Pretend play	0.95 (0.31)	.45**		
	IJA	-1.72 (1.30)	-.19		
	IBR	0.88 (1.59)	.07		
	RJA	2.30 (6.58)	.04		

Note. IJA = initiating joint attention; IBR = initiating behavioural request; RJA = responding to joint attention.

* $p < .05$. ** $p < .01$.

Expressive language age < 2 years. Age could not significantly predict expressive language in the group of children with an expressive language age of less than 2 years old, $F(1, 36) = 1.91, p = .18$. A model with the social-communicative abilities accounted for 55 percent of the variance, $F(6, 31) = 6.22, p < .001$. Imitation, IBR and RJA all explained unique variance in expressive language. While imitation and IBR showed positive predictive values, the predictive value of RJA was negative. See Table 7.

Expressive language age \geq 2 years. The model with age explained 20 percent of the variance in expressive language in children with an expressive language level of 2 years and above. The social-communicative abilities added significant variance to that, $F(5, 38) = 5.24, p = .001$. Together with age they explained 52 percent of the variance. Imitation and pretend play were the only significant predictors in this model. See Table 7.

Direct comparison language age effect. To compare the effect of the predictors from models with different language ages, we computed 95 % confidence intervals (CI) of the difference of the standardized betas of the predictors. When 0 was not included in the CI, we could assume that standardized betas were different. In that way we could compare whether the effect of each of the predictors was larger/smaller for children with a receptive or expressive language age below 2 years old than for children with a receptive or expressive language age above the age of two. Results are presented in Table 8.

Table 7

Hierarchical regression for expressive language

Expressive language level	Step	<i>B</i> (<i>SD</i>)	β	<i>R</i> ²	ΔR^2
< 2 yrs	1 (constant)	-0.26 (2.85)		.05	
	Age	0.10 (0.07)	.22		
	2 (constant)	-2.21 (2.26)		.55**	.50**
	Age	0.05 (0.06)	.11		
	Imitation	0.13 (0.05)	.39*		
	Pretend play	0.24 (0.24)	.14		
	IJA	0.19 (0.71)	.04		
	IBR	2.55 (0.60)	.61**		
	RJA	-6.87 (3.26)	-.35*		
≥ 2 yrs	1 (constant)	2.21 (14.04)		.20**	
	Age	0.78 (0.24)	.44		
	2 (constant)	6.01 (14.10)		.52**	.33**
	Age	0.23 (0.25)	.13		
	Imitation	0.44 (0.17)	.44*		
	Pretend play	0.84 (0.33)	.36*		
	IJA	-2.23 (1.41)	-.22		
	IBR	2.12 (1.91)	.15		
	RJA	0.79 (7.26)	.01		

Note. IJA = initiating joint attention; IBR = initiating behavioural request; RJA = responding to joint attention.

* $p < .05$. ** $p < .01$.

Table 8

95% Confidence Intervals for the difference between standardized betas of predictor variables for the receptive and expressive language age groups below versus above 2 years old.

Predictor	Receptive language	Expressive language
Age	[-0.56, 0.20]	[-0.40, 0.36]
Imitation	[-0.45, 0.46]	[-0.50, 0.39]
Pretend play	[-0.44, 0.35]	[-0.61, 0.18]
IJA	[0.19, 0.98]	[-0.14, 0.66]
IBR	[-0.29, 0.48]	[0.07, 0.84]
RJA	[-0.59, 0.15]	[-0.77, 0.04]

Note. IJA = initiating joint attention. IBR = initiating behavioural request. RJA = responding to joint attention.

Results show that IJA explained more variance in the receptive language of children with a receptive language age of less than 2 years old than in children with a receptive language age of 2 years and above. Moreover IBR explained more variance in the expressive language age of children with an expressive language age of less than 2 years old compared to children with an expressive language age of 2 years and older. The predictive value of age, imitation and pretend play was not different in children belonging to different language age groups. Figure 1 provides an overview of associations between social-communicative abilities and language in the different language age groups.

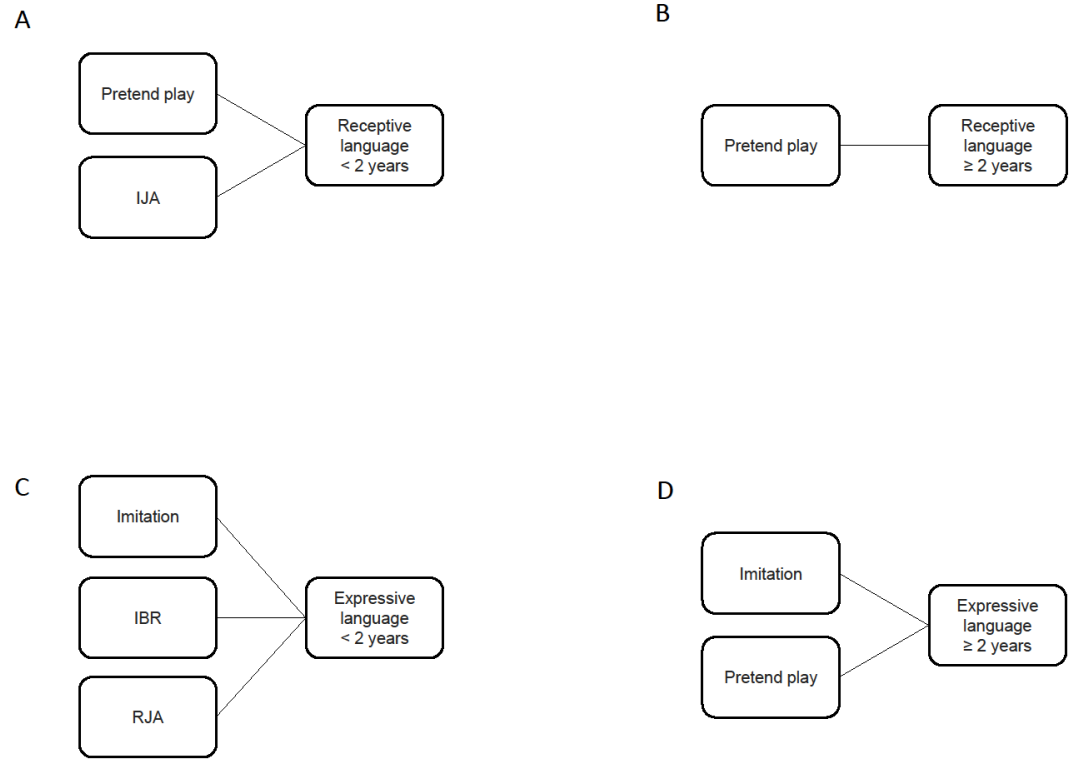


Figure 1. Associations between social-communicative abilities and receptive or expressive language in children with (A) a receptive language age of less than 2 years old, (B) a receptive language age of above 2 years old, (C) an expressive language age of less than 2 years old, (D) an expressive language age above 2 years old.

DISCUSSION

The goal of this study was to look at the associations between social-communicative abilities and language. Our results reveal that relationships are different for receptive and expressive language and also differ greatly depending on the language level of the children.

Receptive language

As shown in Figure 1A, pretend play and IJA both explain unique variance in receptive language in children with a receptive language level of less than 2 years old. In children with a receptive language age above 2 years old, only pretend play explains unique variance in receptive language, as is shown in Figure 1B.

IJA. Previous research pointed to the importance of joint attention for the language development of children with ASD. The association of IJA and receptive language is in line with Charman et al. (2003). However, several other studies that included IJA and RJA, found a unique association between RJA and receptive language, and no association between IJA and language in general (Luyster et al., 2008; Murray et al., 2008; Thurm et al., 2007). Part of the children in these studies had a language age higher than 2 years old. This could explain the different findings because our results show that IJA is a more important predictor for receptive language ability in children with a receptive language age below the age of 2 than in children with a higher receptive language age. An explanation for the importance of IJA for early receptive language, could be that children with ASD especially pay attention to the language of others when they have initiated the joint attention episode. IJA could be an important mechanism in the mapping of words to objects, but seems less important for more complex receptive language skills. We did not replicate the unique association between RJA and receptive language, although we did find a significant correlation. Possibly a complexity measure of RJA (as was used in several previous studies), rather than a frequency measure is more sensitive to capture the unique link of RJA and receptive language.

Pretend play. Our findings reveal that pretend play explains unique variance in receptive language in both language age groups. This could mean that pretend play may be a more important factor for the language development of children with ASD than previously thought (e.g. Lewis, 2003). Pretend play could be particularly related to language understanding because of a common reliance on symbol formation ability. Previous studies with both concurrent (Luyster et al., 2008) and longitudinal (Charman et al., 2003; Stone & Yoder, 2001) designs had not found a unique association between pretend play and language, after controlling for other social-communicative abilities. Other studies did find an association between pretend play and language, under specific conditions. Weismer et al. (2010) found a concurrent association between pretend play and language in children with autism, but not in children with PDD-NOS. Moreover, a study by Toth et al. (2006) revealed an association between pretend play and the rate of communication development, but not with concurrent language. In these studies pretend play was measured less detailed (e.g. with the ADOS) than the other social-communicative abilities, whereas in the present study a more elaborate measurement was used. This could account for the difference.

Expressive language

Figure 1C shows that in children with an expressive language level of less than 2 years old, imitation, IBR and RJA explain unique variance in expressive language. In the children with an expressive language age above 2 years old imitation and pretend play explain unique variance in expressive language.

Imitation. The results concerning expressive language reveal that imitation explains unique variance in expressive language in both children with an expressive language age under and above 2 years old. This indicates that imitation is important at several phases of expressive language development. Previous studies also concluded that imitation was the most important predictor for expressive language abilities (Luyster et al., 2008; Stone & Yoder, 2001; Thurm, Lord, Lee, & Newschaffer, 2007).

The importance of imitation for expressive language development already became apparent both in research focusing on typical development as well as in studies in children with ASD. In typically developing children more frequent vocal imitation of new,

but not of familiar words is associated with a more elaborate vocabulary, suggesting children use vocal imitation as a mechanism to learn new words (Masur & Eichorst, 2002). In the second year of life both motor and vocal imitation are highly frequent in typically developing children in free play interactions with their mothers (Masur & Rodemaker, 1999). Furthermore these authors showed that in the first half of this year, when first words emerge, children mainly imitate the actions of their mothers. In the second half however, when their vocabulary starts to expand more rapidly, vocal imitation becomes more important. Also in children with autism this sequence in which motor imitation precedes vocal imitation and leads to an expansion of the expressive vocabulary has been found (Paul, Campbell, Gilbert, & Tsiouri, 2013). These authors evaluated an intervention strategy to elicit first words in which children were first trained in motor imitation, if necessary. Subsequently they used the Rapid Motor Imitation Antecedent procedure (RMIA): children were first encouraged to imitate a series of simple motor actions, before they were presented with the opportunity to imitate verbal requests or labels. This procedure led to an improvement in the number of spoken words produced by the children. Furthermore both vocal imitation and imitation of actions have been found to be associated with language in children with ASD (Thurm et al., 2007). Taken together these results support the interpretation that imitation is an important mechanism for the expressive language development of children with ASD.

IBR. Apart from imitation, also IBR is associated with expressive language. As was the case with IJA and receptive language, also IBR shows a stronger association with expressive language in children with an expressive language age of less than 2 years old than in children with more complex expressive language skills. Possibly IBR plays a pivotal role in early word learning, but is less central in the development of more elaborate conversational skills. It could be that most children with a language age above 2 have reached a sufficient level of IBR ability, sustaining further language development. In these children variations in pretend play and imitation may be more crucial for the understanding of language differences. In typically developing children IJA was positively related to vocabulary between 6 and 18 months, but not at 21 or 24 months (Morales et al., 2000) and IJA was positively related to language at 21 and 26 months,

but not at 31 months (Vuksanovic & Bjekic, 2013). These studies suggest that also for other joint attention variables associations with language are in particular apparent at younger ages, which is in line with our results.

Previous studies that examined the relationship between joint attention and language have primarily looked at IJA and RJA, not IBR. To our knowledge only one study (Toth et al., 2006) did include IBR as a possible predictor for concurrent language abilities. These researchers did however not find an association between the imperative form of joint attention and expressive language, as in the present study. It is possible that IBR plays a more important role in expressive language development of children with ASD than IJA, because of motivational factors. Possibly children with autism are more motivated to learn new words for instrumental purposes than for the purpose to share their interests with someone else. This explanation corresponds with the social motivation theory of autism which links a lack of social attention early in life to a deprivation of social learning experiences that further negatively impacts social development (Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012). Because most of the children in our sample had spoken language, we expanded the original coding scheme for the ESCS with verbal utterances to share interest or request. The ESCS was originally developed to assess joint attention in children with a mental age of less than 30 months (Mundy et al., 2003). For older children verbal language also becomes an important means of joint attention. In previous studies this was however not taken into account, which could also explain the difference of our findings in comparison to earlier studies.

RJA. Remarkably, while the correlation between RJA and expressive language is low and non-significant, RJA has a negative predictive value in the regression model when included together with IBR and imitation. This deserves further investigation.

Pretend play. In children with an expressive language age above 2 years old besides imitation, also pretend play significantly predicts expressive language. A possible explanation for this association is that children with better pretend play skills are also more skilled in social pretend play, which can provide a context to expand expressive language abilities. Research in children with language impairments suggests that conversations between dyads of children are more elaborate in social pretend play than in other forms of play (DeKroon, Kyte, & Johnson, 2002). Social pretend play emerges

around 24 to 30 months (Howes, 1987), which could explain why pretend play explains unique variance in expressive language of children with a language age above 2 years old, but not in children with a younger expressive language age.

Predictors of language: integration

Taken together, these findings can contribute to our understanding of language development in children with ASD. In neither language age group, chronological age is a significant predictor for language over and above the social-communicative abilities. Moreover, all social-communicative abilities that were measured in this study seem to play a role in language development. However, relationships are specific for receptive and expressive language and differ depending on the language age of the children. While imitation and pretend play show unique associations with language in children with a language age under 2 years old and children with a language age above 2 years old, joint attention abilities are only uniquely associated with language in children with the youngest language age.

These findings are in line with studies on the development of these abilities in typically developing children where imitation and pretend play still show clear development after the age of two and become increasingly complex abilities (e.g. Fein, 1981; Kuczynski, Zahnwaxler, & Radkeyarrow, 1987). Joint attention abilities on the other hand develop especially by the end of the first and in the second year of life (Beuker, Rommelse, Donders, & Buitelaar, 2013). Previous studies had not yet taken into account the effect that the language age of the children may have on these associations. This may be a factor that contributed to contradictory results in previous research.

Clinical implications

Our results are in accordance with the growing body of literature that supports the idea that imitation, joint attention and pretend play are important intervention targets for children with ASD. Given their association with language, one of the most important predictors for the outcome in the long run, stimulating these abilities could also have an effect on language abilities and future development in general. Previous studies indeed

showed improvement in language after a training in one of these abilities (Kasari et al., 2008; Paul et al., 2013). Because they all explain unique variance in language, a training programme that focuses on all abilities at once could even be more beneficial, especially in children with limited language abilities. We showed that IJA and IBR are more strongly related to language in children with limited language abilities, than in children with a language age above the age of 2. This implies that a training in joint attention abilities may especially be important for children with minimal language abilities. For children with somewhat better language abilities, a more direct focus on language itself may be more appropriate.

Strengths and limitations

The current study has taken into account several limitations of previous studies. First, the total sample size and even the number of participants in the subgroups was larger than sample sizes in the majority of earlier studies on this topic. Second, we used a more thorough assessment of the social-communicative abilities than in most of the previous studies. Third, to our knowledge no other study has compared associations between social-communicative abilities and language in different language age groups. However, an important limitation of this study is that we only looked at the concurrent relationships between social-communicative abilities and language. These findings need further replication with a longitudinal design, in which children are followed up throughout several phases of language development.

Conclusion

In summary, this study is to our knowledge the most comprehensive study on the associations between social-communicative abilities and language in children with ASD. We showed that imitation, pretend play, IJA, IBR and RJA are all uniquely associated with language. However, these associations depend on the language level of the children and the specific language ability that is measured. Because language is one of the most important predictors of the future outcome, stimulating social-communicative abilities associated with language development should be an important goal of early intervention in children with ASD.

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**EFFECT OF COMMUNITY INTERVENTIONS
ON SOCIAL-COMMUNICATIVE ABILITIES OF
PRESCHOOLERS WITH AUTISM SPECTRUM
DISORDER¹****ABSTRACT**

Purpose: To evaluate the effect that different intervention methods have on the social-communicative abilities of children with ASD in community settings.

Methods: Intervention based on Applied Behavior Analysis was compared with a more specific intervention programme targeting imitation and joint attention and with treatment as usual in a sample of 85 children with ASD. Objective measures for imitation, joint attention, pretend play, language, autism severity and parent report measures were used to assess the effect of 6 months of intervention.

Results: Results revealed no differences between the intervention methods. There was however great individual variability in outcome within each treatment method.

Conclusion: These results suggest that it is important to focus on “What works for whom” instead of trying to find a one-size-fits-all-treatment for children with ASD.

¹ Based on Van der Paelt, S., Warreyn, P., Roeyers, H. (2014). *Effect of community interventions on social-communicative abilities of preschoolers with autism spectrum disorder*. Manuscript submitted for publication.

INTRODUCTION

A reliable diagnosis of an autism spectrum disorder (ASD) is possible from the age of two onwards (Chawarska, Klin, Paul, Macari, & Volkmar, 2009). Since age at the start of the treatment is an important predictor for the effect of an intervention (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009), it is essential to start the most beneficial treatment soon after diagnosis. Of the available interventions Applied Behavior Analysis (ABA) is widely recognized as one of the most well-established treatments for ASD. Many controlled studies showed gains in language, cognitive and adaptive functioning, following intensive behavioural intervention (e.g. Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Remington et al., 2007; Sallows & Graupner, 2005; Smith, Groen, & Wynn, 2000). Reichow (2012) reviewed 5 recent meta-analyses on ABA and concluded that no other comprehensive treatment model for children with ASD has the same amount of empirical support. Several other reviews also concluded ABA is the treatment of choice for children with ASD (Eikeseth, 2009; Vismara & Rogers, 2010). A few critical comments should however be added to these positive results. Almost all studies in favour of ABA evaluated very intensive programmes, usually of 20 to 40 hours a week. Implementing such programmes on a large scale in clinical practice is difficult because of a lack of financial resources and trained staff. Studies with less intensive forms of ABA (12 to 20 hours) do not seem to be as effective as the traditional type of ABA (Eldevik, Eikeseth, Jahr, & Smith, 2006). Furthermore most studies have looked primarily at the effects of the intervention on cognitive and adaptive abilities. Recently the effect on the core symptoms of ASD has also received some attention (Strauss et al, 2012), but most of the evidence for ABA comes from studies that did not look at the effects on social and communicative abilities. It is also important to note that there has been little attention to variability in outcome. The first results on ABA from the study by Lovaas (1987) already suggested that ABA did not have positive effects for all children with ASD. Some recent studies tried to explain the variability in outcome by looking at factors that predict success of the intervention. Treatment intensity, age, severity of autism and cognitive functioning are all related to outcome (Mazurek, Kanne, & Miles, 2012; Perry et al., 2011; Virues-Ortega, Rodriguez, & Yu, 2013; Zachor & Ben Itzhak, 2010).

Apart from comprehensive treatments like ABA, there is recent attention for specific training programmes in social-communicative abilities. These interventions often also use behavioural techniques, but in a shorter time frame and the number of treatment goals is more limited. Social-communicative abilities are proposed by several researchers as important treatment goals because they are considered to be pivotal areas of development (e.g. Ingersoll & Schreibman, 2006; Whalen, Schreibman, & Ingersoll, 2006). Young children with ASD already show clear deficits in social-communicative abilities such as imitation and joint attention and these deficits are the first to raise parental concern (Kozlowski, Matson, Horovitz, Worley, & Neal, 2011; Paparella, Goods, Freeman, & Kasari, 2011; Vanvuchelen, Roeyers, & De Weerd, 2011a). Because these abilities are important for further language and social-cognitive development (Charman, 2003; Luyster, Kadlec, Carter, & Tager-Flusberg, 2008; Poon, Watson, Baranek, & Poe, 2012), children with ASD will miss chances to develop a range of abilities from early on. Targeting these pivotal developmental behaviours in young children with ASD should help prevent further developmental delays.

Several researchers have shown that imitation and joint attention abilities of children with ASD can improve with a specific training (Ingersoll, 2010; Kasari, Freeman, & Paparella, 2006; Warreyn & Roeyers, 2013). Moreover effects seem to generalize to abilities that have not been targeted. For instance Kasari, Paparella, Freeman, and Jahromi (2008) concluded that children with ASD showed gains in language after a training in joint attention or symbolic play and Ingersoll and Schreibman (2006) found that the effects of reciprocal imitation training generalized to language, pretend play and joint attention. Research also demonstrated that these treatments may also be effective when provided at a low intensity. A study by Goods, Ishijima, Chang, and Kasari (2013) revealed that children who did not respond to ABA after one year of treatment, benefitted from an intervention targeting joint attention, symbolic play, and regulation. Thirty minutes twice a week of their regular ABA-intervention was replaced by the social communication intervention. After 12 weeks these children demonstrated greater play diversity, initiated more interactions and showed more engagement. Moreover, intervention techniques targeting social-communicative abilities can be taught to parents. Several recent studies have shown that parents can use these techniques

effectively and that social-communicative abilities of their children improve more than in children receiving standard care (Casenhiser, Shanker, & Stieben, 2013; Schertz, Odom, Baggett, & Sideris, 2013).

It should be noted however that most of these studies rely primarily on observational methods, not on standardized assessment of the social-communicative abilities. Effects on standardized language and cognitive tests are somewhat mixed, with some studies reporting greater improvement than in standard care (Kasari et al., 2008), and other studies not (Casenhiser et al., 2013; Green et al., 2010).

Although treatments based on ABA and specific interventions for social-communicative abilities are promising, most studies took place in research settings under controlled circumstances. It is also important to look at the effect of interventions when they are being used in clinical practice, because clinicians tend to adapt evidence-based programmes to characteristics of the child or setting (Stahmer, Collings, & Palinkas, 2005). This limits the external validity of randomized controlled trials (RCT), which test the use of an intervention under ideal circumstances, which cannot be achieved in the real world. Results from studies that have compared community-based interventions were not always in favour of ABA and have found similar improvements as in treatment as usual (Magiati, Charman, & Howlin, 2007; Zachor & Ben Itzhak, 2010).

In Belgium, where the present study was conducted, the majority of children with ASD do not have access to intensive early intervention services. Supplementary to regular or special education, children with ASD are entitled to a couple of hours a week of publicly funded intervention. This is usually provided by the multidisciplinary team of a rehabilitation centre, serving children with developmental and learning disabilities. A regular care system with a lack of access to intensive intervention services is not unique to Belgium, and is therefore an important issue that has not received sufficient attention in the international literature. The number of studies that have looked at community interventions in children with ASD is already low, but even less data are available on low-intensive interventions in community settings. To our knowledge no study has looked at the effect of this type of intervention on a broad array of objective measures of social-communicative abilities in children with ASD.

The main goal of the present study was to evaluate the effect of different methods of intervention, used in community settings, on social-communicative and related abilities in young children with ASD. Measures of adaptive behaviour, symptom severity and social-emotional functioning were used in addition to social communication measures, in order to provide a broad picture of children's progress. More specifically intervention based on ABA was compared with a more specific intervention programme targeting imitation and joint attention (JA) and with treatment as usual (TAU), in a large sample of children with ASD receiving community intervention in comparable settings. A second aim was to map the individual variability in the different intervention groups.

METHOD

Participants

Ninety-two children were recruited from 16 publicly funded specialized multidisciplinary treatment centres, for children with developmental disabilities. Children qualified for these services based on a diagnosis of ASD and their need for multidisciplinary intervention (at least by two therapists of a different discipline). The children were diagnosed with ASD by a multidisciplinary team based on DSM-IV-TR criteria (American Psychiatric Association, 2000). Eight children received a working diagnosis (preliminary diagnosis, Charman & Baird, 2002) because they were considered at risk for ASD due to their young age or because they did not meet full criteria. Five treatment centres used ABA, six used a specific training in imitation and joint attention (imitation/JA) and five provided TAU. Since this was a community intervention study, there was no random assignment. Seven children dropped out before the end of the study, because they started special education² ($n = 5$), because of practical issues ($n = 1$) or because parents chose to end the treatment ($n = 1$). These children were excluded from further analysis. The remaining 85 children, aged 22-75 months were divided into three groups, based on the intervention method. Their cognitive level was assessed

² Some treatment centres only provided intervention to children in regular education

before the start of the study by the treatment centre with the Dutch version of one of the following tests: Bayley Scales of Infant Development, second edition (BSID-II-NL; van der Meulen, Rutter, Spelberg & Smrkovsky, 2000; $n = 42$), Wechsler Preschool and Primary Scale of Intelligence, third edition (WPPSI-III; Hendriksen & Hurks, 2009; $n = 13$), Wechsler Preschool and Primary Scale of Intelligence – Revised (WPPSI-R NL; Vander Steene & Bos, 1997; used because the WPPSI-III was not yet available in Dutch in all treatment centres at the time of the assessment, $n = 13$), Snijders-Oomen Non-verbal Intelligence Test – Revised (Tellegen, Winkel, Wijnberg-Williams & Laros, 1998; $n = 14$), Psychoeducational profile – Revised (PEP-R; Pameijer & van Beukering, 2007; $n = 2$) and McCarthy Developmental Scales (MOS; Van der Meulen & Smrkovsky, 1985; $n = 1$). There was no initial difference between the groups in the mean age, $F(2, 82) = 1.77$, $p = .17$, severity of autism symptoms (ADOS; Lord, Rutter, DiLavore & Risi, 1999), $F(2, 82) = 2.52$, $p = .09$, amount of intervention before the start of this study (information provided by the treatment centre), $F(2, 82) = 0.30$, $p = .74$, and the educational level of the parents, $F(2, 82) = 0.34$, $p = .72$ for maternal years of education and $F(2, 82) = 0.44$, $p = .64$ for paternal years of education. Mean scores and standard deviations are presented in Table 1.

Table 1

Child's characteristics and parental education data in the different intervention groups

Characteristic		ABA (<i>n</i> = 20)	Imitation/JA (<i>n</i> = 30)	TAU (<i>n</i> = 35)
Age ^a	Mean (<i>SD</i>)	44.47 (16.28)	51.79 (11.29)	49.09 (13.49)
	Range	21.64-69.40	30.36-71.92	24.41-70.73
Autism severity	Mean (<i>SD</i>)	6.55 (2.21)	5.97 (2.44)	5.23 (1.85)
	Range	1-10	1-10	1-8
Time elapsed since start of the intervention ^a	Mean (<i>SD</i>)	8.12 (11.04)	8.89 (7.06)	7.31 (7.36)
	Range	0.20-41.25	1.15-23.26	0.30-36.38
Maternal years of education	Mean (<i>SD</i>)	13.30 (2.39)	13.00 (2.23)	13.43 (1.87)
	Range	6-17	6-17	12-17
Paternal years of education	Mean (<i>SD</i>)	12.45 (2.01)	13.03 (1.81)	12.91 (2.26)
	Range	6-15	12-17	6-17

Note. ABA = Applied Behaviour Analysis; JA = joint attention; TAU = treatment as usual. ^ain months.

Furthermore the distribution of gender, $\chi^2(2) = 0.49$, $p = .78$, diagnosis, $\chi^2(2) = 2.79$, $p = .25$ and IQ $\chi^2(8) = 13.95$, $p = .08$, was also equivalent in the three groups. The only initial difference between the groups was in type of education, $\chi^2(6) = 24.39$, $p < .001$. The decision about what type of education a child with ASD will follow is usually made based upon the child's ability to function in a group of typically developing children. Children in special education are believed to function better in a smaller group, with more individual support. Most children in the TAU group followed regular education (with and without extra support at school). The children in the imitation/JA group were mainly in regular education with extra support or in special education. The ABA group had a larger part of children who did not go to school yet compared to the other two groups. See Table 2. In all groups a part of the children in regular education received 1:1

intervention at school to help them integrate in a regular school setting. Usually this support is given for 100 minutes a week (in some children 50 or 150 minutes).

Table 2

Distribution of gender, IQ, diagnosis and school placement in the different intervention groups

Characteristic	ABA	Imitation/JA	TAU
Gender			
Male	15 (75%)	24 (80%)	29 (83%)
Female	5 (25%)	6 (20%)	6 (17%)
IQ			
<55	11 (55%)	12 (40%)	4 (11%)
55-70	3 (15%)	7 (23%)	10 (29%)
71-85	3 (15%)	5 (17%)	11 (31%)
86-115	3 (15%)	6 (20%)	9 (26%)
>115	0 (0%)	0 (0%)	1 (3%)
Diagnosis			
Clinical diagnosis	20 (100%)	26 (87%)	31 (91%)
Working diagnosis	0 (0%)	4 (13%)	4 (9%)
Education type			
Regular education	5 (25%)	4 (13%)	14 (40%)
Regular education with support	3 (15%)	13 (43%)	14 (40%)
Special education	4 (20%)	11 (37%)	1 (3%)
Not in school yet	8 (40%)	2 (7%)	6 (17%)

Note. Percentages are within each treatment group. ABA = Applied Behaviour Analysis; JA = joint attention; TAU = treatment as usual.

Interventions

ABA. Therapists were trained in ABA-techniques by a Board Certified Assistant Behaviour Analyst before the start of the study and also received monthly/bimonthly supervision by this person during the period they participated in this study. The training focussed on the verbal behaviour approach (Sundberg & Michael, 2001). This specific type of ABA-intervention is based on the theory of Skinner (1957) who specified different categories of verbal behaviour such as mands (requesting for desired objects and activities), tacts (naming objects), echoics (imitating language) and intraverbals (answering questions). According to the verbal behaviour approach each of these categories should be taught explicitly to children with ASD. For example a child that can tact certain objects, will not automatically be able to mand for those same objects and will need explicit instruction to learn this. Therapists used the Verbal Behaviour Milestones Assessment and Placement Program (VB-Mapp; Sundberg, 2008) to evaluate progress and determine new targets. This program puts an emphasis on language, cognitive and social communication goals (play, imitation, social skills in groups). The verbal behaviour approach combines both incidental teaching as well as discrete trial teaching. Treatment fidelity was checked by the first author through a file the therapists were asked to complete every week, in which they described the amount of time spent on ABA, the goals, methods and behaviour of the child during the sessions. Additionally a video of an intervention session was made to check if the therapists implemented the techniques correctly³. Since this was a community intervention study, it was expected that therapists would adapt the intervention and combine it with other intervention methods (Stahmer et al., 2005). For this reason only broad fidelity criteria were used to check whether the main teaching techniques (such as systematic use of prompts and reinforcement) of ABA were used. All therapists achieved sufficient levels of treatment fidelity. From the written descriptions and the analysis of the video we could conclude that therapists used mainly incidental teaching techniques: they followed the child's lead and used activities/toys the child was motivated for, to prompt for more complex

³ The videos were collected for a separate study on the interaction between therapist and child during an ABA-session (see Chapter 5) and were thus only available for the children in the ABA-group.

behaviours. Therapists used several strategies to provoke communication in the child (e.g. putting objects in the visual field of the child, but out of their reach). When the child initiated communication, therapists used prompts and prompt fading to increase the complexity of the child's communicative attempt. In all children manding was targeted and in the majority of the children this remained the main goal of the ABA-intervention throughout the study. Other goals were determined individually and included imitation (in 65% of the children), play (50%) listener responding (following instructions; in 25% of the children), tacting (in 20% of the children), social skills with peers (in 10% of the children) and intraverbals (in 5% of the children). These skills were taught through differential reinforcement, prompt and prompt fading strategies, reinforcer assessment, following the child's lead and imitating the child. In some children (15%) discrete trial training was used in addition to incidental strategies. In 25% of the children parents attended the ABA-sessions on a regular basis and implemented some of the techniques at home. In addition to the ABA-intervention children in this group received TAU targeting mainly cognitive, language, fine, gross motor and visual-spatial abilities and daily living skills.

Imitation/JA intervention. The treatment centres in this group had previously taken part in a study to test the effect of the imitation/JA-intervention (Warreyn & Roeyers, 2013) and had incorporated the principles of this intervention in their regular care. They all received a training manual with 24 sessions describing specific activities to stimulate imitation (of actions with objects, gestures, body movements and symbolic imitation), following and initiating imperative and declarative joint attention. The training manual briefly described how to use different levels of prompting to increase the imitation and joint attention ability of the children. See Warreyn and Roeyers (2013) for a more detailed description of the intervention. It is important to note that although this intervention method had some similarities with the ABA intervention, such as the use of prompts and rewards, it was also clearly different in a number of ways. First, this intervention used prescribed activities to stimulate imitation and joint attention, while the ABA-intervention used mainly activities for which the child was motivated, to teach new skills. Second, the ABA-intervention relied heavily on the prompt-behaviour-reward sequence which was repeated over and over again, within a session as well as in several

subsequent sessions, until a child could perform a specific skill spontaneously. Prompting had a far less important place in the imitation/JA programme, which focussed more on spontaneous behaviour of the children elicited by the specific situation. Treatment fidelity in the imitation/JA group was also checked through a file the therapists were asked to complete every week, in which they described the amount of time spent on imitation and joint attention, the specific goals, methods, whether they used sessions from the manual and the behaviour of the child during the sessions. The amount of time spent on these goals depended on the individual needs of the children. In most children around 30 minutes a week was dedicated to direct training of these abilities, but imitation and joint attention were also stimulated more indirectly during other activities (e.g. teaching the child to ask for a drink during snack time). Because the aim of the present study was to look at the effect of this training as it was used in practice, the therapists could use the training as they would normally do. In the majority of the children (63%) therapists used a combination of sessions described in the manual and variations on those exercises with other materials. In the other children the same teaching principles were used, but not with the exercises described in the manual. For example, the manual describes several exercises in which the therapist sabotages an activity for the child (e.g. giving the child a broken crayon) and waits for the child to ask for help. Also the therapists that did not follow the manual used this principle (e.g. giving the child an empty cup during snack time). Both describing using specific sessions from the manual and describing similar techniques as in the manual were considered sufficient to achieve treatment fidelity (given the community focus of the study). In addition to imitation and joint attention treatment targeted cognitive, language, fine, gross motor and visual-spatial abilities and daily living skills.

TAU. The majority of the therapy centres of this group used one or more methods designed primarily for children with ASD. They mainly included strategies from the TEACCH-model (in 34% of the children), social skills training with social scripts and role-play (17%) and Hanen (11%). In 34% of the children no ASD-specific method was used. In the last three months before the posttest the therapists of one child had started a training in ABA and started to use some ABA-techniques with this child. A specific training for imitation and joint attention was used with none of the children. This

implicated that the intervention methods in TAU were clearly different from the methods in the other two groups. Cognitive, language, fine, gross motor and visual-spatial abilities and daily living skills were targeted in most of the children. Social-communicative abilities were also mentioned as a treatment goal in all children. In some children therapists targeted play (43%), imitation (20%) and/or joint attention (11%).

Treatment intensity. See Table 3 for an overview of the average distribution of the intervention time in the different groups. The total amount of time spent on 1:1 intervention (in the treatment centre and for some children also at school) was the same in all three groups, $F(2,82) = 2.17, p = .12$. However, the total amount of time in group intervention was not the same in the different groups, $F(2, 82) = 6.10, p = .003$. Games-Howell post hoc procedure (used because of inequality of variances and different sample sizes) showed that children in the ABA group had significantly less group intervention than children in the imitation/JA group, 95% CI of difference [2.84, 111.33], $p = .04$, or TAU group, 95% CI of difference [52.17, 141.90], $p < .001$. There was no difference between the imitation/JA and TAU group, $p = .34$.

Table 3

Average distribution of the treatment time and total weekly treatment duration in the different intervention groups

Intervention type		ABA	Imitation/JA	TAU
ABA-intervention	Individual	42% (27%)	0%	0%
	Group	0%	0%	0%
Imitation/JA training	Individual	0%	14% (8%)	0%
	Group	0%	1% (3%)	0%
Other ASD specific	Individual	1% (4%)	2% (6%)	7% (13%)
	Group	0%	1% (4%)	15% (26%)
General speech-language therapy	Individual	12% (18%)	16% (12%)	20% (19%)
	Group	0%	7% (10%)	5% (7%)
Occupational training	Individual	20% (17%)	19% (11%)	17% (12%)
	Group	0%	4% (9%)	6% (9%)
Physiotherapy	Individual	16% (15%)	15% (12%)	12% (11%)
	Group	2% (6%)	6% (9%)	8% (12%)
School intervention	Individual	6% (15%)	15% (19%)	12% (16%)
	Group	0%	0%	0%
Total intervention time	Individual	178.50 (49.77)	196.67 (77.17)	162.00 (65.70)
	Group	5.25 (12.82)	62.33 (119.49)	102.29 (107.21)
	Total	183.75 (51.55)	259.00 (101.95)	264.29 (117.61)

Note. Percentages are averages and standard deviations (between brackets) within each treatment group. Total intervention time is presented in minutes a week; ABA = Applied Behaviour Analysis; JA = joint attention; TAU = treatment as usual.

Outcome measures

The severity index of the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore & Risi, 1999) was used to assess severity of autism symptoms (Gotham, Risi, Pickles, & Lord, 2007).

The Preschool Imitation and Praxis Scale (PIPS; Vanvuchelen, Roeyers, & De Weerd, 2011b) was used to measure motor imitation. The PIPS consists of 30 items, of which 21 items measure bodily imitation (gestural and facial imitation) and 9 procedural imitation. The bodily imitation scale comprises meaningful (e.g. wave good-bye) and non-meaningful (e.g. place one fist on top of the other) actions. The procedural scale encompasses goal directed (e.g. raise a toy bear by pulling a cord) and non-goal directed (e.g. open a box, turn it upside down and put a block on the bottom of the box) actions.

The structured version of the Test of Pretend play (ToPP; Lewis & Boucher, 1997) was used to assess three main types of pretend play: object substitution, property attribution and reference to an absent object. The test assesses the child's ability to use him/herself as the object of pretend play as well as the ability to use a doll or teddy bear as agent. Moreover the ability to combine play acts into a script is tested. A nonverbal version, in which actions were modelled, was used in children with a language comprehension level of less than 3 years old. In children with a better language comprehension we used the verbal version, in which besides modelled actions, also verbal instructions were used. Every item consists of a part where the child can produce original play and a part where the child is asked to copy a modelled action (e.g. using an ambiguous object as a hat for a doll) or to follow an instruction ("show me the bear is sad").

The abridged version of the Early Social Communication Scales (ESCS; Mundy et al., 2003) was used to measure initiation of joint attention (IJA), initiating behaviour request (IBR) and response to joint attention (RJA). Four different mechanical toys (three wind-up toys and a pop-up puppet) were activated in sight of the children. The experimenter gave each toy to the child when he or she requested it. The child could play with the toy for 30 seconds, after which the experimenter requested the toy back and activated it again. This procedure was repeated with each toy three times. Two of the toys were first

placed in a box that the child could not open by himself and were given to the child in the box in order to elicit requesting to open it. In order to assess RJA four pictures (A4 size) of Winnie the Pooh and friends were placed on the walls right and left of the child, two in their visual field (at approximately 60 degrees from the child's midline) and two behind the child (at approximately 150 degrees from the child's midline). After gaining the child's attention, the experimenter gazed at each of the four posters and said the name of the child three times before looking back to the child. If the child did not follow the gaze of the experimenter to the first two posters, a pointing gesture was added for the last two posters. Children received a score from 0 to 4, depending on the number of posters they followed the gaze and/or point to.

The coding of the ESCS was done with the Observer XT, version 9.0 (Noldus, 2009) by four independent coders. Scores for IJA and IBR were based on frequency counts of nonverbal and verbal communication during the whole observation. Verbal communication was included because we tested children up to 6 years old in our sample. It can be expected that the older children become, the more they will use language as a means for sharing attention. Yoder, Stone, Walden, and Malesa (2009) also used the ESCS to count the frequency of nonverbal and verbal joint attention, (called *unweighted triadic communication*) and showed that the frequency of the unweighted triadic communication remained stable in siblings of children with ASD between 15 and 34 months. Because this is a period in which children become more verbal, these results suggest that the amount of nonverbal joint attention decreased in that same period. It seemed thus important for the present study to use a combined measure of nonverbal and verbal joint attention to be able to draw conclusions on the effect of the interventions on joint attention.

The following nonverbal IJA behaviours were observed: 1) making eye contact with the experimenter to share interest, 2) alternating eye contact between an active/moving toy and the experimenter, 3) proximal or distal pointing with or without eye contact to share interest, 4) showing an object to the experimenter with eye contact. Verbal IJA was defined as using one or more words to share interest with the experimenter. The following nonverbal IBR behaviours were coded: 1) making eye contact with the experimenter to request something, 2) reaching for a toy, with and without eye contact,

3) proximal or distal pointing with and without eye contact to request, 4) giving an object to the experimenter. Verbal IBR was defined as using one or more words to request something. Nonverbal and verbal scores for IJA and IBR were combined in a total IJA score and a total IBR score. Interrater reliability was determined with single measures intraclass correlations (ICCs) by double coding of 25% of the observations. The ICCs were .94 for nonverbal IJA, .96 for verbal IJA, .87 for nonverbal IBR, .91 for verbal IBR and .84 for IJA.

The Reynell Developmental Language Scales – Dutch version (RTOS; Schaerlaekens, Zink, & Van Ommeslaeghe, 2003) was used to assess expressive and receptive language. Normative data, based on a sample of Dutch speaking children, were available.

Parents were asked to fill out a screener version of the Vineland Adaptive Behavior Scales (Scholte, Van Duijn, Dijxhoorn, Noens, van Berckelaer-Onnes, 2008). This questionnaire was used to measure adaptive behaviour.

The Social Communication Questionnaire (SCQ, Rutter, Bailey, & Lord, 2003; Dutch translation by Warreyn, Raymaekers, & Roeyers, 2004) was used as a parent report measure of symptom severity at home.

The total problem score on the Child Behavior Checklist 1^{1/2}-5 years (CBCL, Achenbach & Rescorla, 2000; Dutch translation by Verhulst & van der Ende, 2000) was used as a measure of social-emotional problems at home.

Procedure

Pre-and post-tests were administered in the treatment centres of the children, both on two separate days, with approximately one week in between. The first assessment started with the ADOS, after which the PIPS was administered. The second assessment consisted of the ESCS, ToPP and RTOS, in this order. Both assessments took approximately 60 to 90 minutes. Time between pre- and post assessment was 6 months. The assessment was videotaped and all the tests were scored afterwards from the video.

Parents received the questionnaires from the therapy centre. They were asked to fill them out at home and hand them in afterwards in the therapy centre. 58% of the

parents filled out and returned the questionnaires both at the pre- and posttest. The study design was prospectively reviewed and approved by the Ethics Committee of the Faculty of Psychology and Educational Sciences of Ghent University, where the study was conducted. Parents gave their written consent prior to the inclusion of their children in the study.

RESULTS

Comparison of treatment effect between the intervention groups

We performed two repeated measures MANOVAs with time (pre- versus posttest) as a within group independent variable and intervention group as a between group independent variable. Imitation, pretend play, receptive language, expressive language and ADOS symptom severity were entered as dependent variables in the first analysis. The results from parent questionnaires (adaptive behaviour, ASD symptoms and social-emotional problems) were entered in a separate analysis because these data were not available for all children. Raw scores were used for imitation, pretend play, language and adaptive behaviour because some children had bottom scores on age equivalent scores (AE). Also for social-emotional problems we used the raw scores, because some children were older than the upper age limit of 5. Descriptive statistics for pre- and post measurement in the different intervention groups of all dependent variables are presented in Table 4.

Table 4

Descriptive statistics of the dependent measures at pre- and posttest in the different intervention groups

Measure	ABA		Imitation/JA		TAU		
	Pre	Post	Pre	Post	Pre	Post	
Imitation ^a	Mean (SD)	16.30 (21.10)	23.00 (22.57)	34.80 (24.10)	40.37 (21.91)	39.97 (22.31)	44.69 (19.07)
	Range	0-68	0-66	0-67	0-69	0-78	0-73
Pretend play ^a	Mean (SD)	5.35 (7.49)	8.80 (9.13)	10.33 (8.62)	14.00 (9.25)	13.37 (9.36)	17.17 (9.06)
	Range	0-25	0-27	0-30	0-29	0-33	0-33
Receptive language ^a	Mean (SD)	12.75 (18.42)	20.30 (20.79)	29.27 (21.02)	36.80 (20.37)	36.03 (22.30)	43.31 (19.64)
	Range	0-58	0-64	0-69	0-71	0-69	2-71
Expressive language ^a	Mean (SD)	12.05 (20.68)	17.10 (22.94)	27.03 (23.78)	35.97 (22.76)	34.91 (25.45)	43.37 (22.30)
	Range	0-69	0-65	0-67	0-74	0-75	0-76
ADOS symptom severity	Mean (SD)	6.55 (2.21)	5.70 (1.92)	5.97 (2.44)	5.43 (2.81)	5.23 (1.85)	4.97 (2.18)
	Range	1-10	1-9	1-10	1-10	1-8	1-9
IJA ^b	Mean (SD)	1.81 (2.40)	1.95 (2.02)	2.69 (1.34)	3.26 (2.11)	2.98 (1.55)	3.39 (1.96)
	Range	0.00-9.67	0.00-6.56	0.08-5.33	0.00-7.51	0.24-6.94	0.40-7.56
IBR ^c	Mean (SD)	1.88 (1.40)	2.18 (1.70)	2.10 (1.33)	1.98 (1.37)	2.25 (1.22)	2.27 (1.11)
	Range	0.00-5.66	0.24-6.72	0.45-5.51	0.28-5.71	0.12-5.73	0.22-5.14
RJA ^d	Mean (SD)	.46 (.39)	.43 (.33)	.52 (.29)	.62 (.29)	.60 (.30)	.61 (.30)
	Range	0-1	0-1	0-1	0-1	0-1	0-1
Adaptive behaviour ^a (PR) ^e	Mean (SD)	51.00 (37.31)	56.17 (34.58)	61.24 (28.09)	71.53 (34.76)	68.25 (30.91)	74.80 (27.28)
	Range	8-112	6-118	12-103	6-120	13-118	17-122
ASD symptoms ^a (PR) ^e	Mean (SD)	18.33 (7.79)	18.25 (7.11)	15.94 (6.39)	14.06 (7.27)	16.65 (6.12)	15.05 (5.46)
	Range	6-27	7-28	5-26	1-28	6-30	6-29
Social-emotional problems ^a (PR) ^e	Mean (SD)	58.58 (29.49)	58.17 (31.21)	52.00 (21.38)	49.82 (22.36)	62.40 (27.31)	63.25 (27.28)
	Range	15-111	16-114	15-86	9-80	26-121	19-112

Note. ^a Raw score. ^b Rate per minute of Initiation Joint Attention. ^c Rate per minute of Initiating Behavioural Request.

^d Proportion of Responding to Joint Attention. ^e Parent report

The repeated measures MANOVA with the test results as dependent measures revealed no interaction between intervention group and time, which means that the progress children made, was not different in the three intervention groups, $F(16, 152) = 0.59, p = .89$. There was also no main effect of intervention group, which shows the groups did not have significantly different scores on these measures, irrespective of the progress they had made during the intervention phase, $F(16, 152) = 1.41, p = .14$. However, there was a main effect of time, indicating that irrespective of the intervention group, post scores differed significantly from pre scores, $F(8, 75) = 14.69, p < .001, \eta^2 = .61$. Univariate analyses showed a significant increase in imitation, $F(1, 82) = 20.59, p < .001, \eta^2 = .20$, pretend play, $F(1, 82) = 38.86, p < .001, \eta^2 = .32$, receptive language, $F(1, 82) = 99.70, p < .001, \eta^2 = .55$, expressive language, $F(1, 82) = 47.68, p < .001, \eta^2 = .37$, and IJA, $F(1, 82) = 4.01, p = .048, \eta^2 = .05$, and a significant decrease in ADOS severity score, $F(1, 82) = 5.32, p = .02, \eta^2 = .06$. There was no significant difference between pre- and posttest in IBR, $F(1, 82) = 0.22, p = .64$, or RJA, $F(1, 82) = 0.50, p = .48$.

The repeated measures MANOVA with the parent report variables also showed no difference in the progress of the three intervention groups, $F(6, 90) = 0.47, p = .83$, and no difference between the groups, irrespective of time, $F(6, 90) = 1.00, p = .43$. Again, there was a significant main effect of time, $F(3, 44) = 6.18, p = .001, \eta^2 = .30$. Univariate tests revealed a significant increase in adaptive behaviour, $F(1, 46) = 16.48, p < .001, \eta^2 = .26$, and a marginally significant decrease in ASD symptoms, $F(1, 46) = 3.87, p = .06, \eta^2 = .08$. There was no difference between pre- and posttest in social-emotional problems, $F(1,46) = 0.04, p = .84$.

Individual variability

For imitation, pretend play, language abilities and adaptive behaviour (parent report) AE scores were available, making it possible to compare the progress children had made with a normal developmental path. Difference scores of the pre- and post AE scores were computed for each of these abilities. For each intervention method we categorized each child in one of four groups, based on the progress they had made. A distinction was made between children who declined, made limited progress (0-2 months progress in AE in a 6-month-period), moderate progress (3-5 months progress in AE in a 6-month-

period) or followed a normal developmental path/progressed faster than the average normal developmental path (≥ 6 months progress in AE in a 6-month-period). Figure 1 shows the percentage of children in each group for imitation (a), pretend play (b), receptive language (c), expressive language (d) and adaptive behaviour (e). The graphs show that for all abilities measured and in all the intervention groups, there was clear variability in outcome. It is apparent that for each of the abilities and in each intervention group a substantial number of children either declined (between 5% and 35% depending on the specific ability and intervention method) or made limited progress (between 7% and 70% depending on the specific ability and intervention method), but also a substantial number progressed at an age-equivalent developmental rate or even faster (between 20% and 63% depending on the specific ability and intervention method). For pretend play, receptive and expressive language only a minority progressed at a moderate rate (most percentages between 6% and 14%, except for receptive language in the TAU group 34%). For imitation and adaptive behaviour this group was larger, but still consisted of less than one third of the children (between 18% and 33% depending on the specific ability and intervention method). The distribution of the amount of progress was not different in the three intervention groups for imitation, $\chi^2(6) = 6.99, p = .32$, pretend play, $\chi^2(6) = 6.55, p = .37$, expressive language, $\chi^2(6) = 5.76, p = .45$, and adaptive behaviour, $\chi^2(6) = 2.96, p = .81$. There was however a difference between the groups in the distribution of the progress in receptive language, $\chi^2(6) = 15.82, p = .02$. Children in the TAU group were equally distributed in minimal, moderate and age-equivalent progress, whereas the majority (65%) of the children in the ABA group showed minimal progress and most children in the imitation/JA group either showed minimal (33%) or age-equivalent (50%) progress

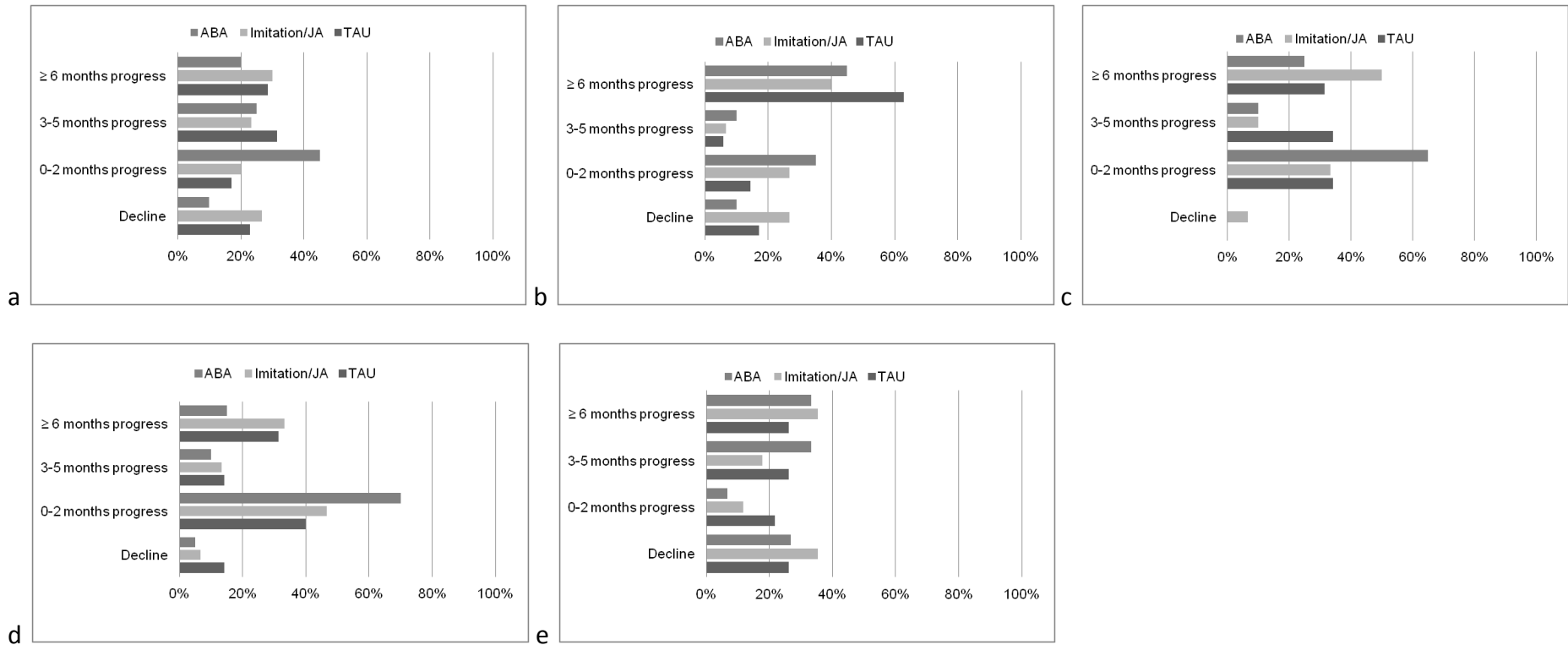


Figure 1. Percentage of children in each of the different outcome categories in the Applied Behaviour Analysis (ABA), Imitation/Joint attention (Imitation/JA) and Treatment as usual (TAU) intervention groups for imitation (a), pretend play (b), receptive language (c), expressive language (d) and adaptive behaviour (e)

Besides a categorisation for each outcome measure separately, it seemed relevant to make a global categorisation to describe the progress children made in general. The categorisation was done post-hoc and was based on the AE scores for imitation, pretend play, receptive and expressive language. The Vineland was not used here because these data were missing for part of the children. The resulting (mutually exclusive) categories were as follows:

- (1) *Good progress*: These children followed for at least three of the four outcome measures a normal developmental path or faster (≥ 6 months progress in AE in a 6-month-period).
- (2) *Moderate – good progress*: These were children who made moderate progress (3-5 months progress in AE) on at least three outcome measures or made moderate progress on two outcome measures and followed a normal developmental path or faster on the other two outcome measures.
- (3) *Mixed*: These children followed a normal developmental path or faster on one or two outcome measures, but made limited (not more than 2 months progress in AE) or no progress or even deteriorated on at least one other outcome measure.
- (4) *Limited – moderate progress*: These children made moderate progress on one or two outcome measures and limited progress, no progress or deteriorated on the other outcome measures.
- (5) *Limited progress*: These children made either limited progress, no progress or deteriorated on each of the four outcome measures.

Figure 2 shows the percentage of children in each outcome category for the three intervention groups.

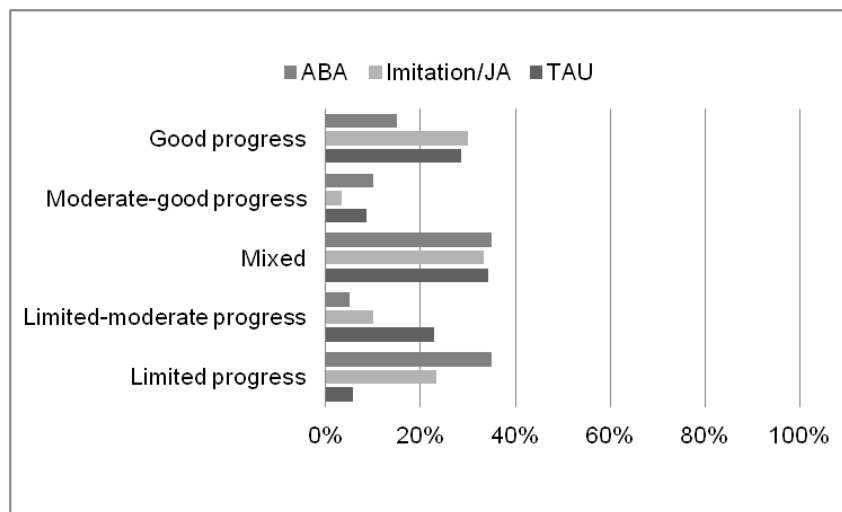


Figure 2. Percentage of children in each of the different global outcome categories in the Applied Behaviour Analysis (ABA), Imitation/Joint attention (Imitation/JA) and Treatment as usual (TAU) intervention groups

The graph shows that the largest part of the children either made good progress (26% of the total group), limited progress (19% of the total group) or showed a mixed profile (34% of the total group). Few children made predominately moderate progress (with 7% of the total group in the moderate to good and 14% in the limited to moderate categories). The distribution of the amount of progress was not different in the three intervention groups, $\chi^2(8) = 11.90, p = .16$.

Predicting outcome

Because we found no difference in the average scores for the different intervention groups, we additionally performed a multinomial logistic regression analysis to explore possible factors contributing to the individual variability in the global outcome categorisation. We chose a model with the global progress categories over several multiple regression analyses with the different outcome measures as dependent variables to avoid making type-I errors due to multiple testing and because predicting the global categorisation seemed more clinically relevant. Age, IQ-category, autism severity and treatment intensity (total number of hours of intervention a week, number

of hours of 1:1 intervention and number of months in intervention before the start of the study) were chosen as predictors because previous research pointed to these variables as predictors of the outcome of an intervention. Moreover, since there was a significant difference in the distribution of the education types in the three intervention groups, we also assessed whether children in different types of education (regular education, regular education with support, special education, not in school yet) progressed in different ways. Intervention group and the interactions between each of the continuous predictors and intervention group were added to test for the possible moderating effect of the intervention group (different effect of predictors on outcome for children who received a different intervention). In order to comply with the assumptions of logistic regression, two adaptations were made. First, we merged the moderate to good and good progress categories, and also the limited to moderate and limited progress categories. This was done to assure that there would be enough observations in each cell of the IQ-category * progress-category-matrix, education-category * progress-category-matrix and intervention group * progress-category-matrix. Second, age was omitted as predictor because this predictor violated the linearity-assumption (there was no linear relationship between age and the logit of the outcome variable). IQ, intervention-group, autism severity, total number of hours of intervention, number of hours of 1:1 intervention and amount of intervention before the study started were forced into the model. Education type and the interaction between the intensity variables and autism severity with the intervention group were entered in a second step with the forward entry method (only variables that significantly improve the predictive ability of the model are added).

The multinomial regression analysis showed that the only significant predictors in the final model were IQ, $\chi^2(6) = 21.04$, $p = .002$ and education type, $\chi^2(6) = 17.02$, $p = .01$. Parameter estimates of the final model showed that children with an IQ below 55 were less likely to belong to the mixed progress group, than the least progress group, in comparison to children with a normal IQ, $\chi^2(1) = 4.57$, $p = .03$. The odds ratio was 0.09 (with a 95% CI of [0.01, 0.82]). Moreover, children with an IQ below 55 were also less likely to belong to the best progress group, than the least progress group, in comparison to children with a normal IQ, $\chi^2(1) = 3.75$, $p = .05$. The odds ratio was 0.10, with a 95% CI

of [0.01, 1.03]. There were no other significant IQ effects. Further, parameter estimates for education type, showed that children in special education were more likely to belong to the mixed progress group than the least progress group, in comparison with children that did not go to school, $\chi^2(1) = 4.30, p = .04$. The odds ratio was 13.97, with a 95% CI of [1.15, 196.16]. There were no other significant education type effects. There was no significant contribution to the model of total number of hours of intervention, $\chi^2(2) = 3.89, p = .14$, number of hours of 1:1 intervention, $\chi^2(2) = 0.68, p = .71$, number of months in intervention, $\chi^2(2) = 0.52, p = .77$, autism severity, $\chi^2(2) = 0.92, p = .63$ or intervention group, $\chi^2(4) = 3.37, p = .50$.

DISCUSSION

The first goal of the present study was to compare the effect of different methods of intervention, used in community settings, on social-communicative abilities in young children with ASD. Our results reveal that on average there is no difference between the intervention methods in the amount of progress children make with respect to their social-communicative abilities in a 6-month-period. This is in contradiction with several previous studies that have found that ABA (Eikeseth, Smith, Jahr, & Eldevik, 2002; Eldevik et al., 2006; Howard et al., 2005; Strauss et al., 2012) or interventions targeting imitation or joint attention (Casenhiser et al., 2013; Schertz et al., 2013; Warreyn & Roeyers, 2013) were more effective in stimulating these abilities than TAU. There are several possible explanations for the lack of difference between the interventions. First, we studied the interventions in a community setting, where it is more difficult to clearly distinguish one method from another than when using an RCT. Clinicians tend to adapt evidence-based interventions and often use combinations of interventions, with a varied level of scientific support (Stahmer et al., 2005). Indeed, also in the present research few therapists in the imitation/JA group exactly followed the intervention manual they were given. Instead, most therapists only used part of the sessions described in the manual, supplemented with variations to the sessions with other materials. Moreover, the goals targeted in the three intervention groups were partly similar, with social-communicative abilities being targeted in almost all children. This means that despite the clear

differences between the intervention methods, they also had similarities which could have been responsible for the similar effect observed with all three methods. Our results are in line with previous studies that also found no difference between ABA and TAU in community settings (Magiati et al., 2007; Zachor & Ben Itzhak, 2010).

A second factor, that could explain the lack of difference found in the present study, is the low treatment intensity. Previous studies (Mazurek et al., 2012; Virues-Ortega et al., 2013) have shown that the treatment intensity is associated with the amount of progress children make. Moreover Eldevik et al. (2006) found that less intensive ABA (12 to 20 hours a week) is not as effective as the traditional 40 hours a week of ABA-intervention. In the present study children in the ABA group only received one hour of ABA-intervention a week on average (maximum 4.5 hours a week). Since ABA is a method that relies heavily on the repetition of the prompt-behaviour-reward-sequence, it is plausible that one hour per week does not give a child with ASD an adequate amount of opportunities to practice the skills that are being taught. Moreover imitation and joint attention were on average targeted for only 30 minutes a week in the imitation/JA group. Although previous studies have shown that also low-intensive interventions can lead to a bigger improvement in social-communicative abilities compared to TAU (Goods et al., 2013; Warreyn & Roeyers, 2013), it is plausible that a more intensive training of these abilities would be more likely to reveal differences with TAU.

Third, if children in the TAU group make on average the same amount of progress than children receiving ABA and imitation/JA interventions, this could point to a good quality of regular care for children with ASD in Flanders (the Dutch speaking part of Belgium, where the study took place). Support for this claim can be found in the significant progress that children in the TAU group have made on most outcome measures, which contrasts with several previous studies that found no progress or even a deterioration in TAU (Casenhiser et al., 2013; Eikeseth, 2009; Eldevik et al., 2006; Howard et al., 2005; Schertz et al., 2013). However, we cannot be sure that the participating centres of the TAU group are representative of regular care in Flanders. There could be a selection bias, with centres providing more than average quality of care to children with ASD, being more willing to participate in the study. Either way, since

children in the TAU group made substantial progress, it was more difficult to find a significant difference with the imitation/JA and ABA interventions.

Even though the intervention was less intensive than interventions in a lot of earlier reported studies, we found significant progress on almost all dependent measures, irrespective of the method. Especially the decrease in the ADOS severity score is remarkable, since several previous studies with more intensive interventions, failed to show a decrease in symptoms of ASD on the ADOS (Green et al., 2010; Zachor & Ben Itzhak, 2010). The majority of the studies on early intervention use cognitive and adaptive behaviour and sometimes also language as outcome measures. The present study is one of the first to show significant progress with a low-intensive intervention on a comprehensive standardized assessment battery of social-communicative abilities in a large sample of preschoolers with ASD.

A second goal of the study was to assess the individual variability in outcome. We found clear individual variability for all outcome measures, for which AE scores were available. There was no difference between the intervention groups in the distribution of the amount of progress for four out of five outcome measures. Only the distribution of receptive language differed. Half of the children in the imitation/JA group progressed at a rate equivalent to normal development or faster. This is in line with studies showing a collateral effect of training imitation and joint attention on language (Kasari et al., 2008; Whalen et al., 2006). However, also 40 percent of the children in this group made very limited progress or declined on receptive language, which means that the training did not have the same effect on all children. In the ABA-group 65 percent made no progress or limited progress on receptive language, while only 25 percent progressed at a normal rate. Although on average there was no significant difference on any of the outcome measures between the groups at the start of the study, the ABA-group had the largest part of children who had no spoken language at the pre-test and showed no or limited receptive language skills. Before receptive language could be stimulated in these children, certain other skills (for example basic interaction skills and joint attention) may have had to improve first. This could account for the large part of children of the ABA-group making limited progress on receptive language.

Also the general categorisation of children, taking into account progress on imitation, pretend play and language, shows clear individual variability. The large individual variability could imply that there are good and poor responders to each of the intervention methods. Children who manage to make the same amount of progress or even more than typically developing children on social-communicative abilities are children who seem to respond well to the intervention. In general, 26 percent of the children made good progress on most outcome measures. Thirty-four percent showed a mixed profile, with good progress on some but very little or no progress on other outcome measures. Possibly the limited intensity of the intervention implies that therapists can only target some of the social-communicative abilities at once in the 6-month-period, which could explain the discrepancy in the progress in this group of children. However, there is also a substantial part of the children (19 percent) that made little or no progress or even deteriorated on imitation, pretend play and language. It seems thus important to gain more information on the characteristics of these good and poor responders. Possibly these are different for several intervention methods, making it crucial to focus future research on the question “What works for whom?” instead of trying to find a one-size-fits-all-treatment for children with ASD.

Few studies report on the individual variability of outcome in community interventions, making it difficult to compare our results. An exception is the study by Perry et al. (2008), who divided 332 children in several categories based on their outcome after completion of an intensive ABA intervention in community settings. Although this study used different outcome measures (autism severity, cognitive and adaptive functioning) and the intervention was much more intensive, the results are quite similar to ours. They found that 25 percent of their sample made clear improvement (had typical rates of development or better and a decrease in autism severity), 41 percent moderate improvement (rate of development between .50 and average or significant improvement in autism severity) and 33 percent minimal improvement or deterioration (rate of development of less than .50 and no improvement in autism severity).

Remarkably only a minority of the children in our study belonged to the category that made predominantly moderate progress. This has important implications, because

a lot of the research on early intervention in ASD bases its conclusions on group-averages. If few children are average, conclusions based on averages may be less informative. It seems crucial for future research to take into account more the variability in outcome.

Our results show that part of the variability in progress can be explained by differences in IQ and education type. That IQ is a significant predictor for the outcome of an intervention replicates earlier studies (e.g. Mazurek et al., 2012; Perry et al., 2011). In our sample especially children with an IQ below 55 had a smaller chance of making moderate or good progress compared to children with an average IQ. To our knowledge no study before compared children with ASD in regular and special education to children who do not go to school. Our results reveal that children with ASD who do not go to school yet, have a higher chance at making minimal progress compared to mixed progress (good progress on some, but limited progress on other outcome measures) than children in special education. A possible explanation for this finding could be that children who do not go to school receive substantially less stimulation of their social-communicative abilities, which could lead to a lesser amount of progress. An alternative explanation is that these children are less used to following instructions, which leads to less cooperation during testing. However, causal inferences cannot be made from this kind of analysis, which implies that a third unknown factor related to the education type, could also be responsible for the results. There was only a significant difference between no education and special education, not between no education and regular education. This could have been caused by a more even distribution between mixed and good progress in the children who attended regular education, while children in special education were more in the mixed category. The different progress dependent on education type is an important finding, given the differences in distribution of education types in the intervention groups. The ABA group had more children who did not go to school yet, which may have influenced the results. The predictive value of the intensity of the intervention that was found in previous studies was not replicated here. A possible explanation of this result is that relatively small differences in intensity (e.g. one hour more or less) do not have an equally big impact on the outcome as the larger differences in intensity that were reported in other studies (e.g. Mazurek et al., 2012).

Whether age could predict the progress children made, could not be assessed, since the assumption of linearity was not met. Possibly the relationship between age and progress is non-linear with peaks in progress at certain ages.

A limitation of the present study is that since random assignment was not possible, we cannot assure that the three groups differed only on the intervention method. There was however no bias in the allocation to the treatment groups, because parents chose for a particular treatment centre based solely on the place of residence. Moreover, we showed that the treatment groups did not differ significantly on any of the outcome measures at the start of the study. However, we should note that the p-levels of the tests concerning the pre-existing differences between the groups on the outcome measures, age and IQ were all below .20, which is too low to conclude that the groups were well-matched. Although there were no average age differences, the youngest child in the imitation/JA group was already 30 months, while the youngest children in the ABA and TAU group were respectively 22 and 24 months old. Moreover, there were differences in education type, which is a factor that was associated with overall progress. Although quasi-experimental designs have obvious disadvantages, the benefit of studying interventions in the real world is that it maximizes external validity. RCT's are important in showing the effect of an intervention under ideal circumstances. It is however equally important to show that a treatment is effective in a naturalistic setting, where circumstances are seldom ideal.

Second, since there was no comparison group which received no treatment, we cannot be sure that the progress we observed was caused by the treatment and not merely by maturation. However, the significant decrease in symptoms of ASD after only 6 months of intervention, does not seem to be the result of maturation. Moreover, a substantial subgroup made progress in social-communicative abilities at the same rate as typically developing children, which is not what one would expect without intervention, given that these abilities are generally impaired in children with ASD (Jarrold, 2003; Paparella et al., 2011; Vanvuchelen et al., 2011a).

A third limitation is the rather low response rate on the parent questionnaires. We cannot rule out that parents who were more motivated to fill out questionnaires differ in some respects from parents who did not fill out the questionnaires. For example this

could be parents that were more involved with the intervention of their children or parents that were higher educated, which are factors that could have an influence on the progress children make. Fourth, the assessments were conducted by the first author or one of three research assistants. Only the research assistants were blind for the treatment group. A last limitation is the rather small sample size of the subgroups, especially of the ABA group. A study with a larger sample size would have had more power to detect differences between the intervention groups. Given the large p-values for the repeated measures analyses of the interaction between intervention group and time, it seems however highly unlikely that the lack of difference in treatment effect can be attributed to limited power. On the other hand, a larger sample size would have been useful to assess the effect of the intervention method as a moderator in the regression model. We found no significant moderating effect of intervention group, but cannot exclude that this was not due to limited power.

This study has important implications for clinical practice. First of all, it does not seem beneficial to add low intensity ABA or imitation/JA intervention to TAU for all children with ASD. However, adding these interventions can possibly lead to better results for a subgroup of children. Therefore more research is needed to define the characteristics of those children. Second, there is a substantial number of children that makes limited or no progress. Possibly these children would benefit from a more intensive intervention or would make more progress with a different intervention method. Future research could address this question by studying poor responders and looking at the effect of changes in treatment intensity and method. Clinicians can address this issue by regular evaluation of the treatment effect and adapting the intervention method used, when progress fails to occur.

Concluding, on average there is no different effect of low-intensive ABA, imitation/JA training and TAU used in community settings after 6 months intervention on social-communicative abilities, symptoms of ASD, adaptive behaviour and social-emotional functioning. On average children in all three groups made significant progress on imitation, pretend play, IJA, receptive and expressive language and adaptive behaviour and showed a decrease in autism severity. There was however great individual variability in the outcome in all three intervention groups. While a substantial proportion of

children made good progress, there was a subgroup that made hardly any progress. It seems important to focus on “What works for whom” instead of trying to find a one-size-fits-all-treatment for children with ASD.

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CHAPTER 4

PROJECT IMPACT INTERVENTION: PARENT TRAINING IMPROVES THE SOCIAL- COMMUNICATIVE ABILITIES OF NONVERBAL CHILDREN WITH AUTISM SPECTRUM DISORDER¹

ABSTRACT

Purpose: This study investigated the effect of Project ImPACT, a comprehensive parent-implemented intervention programme to stimulate social-communicative abilities in preschoolers with autism spectrum disorder (ASD).

Method: Participants were four families with a child with ASD, below the age of 4. A multiple baseline design was used to assess the effect of the intervention on children's social engagement, communication, imitation, play and parents' synchronous communication. These outcome measures were supplemented with pre-post parent report measures. Allocation of the participants to the different baseline lengths happened at random.

Results: Social engagement, communication, imitation and play improved in all children after the start of the intervention. Moreover parents showed more synchronous communication than before the intervention started. There was however individual variability in the magnitude of the changes and in the extent to which changes remained during follow-up.

Conclusions: The present study confirms that the Project ImPACT parent training is an effective intervention programme for nonverbal children with ASD. Further research in a larger sample is necessary to provide information on the generalizability of these findings. The intervention has the potential to become a cost-effective alternative for intensive intervention programmes implemented by therapists.

¹ Based on Van der Paelt, S., Warreyn, P., Roeyers, H. (2014). *Project ImPACT intervention: Parent training improves the social-communicative abilities of nonverbal children with autism spectrum disorder*. Manuscript submitted for publication.

INTRODUCTION

Social-communicative abilities have been proposed to be important intervention targets for preschoolers with autism spectrum disorder (ASD; e.g. Ingersoll & Schreibman, 2006; Kasari, Freeman, & Paparella, 2006). First, impairments in these abilities are among the first signals of ASD (Dereu et al., 2010; Wetherby et al., 2004). Second, abilities such as imitation, joint attention and pretend play are related to later social, social-cognitive and language development (Charman, 2003; Poon, Watson, Baranek, & Poe, 2012). Third, research revealed that these abilities can be taught successfully with specific trainings and improve related abilities (Kasari, Paparella, Freeman, & Jahromi, 2008; Warreyn & Roeyers, 2013; Whalen, Schreibman, & Ingersoll, 2006).

Training programmes targeting social-communicative abilities often use behavioural intervention principles. In general, Applied Behaviour Analysis (ABA) is considered the treatment of choice for children with ASD (Eikeseth, 2009; Vismara & Rogers, 2010). However, in the majority of the studies that proved ABA to be superior to treatment as usual the intervention was intensive. This is important, since it has been shown that the success of an intervention is related to the amount of hours per week that it is provided (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009). Worldwide, only few children with ASD have access to such programmes that provide 20 to 40 hours of 1:1 intervention a week (Cassidy, McConkey, Truesdale-Kennedy, & Slevin, 2008; Mackintosh, Goin-Kochel, & Myers, 2012; Raz, Lerner-Geva, Leon, Chodick, & Gabis, 2013; Salomone et al., 2013). In Belgium, where the present study was conducted, most children with ASD receive only a couple of hours of individual intervention a week (Van der Paelt, Warreyn, & Roeyers, 2014). It is therefore important to find alternative ways to stimulate social-communicative abilities from early onwards in children with ASD.

Parent training appears to be a cost-effective and more generally applicable alternative for intensive 1:1 intervention. Young children spend a great amount of time with their parents. By teaching parents techniques to stimulate social-communicative abilities in daily routines, intervention intensity can increase substantially. An additional benefit is that parents can stimulate these social-communicative abilities in a range of different situations, which facilitates skill generalization. This is essential because

generalization of skills that are learnt through intervention with a professional therapist to daily life is often difficult to accomplish in children with ASD (National Research Council, 2001). Moreover, parent training has also been proven to reduce stress in parents of children with ASD (Keen, Couzens, Muspratt, & Rodger, 2010). A comprehensive parent-training programme targeting several social-communicative abilities seems beneficial, given the clear deficits that children with ASD show in each of these areas (Lam & Yeung, 2012; Paparella, Goods, Freeman, & Kasari, 2011; Vanvuchelen, Roeyers, & De Weerd, 2011).

Intervention techniques can be taught successfully to parents and several abilities of children with ASD – such as directed positive affect, initiating and responding to joint attention, imitation, play diversity, receptive and expressive language – can improve significantly (Casenhiser, Shanker, & Stieben, 2013; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Rogers et al., 2006; Schertz, Odom, Baggett, & Sideris, 2013; Siller, Hutman, & Sigman, 2013; Wainer & Ingersoll, 2013). However, the majority of these studies tested specific intervention programmes targeting mainly joint engagement, language, or, to a lesser degree, imitation. Only a limited number of intervention programmes for parents are more comprehensive and focus on a variety of social-communicative abilities as well as on language. The parent training programme of Aldred, Green, and Adams (2004), for example, targeted joint engagement, language and play. Their participants showed a significant improvement on reciprocal social interaction, language, communicative initiations and parent-child interaction. Most of the social communication intervention programmes for parents use mainly developmental strategies, whereas there is in general more evidence for the efficacy of a behavioural approach in children with ASD.

The aim of the present study was to test the effect of a comprehensive parent-implemented intervention programme for preschoolers with ASD. Project ImPACT (Improving Parents As Communication Teachers) is a parent training curriculum that was developed to teach parents developmental and naturalistic behavioural techniques to improve the social-communicative abilities of children with ASD (Ingersoll & Dvortcsak, 2010). A pilot study conducted by one of the authors of the programme showed that parents can effectively use the intervention strategies and that parents and teachers

report significant improvement of the social-communicative abilities. Moreover the frequency of the verbal utterances of the children improved during free play and during a home-based routine (Ingersoll & Wainer, 2011). However, the lack of a control group and the use of predominately parent and teacher report measures limit the conclusions that can be drawn from this study. A more recent study with a multiple baseline design confirmed these results by showing that spontaneous language of the children started to improve soon after the start of the intervention and was dependent upon parents' treatment fidelity (Ingersoll & Wainer, 2013). However, Project ImPACT is designed to target not only language, but also social engagement, imitation and play. It therefore seems important to test the effect of the intervention on these abilities using both a design with experimental control and a more objective measurement than only parent or teacher report. The study by Ingersoll and Wainer (2013) showed no improvement in the two children (out of eight) who were not using spoken language before the start of the study. The question remains thus to what extent project ImPACT can improve basic social-communicative abilities in nonverbal children with ASD.

The present study used a multiple baseline design to assess on a regular basis the evolution of social engagement, communication, imitation and play before, during and after implementation of the intervention. That way we aimed to obtain detailed information on the influence of Project ImPACT on each of these intervention targets. As discussed by Byiers, Reichle, and Symons (2012) controlled single subject designs are a useful alternative to randomized controlled trials, because they can provide a systematic evaluation at an individual level. We hypothesized that the social-communicative abilities of the children would improve during the intervention. A second goal was to assess whether the parents would increase their synchronous behaviour, since following the child's attention focus (instead of trying to direct the attention and behaviour of the child) forms the basic technique of the intervention. The amount of synchronization in parents of children with ASD is predictive of later language and joint attention abilities, which suggests that it is an important skill for parents of children with ASD to master (Siller & Sigman, 2002). A third goal of this study was to evaluate parental satisfaction with the intervention.

METHOD

Participants

Four children with ASD and their parents participated in this study. They were diagnosed based on DSM-IV-TR criteria (American Psychiatric Association, 2000) by specialised diagnostic agencies. In three children (Child 2, 3 and 4) the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore & Risi, 1999) was administered before they participated in this study. They scored above the cut-off for autism. The cognitive level of two participants was assessed with the Bayley Scales of Infant Development II (BSID-II-NL; van der Meulen, Rutter, Spelberg, & Smrkovsky, 2000) at the diagnostic agency. In the two others the BSID-II-NL could not be completed because the children refused to cooperate. The families were recruited through a service for home guidance for parents of children with ASD. Families on the waiting list of that service with a child below the age of six were invited to participate in the study. They were invited for an intake by the service where they were informed about the possibility to take part in this study. The first four families that were informed about the study, agreed to participate. All parents signed an informed consent form.

Child 1. The first participant was a boy of 3 years and 7 months at the start of the study. He was an only child. Both of his parents participated in the study. His cognitive level could not be assessed at the diagnostic agency because he did not cooperate when they tried to take the BSID-II-NL. He had a visual disability, which caused limited vision. Parents reported limited social engagement (e.g. did not initiate contact with them, did not like to play near them, but could enjoy social games sometimes). Child 1 did not use any verbal language, but started to use some communicative gestures when prompted. His imitation abilities were limited. His play was mainly exploratory, but sometimes he played at a combinational or cause-and-effect level. There was no functional or symbolic play. He followed special education for children with a visual or auditory disability and received no specific early intervention services for children with ASD.

Child 2. Child 2 was a boy of 2 years and 8 months. He did not have siblings. Both parents participated in the study. The BSID-II-NL could not be completed because the child refused to do most of the tasks. Parents reported that there was some social

engagement (e.g. initiating contact with parents and frequent eye contact) but that it was difficult to remain actively engaged with him for more than a couple of minutes. Child 2 did not use any verbal language or communicative gestures. He seldom imitated his parents and played exploratory or with cause-and-effect-toys, but not functionally or symbolically. Child 2 did not attend school yet. He received early intervention services for two hours a week at a rehabilitation centre, serving children with developmental disabilities.

Child 3. This boy was 1 year and 11 months old. He was part of a non-identical twin and also had a brother of 3 years old. His parents were divorced. He lived with his mother and siblings, and had no contact with his father. He had a developmental index below 55 on the BSID-II-NL and a mental age of 7.5 months at a chronological age of 20 months. His mother reported no social engagement (Child 3 did not like to be near others, made very limited eye contact, did not initiate contact). He used no verbal language or communicative gestures and also little vocalizations. His imitation ability was very limited and he engaged mainly in exploratory and cause-and-effect play. He did not attend school yet and received monthly home guidance aimed at developmental stimulation, but no specific ASD intervention services.

Child 4. The fourth participant was 3 years and 7 months when the study started. He was an only child and lived with both parents. Only his mother participated in the intervention. He had a developmental index of 62 on the BSID-II-NL, which was equivalent with a mental age of 21 months, at a chronological age of 34 months. His mother reported some social engagement (e.g. preferring to play near her, frequent eye contact and frequent responses when she tried to gain his attention), but limited social initiative and problems to stay actively engaged for more than a few minutes. Child 4 just started to use a couple of words when the intervention started, but did not use them communicatively. He used some communicative gestures (e.g. pointing) to request desired objects. He sometimes imitated the actions or gestures of his mother. Most of the time he played in a combinational way, but he could also play functionally. There was no symbolic play before the start of the intervention. Child 4 attended regular education and received 1:1 early intervention at school for 100 minutes a week and at a

rehabilitation centre serving children with developmental disabilities for three hours a week.

Research design

A multiple-baseline design across participants (Herson & Barlow, 1976) was used to evaluate the effects of the parent training. The duration of the baseline and follow-up phases was between 4 and 12 weeks (with three to seven data points during baseline and two to six data points during follow-up). Baseline and follow-up length were chosen a priori such that the shortest length would provide a sufficient number of data points to determine behavioural stability (Beeson & Robey, 2006). The intervention phase was 12 weeks for all children (with six data points). Baseline length was assigned at random. The study design was reviewed and approved by the Ethics Committee of the Faculty of Psychology and Educational Sciences of Ghent University, where the study was conducted.

Setting and materials

All sessions took place in the participants' homes. A standard set of toys (jigsaws, garage with cars, toy register, cut and play food, dinner set, two phones, two dolls, ball run, pop-up) was provided for the study, but also other toys available in the home were used. Parents received a manual, with an explanation of the intervention techniques and home work assignments (Ingersoll & Dvortcsak, Dutch adaptation by Roeyers, Van der Paelt, & Warreyn, 2012).

Treatment fidelity

Parents' fidelity of implementation was evaluated with the Project ImPACT fidelity form (Ingersoll & Dvortcsak, Dutch adaptation by Roeyers, Van der Paelt & Warreyn, 2013). Parents received a score of 1 (Parent does not implement the technique throughout session) to 5 (Parent implements the technique throughout the session) for each technique. Based on these individual scores summary scores were given for the five fidelity dimensions (Makes play interactive, Models and expands language, Provides

opportunities for initiations, Helps increase the complexity of initiations and Paces the interaction). Parents were considered to achieve sufficient fidelity when they received a score of at least 4 on each of the component summary scores. These summary scores were averaged to give a global treatment fidelity rating. Of each parent-child dyad the last video of baseline, intervention and follow-up were rated. Average treatment fidelity of the mothers² is presented in Table 1.

Table 1

Average treatment fidelity rating of the mothers during the last baseline, intervention and follow-up video

	Mother 1	Mother 2	Mother 3	Mother 4
Baseline	2	2.2	1.6	1.2
Intervention	4.2	4.2	4.2	4
Follow-up	3.8	2.2	4.2	3.4

All mothers reached treatment fidelity at the end of the intervention phase. However, only the mother of Child 3 still obtained sufficient treatment fidelity on all dimensions at the end of the follow-up phase. The mothers of Child 1 and 4 still implemented the techniques with greater fidelity than during baseline (Mother 1 obtained fidelity on four out of five dimensions, and Mother 4 on three out of five). However, Mother 2 dropped back to baseline level, implementing only one dimension with sufficient treatment fidelity.

Procedure

The parent trainer (first author of the study) received an official training in the intervention. Before the start of the baseline the parent trainer visited the families in order to provide information on the intervention programme and the study. Parents

² Only data of the mothers are presented here because they were available for all four children.

were instructed to make a 15-minute-video of a play interaction of their child with each of them separately (if they both participated in the intervention) every 2 weeks. They were instructed to use the standard set of toys provided for the study, but since the videos were taken at home, it was difficult to prevent the children from also playing with their own toys. Parents were instructed to interact with their child as they would on a daily basis and were not given any further instructions about how to interact. Parents were reminded by an undergraduate student to make the video(s) and were asked to transfer the video(s) online to the parent trainer.

The intervention consisted of 24 sessions that were provided twice a week at home. The sessions took approximately one to two hours, depending on the content and whether one or two parents participated. The intervention was conducted according to the manual of the project ImPACT (Ingersoll & Dvortcsak, Dutch adaptation by Roeyers et al., 2013). Parents were taught developmental and naturalistic behavioural techniques. The developmental techniques were taught first, because they are considered to form the foundation for the other techniques. During the first sessions parents' responsiveness and social reciprocity were promoted to increase social engagement of the child. Parents were taught to follow their child's lead, to imitate their child, to be animated and to model and expand their child's language. Afterwards, parents learned to further stimulate the spontaneous communication of their child by using communicative temptations (e.g. holding a desired object in sight but out of reach), turn-taking and playful obstruction of the child's activity. Then parents learned to expand their child's language, imitation and play abilities by the use of prompts and rewards (naturalistic behavioural techniques). In the last two sessions parents were taught to integrate all the techniques.

Every session followed the same structure, except for the first two sessions. In the first session the parent trainer and parent(s) agreed on individualized goals for the child to improve social engagement, communication, imitation and play. Longer and more active social engagement was targeted in all children. The communication goals were the use of communicative gestures and stimulation of nonverbal communication for Child 1, 2 and 3 and the use of single words for Child 4. For Child 1 the imitation goal was to imitate functional actions in daily routines. For the other children this was to imitate

familiar play actions. In Child 1, 2 and 3 combinational play was targeted, and in Child 4 functional play. In the second session the parents were taught how to create an ideal learning environment for their child. The other sessions started with reviewing the homework assignment made by the parent(s). In this way the trainer could evaluate how the parent(s) succeeded in implementing the techniques in daily routines and answer any questions the parent(s) still had. Subsequently the trainer explained the new technique, after which the technique was modelled by the trainer. The largest part of the session was spent on letting the parent(s) practice the technique with live feedback from the trainer. At the end of the session the new homework assignment was explained by the trainer.

Dependent Measures

Video coding. The main dependent measures were coded from the videos using Noldus Observer behavioural coding software, version XT 9.0 (Noldus, 2009) by three undergraduate students, blind for the phase in which the video was taken. The main categories of the Parent Child Interaction (PCI; Aldred, Green, & Adams, 2004) coding scheme were used as a basis for the current coding scheme, but were expanded with imitation and play categories to be able to evaluate progress on all the main treatment goals. Furthermore, because the children used no/minimal spoken language nonverbal communication was coded in more detail instead of using the specific subcategories for coding verbal behaviour of the PCI. Of every video 8 minutes were coded, starting after 4 minutes, to allow parent and child to settle into play. Each tape was watched five times at normal speed to complete the codes.

Parent communication. Parent verbal and nonverbal behaviours that had communicative intent were coded into one of two categories. When the parent's communication was used to direct the behaviour or attention of the child, the communication was coded as asynchronous. When the parent followed the attention focus of the child, reinforced or confirmed the child's actions or imitated the child, the communication was coded as synchronous. A ratio score was computed where the frequency of synchronous communication was divided by the total number of communicative instances (synchronous + asynchronous).

Child communication. The child's verbal and nonverbal behaviours with a communicative intent were coded as either an initiative or a response. Initiations were then coded as request or directing attention (for a declarative purpose). Responses were coded as acknowledgment (positive response to parent) or negation (negative response to parent). Each communication code could be supplemented with a code for the means of communication, which could be verbally (if the child communicated by using one or more words or word approximations) and/or with a communicative gesture (e.g. pointing, reaching, showing, giving). We computed frequency scores for each type of communication.

Child imitation. Whenever the child repeated the parent's action, gesture or language within 5 seconds of the behaviour of the parent, imitation was coded, resulting in a frequency score.

Child play. The child's play was coded continuously into one of the following categories: exploratory (exploring sensory characteristics of objects, e.g. looking at, touching toys), combinational (combining objects, e.g. stacking, putting one object in another), cause-and-effect (performing an action to obtain a desired effect, e.g. with musical toys), functional (using a toy for its intended purpose, e.g. pushing a car), pretend play (object substitution, make-believe property attribution or reference to an absent object, e.g. pretending a doll is eating), social (the social aspect of the play is dominant, e.g. rough-and-tumble play, parent and child dancing together), no play (e.g. looking outside, walking around). The total duration of each type of play was computed.

Parent and child social engagement. Episodes where parent and child shared their attention focus and both acknowledged this mutual shared attention for at least 2 seconds by means of eye contact, gestures, language, smiling were coded as social engagement. The duration of each episode was coded.

Interrater reliability. Interrater reliability was determined with single measures intraclass correlations (ICCs) by double coding of 45% of the observations. ICC's are presented in Table 2.

Table 2

Intraclass correlations (ICC) for all behaviours coded from the videos

Behaviour	ICC
Social engagement	.95
Request: in total / with gesture	.90 / .82
Directing attention	.83
Positive response: in total / with gesture	.90 / .69
Negative response: in total / with gesture	.81 / .71
Imitation	.76
Play: total duration	.84
Exploratory play	.84
Combinational play	.98
Cause-and-effect play	.91
Functional play	.99
Symbolic play	.99
Social play	.96
Parent synchronous communication ratio	.91

Parent report. During the first and again during the last intervention session, parents were asked to fill out the Social-Communication Checklist, provided in the manual of the Project ImPACT parent training (Ingersoll & Dvortcsak, Dutch adaptation by Roeyers et al., 2013). Parents rated their child's social engagement, form of expressive language, function of expressive language, receptive language, social imitation and play. For every domain parents were presented with specific child social-communicative abilities (e.g. making eye contact, gesture use) and were asked to rate whether their child could usually (75% of the time), sometimes but not consistently or seldom/never use that ability. There was also a fourth category for behaviours not observed.

Parent satisfaction. After the last intervention session parents filled out a parent satisfaction questionnaire (Ingersoll & Dvortcsak, Dutch adaptation by Roeyers et al., 2013). They answered 12 questions on a 5-point scale (totally agree, agree, not sure, disagree, totally disagree). They stated whether they were satisfied with the goals targeted during the intervention, whether they understood how to use the techniques, whether their child made progress, whether the homework assignments were manageable, whether the trainer was available, whether their child liked the intervention and whether they would recommend the intervention to others.

Data-analysis

Data were analysed by visual inspection. Additionally we calculated effect sizes of the difference between the average score during intervention and baseline and of the difference between follow-up and baseline. Following Beeson and Robey (2006) who compared several effect size measures for single-case research we used $d1$. This is a variation of Cohen's d statistic (Cohen, 1988), as calculated by Busk and Serlin (1992). The statistic $d1$ is calculated by subtracting the average of the baseline phase from the average of the intervention or follow-up phase and by dividing this result by the standard deviation of the baseline phase. When a behaviour never occurred during baseline a variant $d2$ was calculated with the pooled standard deviation (because in that case the standard deviation of the baseline phase is 0). Only the data of the mothers interacting with their child will be presented in the results section, because these were available for all four children. Results on the evolution of the interactions with the fathers for Child 1 and 2 are presented in the Appendix.

RESULTS

Social Engagement

All four children showed longer episodes of social engagement during the intervention than during baseline, as is illustrated in Figure 1. The average effect size $d1$ was 3.51, which indicates a large effect. In Child 1 and 2 a clear increase in social

engagement was already evident in the second observation of the intervention phase. In Child 3 the increase was more gradual, with longer social engagement every time, until he remained engaged with his mother for almost the whole observation time at the last follow-up probe. Child 4 and especially Child 2 showed large fluctuations in social engagement during the intervention phase. During follow-up Child 1 and 3 further increased the duration of their social engagement (large effect sizes of resp. $d1 = 7.92$ and $d1 = 83.20$) while Child 2 and 4 showed a decrease to a duration that was only slightly higher than during baseline (small effect sizes of resp. $d1 = 0.21$ and $d1 = 0.26$). On the Social-Communication Checklist parents of all four children reported better social engagement after the intervention. All children usually liked to play near their parents after the intervention, while only Child 4 already did this before the intervention. Three children maintained simple social games initiated by the parents more often. All children showed increased active engagement with the parents during play. Three children responded sometimes to attempts of the parents to draw their attention after the intervention, while they did not do so before the start of the intervention. Child 4 usually responded to these attempts already before the start of the intervention. Child 3 sometimes made eye contact with his mother after the intervention, while he seldom did this before. Child 2 and 4 usually did this already before the start. Child 1 and 4 initiated more activities or play with the parents after the intervention. Child 2 already did this usually and child 3 still seldom initiated activities or play with his mother after the intervention. Child 2 and 3 improved their turn-taking abilities, while the other two children still seldom took turns with their parents. Child 2 and 4 usually provided greetings and farewells to other people after the intervention, while they did not do this before. The other children still did not do this after the intervention.

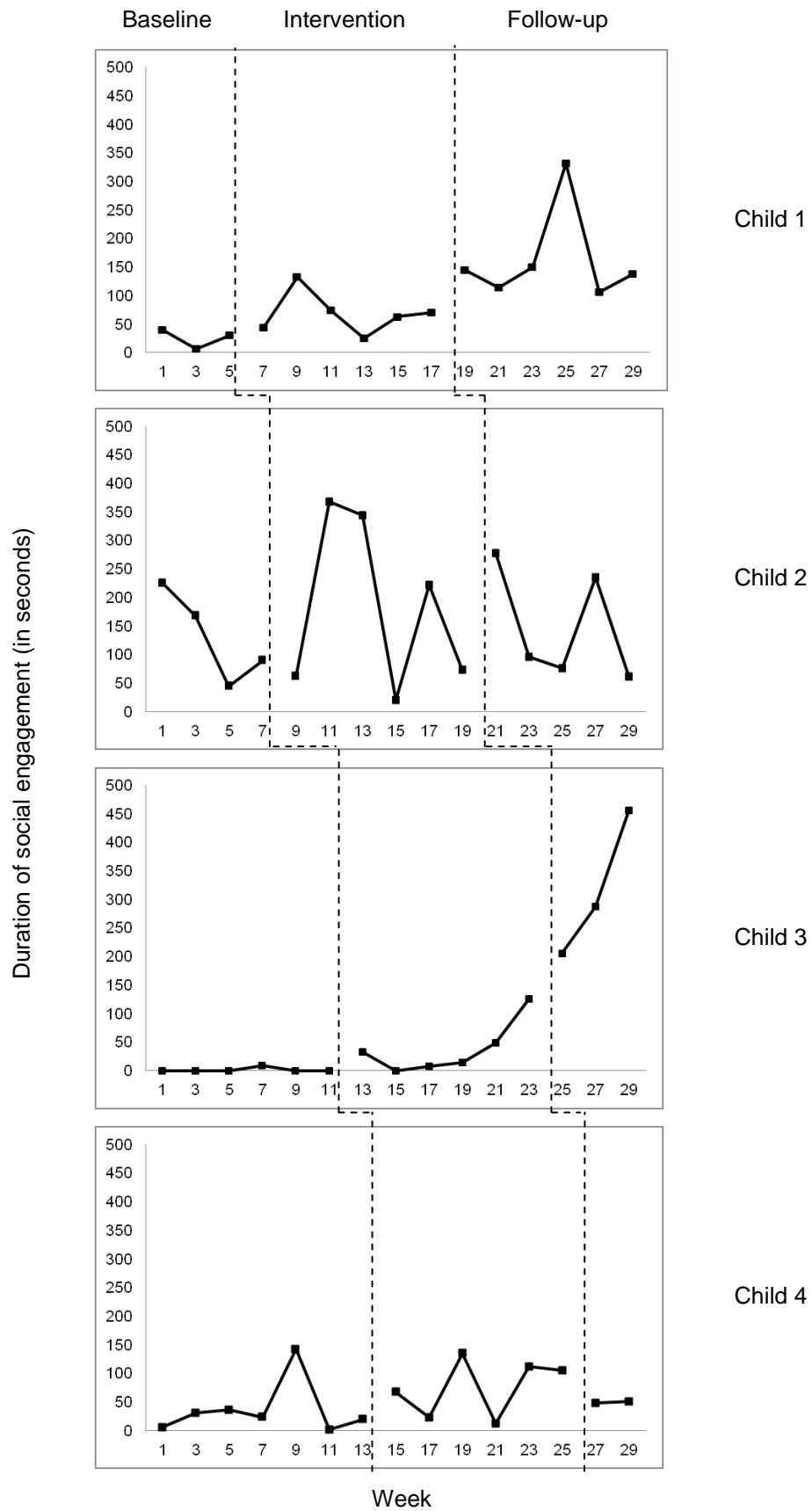


Figure 1. Duration of social engagement during baseline, intervention and follow-up phases

Child communication

Figure 2 shows an increase in the number of *requests* in all children, soon after the intervention started. This led to a higher number of requests during the intervention than during the baseline phase for all children. The average effect size $d1$ was 5.92, which is indicative of a large effect. For three of the four children the number of requests increased further during the follow-up phase. In Child 2 however, we saw a slight decrease during the follow-up phase, approximately to baseline level. The average effect size for the difference between follow-up and baseline was 12.68, again suggesting a large effect. Further, also the number of requesting gestures rose from baseline to intervention in all children (average effect size = 3.69) and was still higher at follow-up for three of the four children (average effect size = 4.57). Two children started using word approximations to request by the end of the follow-up phase: Child 3 used one word approximation in week 27 and 16 word approximations in week 29. Child 4 used five word approximations in the last observation. Figure 2 also shows that the majority of the children showed more *positive responses* to their mother during the intervention than during the baseline period. Only for Child 1 the number of positive responses remained approximately the same as during the baseline period. On average the effect of the difference between baseline and intervention was large (average $d1 = 1.29$). This was also the case for the difference between baseline and follow-up phase (average $d1 = 1.62$). Only Child 2 did not show a higher number of positive responses during follow-up compared to baseline. The use of gestures to communicate a positive response was non-existent in all children during the baseline phase, as is shown in Figure 2. All children used some responsive gestures during intervention and/or follow-up phases, but this was still infrequent and did not clearly co-occur with the start of the intervention. *Directing the attention* of the mother for a social purpose was much less common than requesting. See Figure 3.

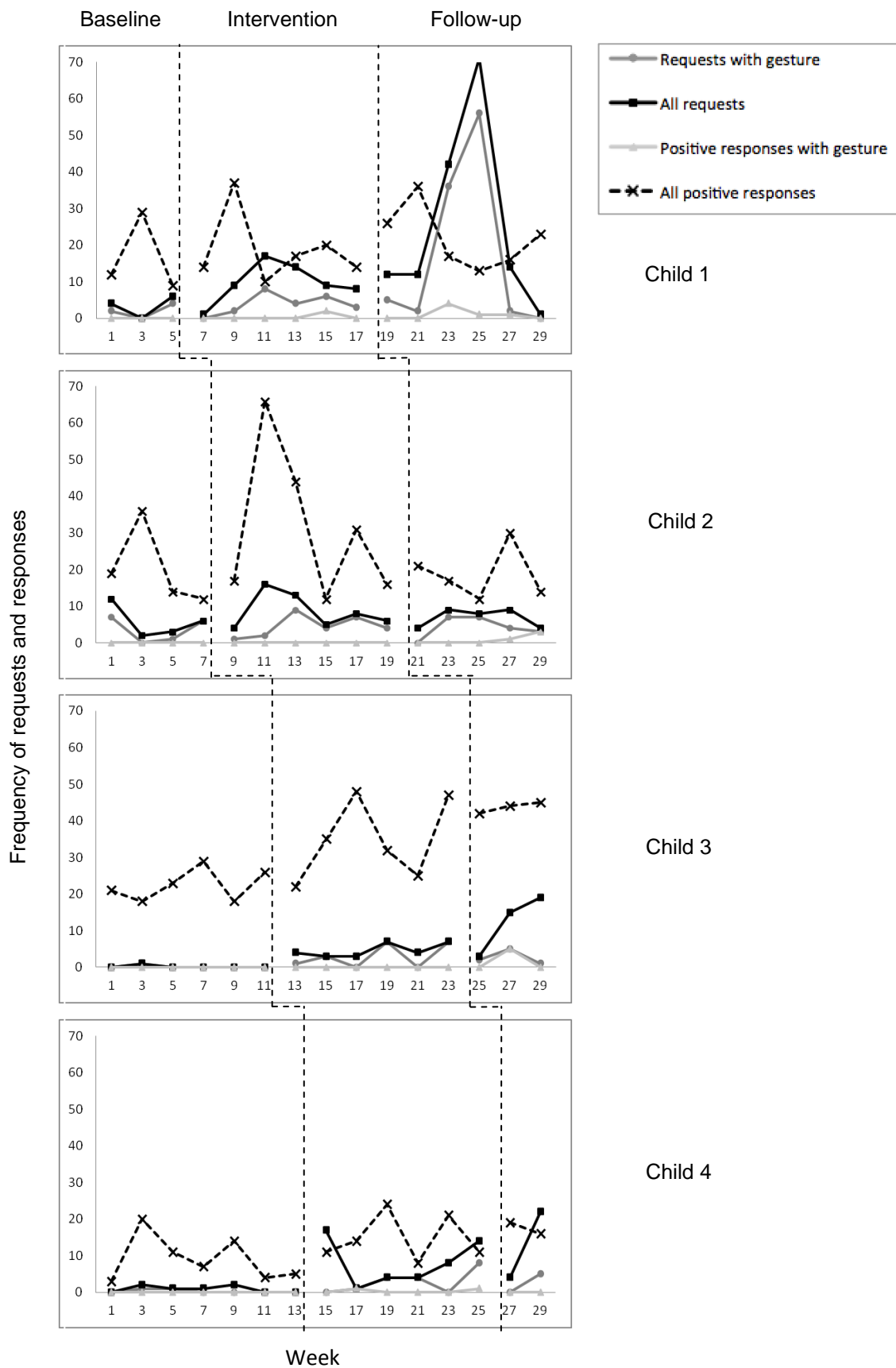


Figure 2. Frequency of child requests and positive responses during baseline, intervention and follow-up phases

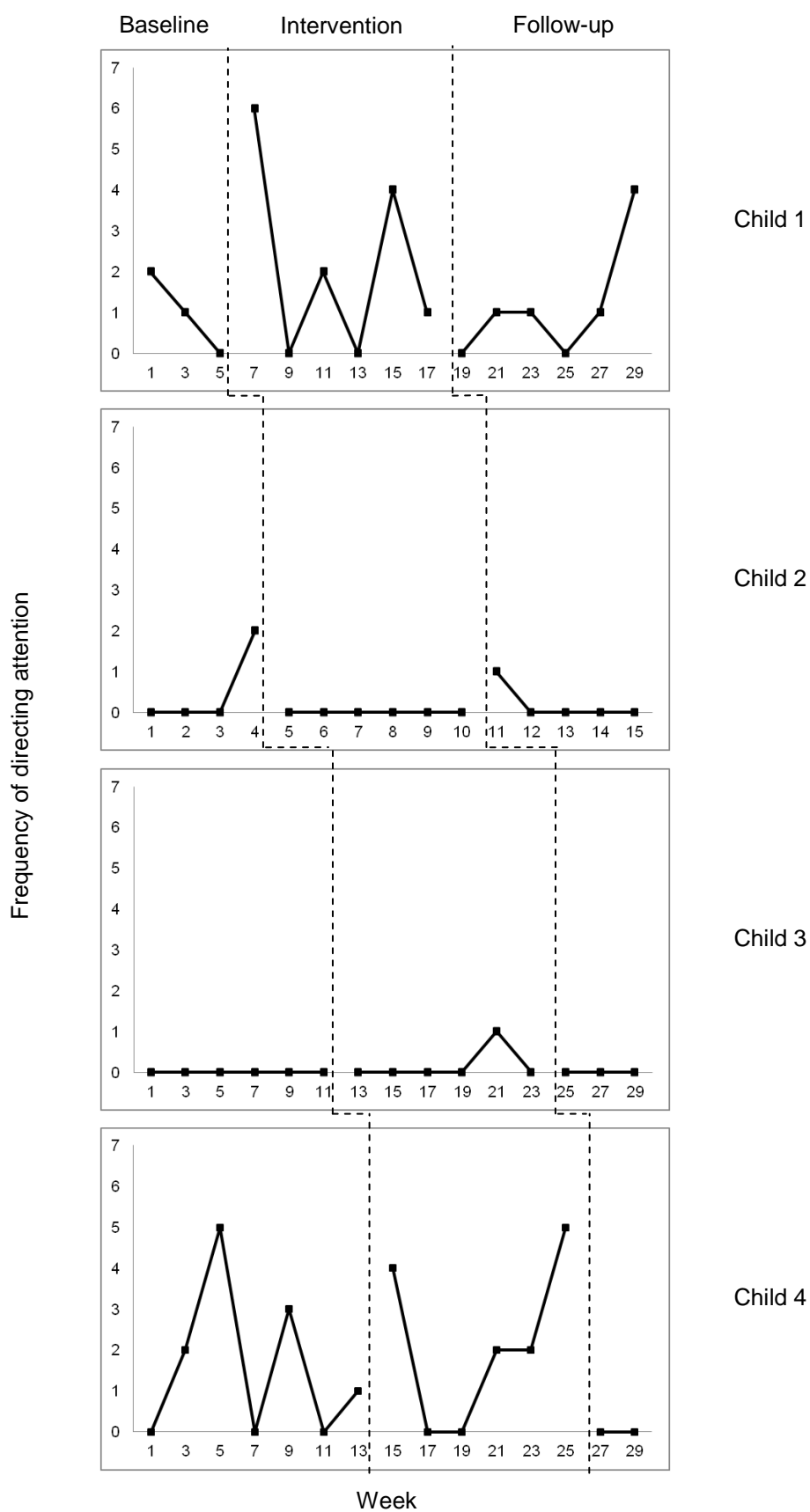


Figure 3. Frequency of child directing attention during baseline, intervention and follow-up

There was no clear pattern in the *negative responses* towards the parent. See Figure 4. On the Social-Communication Checklist parents of all four children reported better communicative abilities. The form of communication improved: Child 1, 2 and 3 used more communicative gestures and Child 4 started using single words. Also the function of the communication improved: Child 1, 2 and 3 used more (nonverbal) language to request, Child 1 and 2 also used more often language to protest. Child 4 used more language to gain the attention of his parents. Three children also improved their ability to follow instructions of the parents. Child 2 and 3 sometimes followed simple instructions after the intervention, while they almost never did this before the intervention. Child 4 started following directions with more than one step after the intervention. Child 1 sometimes followed simple instructions before the intervention and continued to do so after the intervention.

Imitation

Three children never imitated during the baseline phase and started to imitate soon after the start of the intervention. See Figure 5. Child 4 already imitated his mother during the baseline phase and continued to imitate at the same frequency during the intervention phase. The average effect size of the difference between baseline and intervention was 0.86, indicating a large effect. All children continued to imitate their mothers as frequent or even more frequent during the follow-up phase. The average effect size of the difference with the baseline phase was 1.48, which shows a large effect.

On the Social-Communication Checklist all parents reported ameliorated imitation abilities. Child 1, 3 and 4 imitated more gestures after the intervention and Child 2 and 3 imitated more novel play actions than before.

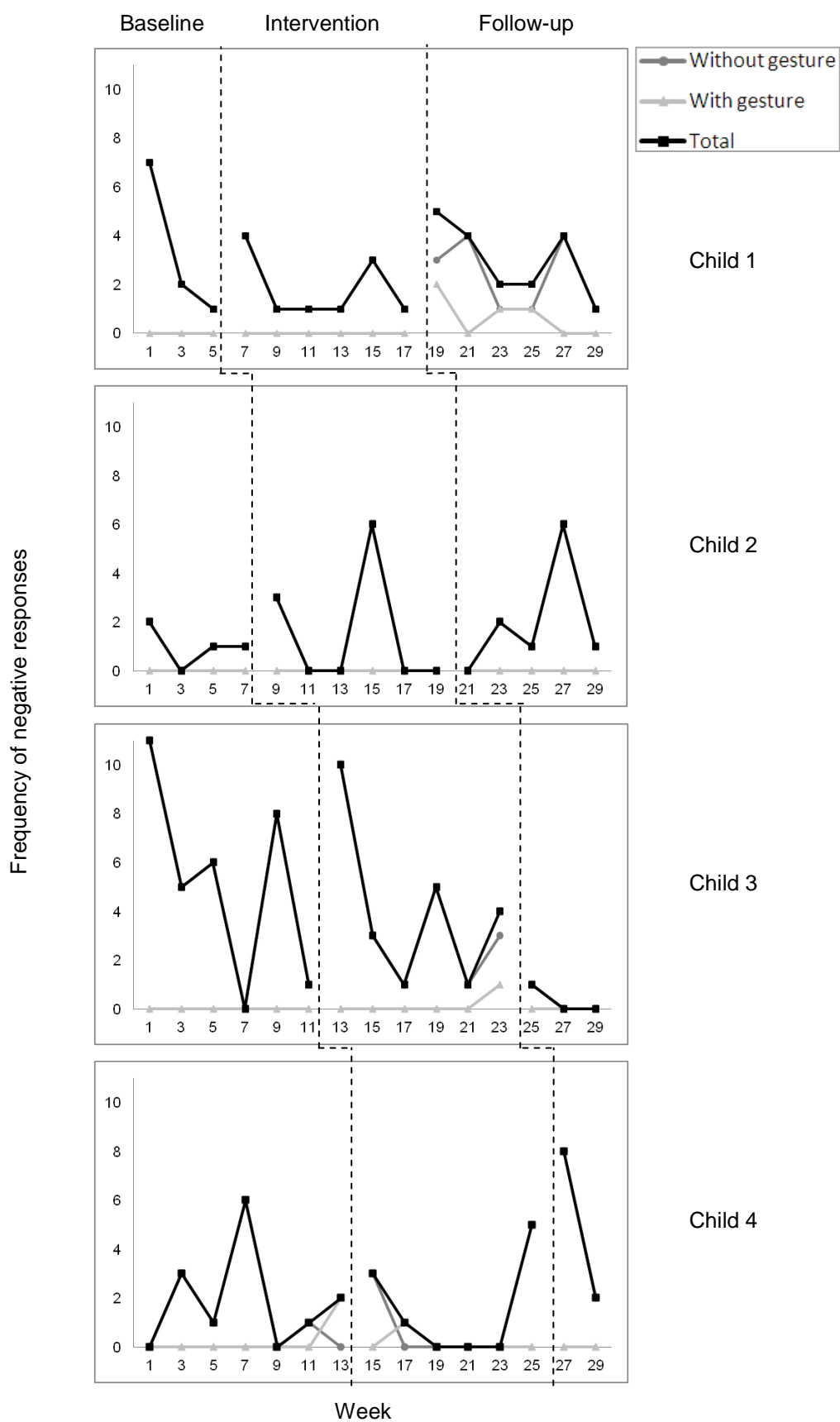


Figure 4. Frequency of child negative responses during baseline, intervention and follow-up phases

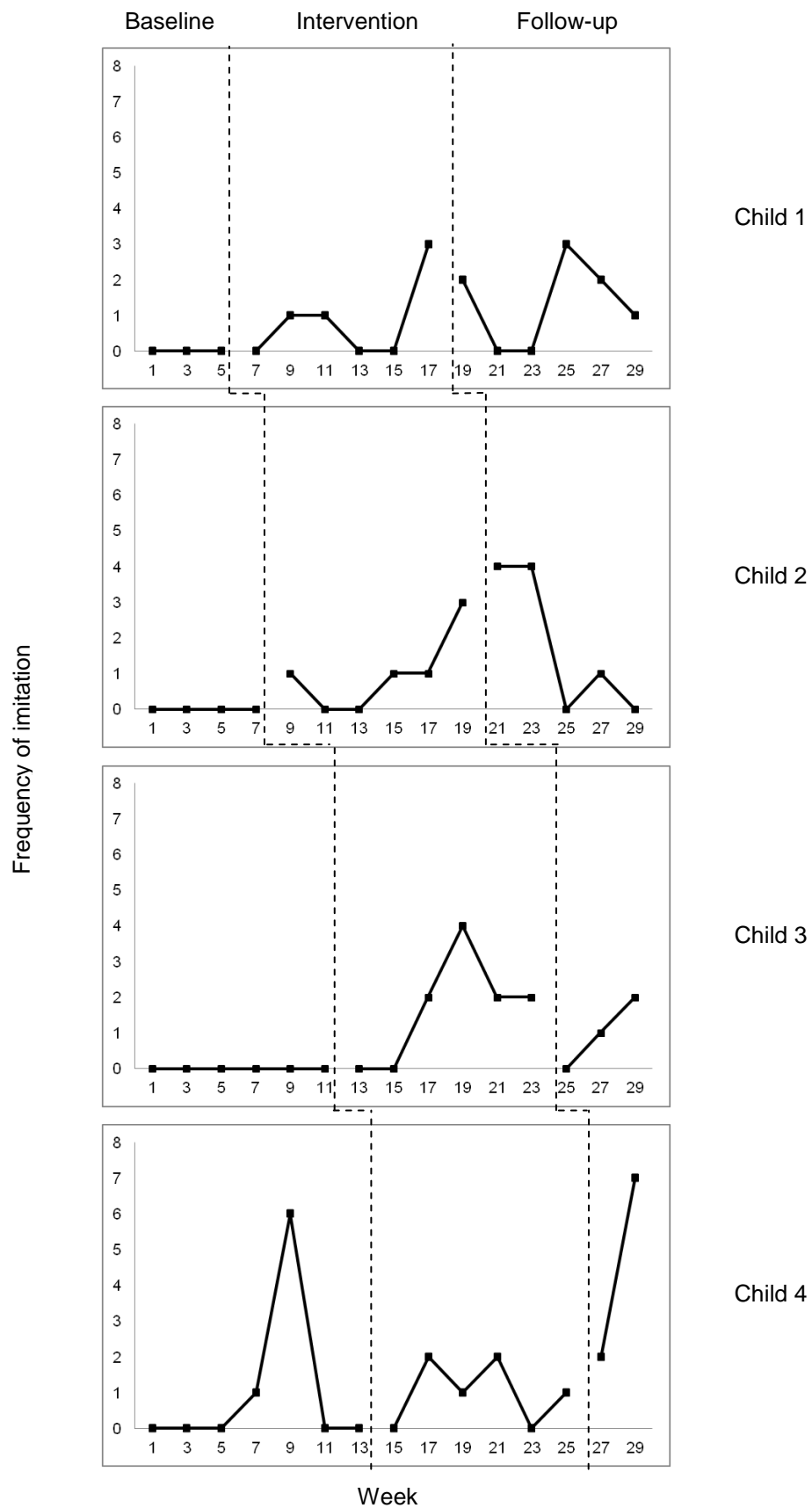


Figure 5. Frequency of child imitation during baseline, intervention and follow-up phases

Play

Child 2 and 3 clearly showed an increase in the total time they spent playing during intervention (large effect sizes of resp. $d1 = 4.10$ and $d1 = 1.76$) and follow-up phases (large effect sizes of resp. $d1 = 1.85$ and $d1 = 1.83$) in comparison to the baseline phase. See Figure 6. Child 1 and 4 showed a smaller increase in both intervention (small to moderate effect sizes of resp. $d1 = 0.43$ and $d1 = 0.54$) and follow-up (small to moderate effect sizes of resp. $d1 = 0.62$ and $d1 = 0.46$) compared to baseline-level. On average the effect size of the difference between baseline and intervention was 1.62 and between baseline and follow-up 1.19, which can be considered large effects.

There were also changes in the types of play, as can be seen in Figures 7 and 8. In all children we saw more *exploratory play* during the intervention than during baseline (large average effect size $d1 = 2.16$). In Child 1 and 4 this was also the case during follow-up (large effect sizes of resp. $d1 = 3.87$ and $d1 = 2.80$), while this type of play decreased slightly in Child 2 and 3 during follow-up (small to moderate effect sizes of resp. $d1 = -0.44$ and $d1 = -0.58$). *Cause-and-effect play* remained on average the same in Child 1 and 2 in baseline and intervention (effect sizes of resp. $d1 = 0.11$ and $d1 = 0.09$), and diminished during intervention in Child 3 and 4 (large and moderate effect sizes of resp. $d1 = -1.49$ and $d1 = -0.54$). At follow-up this type of play was seen less than during baseline in the majority of the children (moderate average effect size $d1 = -0.62$). Only in Child 2 there was an increase in cause-and-effect-play in the follow-up phase (moderate effect size $d1 = 0.58$). There was no consistent pattern in the evolution of *combinational play*. In Child 1 and 2 combinational play was very infrequent, while in Child 3 and 4 there were large fluctuations. Higher levels of play (*functional and symbolic play*) were infrequent or even nonexistent in all children. *Social play* however, was infrequent during baseline, but increased in all children during the intervention and remained higher during follow-up (large average effect sizes of resp. $d1 = 6.56$ and $d1 = 4.58$).

On the Social-Communication Checklist parents reported some differences on the questions on how often their child engaged in the diverse types of play. Child 2 and 3 engaged more in combinational play and less in cause-and-effect-play. Parents of Child 2 also reported less functional play. Child 3 played more with cause-and-effect toys after the intervention and the mother of Child 4 reported more symbolic play.

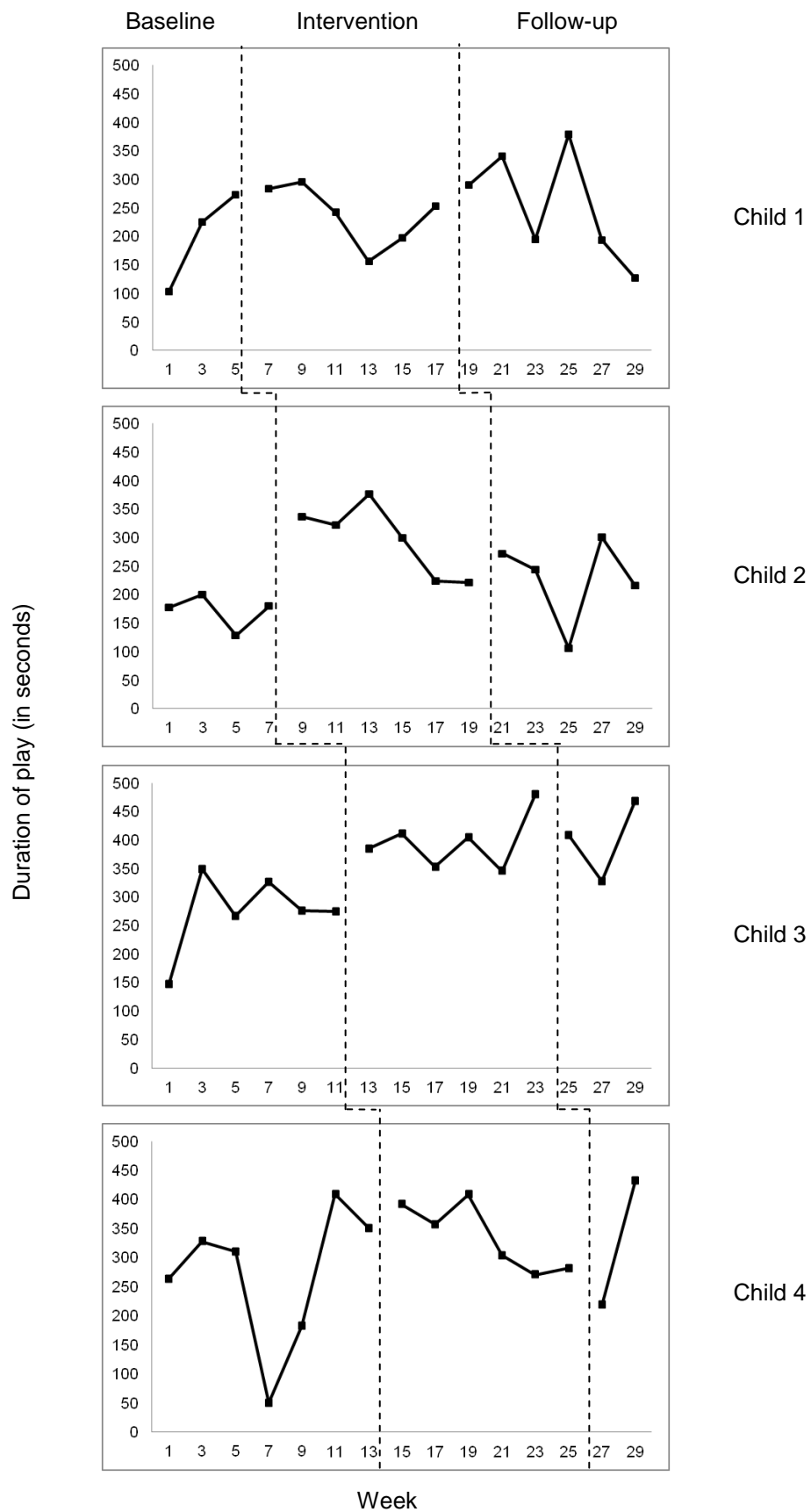


Figure 6. Duration of child play during baseline, intervention and follow-up phases

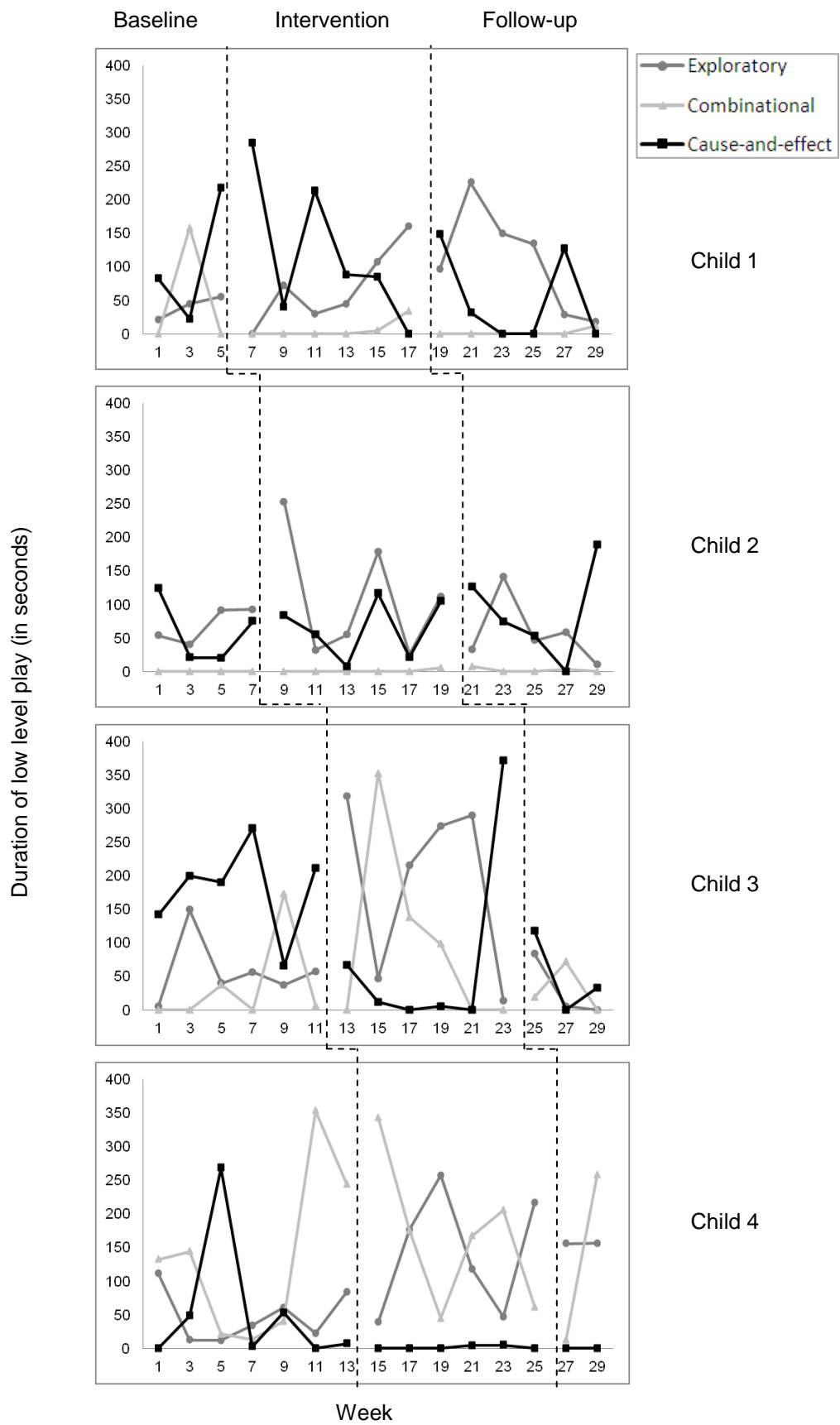


Figure 7. Duration of child low level play during baseline, intervention and follow-up phases

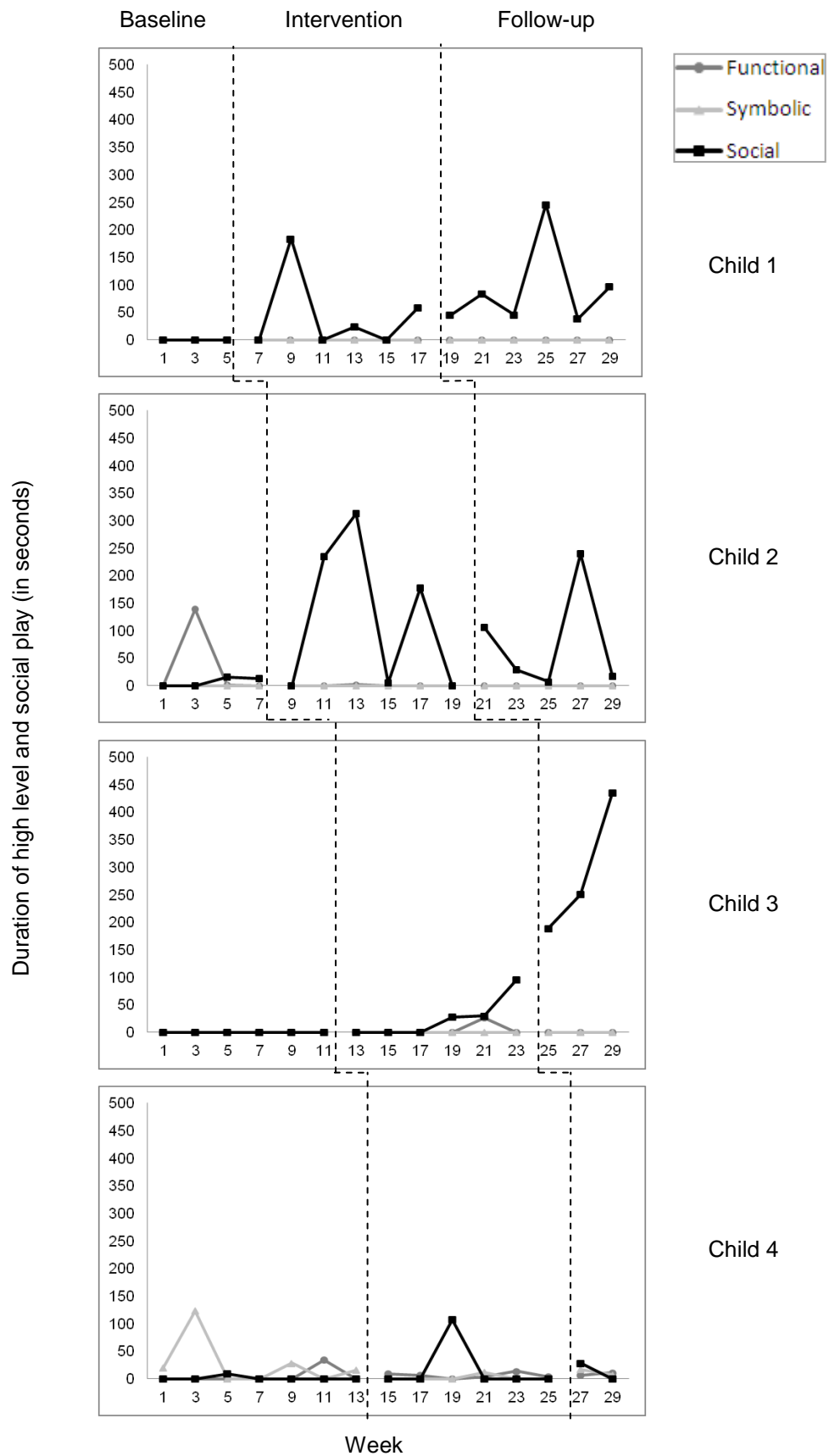


Figure 8. Duration of child high level and social play during baseline, intervention and follow-up phases

Summary of child effects

The effect of the intervention on each individual child was summarized by computing an average effect size for the outcome on the main intervention targets: social engagement, initiation of communication (only requesting was directly targeted), imitation and play (total duration, irrespective of play type). See Table 3.

Table 3

Average effect sizes for the main intervention targets (social engagement, requesting, imitation and play)

	Intervention	Follow-up
Child 1	1.45	4.26
Child 2	1.63	0.86
Child 3	6.00	29.18
Child 4	2.32	3.94

For all children effect sizes for intervention and follow-up phases were large. In three children the effect for the difference between follow-up and baseline was even more pronounced than the effect for the difference between intervention and baseline.

Mother's synchronous communication

In all four mothers there was an immediate increase in synchronous communication when the intervention started, which remained throughout the entire intervention phase (large average effect size $d1 = 3.73$). See Figure 9. The mothers of Child 1 and 3 also showed much more synchronous communication during follow-up compared to baseline (large effect sizes of resp. $d1 = 6.13$ and $d1 = 2.40$). The mother of Child 4 became less synchronous during follow-up than during the intervention, but still showed more synchronous communication than during baseline (moderate effect size $d1 = 0.63$). The mother of Child 2 also became less synchronous during follow-up, and returned to baseline level (effect size $d1 = 0.15$, no effect).

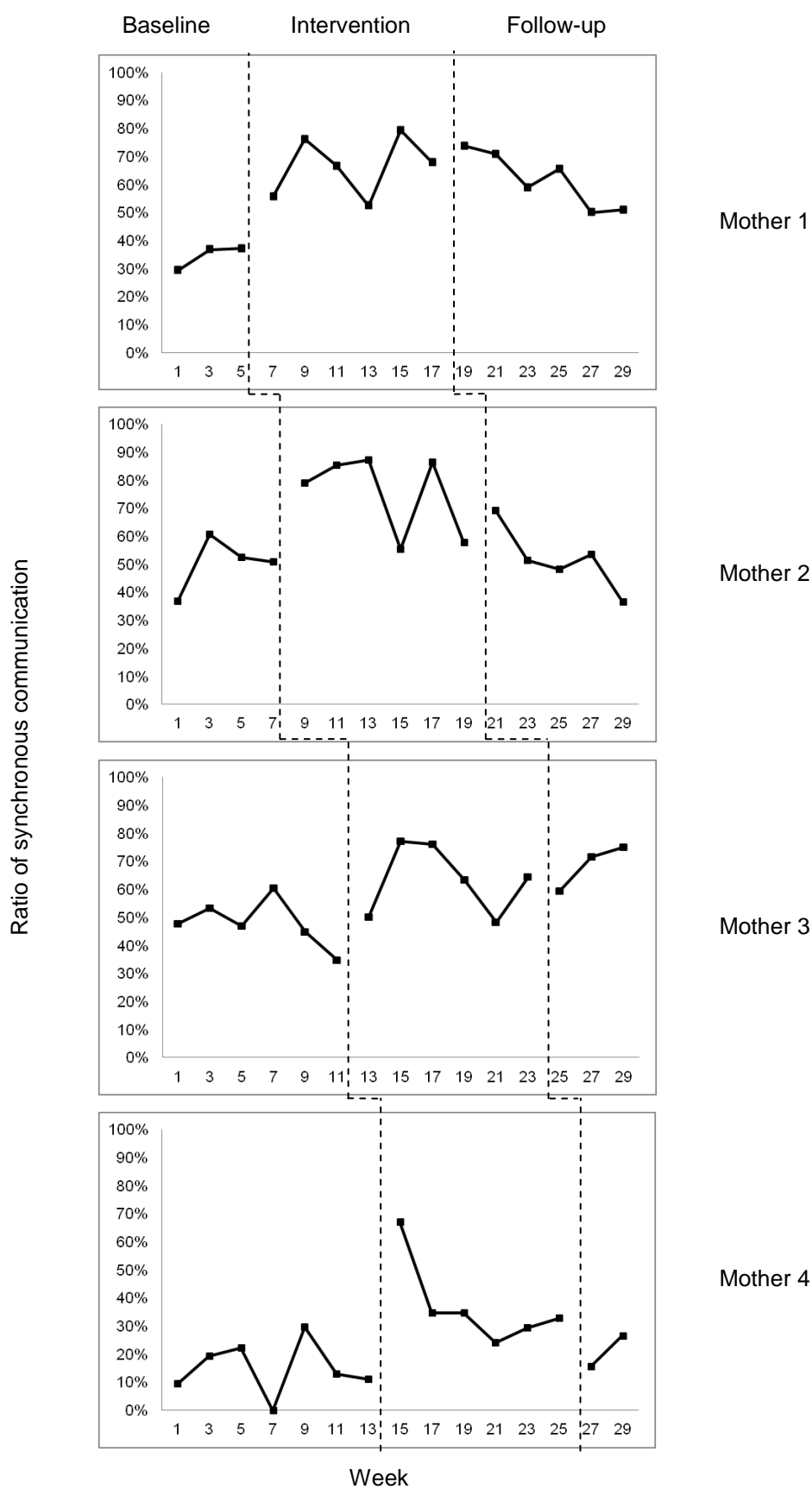


Figure 9. Synchronous communication ratio of the mothers during baseline, intervention and follow-up phases

Parent satisfaction

Parents reported a high satisfaction with the intervention on the Parent Satisfaction Survey. All parents answered agree or strongly agree on each of the questions concerning child goals, their understanding of the implementation of the intervention, progress of their child and availability of the trainer. All parents strongly agreed on the question whether they would recommend the programme to others.

DISCUSSION

Our results indicate that the Project ImPACT parent training is an effective intervention programme to stimulate the social-communicative abilities of nonverbal children with ASD. As we hypothesized, the main targets of the intervention: social engagement, communication, imitation and play improved in all children after the start of the intervention. There was however individual variability in the magnitude of the changes and in the extent to which changes remained during follow-up. These findings add to previous effectiveness studies of this intervention (Ingersoll & Wainer, 2011, 2013), in showing that not only changes in language, but also changes in social engagement, imitation and play can be observed reliably in parent-child interaction. Furthermore, in contrast to the study of Ingersoll and Wainer (2013), this study proved that Project ImPACT can also be effective for nonverbal children with ASD.

Progress in social communication during parent-child interaction

Two children showed a large increase in *social engagement* and continued to show improvement after the end of the intervention. The other two children showed more fluctuations in their social engagement and showed only slightly more social engagement during follow-up than during baseline. This may be due to differences in the effective use of the techniques by the parents. Social engagement is predominately influenced by the use of interactive techniques. Possibly using the direct teaching techniques too frequently could lead to lower social engagement. Evidence for this can be found in the drop in social engagement that was observed in all children during the

first observation session after the introduction of the direct teaching techniques. This coincided with a similar drop in the synchronous communication of the mothers. Also the fact that the mothers of the children with the smallest progress in this area showed a drop in synchronous communication during the follow-up phase, points in the direction of a relationship between social engagement of the child and synchronous communication of the mother.

The second goal of the intervention was to stimulate *communication* abilities of the children. We saw a clear effect on the requesting abilities of all children. After the first half of the intervention, when techniques to provoke communication had been taught, there was also an increase in the use of gestures used for requesting. This is important because gestures are prerequisite skills for verbal communication and can facilitate the acquisition of verbal language (Goldstein, 2002). Two children started using communicative word approximations. However, since this occurred during follow-up and only in two of the four participants, it is not possible to disentangle whether this was a consequence of the parent training. In contrast with the progress in requesting, children still rather infrequently directed the attention of the mother with a social focus. This was not surprising, given that this is a difficult ability for children with ASD, which was not directly targeted during the intervention. It may be necessary to provide more explicit teaching of declarative joint attention behaviour for clear improvement in this area. Besides progress in communicative initiations, also the number of positive responses to the mother increased in three of the four children. All four children also started to use some responsive gestures.

All four children showed progress in their *imitation* abilities. This is essential because imitation is important to develop other abilities, such as language, joint attention and play (Ingersoll & Schreibman, 2006). Moreover, there was also an increase in the time children spent *playing* after the start of the intervention, which could lead to an increase in the overall number of learning opportunities, because like imitation also play is an important learning mechanism (e.g. Kasari et al., 2008). Concerning the different types of play, especially the increase in social play was apparent. This could be related to the increase we observed in social engagement. Making the social aspect of play rewarding may be an important mechanism to increase joint engagement. During social play it may

be easier to remain engaged with the parent because there is no competition between attention for an object and attention for the parent.

The effect on the developmental level of the play was less pronounced. In general children spent more time on exploratory play and less time on cause-and-effect play after the intervention started. This could lead to the conclusion that the children spent more time on play of a lower developmental level than before the intervention. However, part of the time spent on cause-and-effect play appeared to be repetitive play (e.g. repeatedly pushing buttons of the toy phones). This suggests that the children engaged less in repetitive play after the intervention started. Spending more time on exploratory play may be positive, given the low developmental level of the children. Exploratory play forms the basis of playing and by engaging in this type of play children may expand their interest in different types of toys. For three of the four children the play goal was to engage more in combinational play and for the fourth child this was to improve the amount of functional play. The videos showed no clear improvements on these types of play, except for an increase in combinational play in one of the children, that did not remain during follow-up. The parents of two children reported some improvement in combinational play. Taken together, there is not sufficient evidence of an improvement in combinational and functional play, although these types of play were specifically targeted. An explanation for this finding is that teaching play skills is the theme of one of the last sessions, and that teaching new play behaviours may take a longer amount of time. Further research with a longer follow-up period would be useful to evaluate the effect of the intervention on the complexity of play.

Parent report of social communication

The parent report measure leads in large part to the same conclusions as the coding of the behaviour during parent-child interaction. Small differences (e.g. a parent that reports more symbolic play while this was not seen in the video observations) could probably be attributed to the short duration of the videos which limited the chance to see behaviours that were still rare. Parents base their report on all their experiences with their child, thus are more likely to report on just emerging skills. The fact that

parents see improvement on each domain gives some support for the generalization of the skills outside of the play context, to daily routines in general.

Clinical implications

From a clinical perspective, this study suggests that the Project ImPACT parent training could be a feasible intervention to implement in practice. First of all, we showed that clear improvement can be achieved in a short period of time. Moreover parent satisfaction was high. Since this is also a cost-effective intervention, it may be a useful intervention to offer to families on a waiting list before they have access to more intensive forms of intervention.

Strengths and limitations

A strength of the current study is the use of a coding scheme that was both detailed (e.g. function and means of communication, distinction between different types of play) and elaborate (broad array of social-communicative behaviours). The first four families that were asked to participate consented, which implicates that there was no self-selection bias. Moreover, observations did not take place in a research setting, but at home, which improves external validity. Also the fact that the same parent trainer provided the intervention in all four families can be seen as a merit of this study.

A limitation of the present study is that given the small sample size, the extent to which these findings generalize to all children with ASD cannot be determined. We showed that the Project ImPACT has the potential to improve the social-communicative abilities of nonverbal children with ASD. Together with the positive results from previous studies (Ingersoll & Wainer, 2011, 2013), this seems a promising intervention programme. However, more research is needed to confirm these results, both with single-subject designs in different subgroups of children with ASD and with a randomized control design in a larger sample.

A second limitation is the lack of information on the evolution of the children in the long term. For all children the overall effect of the follow-up phase compared to baseline was positive. For three of the four children the progress was even more pronounced

during follow-up than during the intervention, which is what one would expect if parents manage to use the interactive and direct teaching techniques efficiently together. However, one of the children relapsed on several areas during follow-up. This could be related to the drop in the fidelity of implementation of the mother. These results suggest that future research should look at the effect of the intervention in the long term because it is reasonable to assume that treatment fidelity will diminish even further as time progresses. Possibly booster sessions (e.g. monthly during the first half year after the end of the intervention) could help prevent this.

Conclusion

The present study confirms and expands the positive results of previous research on the Project ImPACT parent training. Especially the effect on a broad range of social-communicative abilities in nonverbal children with ASD forms an important contribution of this study.

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Appendix

In two children (Child 1 and 2) both parents participated in the intervention. For them separate observations with the mother and with the father were recorded throughout baseline, intervention and follow-up phases. Figures A1 to A10 present a comparison between the outcome measures in interaction with the mother and with the father. Table A1 presents the effect sizes for both parents. Figure A1 shows that in both children the mother and the father increased their synchronous communication, soon after the start of the intervention and showed a similar evolution in this behaviour throughout the different phases of the study. While the parents of Child 1 showed approximately the same level of synchronization in most observations, the mother of Child 2 showed more synchronous communication than the father, especially in the baseline and intervention phase. The evolution in the social-communicative behaviours of the children was very similar with both parents. The clearest differences between the parents were observed for the play behaviours (Figures A8, A9 and A10). While for Child 1 the total time spent playing increased in interaction with his mother, it decreased with his father. It is important to note that the total play time with the father was longer than the total play time with the mother during baseline, which may be the reason for this difference. In Child 2 the increase in the play time was greater for the mother than for the father during the intervention phase, but became similar during follow-up. In general, the data of the interaction with the fathers confirm the positive effect of the Project IMPACT parent training on social engagement, communication, imitation and play.

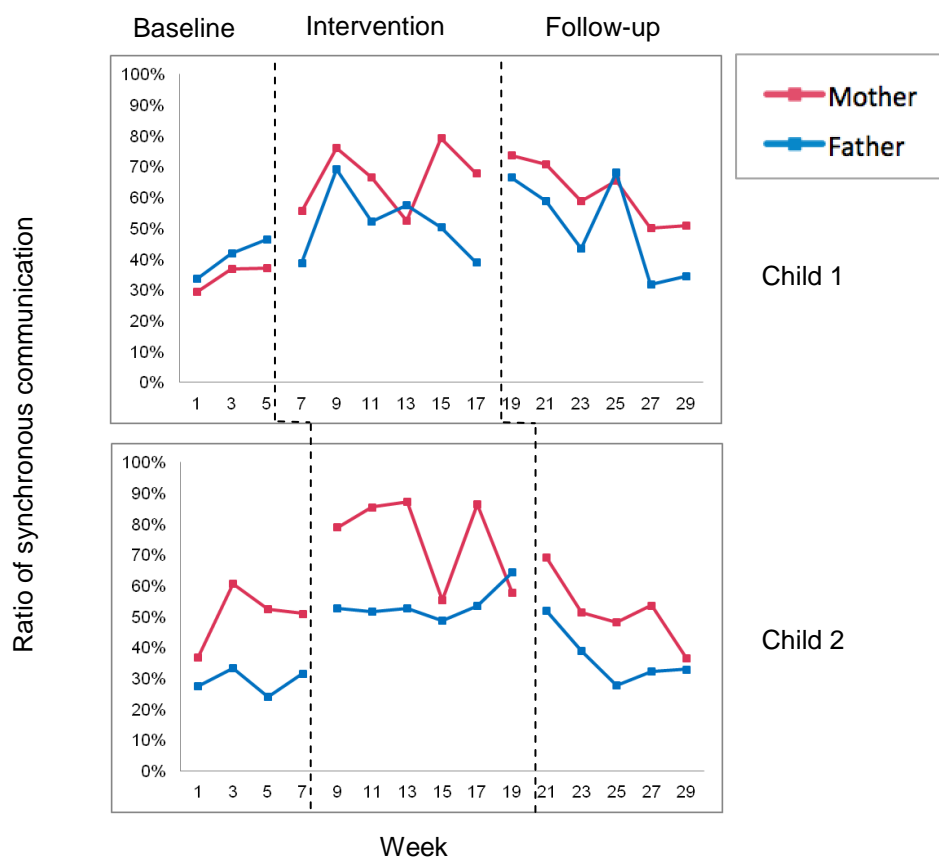


Figure 1A. Synchronous communication ratio during baseline, intervention and follow-up phases

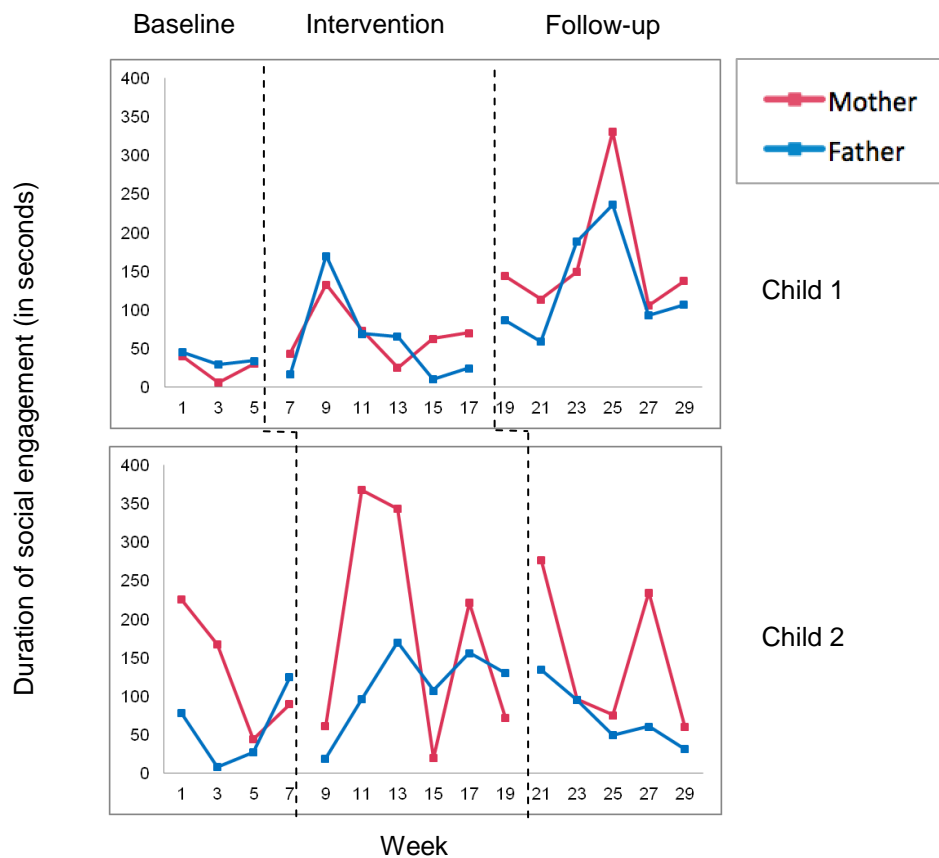


Figure 2A. Duration of social engagement during baseline, intervention and follow-up phases

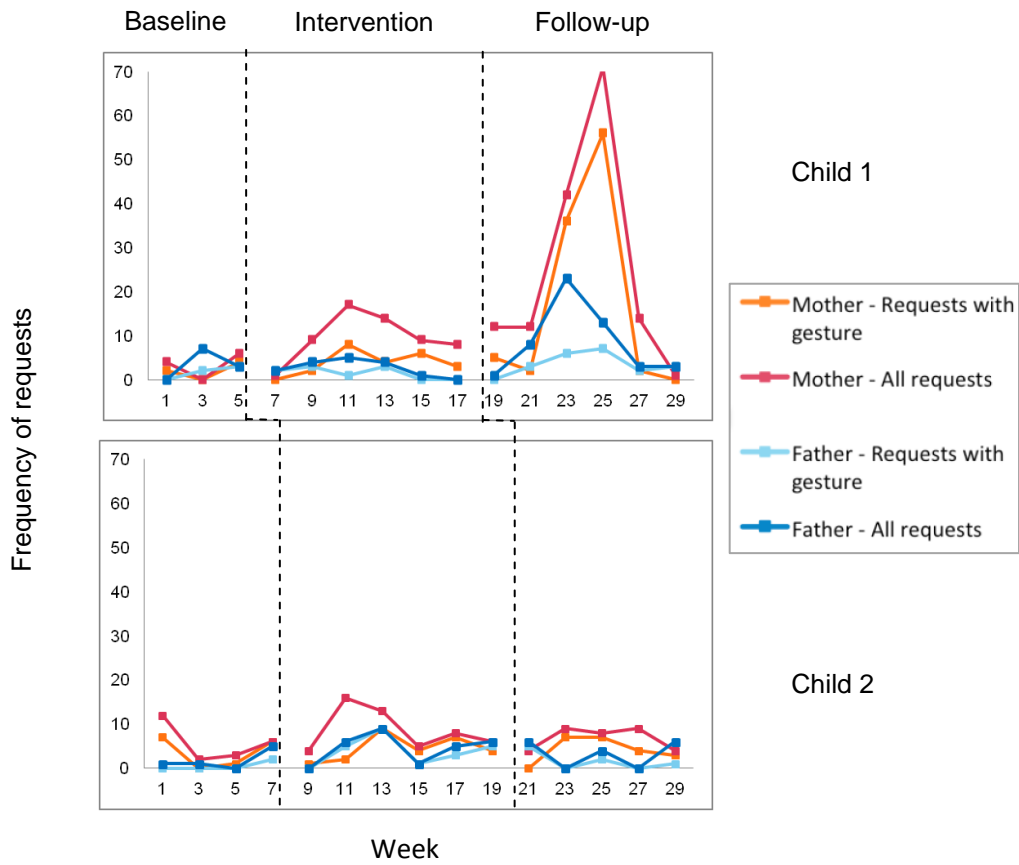


Figure 3A. Frequency of child requests during baseline, intervention and follow-up phases

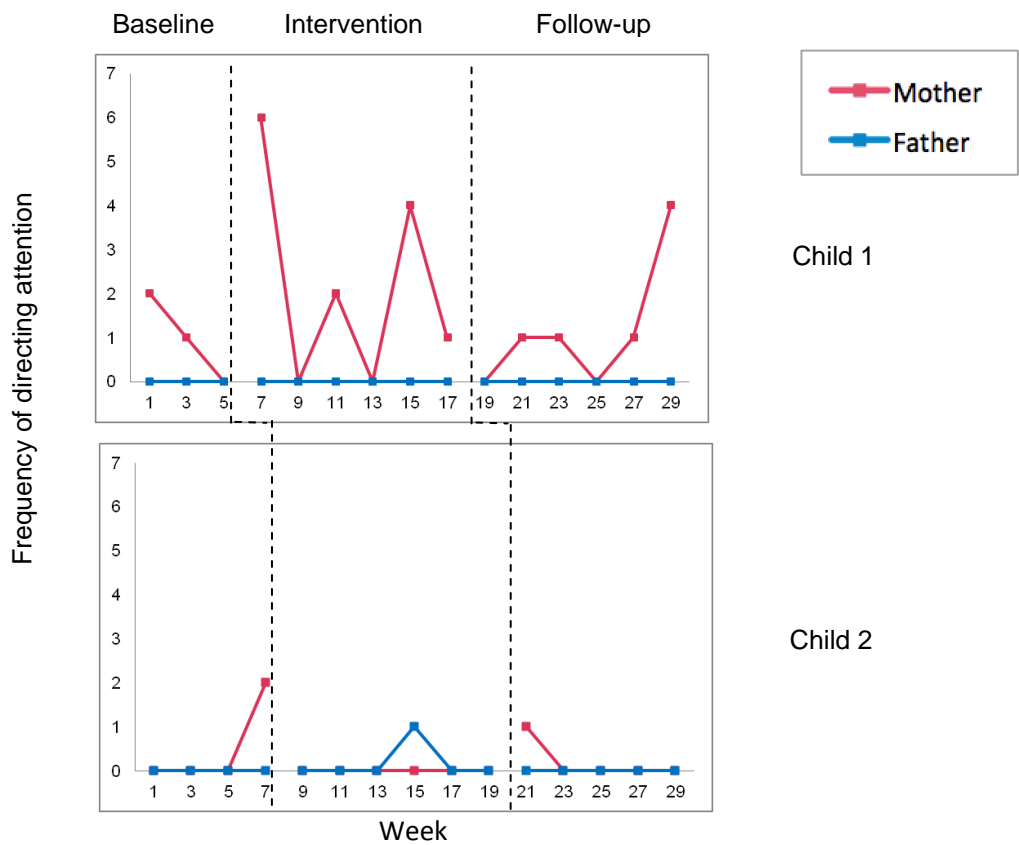


Figure 4A. Frequency of child directing attention during baseline, intervention and follow-up phases

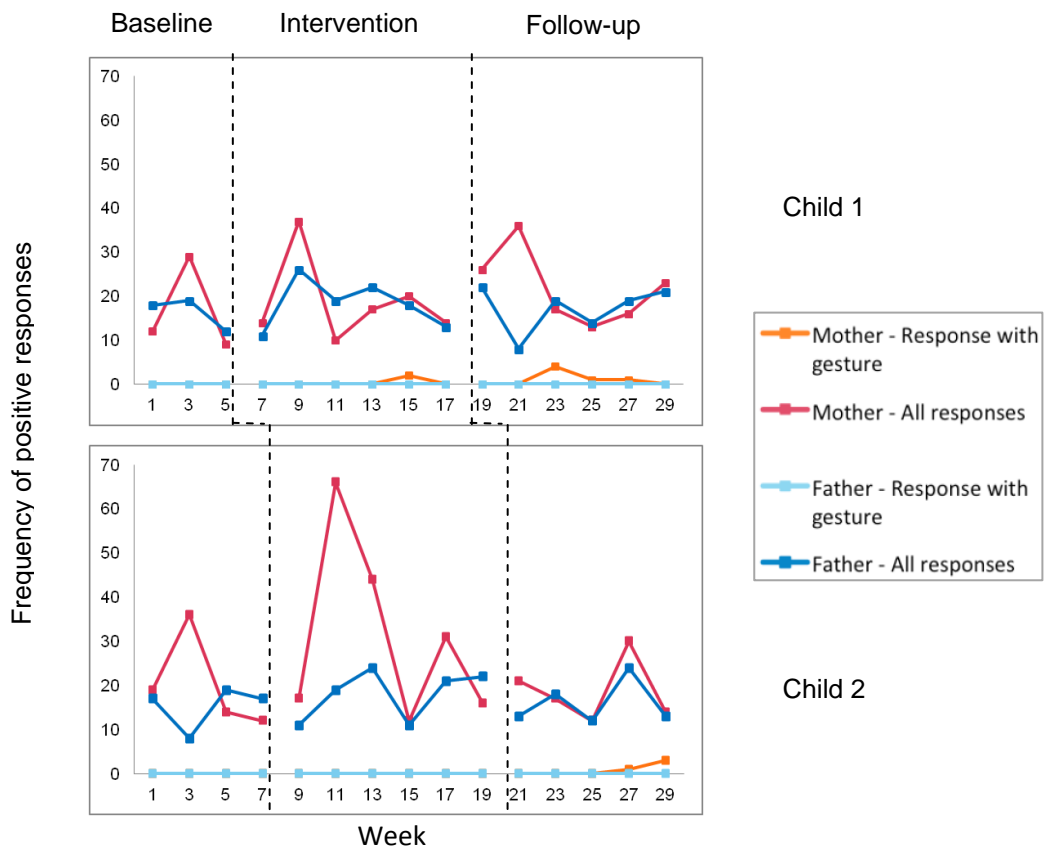


Figure 5A. Frequency of child positive responses during baseline, intervention and follow-up phases

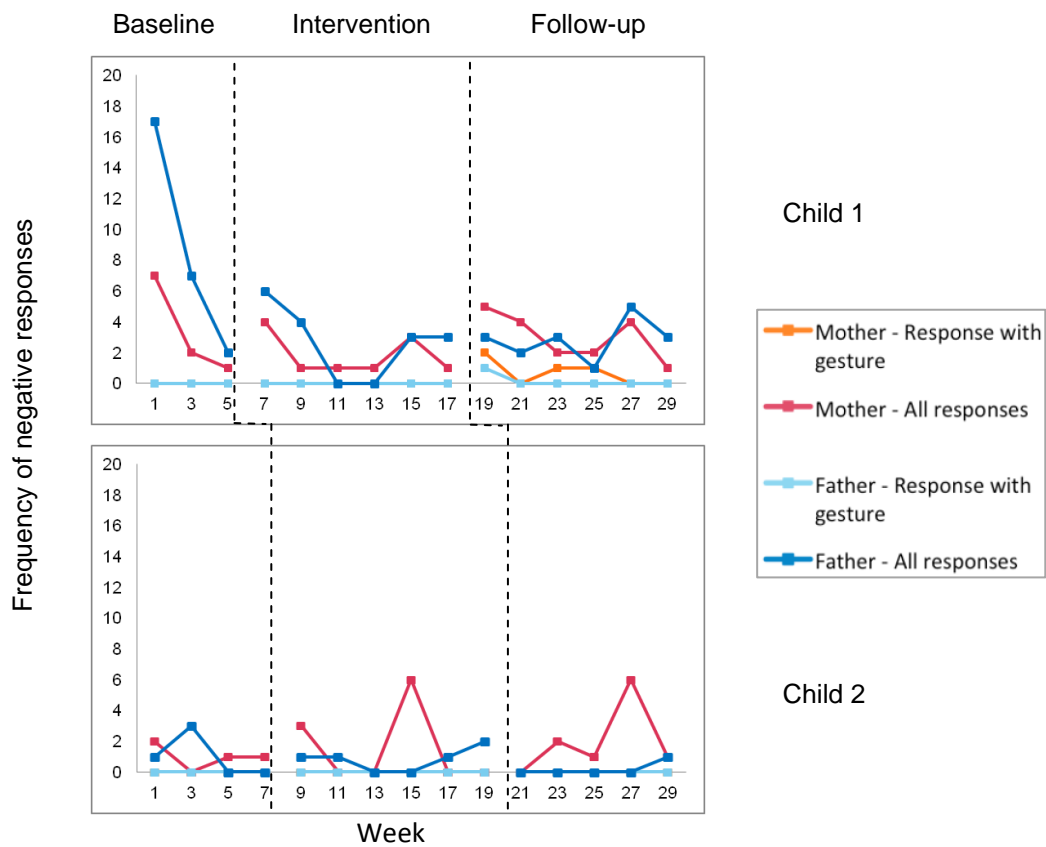


Figure 6A. Frequency of child negative responses during baseline, intervention and follow-up phases

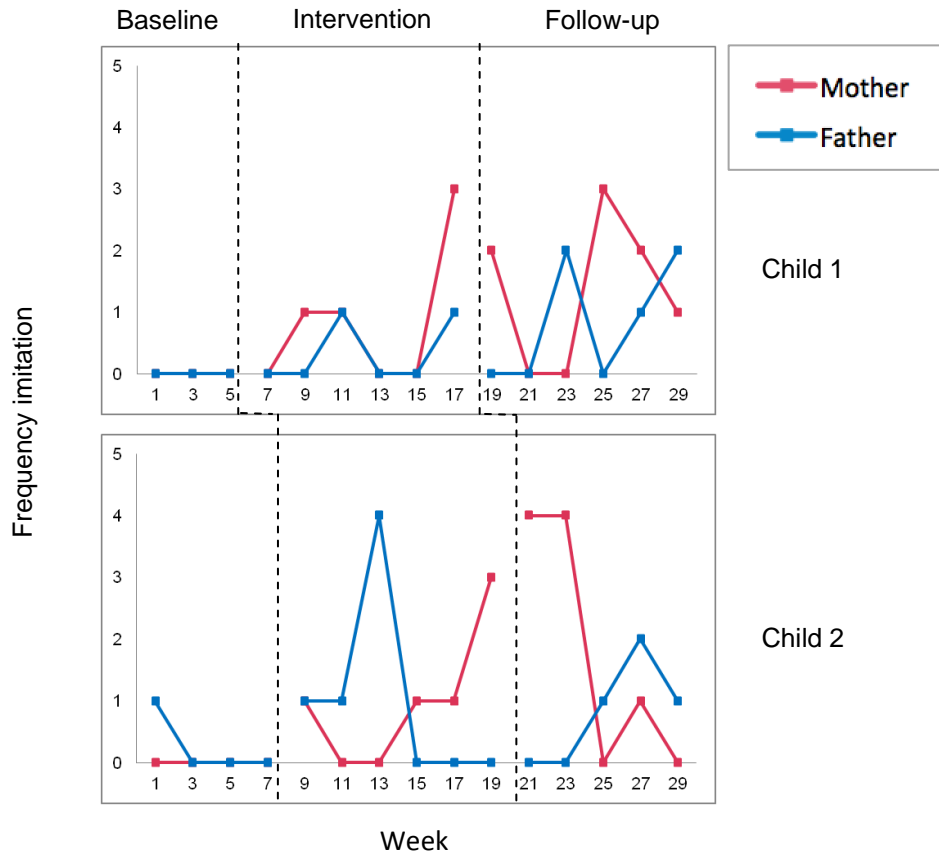


Figure 7A. Frequency of child imitation during baseline, intervention and follow-up phases

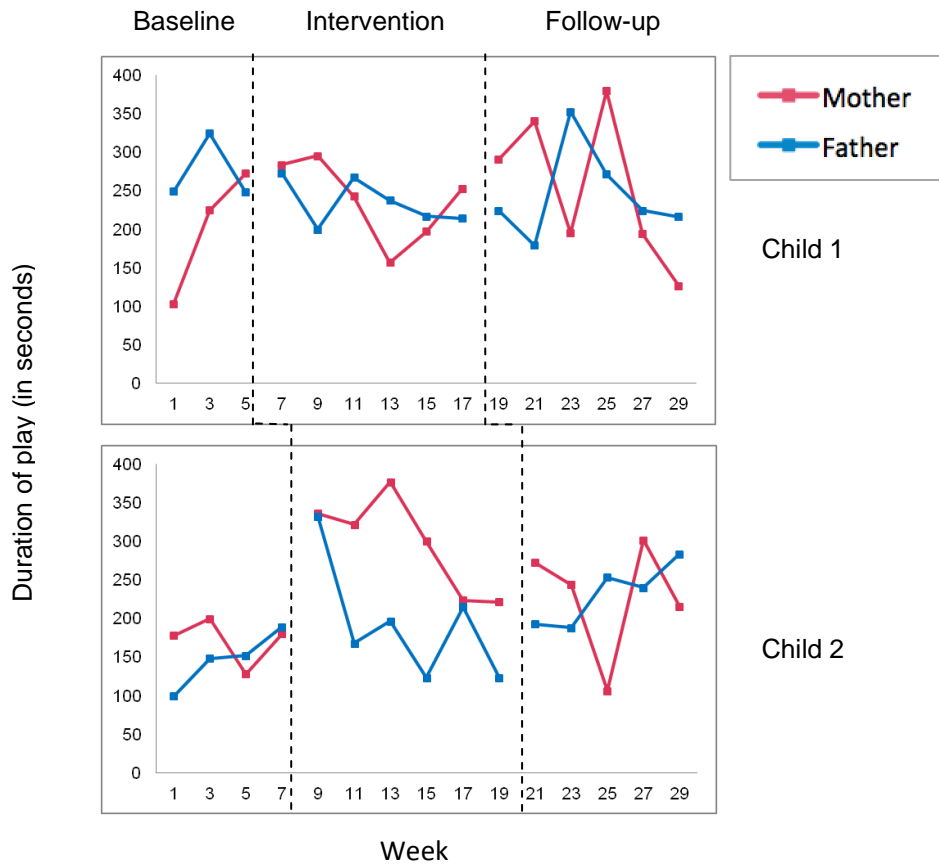


Figure 8A. Duration of child play during baseline, intervention and follow-up phases

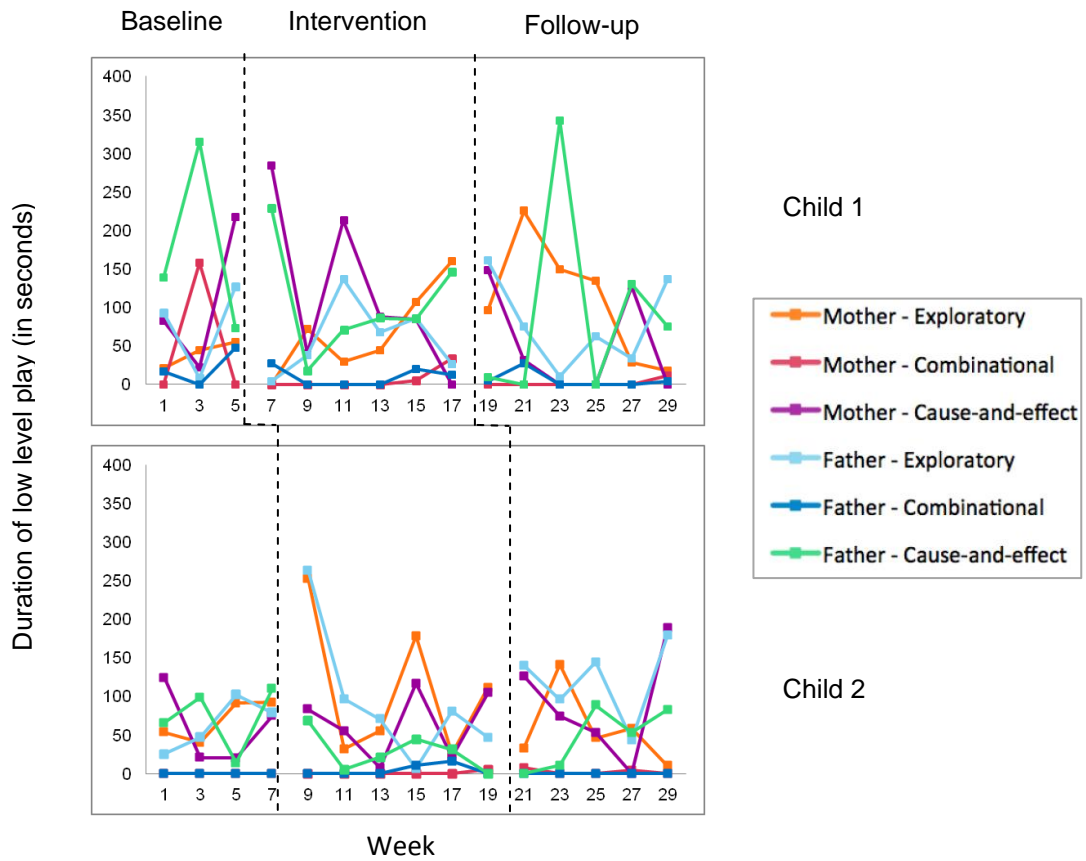


Figure 9A. Duration of child low level play during baseline, intervention and follow-up

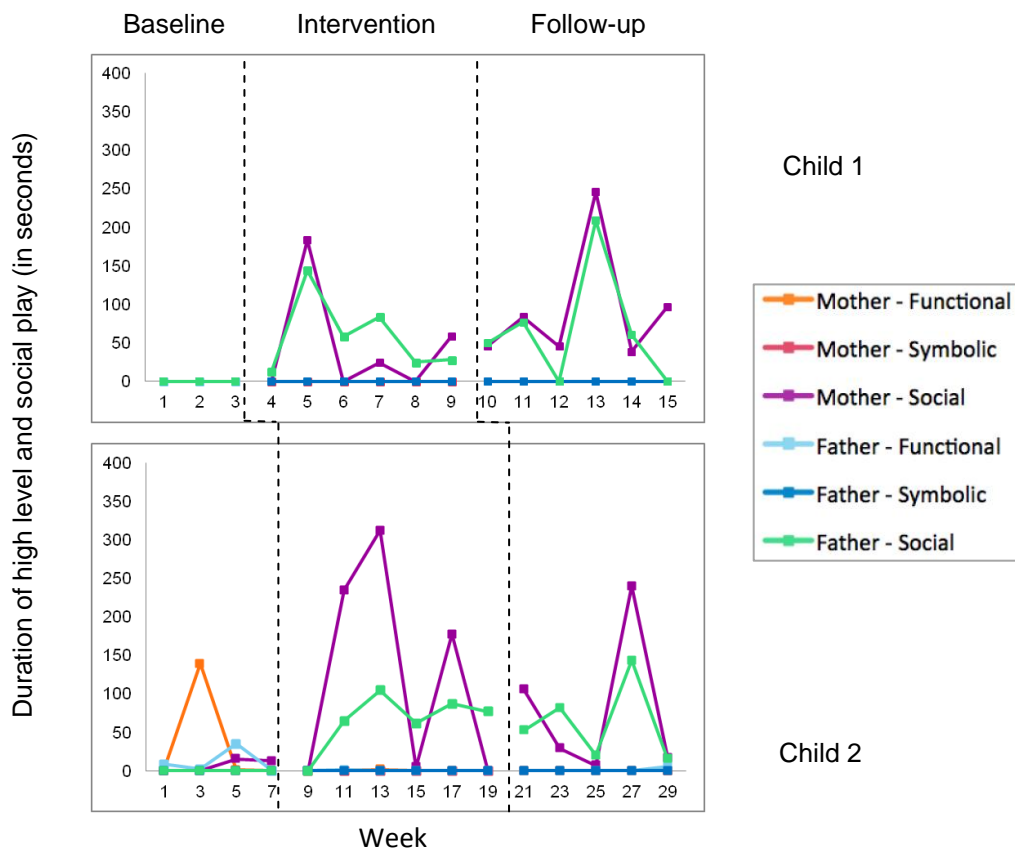


Figure 10A. Duration of child high level and social play during baseline, intervention and follow-up phases

Table 1

Comparison between effect sizes (d1 or d2) for the mother and father of Child 1 and 2

	Child 1				Child 2			
	Mother		Father		Mother		Father	
	I	FU	I	FU	I	FU	I	FU
Parent synchronous communication	7.18	6.13	1.65	1.65	2.50	0.15	5.96	1.84
Social engagement	2.44	7.92	2.87	11.37	0.61	0.21	1.02	0.27
Request (total)	2.07	7.20	-0.19	1.47	0.65	0.23	1.24	0.65
Request with gesture	0.92	7.42	-0.11	1.20	0.28	0.20	3.33	1.10
Directing attention	1.17	0.17	0.00	0.00	-0.50	-0.30	0.52	0.00
Positive response (total)	0.19	0.48	0.48	0.22	0.99	-0.13	0.56	0.15
Positive response with gesture	0.48	0.76	0.00	0.00	0.00	0.81	0.00	0.00
Negative response (total)	-0.47	-0.10	-0.79	-0.76	0.61	1.22	-0.12	-0.57
Negative response with gesture	0.00	0.97	0.00	0.48	0.00	0.00	0.00	0.00
Imitation	0.84	1.30	0.76	1.00	1.15	1.16	1.50	1.10
Play: total duration	0.43	0.62	-0.90	-0.67	4.10	1.85	1.25	2.30
Exploratory play	1.62	3.87	-0.27	0.06	1.50	-0.44	0.89	1.68
Combinational play	-0.51	-0.56	-0.47	-0.64	0.52	0.90	0.79	0.00
Cause-and-effect play	0.11	-0.56	-0.56	-0.66	0.09	0.58	-1.02	-0.59
Functional play	0.00	0.00	0.00	0.00	-0.50	-0.51	-0.69	-0.64
Symbolic play	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Social play	0.73	1.39	1.41	1.01	14.05	8.94	2.33	1.58

Note. I = Intervention; FU = Follow-up

**ABA UNDER THE LOOKING GLASS: TEACHING
SOCIAL-COMMUNICATIVE ABILITIES TO
CHILDREN WITH AUTISM SPECTRUM
DISORDER****ABSTRACT**

This study performed a micro-analysis of the interaction between children with autism spectrum disorder (ASD) and their therapists during an Applied Behaviour Analysis (ABA) intervention session. We coded social-communicative behaviour of 16 children with ASD, as well as its antecedents and consequences provided by the therapists. Besides a descriptive analysis of prompts and rewards used and the individual variability in the interaction between therapists and children, the study focused on the extent to which these observational data predicted the progress which children made during 6 months of intervention. The results revealed that therapists mainly used verbal prompts as antecedent, and verbal and natural material rewards as consequence for social-communicative behaviour. There were clear intra-individual and inter-individual differences in the interaction sequences characterizing social-communicative behaviour. Joint attention and play interaction sequences predicted the progress of children after a period of 6 months of intervention. This study shows the value of studying moment-to-moment interactions of children with ASD with their therapist to gain more insight into factors contributing to the effectiveness of ABA.

INTRODUCTION

Applied Behaviour Analysis (ABA) is widely recognized as one of the most well-established treatments for children with autism spectrum disorder (ASD) (Eikeseth, 2009; Reichow, 2012; Vismara & Rogers, 2010). Since Lovaas (1977) first described this intervention, it has evolved in many ways. The original method primarily consisted of discrete trial teaching (DTT), which is a structured and adult-directed approach to teach skills, often with the use of artificial reinforcement. This method has been criticized because it might interfere with children's abilities to communicate spontaneously and preclude generalization of what is learnt (Goldstein, 2002). This led to the development of several naturalistic behavioural treatments, which incorporate techniques from the developmental social pragmatic approach and emphasize teaching in the natural environment, child initiations and natural reinforcement (Ingersoll, 2010). Naturalistic behavioural treatments are more effective than DTT to teach language to children with ASD (Delprato, 2001). Furthermore, whereas traditional ABA effectiveness studies looked predominantly at cognitive, language and adaptive abilities as outcome measures (e.g. Cohen, Amerine-Dickens, & Smith, 2006; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Lovaas, 1987; Smith, Groen, & Wynn, 2000), studies using naturalistic behavioural treatments have shown that children also made progress on social-communicative abilities (e.g. Ingersoll & Wainer, 2011; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010). This is an important finding given the pivotal role these abilities play in the development of children with ASD (Charman, 2003; Poon, Watson, Baranek, & Poe, 2012).

Although the positive effect of ABA has repeatedly been demonstrated, it remains unclear how variations in techniques affect the results. Especially the evolution to the naturalistic behavioural treatment resulted in an intervention that is implemented in various ways. Some single-case studies have evaluated the effects of differences in techniques, for example by manipulating prompting or reinforcement strategy (Fentress & Lerman, 2012; Karsten & Carr, 2009; Volkert, Lerman, & Vorndran, 2005). However, since therapists tend to adapt evidence-based strategies (Stahmer, Collings, & Palinkas, 2005), it is important to gain more insight in how ABA-interventions are used in practice and how this affects the outcome.

Another poorly understood question is why part of the children with ASD fails to show progress with ABA. The variability in outcome can be partially explained by differences in IQ, autism severity, age at the start of the intervention and treatment intensity (Mazurek, Kanne, & Miles, 2012; Perry et al., 2011; Virues-Ortega, Rodriguez, & Yu, 2013; Zachor & Ben Itzchak, 2010). A recent study by Klintwall and Eikeseth (2012) showed that also the number and controllability of possible reinforcers are important predictors of the outcome. As yet, a large part of the variance remains unexplained. Possibly, features of the interaction between therapist and child during intervention account for some of the variance that is not explained by more general child and intervention characteristics.

Observational studies of the interaction between therapist and child during intervention can expand the current knowledge on the effect of variations in implementation and give insight into factors contributing to the variability in outcome. ABA is based on the idea that all behaviour can be taught by applying the principles of operant conditioning. It is therefore of interest to look at the antecedents and consequences of social-communicative behaviour of children with ASD during an intervention session. To our knowledge no study reported on such a micro-analysis of the interactions between child and therapist in an ABA-session, focussing on social-communicative behaviour. One study looked at the consequences provided by the therapist following verbal behaviour of the child and found that the majority of these behaviours was followed by positive attention and only a minority by material rewards (Rivard & Forget, 2012). A few studies focussed on antecedents and consequences of the social-communicative behaviour of children with ASD in preschool classrooms. Wong and Kasari (2012) showed that teachers provided limited prompts and rewards for play and joint attention. Moreover Keen, Sigafos, and Woodyatt (2005) found that on average not much more than 60% of communicative attempts of the children were followed by a response of the teacher. According to these authors this might not be sufficient, given the communication deficit of children with ASD. Chiang (2009a) demonstrated that the most common response of teachers to both elicited and spontaneous communication was a verbal acknowledgement. However, the dominant communicative function of the spontaneous communication was requesting, which made the author conclude that only a small part of those requests are followed by receiving the desired object or activity. In the same study, it was shown that the elicited communication of the children was most often

preceded by verbal prompts and modelling. The frequency of these verbal prompts and modelling was associated with the children's number of requests and comments (Chiang, 2009b).

These observational studies revealed that studying moment-to-moment interactions of children with ASD can provide us with valuable information. We can expect that therapists trained in ABA will provide more adequate prompts and rewards for social-communicative behaviour during a one-on-one interaction with a child than teachers who did not receive such a training and who are obliged to divide their attention between several children in a preschool classroom. The aim of the present study was to perform a micro-analysis of the interaction between children with ASD and their therapists during an ABA-intervention session. We had three main objectives. First, we wanted to assess what the most prevalent types of prompts and rewards were that facilitated social-communicative abilities. Second, we aimed to describe the frequency of interaction sequences, characterized by social-communicative behaviour of the child and the antecedents and consequences provided by the therapist. That way we could compare the individual variability in those interaction sequences and compare the average frequencies of the sequences. Third, we wanted to assess whether the frequencies of the interaction sequences predicted the progress children made in a period of 6 months of ABA-intervention.

METHOD

Participants

Sixteen children who received ABA were selected from a larger intervention study (see Van der Paelt, Warreyn & Roeyers, 2014). They were recruited from five treatment centres, serving children with developmental delays. In total, seven therapists from these centres had received an ABA training, and had started an ABA-intervention with one or more of the 16 participants. Children were diagnosed with ASD by a multidisciplinary team based on DSM-IV-TR criteria (American Psychiatric Association, 2000). The diagnoses were confirmed with the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore & Risi, 1999) for the present study. The cognitive level of the children was assessed before the start of the

study by the treatment centre with the Dutch version of one of the following tests: Bayley Scales of Infant Development, second edition (BSID-II-NL; van der Meulen, Ruiters, Spelberg & Smrkovsky, 2002; $n = 8$), Wechsler Preschool and Primary Scale of Intelligence, third edition (WPPSI-III; Hendriksen & Hurks, 2009; $n = 3$), Snijders-Oomen Non-verbal Intelligence Test – Revised (Tellegen, Winkel, Wijnberg-Williams & Laros, 1998; $n = 3$) and the Psychoeducational profile – Revised (PEP-R; Pameijer & van Beukering, 2007; $n = 2$). Child and therapist characteristics are presented in Table 1.

Intervention

Therapists were trained in ABA-techniques by a Board Certified Assistant Behaviour Analyst before the start of the study and also received on average 3 days of supervision by this person, before data collection of the present study. The training focussed on the verbal behaviour approach (Sundberg & Michael, 2001). This specific type of ABA-intervention is based on the theory of Skinner (1957) who specified different categories of verbal behaviour such as mands (requesting for desired objects and activities), tacts (naming objects), echoics (imitating language) and intraverbals (answering questions). According to the verbal behaviour approach each of these categories has to be taught explicitly to children with ASD. For example a child who can tact certain objects, will not automatically be able to mand for the same objects and will need explicit instruction to learn this. Therapists used the Verbal Behaviour Milestones Assessment and Placement Program (VB-Mapp; Sundberg, 2008) to evaluate progress and determine new targets. This program emphasizes language, cognitive and social communication goals (play, imitation, social skills in groups). The verbal behaviour approach combines both incidental teaching as well as discrete trial teaching.

Table 1
Child and therapist characteristics

Child	Age (years – months) ^a	Gender	IQ	Months elapsed since start ^a		Intensity (minutes per week)		Therapist	Therapist's experience ^b
				All Treatment	ABA	All treatment	ABA		
1	5-5	M	<55	25.36	6.38	120	60	1	7
2	4-7	F	81	6.48	6.48	120	60	1	
3	2-6	F	<55	5.89	6.05	215	60	2	25
4	3-0	M	<55	6.48	6.48	180	60	2	
5	2-9	M	<55	2.11	2,34	180	60	2	
6	3-1	F	<55	17.17	6.05	215	60	2	
7	3-2	M	58	6.35	6.51	215	60	2	
8	5-6	M	86	6.51	6.51	180	60	3	25
9	6-3	M	<50	46.78	11.74	180	60	3	
10	6-3	M	75	32.93	5.89	220	30	4	10
11	6-0	M	90	12.43	4.84	310	60	5	4
12	5-2	M	97	25.46	8.42	120	30	5	
13	5-3	M	<50	11.09	6.05	180	60	5	
14	3-2	M	66	6.45	6.55	120	120	6	6
15	2-6	M	60	5.07	5.07	180	180	6	
16	3-9	M	<55	7.11	7.11	120	60	7	10

Note. ^a At the time of the observation of the intervention session ^b Years of experience with intervention in children with ASD

Coding scheme

Of every child one treatment session was filmed by a research assistant, which was one of the first sessions after the therapist and parents of the child had agreed to participate. The main dependent measures were coded from the videos using Noldus Observer behavioural coding software, version XT 9.0 (Noldus, 2009) by two undergraduate students, who were unaware of the specific research questions. Of every session, 15 minutes were coded, starting after 5 minutes, to allow for a warming-up period. Each tape was watched five times at normal speed and once at half speed to complete the codes. Some of the behaviours coded were not used for the present study because they were not relevant to the research questions.

Child. First, the child's verbal and nonverbal behaviours with a communicative intent were coded as either a vocalisation, word, sentence, gesture or action (only for actions that were imitated or performed on instruction). Laughing, directed at the therapist was also coded, but was not used in further analyses. Additionally, every communicative behaviour received a set of supplementary codes, called *modifiers*. Two of these modifiers were used for the present study. One modifier specified the function: declarative, imperative or other. A second modifier specified whether the behaviour was an imitation of the therapist's language, action/gesture, both or no imitation. Modifiers for initiation versus response and type of gesture were not used further. Second, the child's play was coded continuously (both starting point and duration) into one of the following categories: exploratory, construction, cause-and-effect, functional, symbolic play, social, rule-based play, no play. The child's looking behaviour (coded at half speed) and inappropriate behaviour were coded as well, but are not discussed further. Based on these codes several behaviour categories were computed. Table 2 specifies the operational definitions of all behaviour categories that were used in the analyses.

Table 2

Operational definitions of behaviours in coding scheme

Behaviour		Operational definition
Child	Imperative joint attention	Requesting for an object or activity (it is clear that the child wants the therapist to give or do something)
	Declarative joint attention	Sharing interest with the therapist
	Imitation	Repeating the verbal behaviour, gesture or action of the therapist within 5 seconds of the therapist's behaviour
	Low level play	Exploratory play: exploring sensory characteristics of objects, e.g. looking at, touching toys; cause-and-effect play: performing an action to obtain a desired effect, e.g. with musical toys; constructional play: combining objects to create something, e.g. stacking blocks, making a puzzle
	High level play	Functional play: using a toy for its intended purpose, e.g. pushing a car; symbolic play: object substitution, make-believe property attribution or reference to an absent object, e.g. pretending a doll is eating
Therapist	Prompt	Directing the behaviour or attention of the child
	Reward	Following the attention focus of the child, reinforcing or confirming the child's actions or imitating the child

Joint attention. All communicative behaviours of the child with an imperative function (vocalisations, words, sentences and gestures) were summed together. The same was done for the communicative behaviours with a declarative function. Within the category of declarative joint attention, only the spontaneous (unprompted) communication was used in the analyses, since we did not consider prompted declarative communication as real joint attention.

Imitation. Almost all imitation that occurred was verbal imitation. For this reason it did not seem useful to further distinguish between different forms of imitation. All communication that was coded as imitation (regardless of the type of imitation) was lumped together.

Play. We computed a category of play of a low developmental level (exploratory, constructional and cause-and-effect play) and a category of play of a high developmental level (functional and symbolic play). Social play and rule-based play were only observed in 6 and 3 children respectively and were therefore not used in the analyses.

Therapist. First, all acts of the therapist were coded continuously as one of the following mutually exclusive categories: giving an object to the child, starting a pleasant activity (e.g. blowing bubbles), playing with toys, giving physical assistance to the child (e.g. moving the hand of the child to operate a toy), pointing to an object or event, other gestures (different from pointing or showing), observing the child without engaging in other behaviour and a rest category for any behaviour that did not fit with the other behaviour definitions. Second, the verbal behaviour of the therapist was coded as either a vocalisation, word or sentence. Both the acts and the language received modifiers to specify the function (prompt, reward, follow the child's interest or other). Modifiers for the focus of the therapist's behaviour and the type of play were not further used. Based on these therapist codes two behavioural categories (with subcategories) were created.

Prompt. Separate categories were created for each type of prompt: verbal prompt (no distinction between vocalisation, word or sentence), giving an object, starting an activity, play prompt, physical prompt, pointing, gesture prompt and other prompt. In addition, we calculated the total number of prompts, regardless of the type.

Reward or acknowledge. The same categories were made for each type of reward: verbal reward (no distinction between vocalisation, word or sentence), giving an object, starting an activity, play reward, physical assistance, pointing, rewarding gesture and other reward. In addition, we computed the total number of rewards, regardless of the type.

Interrater reliability. Interrater reliability was determined with single measures intraclass correlations (ICCs) by double coding of 44% of the observations. The ICCs were .86 for imperative joint attention, .76 for declarative joint attention, .67 for imitation, .64 for low level play, .90 for high level play .90 for prompt and .74 for reward.

Outcome measures

The abridged version of the Early Social Communication Scales (ESCS; Mundy et al., 2003) was used to measure imperative and declarative joint attention. Motor imitation was assessed with the Preschool Imitation and Praxis Scale (PIPS; Vanvuchelen, Roeyers, & De Weerd, 2011). The structured version of the Test of Pretend play (ToPP; Lewis & Boucher, 1997) was used to assess pretend play. We used the Reynell Developmental Language Scales – Dutch version (RTOS; Schaerlaekens, Zink, & Van Ommeslaeghe, 2003) to measure expressive and receptive language. For a detailed description of the outcome measures, see chapter 3 of this dissertation.

Procedure

Pre-and post-tests were administered in the treatment centres of the children, both on two separate days with approximately one week in between. The first assessment started with the ADOS, after which the PIPS was administered. The second assessment consisted of the ESCS, ToPP and RTOS, in that order. Both assessments took approximately 60 to 90 minutes. Time between pre- and post assessment was 6 months. The assessment was videotaped and all the tests were scored afterwards from the video.

Treatment sessions were filmed on average 4 months ($SD = 1.51$) after the first assessment. The session took place in the treatment centre, in the room where the child

was used to receive intervention. The therapist worked one-on-one with the child during the session. Only the research assistant was present in the corner of the room with a handheld camera. There was no interaction between the research assistant and the therapist or child during the observation. The therapists were asked to provide the intervention as they would normally do and were naive with respect to the specific objectives of the study.

The study design was reviewed and approved by the Ethics Committee of the Faculty of Psychology and Educational Sciences of Ghent University, where the study was conducted. Parents gave their written consent prior to the inclusion of their children in the study.

Data-analysis

We used lag sequential analysis in The Observer XT 9 (Noldus, 2009) to calculate the frequency of combinations of the behaviour of therapist and child. A time lag of 5 seconds with the option to ignore recurring targets was specified in each of the analyses, which meant that for every behaviour of the child, repetitions of the therapist's behaviour within 5 seconds of the child's behaviour were counted once. The frequency of social-communicative behaviour with at least one prompt within 5 seconds *before* the child's behaviour was computed. In addition, we computed the frequency of social-communicative behaviour with at least one reward within 5 seconds *after* the behaviour of the child. Sequences of three elements (prompt – social-communicative behaviour of the child – reward) were computed as well. Non-parametric tests were used to compare frequencies of these sequences because the data were not normally distributed.

RESULTS

Description of types of prompts and rewards used to facilitate social-communicative abilities

Table 3 presents the frequencies of each type of prompt that occurred within 5 seconds before social-communicative behaviour of the children.

Table 3

Frequencies of combinations between different types of prompts and subsequent social-communicative behaviour

	Imperative JA		Imitation		Low level play		High level play	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Verbal	29.31	20.79	12.31	21.03	3.75	3.21	3.88	4.44
Giving an object	1.00	2.00	2.88	10.88	1.19	1.70	0.25	0.43
Starting activity	0.50	0.94	0.31	0.85	0.19	0.73	0.06	0.24
Modelling play	5.19	5.91	0.44	0.61	1.25	1.48	0.94	1.25
Physical	0.38	0.86	0.13	0.48	0.06	0.24	0.06	0.24
Pointing	2.81	4.11	0.88	2.20	0.06	0.24	0.31	0.46
Other gesture	2.25	5.32	2.44	5.91	0	0	0.25	0.97
Other	0	0	0	0	0	0	0	0

Note. JA= joint attention.

We used post hoc Wilcoxon Signed Rank Tests to determine which type of prompt was most prevalent for each category of social-communicative behaviour. A Bonferroni correction for multiple comparisons was applied ($\alpha = .01$). The comparison of types of prompts that preceded *imperative joint attention* showed that the number of verbal prompts was significantly higher than the number of all other prompts together, $T = 0.00$, $p = .001$. This was also true for *imitation*, $T = 0.00$, $p = .001$. There was a marginally significant difference between verbal prompt and giving an object preceding *low level play*, $T = 11.50$, $p = .01$. There were significantly more verbal prompts than modelling play prompts preceding low level play, $T = 6.50$, $p = .003$. Starting an activity, physical

prompts, pointing or other gesture prompts preceding low level play were rare. There were significantly more verbal prompts than modelling play prompts preceding *high level play*, $T = 63.50$, $p = .006$. Other types of prompts preceding high level play were rare.

Table 4 presents frequencies of each type of reward occurring within 5 seconds after different types of social-communicative behaviour of the children.

Table 4

Frequencies of combinations between different types of rewards and social-communicative behaviour

	Imperative JA		Declarative JA		Imitation		Low level play		High level play	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Verbal	26.38	25.67	24.88	21.23	9.00	12.00	3.31	3.24	4.81	5.92
Giving object	16.56	21.63	1.81	2.20	2.25	3.77	0.38	0.81	0.19	0.40
Starting activity	5.81	12.46	2.56	7.39	1.19	2.07	0.19	0.54	0.38	1.26
Play	2.69	4.60	1.56	2.83	1.00	2.99	0.44	0.81	0.31	0.60
Physical	0.19	0.75	0	0	0.06	0.25	0	0	0	0
Pointing	0.31	0.70	0.25	0.77	0.19	0.40	0	0	0	0
Other gesture	0.31	0.60	0.06	0.25	0.19	0.75	0.06	0.25	0.06	0.25
Other	0.88	2.99	0.25	0.77	0.06	0.25	0	0	0.06	0.25

Note. JA= joint attention.

We used Wilcoxon Signed Rank Tests to determine which type of reward was most prevalent for each category of social-communicative behaviour. A Bonferroni correction for multiple comparisons was applied ($\alpha = .0045$). There was no significant difference between verbal rewards and giving an object following *imperative joint attention*, $T =$

90.00, $p = .09$. Verbal rewards for imperative joint attention were however more prevalent than starting an activity following this behaviour, $T = 98.50$, $p = .004$. There was no significant difference between giving an object and starting an activity following imperative joint attention, $T = 16.50$, $p = .02$. Giving an object was however more prevalent than play behaviour of the therapist following imperative joint attention, $T = 98.50$, $p = .004$. There was no significant difference between starting an activity and playing following imperative joint attention, $T = 22.00$, $p = .57$. For *declarative joint attention* the number of verbal rewards was significantly higher than the number of all other rewards together, $T = 120.00$, $p = .001$. This was also true for *low level play*, $T = 88.00$, $p = .003$, and *high level play*, $T = 78.00$, $p = .002$. The results for *imitation* were similar to the result for imperative joint attention. There was no significant difference between verbal rewards and giving an object, $T = 4.50$, $p = .007$, but a significant difference between verbal rewards and starting an activity, $T = 0.00$, $p = .002$ and play, $T = 0.00$, $p = .001$.

Prompt – Behaviour – Reward interactions sequences

Table 5 presents the interaction sequences for the different types of social-communicative behaviour.

Table 5
Frequencies of social-communicative behaviour that was either prompted or spontaneous and rewarded or not rewarded

	Imperative JA		Declarative JA		Imitation		Low level play		High level play	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Prompt – reward	18.81	16.99	/	/	7.94	13.48	1.94	1.98	2.88	3.38
No prompt – reward	18.25	21.43	13.00	12.62	2.75	3.30	1.69	1.54	2.06	3.70
Prompt – no reward	12.13	10.48	/	/	4.63	9.11	2.88	2.50	1.63	2.28
No prompt – no reward	8.63	8.08	9.31	8.91	0.81	1.28	3.38	2.94	1.56	1.93

Note. Only the unprompted declarative joint attention was used in the analyses; JA= joint attention

We performed Friedman's ANOVAs to compare the frequencies of the different sequences for each social-communicative behaviour category. For declarative joint attention the sequences were compared with the Wilcoxon Signed Rank Test (because there were only two categories). There was no difference between the interaction sequences for imperative joint attention, $\chi^2(3) = 7.67$, $p = .053$, declarative joint attention, $T = 42.50$, $p = .32$ and high level play, $\chi^2(3) = 4.36$, $p = .23$. However, there was a significant difference between the interaction sequences for imitation, $\chi^2(3) = 11.34$, $p = .01$. Wilcoxon tests were used to follow up this finding. We were interested in three specific combinations: prompt and reward versus no prompt and reward (Is prompted behaviour more often rewarded than spontaneous behaviour?), prompt and reward versus prompt and no reward (Is prompted behaviour more often rewarded than not rewarded?) and no prompt and reward versus no prompt and no reward (Is spontaneous behaviour more often rewarded than not rewarded?). A Bonferroni correction was applied ($\alpha = .017$). There were no significant differences for each of the comparisons ($p \geq .05$). Also for low level play there was a significant difference between the four interaction sequences, $\chi^2(3) = 12.35$, $p = .006$. Wilcoxon tests were used to test the same three combinations as were tested for imitation, with the same correction for multiple testing. There was a marginally significant difference between spontaneous low level play that was rewarded versus not rewarded, $T = 59.50$, $p = .018$. The spontaneous play was more often not rewarded than rewarded. The other two Wilcoxon tests were not significant ($p > .10$). Besides an analysis at a group level, we were interested in the individual variation in these interaction sequences. Figure 1 shows that there were intra-individual and inter-individual differences in the frequencies of *joint attention* interaction sequences. It is apparent that some children (Child 3, 4 and 5) showed little or no imperative or declarative joint attention. Four children (Child 2, 9, 14 and 15) clearly showed more imperative than declarative joint attention. For three of them (Child 9, 14 and 15) it was also obvious that within the imperative joint attention category, there was much more rewarded than unrewarded communication. Three children (Child 6, 13 and 16) demonstrated the opposite pattern with more declarative than imperative joint attention and an overweight of rewarded communication within the declarative joint attention category.

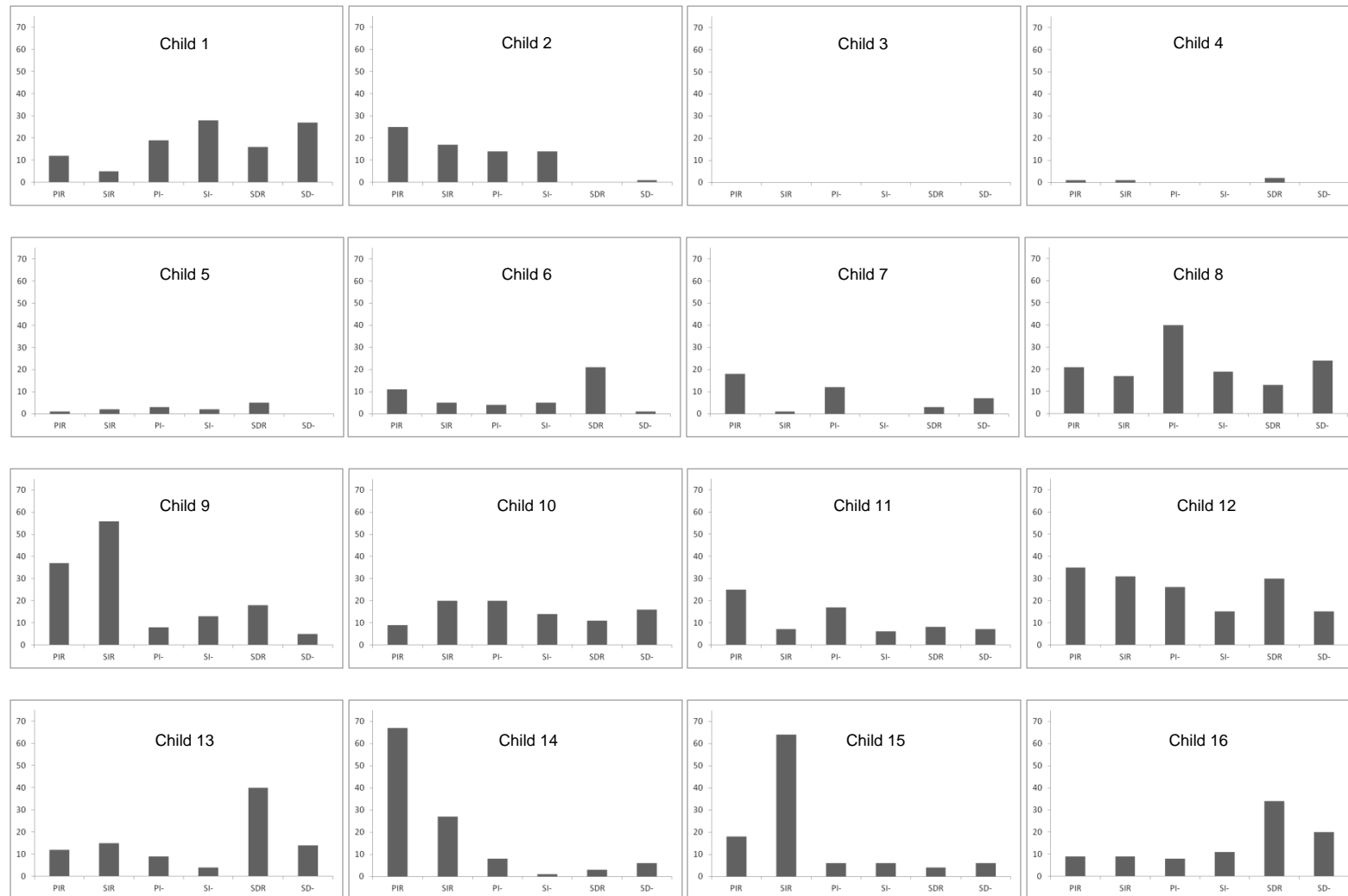


Figure 1. Distribution of frequency of joint attention interaction sequences for each child. PIR = prompt – imperative joint attention – reward; SIR = spontaneous – imperative joint attention – reward; PI- = prompt – imperative joint attention – no reward; SI- = spontaneous – imperative joint attention – no reward; SDR = spontaneous – declarative joint attention – reward; SD- = spontaneous – declarative joint attention – no reward.

For the remaining children (Child 1, 7, 8, 10, 11 and 12) the difference between imperative and declarative communication was less clear. Although in some children we observed more prompted (Child 7, 11, 14) than spontaneous imperative communication, the majority of the children did not clearly show this difference.

Figure 2 shows that also for *imitation* there was clear variability. Again, some children showed little or no imitation (Child 3, 8, 10, 11 and 12). There were different patterns in the ratio of prompted to spontaneous imitation. Some children (Child 2, 7 and 14) imitated especially when the therapist had used a prompt just before and almost never spontaneously. For two of these children (Child 2 and 7) the imitation was more often rewarded than not, while for the third child the number of rewarded and unrewarded imitations was approximately equal. Other children (5 and 6) imitated more spontaneously than after a prompt and were also more rewarded for this behaviour than not rewarded. The remaining children (Child 1, 4, 9, 13, 15 and 16) did not show a clear difference between prompted and spontaneous imitation. The majority of them (Child 4, 9, 13 and 16) was more often rewarded than not for imitation.

In Figure 3 we present the individual variation in the *play* interaction sequences. It is important to note that these results are frequencies of transitions from one play category to another and the prompts and rewards that accompanied those transitions. Children who showed the same type of play for long periods at once will therefore have had less play transitions. Some children (Child 7, 11 and 14) indeed showed little low or high level play transitions. This did not mean that there was little play. Child 7 showed 435 seconds of cause-and-effect play and 268 seconds of rule-based play (with 2 transitions), Child 11 showed 704 seconds of rule-based play (with 3 transitions) and Child 14 showed 314 seconds of exploratory play, 104 seconds of construction play and 300 seconds of cause-and-effect play. Five children (Child 3, 4, 5, 8 and 15) especially showed play of a lower developmental level (based both on number of transitions and total duration in each category). It is apparent that the low level play was more often not rewarded than rewarded, but when the children did show high level play, it was always followed by a reward of the therapist (except in Child 5). In some of these children (Child 3 and 4) the low level play was more often prompted than spontaneous, while in others (Child 5, 8 and 15) it was the other way around. Five children (Child 1, 6,

9, 12 and 13) exhibited a pattern with more high level than low level play (based both on number of transitions and total duration in each category). Two of those children (Child 1 and 6) showed more prompted than spontaneous high level play and were more often rewarded than not rewarded for this play. Child 13 showed the opposite pattern with more spontaneous than prompted high level play. Child 12 showed an equal number of spontaneous and prompted high level play episodes with especially rewards for the spontaneous play, while Child 9 was especially rewarded for the prompted play.

Predicting outcome

We performed several multiple regression analyses to explore whether the interaction sequences were associated with the progress (difference score on outcome measures) children made during intervention. A backward stepwise procedure was used because of the exploratory nature of the analyses. The first four regression analyses had as predictors the six joint attention interaction sequences: prompt – imperative joint attention – reward (PIR), spontaneous – imperative joint attention – reward (SIR), prompt – imperative joint attention – no reward (PI-), spontaneous – imperative joint attention – no reward (SI-), spontaneous – declarative joint attention – reward (SDR) and spontaneous – declarative joint attention – no reward (SD-). We studied the association of these predictors with progress on declarative and imperative joint attention, receptive and expressive language. The reason for also studying associations with language was that the joint attention behaviours were expressed by verbal or nonverbal language.

A model with all the joint attention interaction sequences could not significantly predict the progress in *imperative joint attention*, $F(6,15) = 2.02$, $p = .17$, $R^2 = .58$. After elimination of two predictors from the initial model, a model with SIR, SI-, SD- and SDR was marginally significant, $F(4,15) = 3.27$, $p = .054$, $R^2 = .54$. Only SDR explained significant variance, over and above the effect of the other predictors in the model, $\beta = .59$, $t(15) = 2.36$, $p = .04$. There was no significant effect of SIR, $\beta = .34$, $t(15) = 1.58$, $p = .14$., SI-, $\beta = .55$, $t(15) = 1.63$, $p = .13$. and SD-, $\beta = -.65$, $t(15) = -1.73$, $p = .11$. to the model.

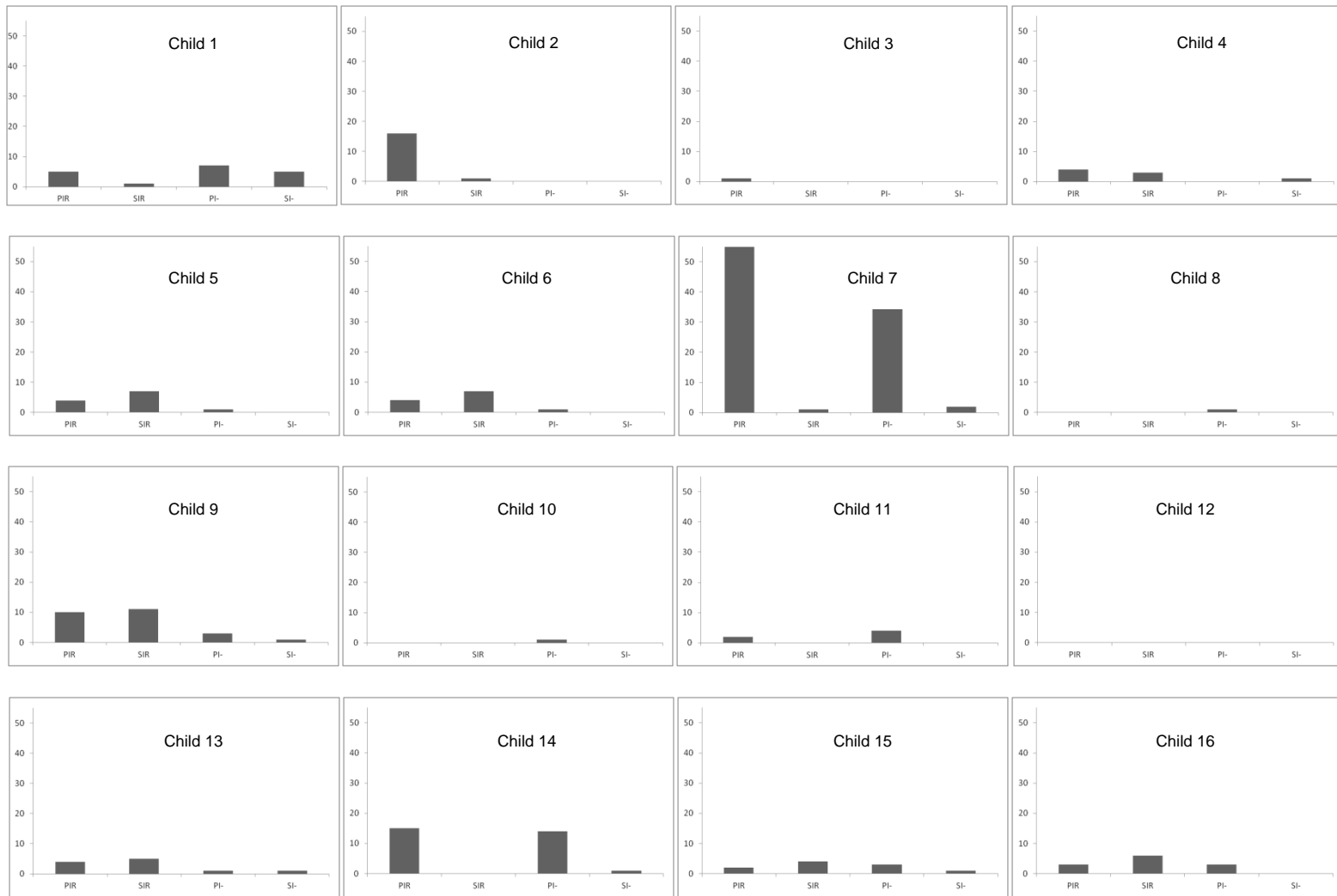


Figure 2. Distribution of frequency of imitation interaction sequences for each child. PIR = prompt – imitation – reward; SIR = spontaneous – imitation – reward; PI- = prompt – imitation – no reward; SI- = spontaneous – imitation – no reward.

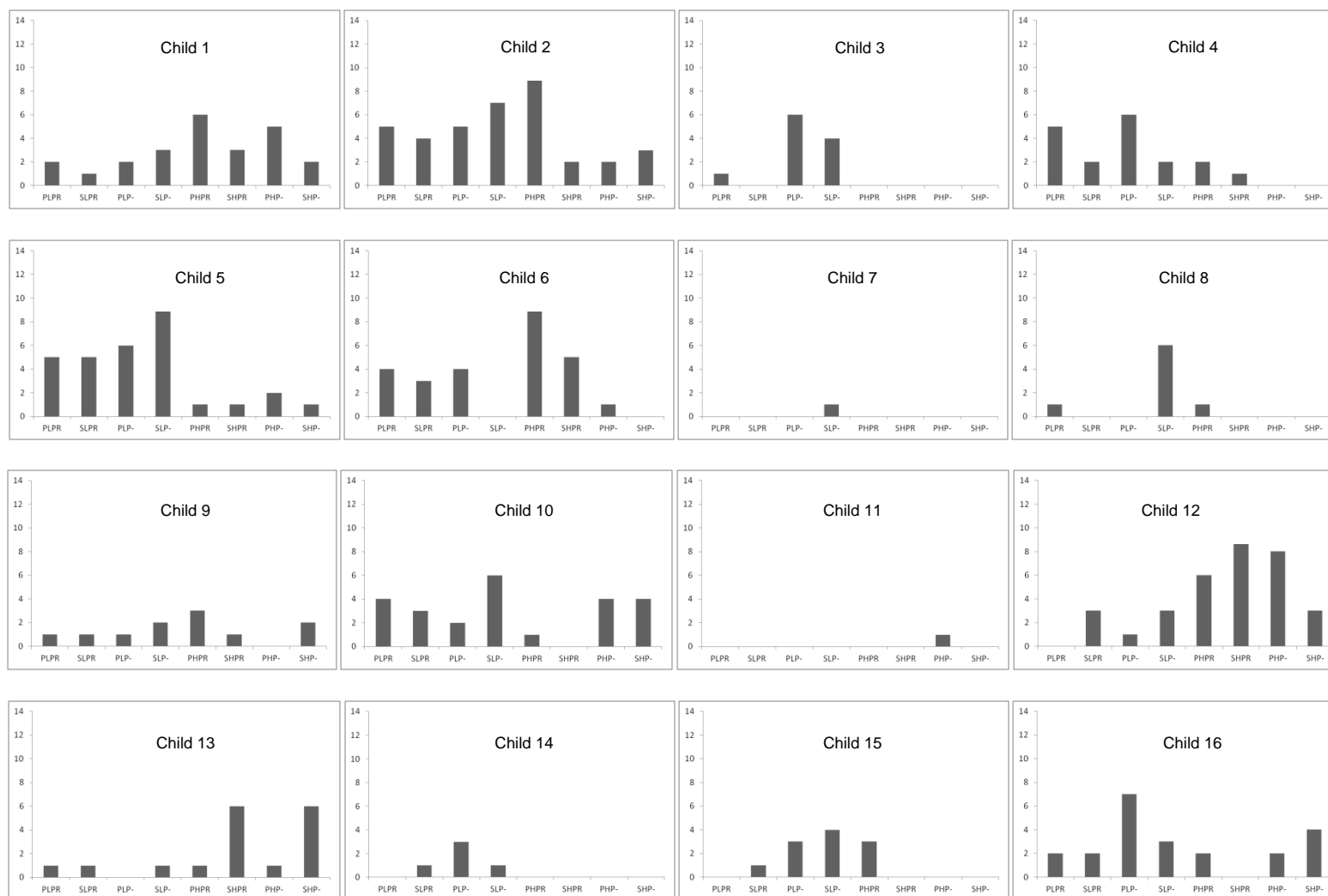


Figure 3. Distribution of frequency of play interaction sequences for each child. PLPR = prompt – low level play – reward; SLPR = spontaneous – low level play – reward; PLP- = prompt – low level play – no reward; SLP- = spontaneous – low level play – no reward; PHPR = prompt – high level play – reward; SHPR = spontaneous – high level play – reward; PHP- = prompt – high level play – no reward; SHP- = spontaneous – high level play – no reward.

Progress in *declarative joint attention* could not be significantly predicted from a model with all the joint attention interaction sequences, $F(6,15) = 1.06$, $p = .45$, $R^2 = .41$. However, after elimination of 5 predictors from the model, a model with only PI- could significantly predict the outcome, $\beta = -.55$, $t(15) = -2.43$, $p = .03$, $R^2 = .30$.

A model with all the joint attention predictors was marginally significant in explaining the variance in progress in *receptive language*, $F(6,15) = 2.98$, $p = .07$, $R^2 = .67$. After stepwise elimination, a model with only the predictors SD- and PIR could significantly predict the outcome, $F(2,15) = 7.42$, $p = .007$, $R^2 = .53$. Both SD-, $\beta = .54$, $t(15) = 2.84$, $p = .01$ and PIR, $\beta = .48$, $t(15) = 2.52$, $p = .03$ explained significant variance.

For *expressive language* a model with all the joint attention predictors significantly explained 70% of the variance, $F(6,15) = 3.52$, $p = .04$, $R^2 = .70$. After eliminating five predictors, a model with only SD- significantly explained 53% of the variance, $\beta = .73$, $t(15) = 3.99$, $p = .001$, $R^2 = .53$.

To predict the progress in *imitation*, we tested a regression model with the imitation interaction sequences as predictors: prompt – imitation – reward (PImR), spontaneous – imitation – reward (SIImR), prompt – imitation – no reward (PIm-) and spontaneous – imitation – no reward (SIIm-). PIm- and PImR correlated highly ($r = .92$) and had high variance inflation factors. For this reason we used a sum score of both variables in the regression model. Neither the regression model with all three imitation interaction sequences, $F(3,15) = 0.96$, $p = .44$, $R^2 = .19$, nor the model after stepwise elimination, $F(1,15) = 2.83$, $p = .12$, $R^2 = .17$, could significantly explain the variance in imitation progress.

Finally, a model with progress in *pretend play* as dependent variable was tested. The predictors were the play interaction sequences: prompt – low level play – reward (PLPR), spontaneous – low level play – reward (SLPR), prompt – low level play – no reward (PLP-), spontaneous – low level play – no reward (SLP-), prompt – high level play – reward (PHPR), spontaneous – high level play – reward (SHPR), prompt – high level play – no reward (PHP-), spontaneous – high level play – no reward (SHP-). A model with all these predictors significantly explained 83% of the variance in progress in pretend play, $F(8,15) = 4.41$, $p = .03$, $R^2 = .83$. After stepwise elimination a model with PHP-, PLPR and

SHPR still explained 68% of the variance, $F(3,15) = 8.67$, $p = .002$, $R^2 = .68$. There was a significant contribution to the model of PHP-, $\beta = .87$, $t(15) = 3.67$, $p = .003$, PLPR, $\beta = -.68$, $t(15) = -4.06$, $p = .002$, and SHPR, $\beta = -.52$, $t(15) = -2.20$, $p = .048$.

DISCUSSION

We performed a micro-analysis of the interaction between children with ASD and their therapists during an ABA-intervention session. The results reveal that therapists use mainly verbal prompts preceding social-communicative behaviour of the children and reward the behaviour especially verbally and with natural material reinforcers. There are intra-individual and inter-individual differences in the interaction sequences characterizing social-communicative behaviour. Joint attention and play interaction sequences are predictive for how much progress children make in a period of 6 months of intervention.

Description of types of prompts and rewards used to facilitate social-communicative abilities

Therapists used mainly verbal prompts and rewards. This is not surprising, given that they were trained in the verbal behaviour ABA approach. Moreover, besides purely verbal techniques, other types of prompts and rewards (e.g. giving an object, modelling play) were also often accompanied verbally, which further explains the high frequency of verbal behaviour of the therapists. Previous research has shown that also teachers use mainly verbal prompts and rewards (Chiang, 2009a, 2009b). The most frequent rewards for imperative joint attention were both verbal rewards and natural material reinforcers (giving the child what he/she asked for), while the other social-communicative behaviours were mainly rewarded verbally, with social rewards. Children who are more sensitive to social rewards may therefore benefit more from the intervention. According to Dawson (2008) early behavioural intervention serves to alter children's sensitivity to social rewards, e.g. by pairing a non-social reward consistently with a social stimulus. In this way sensitivity to social rewards might mediate the

treatment effect (Dawson, Bernier, & Ring, 2012). Our results indeed suggest that social reward sensitivity might have an influence on the outcome of the intervention, since imitation, declarative joint attention and play are mainly rewarded socially.

Besides by verbal prompts, children's low level play was also prompted by modelling play or giving an object. Giving objects was however very rare before high level play, which was prompted mainly verbally, or to a lesser extent by modelling play. It seems indeed easier to prompt a child to play on an exploratory, cause-and-effect or construction level by simply handing a toy to the child, whereas functional and symbolic play require more complex prompts, such as giving an instruction or showing the child how to play functionally or symbolically.

Prompt – Behaviour – Reward interaction sequences

On average there were no differences in the frequency of rewards following prompted versus spontaneous behaviour. Prompted social-communicative behaviour was just as often rewarded as not rewarded. Regarding spontaneous behaviour, only low level play seemed to be more often not rewarded. The majority of the children was capable of at least some high level play, which might be why therapists focussed more on high level play as treatment target and consequently refrained from rewarding low level play. Possibly the therapists used the low level play mainly to facilitate communication (e.g. requesting toys), rather than to target new play behaviours. On average half of the social-communicative behaviours were rewarded, which implies that they were not reinforced continuously, but intermittently. This seems beneficial, since research in children with ASD has shown that a partial reinforcement schedule will lead to better generalization and maintenance than a continuous reinforcement schedule (Koegel & Rincover, 1977).

Overall, the group analyses do not give much insight into the interactions between children and their therapists. The analyses on an individual level on the contrary provide more detailed information. There seems to be clear variability in the interactions between children and their therapists, involving joint attention and imitation, as well as play. Both for joint attention and imitation, it is apparent that these behaviours were almost absent in a minority of the children. However, there was a clear difference

between the group of children who showed a lack of joint attention and the group of children with limited imitation behaviour. The former appeared to be the youngest children, with an IQ below 55. Given their low developmental age, it is possible that other basic skills, such as social preference and attention disengagement, had to improve first before joint attention could develop (Schietecatte, Roeyers, & Warreyn, 2012). The latter, on the contrary, were the older children with the highest IQ. These children also had the highest scores on the imitation test. Imitation may not have been targeted in these children, because they had sufficient imitation skills. Child 3 was an exception to this. This was the youngest child with a low IQ and also limited joint attention during the observation. Her lack of imitation can be explained by limited imitation skills, given the bottom score that she had on the imitation test.

Children who did show joint attention or imitation demonstrated intra-individual differences in rewards, following different types of behaviours. It appeared that children who clearly showed more frequent behaviour of one category compared to another, were often rewarded for this behaviour. This was the case for children with predominantly imperative or declarative joint attention and also for children who showed a clear difference between the frequency of prompted and spontaneous imitation. This could point to an immediate effect of rewarding these behaviours. Children might have repeated the behaviour because it was rewarded, which led to a high frequency of the behaviour during the session. This seems plausible, given that several studies, using an experimental design, had already shown this immediate effect of rewarding behaviour within a treatment session (Romani et al., 2013; Zanolli & Daggett, 1998). An alternative explanation is that when therapists decide to target joint attention or imitation by giving a lot of opportunities or prompts for the child to show this behaviour, they might also be more sensitive to acknowledging the behaviour by rewarding it. However, since this effect was observed not only in prompted behaviour, but also in spontaneous behaviour, a direct influence of the rewards on the children seems more likely. This was not observed in the play interaction sequences. The children who mainly showed low level play seemed to be more often not rewarded than rewarded for this behaviour, but were consistently rewarded for showing high level play. Possibly these high level play behaviours were still emerging in these children, which

could explain why there was a dominance of low level play, even though especially high level play was rewarded. This does suggest that therapists were sensitive to these emerging play behaviours and to the importance of reinforcing them.

Further, visual analysis of the interaction sequences shows that for most children there was a good balance between the number of prompted and spontaneous social-communicative behaviours. This means that besides using prompts to teach new forms of social communication, therapists also left room for spontaneity of the child. This is important because it could prevent children from becoming dependent on the prompts of the therapist and might help them to use the abilities in daily life. The better generalizability of abilities in naturalistic behaviour intervention compared to DTT supports this claim (Delprato, 2001).

Since some of the children had the same therapist, it is of interest to compare the interaction sequences of these children. These sequences often differed substantially, especially when comparing children with very different characteristics (such as IQ and age). For instance, the therapist of Child 8 and 9 implemented different strategies in the two children: whereas Child 8 was more often not rewarded for joint attention, Child 9 was rewarded for the majority of his joint attention behaviours and while Child 8 was never rewarded for low level play, Child 9 was intermittently rewarded for this behaviour.

Predicting outcome

The interaction between therapist and child during a 15-minute observation of an intervention session was clearly related to the progress children were making in a period of 6 months of intervention. It was of interest that progress on certain outcome measures was predicted by the rewarded social-communicative behaviour, while progress on other measures was mainly associated with the unrewarded behaviour. Especially for interactions involving behaviours that were usually followed by a social reward (declarative joint attention and play), the unrewarded behaviours were better predictors of progress than the rewarded behaviours. For interactions involving behaviour that was frequently rewarded with material reinforcers (imperative joint attention), especially the rewarded interaction sequences predicted progress. These

findings are in line with studies that found a larger effect of non-social compared to social rewards on the behaviour of children with ASD (e.g. Demurie, Roeyers, Baeyens, & Sonuga-Barke, 2011) and a smaller effect of social reward on children with ASD compared to typically developing children (e.g. Geurts, Luman, & van Meel, 2008). Furthermore, it has been shown that children with ASD show a reduced neural response to social rewards, providing support for the social motivation hypothesis (Scott-Van Zeeland, Dapretto, Ghahremani, Poldrack, & Bookheimer, 2010). However, other studies did not replicate these findings (Dichter, Richey, Rittenberg, Sabatino, & Bodfish, 2012) or suggested a more general reward deficiency in autism, instead of a social reward deficit (Kohls et al., 2013). These contradictory findings could point to heterogeneity in social reward processing in autism. Munson, Faja, Meltzoff, Abbott, and Dawson (2008) had indeed shown individual differences in reward learning in children with ASD. Moreover, these individual differences were predictive of the rate of progress in socialization and communication. This heterogeneity in social reward sensitivity can explain why in the present study rewarded declarative joint attention predicted progress in imperative joint attention, while unrewarded declarative joint attention was associated with progress in language.

When comparing prompted to spontaneous behaviour, especially the prompted interaction sequences were related to progress. This may imply that children who are or become more responsive to prompts will benefit the most from the intervention. Several previous studies had shown that children with more approach and less avoidance behaviours responded better to ABA-interventions (Beglinger & Smith, 2005; Ingersoll, Schreibman, & Stahmer, 2001; Sherer & Schreibman, 2005). This is in line with our results, because children who actively approach the therapist instead of trying to avoid the therapist will have more attention for prompts of the therapist and will most likely have a higher chance of complying with these prompts.

Some interaction sequences had a negative predictive value, which was in most cases not surprising. First, prompted imperative joint attention negatively predicted the progress in declarative joint attention. It is possible that when therapists use prompts very frequently, children become dependent on these prompts because they are used to waiting for a prompt (Clark & Green, 2004). This might have led to a decrease in taking

initiative to spontaneously share interest in some children. Second, progress in pretend play was negatively associated with low level play, preceded by a prompt and followed by a reward and with spontaneous high level play, followed by a reward. The first association was expected, because children who show a high frequency of low level play, most likely still have limited high level play abilities, resulting in less progress in this type of play. The second association was more surprising, because one might expect that children who show more spontaneous pretend play during intervention, will have had more practice in this behaviour and will show more progress. However, these results provide no information as to the specific content of the high level play behaviours. Some of the play behaviours may have been stereotypical. Moreover in the play test, children are asked or prompted to play with certain play materials or even instructed to play in a certain way. Children who show high levels of spontaneous high level play, may not automatically also be proficient at complying with these instructions. These results suggest that spontaneous and prompted pretend play could be distinct abilities in children with ASD. Previous research had already suggested that children's abilities for pretend play differ depending on the context and amount of structure provided (Jarrold, 2003).

Only the progress in imitation could not be predicted from the interaction sequences. A plausible explanation for this finding is that during the observation the children imitated especially language, and rarely gestures and actions with objects, while the imitation test assessed the two latter types of imitation.

Strengths and limitations

No study before provided a detailed analysis of what happens in an ABA intervention session. However, there are some limitations, which should be taken into account when interpreting the results. The main limitation is the small sample size, which precluded certain analyses. It would have been interesting to look at the additive effect of the interaction sequences in a model together with predictors for outcome that had been found in previous studies, to determine the additional variance explained by the interaction between child and therapist. However the number of predictors that could be included in the regression models was limited due to the small sample size.

Conclusions on which specific predictors explain unique variance should also be interpreted with caution for this reason. Our goal was exploratory. Further research should confirm whether these are indeed the most essential predictors. In addition, it was not possible to take into account the multilevel structure of the data (several children who received intervention from the same therapist) in the group analyses. On the other hand this multilevel structure could also be seen as a benefit, because it shows that the interaction sequences of children who share the same therapist are distinct. This suggests that therapists adapt to the needs of an individual child.

Clinical implications

The high variability in the interaction sequences, both between children who received intervention by the same therapist as by a different therapist, suggests that therapists do not rigidly use techniques. Instead they appear to adapt the intervention to each individual child. Researchers have emphasized the importance of a tailor-made treatment, given the heterogeneity and developmental nature of ASD (e.g. Stahmer, Schreibman, & Cunningham, 2011). What happens in an intervention session seems to be clearly associated with the outcome. Because of this, it might be beneficial to study what is characteristic of the intervention sessions of children who fail to make progress. This could be accomplished both on a research level by further studying interactions between child and therapist, and on a clinical level by looking back at videos from sessions to assess how the interaction with a specific child could be improved.

Conclusion

This study shows the value of studying moment-to-moment interactions of children with ASD with their therapist to gain more insight in the factors contributing to the effectiveness of ABA. Although the types of prompts and rewards used are similar in most children, there appears to be clear variability in which behaviours are prompted and/or rewarded. This points to an adaptation of the intervention to the individual child. Social-communicative behaviours that are rewarded seem to occur more frequently, even within a 15-minute session. Moreover the interaction between therapist and child within this session can predict the amount of progress children make in a period of 6

months of intervention. Future studies with a larger sample size would be useful to expand these findings.

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In this doctoral research we studied several aspects of promoting social-communicative abilities in children with autism spectrum disorder (ASD). The first aim was to confirm the importance of social-communicative abilities in development. We expanded on previous research by studying associations between social-communicative abilities in different language age groups. Second, both community interventions and a new parent-implemented intervention targeting social-communicative abilities were studied, also taken into account the variability in progress. Lastly, this dissertation aimed to look at mechanisms of change. In this last chapter we integrate the main findings, discuss the methodology and clinical implications. We also provide an overview of the most important limitations and give suggestions for future studies.

RECAPITULATION OF THE RESEARCH GOALS

The main aim of this dissertation was to extend the current knowledge on the promotion of social-communicative abilities in children with ASD through early intervention. This general goal was translated in several more specific research questions. First, we wanted to gain more insight in the importance of different social-communicative abilities as intervention targets. This goal was accomplished by studying associations between social-communicative abilities and language, which is one of the most important factors for the outcome in the long term (Howlin & Moss, 2012). Limitations of previous studies on this topic were addressed by including a broad assessment battery of social-communicative abilities and by making a distinction between children with limited and more developed language abilities. A second question was how social-communicative abilities of children with ASD can be stimulated. This question was addressed in two ways. We first evaluated the effect of community interventions for children with ASD in Flanders on the social-communicative abilities of the children. Besides an evaluation of current practices, we also wanted to look for ways to improve intervention services for children with ASD in Flanders. For this reason, we assessed the efficacy of a parent-implemented programme to stimulate social-communicative abilities of children with ASD. Third, an overarching goal of the different chapters was to explore the variability in outcome and predictors of the amount of progress in early intervention. A last goal of this dissertation was to gain more insight in mechanisms of change by studying moment-to-moment interactions of therapists and children and how these relate to the progress of the children.

INTEGRATION OF THE MAIN FINDINGS

Importance of social-communicative abilities as intervention targets

Throughout this dissertation three main reasons were formulated for choosing social-communicative abilities as intervention targets for children with ASD. The

different studies of this dissertation replicate and expand findings from previous studies in providing evidence for the importance of these intervention targets.

Deficits in social-communicative and language abilities in children with ASD. A lack of imitation, joint attention and symbolic play are among the first signals of ASD (e.g. Dereu et al., 2010). Moreover, deficits in these abilities persist throughout the preschool period and to a lesser extent also during later childhood years (Bruinsma, Koegel, & Koegel, 2004; Jarrold, 2003; Vanvuchelen, Roeyers, & De Weerd, 2011). Children with ASD also show clear language deficits (Weismer, Lord, & Esler, 2010). For this dissertation we investigated these abilities in a large sample of preschoolers with ASD. Imitation, pretend play and language abilities were assessed with standardized tests that allow for a comparison with typical development. In the previous chapters we always used raw scores instead of age equivalent scores in the analyses, because part of the children had bottom scores, for which no exact age equivalent score was available. Especially because this is a large sample with children at each end of the spectrum, in which several social-communicative abilities are tested, it is of interest to estimate the amount of delay compared to typical development. For this purpose additional descriptive analyses were performed. This was done separately in children with bottom scores, because in these children the delay could not be calculated exactly as for them only an upper limit of the age equivalent was available (e.g. age equivalent less than 2 years old for receptive language could correspond to a true age equivalent anywhere between a few months and 2 years old). Results are presented in Table 1. Joint attention was measured with a semi-structured observation instrument, for which no normative data were available. It was thus not possible to compare the results for joint attention with typical development.

Table 1

Number of children (out of 92), age and number of months delay from typical development for imitation, pretend play and language abilities

	N	Age (in months)		Delay (in months)	
		M	SD	M	SD
Bodily imitation ^a > 15 m	69	51.95	12.98	17.17	9.55
Bodily imitation ≤ 15 m	23	40.44	12.37	≥ 25.44	12.37
Procedural imitation ^b > 9 m	80	50.80	12.83	15.78	12.40
Procedural imitation ≤ 9 m	12	37.56	14.42	≥ 28.56	14.42
Pretend play ≥ 11.3 m	73	51.57	12.95	15.60	13.08
Pretend play < 11.3 m	19	39.47	12.53	> 28.17	12.53
Receptive language ≥ 24 m	57	54.97	10.95	16.43	10.49
Receptive language < 24 m	35	39.46	12.34	> 15.46	12.34
Expressive language ≥ 24 m	50	57.23	9.83	16.67	11.42
Expressive language < 24 m	42	39.35	11.13	> 15.35	11.13

Note. Results are presented separately for children with bottom scores on the age equivalent scores. In these children the bottom age equivalent score was used to determine the minimum delay. ^a Imitation of gestures and facial movements. ^b Imitation of actions on objects.

Children with ASD between 2 and 6 years old who have started to develop these abilities show an average delay between 15 and 17 months. Children who show no sign of imitation or pretend play abilities are at least 2 years delayed at an average age of around 3 years old. This correspondence in amount of delay is not surprising given the interrelations observed in these abilities and the association between these abilities and cognitive functioning (Toth, Munson, Meltzoff, & Dawson, 2006; Weismer et al., 2010).

Associations with social, social-cognitive and language development. Previous studies have shown that social-communicative abilities of children with ASD are related

to concurrent and later social, social-cognitive and language abilities (Charman, 2003; Poon, Watson, Baranek, & Poe, 2012). Especially the association with language is essential, considering it is one of the variables most significantly associated with later outcome (Howlin & Moss, 2012). In Chapter 2 we described concurrent associations between different social-communicative abilities and language. We showed that imitation, imperative JA, declarative JA and pretend play all have their role in language development. An important finding of this study is that relationships were specific for receptive and expressive language and differed depending on the language age of the children. While imitation and pretend play showed unique associations with language in children with a language age under 2 years old and children with a language age above 2 years old, joint attention abilities were only uniquely associated with language in children with the youngest language age. Imitation explained unique variance in expressive language in both children with an expressive language age under and above 2 years old. For pretend play this was the case for receptive language. While Chapter 2 only showed concurrent associations between social-communicative abilities and language, Chapter 5 provided a longitudinal perspective. Given the small sample size it was not feasible to include several social-communicative abilities in one model to predict progress in language. A model with several joint attention behaviours, characterizing the interaction between therapist and child, significantly predicted progress in language. Again there was a dissociation between receptive and expressive language. While only declarative joint attention explained unique variance in progress in receptive language, both declarative and imperative joint attention were unique predictors of progress in expressive language. This coincided largely with the concurrent associations found between joint attention and language in the children with a language age below the age of two. The only difference was that in Chapter 2 declarative joint attention was only related to receptive language and not to expressive language as well, as was the case in Chapter 5. This difference may be attributed to the additional predictors that were included in the study described in Chapter 2. Possibly the variance explained by imitation and response to joint attention overlaps with the variance explained by declarative joint attention. Not this difference, but the similarities were apparent, since the predictors in both chapters were measured in a different way. While in Chapter 2 joint attention in interaction with a researcher was measured with a semi-

structured observation instrument, Chapter 5 looked at joint attention with a therapist during intervention within a range of different activities. This suggests that we were indeed measuring the same constructs in both chapters. Although more studies have found a unique association between response to joint attention and receptive language, some studies also found that initiating declarative joint attention is a unique predictor for receptive language (Charman, Drew, Baird, & Baird, 2003). It is difficult to compare our results on imperative joint attention with previous research findings, because it has only rarely been included as a predictor for language. The distinct predictors for receptive and expressive language correspond with studies that show that receptive and expressive language abilities of children with ASD do not develop as conjointly as seen in typical development or in children with a developmental delay (Weismer et al., 2010).

Possibility to promote social-communicative abilities with intervention. Both in Chapters 3 and 4 we have shown that social-communicative abilities of children with ASD ameliorate with intervention. Children with ASD who receive low-intensive community intervention make significant progress in imitation, pretend play, declarative joint attention, receptive and expressive language and adaptive behaviour and show a decrease in autism severity after a period of 6 months of intervention (Chapter 3). Furthermore, even nonverbal children with limited social-communicative abilities at the start of an intervention, can show substantial improvement in these abilities with a parent-implemented intervention, after only 12 weeks of intervention (Chapter 4). These studies are in line with the growing body of evidence that shows progress on social-communicative abilities in children with ASD after intervention (e.g. Ingersoll & Schreibman, 2006; Kasari, Freeman, & Paparella, 2006; Warreyn & Roeyers, 2013).

How to stimulate social-communicative abilities in children with ASD

Although early intervention in children with ASD is a 'hot topic', most studies took place in research settings under controlled circumstances. These studies are not necessarily informative to clinicians who provide interventions in the real world, in which conditions can deviate substantially from the controlled research environment. Clinicians tend to adapt evidence-based programs to characteristics of the child or setting (Stahmer, Collings, & Palinkas, 2005). In addition, when using methods consisting

of several techniques, not all techniques are implemented with great fidelity (Suhrheinrich et al., 2013). Research that evaluates community-interventions is therefore needed to supplement evidence from randomized controlled trials, that are generally considered as the golden standard in scientific research (Shadish, Cook, & Campbell, 2002). In the general psychological intervention literature, there are few *effectiveness studies*, that look at the effect of an intervention in a clinical setting, compared to *efficacy studies*, that evaluate whether an intervention works with trained therapists who exactly follow the manual in participants who have been selected for the study and are preferably randomly assigned to the intervention (Hunsley & Lee, 2007; McKnight, Sechrest, & McKnight, 2005). Furthermore a systematic evaluation of community-interventions for children with ASD had not been conducted before in Belgium. Recently the national Superior Health Council formulated an advice on quality of life of young children with ASD, in which the need for an evaluation of intervention services in Belgium was emphasized (Hoge Gezondheidsraad, 2013). Although drawing conclusions from quasi-experimental studies, as the one described in Chapter 3, is not always evident, it can provide both researchers and clinicians with valuable information. Prior to conducting a community-intervention study, we carried out a survey in 52 services that provided intervention for young children with ASD to gather information on current practices for this population in Flanders (Van der Paelt, Warreyn & Roeyers, 2012). This showed that intervention in most services was eclectic, with a combination of evidence-based practices and also methods, for which there is currently limited evidence. Some services reported employing Applied Behaviour Analysis (ABA) or a specific intervention programme targeting imitation and joint attention. These interventions are more supported by scientific evidence than eclectic interventions or TEACCH (that were more often reported as a common practice in the survey) (Warren et al., 2011). It seemed thus of interest to compare the effectiveness of interventions based on ABA and imitation/joint attention training to treatment as usual (Chapter 3). The results showed however no difference between the intervention groups. One of the reasons for this lack of difference we mentioned in Chapter 3 was the low intensity of the interventions. Previous studies (Mazurek, Kanne, & Miles, 2012; Virues-Ortega, Rodriguez, & Yu, 2013) have shown that the treatment intensity is associated with the amount of progress children make. Moreover Eldevik, Eikeseth, Jahr, and Smith (2006)

found that less intensive ABA (12 to 20 hours a week) is not as effective as the traditional 40 hours a week of ABA-intervention. In our study no child received more than 4.5 hours a week of the specific interventions and on average only one hour a week of ABA or imitation/joint attention training was provided, in addition to a few hours of eclectic treatment. This may have been insufficient to distinguish these methods from treatment as usual. An intensive intervention of at least 25 hours a week, as recommended internationally (National Research Council, 2001), does not seem feasible with the current organization of intervention services in Belgium. However, some children might need an intervention of such intensity to show progress on social-communicative abilities. Chapter 3 showed that almost one fifth of the children made hardly any progress after a period of 6 months of intervention. Especially for those children, it is essential to look for ways to improve the current intervention services, possibly also by increasing the intensity of the intervention.

In Chapter 4 we evaluated an alternative to intensive intervention provided by a therapist, that is cost-effective and therefore more widely applicable: training parents to stimulate the social-communicative abilities of their child in daily life. We showed that a 12-week-intervention programme can lead to substantial improvement in the social-communicative abilities of children with ASD. It is especially remarkable that we observed clear progress in social engagement, communication, imitation and play, given that the children showed characteristics that were associated with less progress in Chapter 3: all four children had a low developmental level and two of them did not attend school yet. Although these results need replication in a larger sample and in community-programmes, they show the potential of the Project ImPACT parent training. We recently conducted a focus group with practitioners who informed us about their first experiences with the programme. Although the intervention required an extra investment of time, they reported being satisfied with the programme's techniques, structure and rapid effect on the children's social-communicative abilities. This provides preliminary evidence for the feasibility of Project ImPACT in community settings. Social communication interventions provided by natural interaction partners such as parents have also been recommended as an effective treatment approach to improve the core symptoms of ASD in the NICE guidelines (National Institute for Health and Care

Excellence, 2013) developed in the UK. These are guidelines on the management and support of children and young people with ASD, based on the best available scientific research to assist clinicians in making decisions about appropriate treatments.

Heterogeneity in intervention success

A mutual finding of the different studies in this dissertation is the great variability in the progress children make. In Chapter 3 we showed that while one fourth of the children managed to follow a typical developmental path for language, imitation and pretend play, there was also a substantial part of the children (about one fifth) who made hardly any progress in these areas. Moreover a rather large group (34%) showed a mixed profile with good progress on some but no progress on other measures. This implies that especially the extremes on the continuum between no progress and good progress are common, instead of the category of children that makes predominantly moderate progress (21%). This heterogeneity in progress was present regardless of the intervention method. Also the results of the parent training study show variability (Chapter 4). Because we used a single-case design with regular assessment of the social-communicative abilities, we were able to show that the variability was not only present in the amount, but also in the process of change. Whereas for some children and for some of the abilities progress was gradual (e.g. the steady increase in social engagement in Child 3, see Figure 1 page 107), for other children and abilities progress occurred sudden and/or showed a relapse (e.g. the clear increase in the amount of time spent playing in Child 2 and 3 in the first observation during the intervention phase, that showed a relapse in the former and remained stable in the latter, see Figure 6 page 115). Besides inter-individual differences, also intra-individual variability was apparent: although all children showed at least to some extent progress on all social-communicative abilities, the abilities for which progress was most pronounced differed for each individual child. Variability was also seen at the level of the interaction with the therapist during an ABA-session (Chapter 5).

This clear variability is not surprising, given the heterogeneity within the spectrum: in spite of a common diagnosis, no two children with ASD are alike. This was also evident from the parent training study: although the children had similar characteristics

regarding age, language and cognitive functioning, the children also differed in several respects, such as in their ability to initiate interaction, presence of communicative gestures, play skills et cetera. These differences, together with differences in fidelity of implementation of the intervention by the parents and amount of time the parents spent using the techniques are factors that may have contributed to the variability in the progress they made.

Although this heterogeneity is clearly an important factor to consider when studying the effect of an intervention, this topic has not received much attention in the literature. Evidence for the effectiveness of an intervention is usually based on the average score of a group. However, if only few individuals in that group have an average score, it is relevant to question the extent to which these results are truly informative. A lack of progress in an individual child can be associated with child factors, such as cognitive functioning, age or symptom severity (Mazurek et al., 2012; Sallows & Graupner, 2005; Virues-Ortega et al., 2013), characteristics of the interventions, such as the intensity or the method used (Mazurek et al., 2012; Yoder & Stone, 2006), characteristics of the therapist, such as the amount of experience and most likely also the interaction between all of the above. Given that all these factors are involved, predicting whether an individual child will make good progress with a certain intervention is a complex matter. Both in Chapters 3 and 5 we aimed to predict the progress children make after 6 months of intervention. We showed that IQ and education type were significantly related to the general categorization of the progress children make on imitation, pretend play and language, over and above autism severity and treatment intensity (Chapter 3). In Chapter 5 it was shown that the progress children make is also clearly related to the interaction with the therapist during intervention. This is important because while child characteristics such as IQ are relatively stable, moment-to-moment interactions with the therapist may be more easy to alter.

Mechanisms of change

Besides the question whether an intervention is effective and for whom, it is important to gain insight in why it works. The social motivation hypothesis (Dawson, 2008; Dawson, Webb, & McPartland, 2005) links both the ontogenesis of early autism

symptomatology and the susceptibility to early intervention to the rewarding value of social stimuli for children with ASD. According to this hypothesis early genetic and environmental risk factors will cause a deviant way of interacting with the social environment, characterized by a lack of social attention. This will further preclude social experience and will lead to an abnormal development of the neural circuitry and full autism syndrome. According to Dawson (2008) early behavioural intervention could alter the abnormal developmental trajectory by influencing social attention and social reward sensitivity. Given the plasticity of the brain, especially in the first years of life, intervening at a very young age could even alter these processes at a neural level. Evidence for this was found in a study on the Early Start Denver Model (ESDM) that showed normalized brain activity in response to faces after 2 years of intervention in a group of 18-to-30-month-old children with ASD (Dawson, Jones, et al., 2012). Furthermore, these authors showed that a comparison group who received community intervention showed the opposite pattern, with more cortical activation to objects instead of faces. The amount of cortical activation to faces was also related to improved social behaviour (Dawson et al., 2012). The treatment effect is hypothesized to be mediated by social attention, that is linked to social reward sensitivity because the perceived rewarding value of stimuli will influence how attention is allocated (Dawson, Bernier, & Ring, 2012). In other words: as the interaction with the therapist becomes more rewarding to the child, possibly through the classical conditioning of pairing the therapist consistently to pleasant activities and objects (Dawson, 2008), the child will increase its attention for the therapist and will be better able to learn new behaviours from him/her.

The findings from Chapter 5 seem in concordance with this hypothesis. First, the interactions with the therapist, involving joint attention and play, during a 15-minute intervention session significantly predicted progress on standardized assessment measures of language and pretend play and a semi-structured observation of joint attention. Thus, children who showed more motivation to interact with the therapist, possibly because this therapist had become rewarding to them, made more progress. Second, the idea that attention to the behaviour of the therapist is essential was confirmed by the observation that mainly the prompted interaction sequences were

related to the progress of the children. This means that children who were more attentive to the prompts of the therapist and willing to comply with these prompts, showed most progress. Third, especially for interactions involving behaviours that were usually followed by a social reward (declarative joint attention and play), the unrewarded behaviours were better predictors of progress than the rewarded behaviours. This is in line with the decreased value of social reward described in the social reward hypothesis and confirmed by experimental studies (Demurie, Roeyers, Baeyens, & Sonuga-Barke, 2011; Geurts, Luman, & van Meel, 2008; Scott-Van Zeeland, Dapretto, Ghahremani, Poldrack, & Bookheimer, 2010).

Besides social motivation, also the synchronous behaviour of the interaction partner, has been proposed as a mediator for intervention success. Siller and Sigman (2002) showed that parents of children with ASD with a higher initial level of synchronous behaviour had children who developed better joint attention and language abilities over a period of 1, 10 and 16 years than children of parents who were less synchronized. In Chapter 4 we discussed that this synchronous communication of the parent seemed to be related to the child's social engagement. A recent study on parent-child interaction in children with ASD showed that there is indeed a correlation between the parent's synchrony and the child's social engagement and initiations (Hudry et al., 2013). The Project ImPACT parent training aims to teach parents to find a good balance between following the child's lead by the use of interactive techniques and directing the behaviour of the child to teach the child new behaviours. A recent study (Ingersoll & Wainer, 2013) showed that both the fidelity in implementation of the interactive techniques and the direct teaching techniques explained unique variance in the children's progress in language. This could imply that finding this balance between following and directing is also a mechanism associated with change.

METHODOLOGICAL CONSIDERATIONS

Group design versus single case study

In this dissertation different methodologies were used: a group design in Chapters 2 and 3, an experimental single-case study in Chapter 4 and a combination of a group-based and single-case observational study in Chapter 5. The group studies have the benefit of a greater external validity compared to the single-case studies: the effects are more representative of the population of children with ASD under the age of 6 when they are assessed in a large sample than when only four or 16 cases are studied. Group-studies are useful to assess the average effect of an intervention, for example showing that symptom severity decreased on average after only 6 months of intervention. The single-case studies on the other hand give us more insight in the process of change. By regularly assessing the progress, we showed that change could occur very sudden or more gradually and that there can be large fluctuations in social-communicative abilities in a short period of time (Chapter 4). Single-case studies can show when change occurs and how this is influenced by the content of the intervention. For example, we showed that all the children in the parent training study showed a drop in social engagement in the first observation after introduction of the direct teaching techniques. This also gives more insight in the mechanisms of change. Although a single-case study is obviously the best suited to assess individual variability, we showed that also a group design can be supplemented with assessment of the heterogeneity in the sample. This seems especially important, given that the average category is not necessarily the most prevalent, as we showed in Chapter 3.

Both group designs and single-case studies have advantages and disadvantages, but both can provide us with valuable information. Using a combination of methodologies seems best to evaluate interventions thoroughly. This was also the conclusion of a working-group that developed guidelines for designing research for psychosocial interventions for individuals with ASD (Smith et al., 2007). Since each design comes with its own methodological pitfalls and advantages, these authors suggest a staged model for intervention research, where single-case studies, randomized control trials (RCT) and community effectiveness studies each have their role. However, studies that do not use

randomization are still often disregarded because evidence from these studies is considered inferior to evidence from RCT's. The NICE guidelines on autism intervention (2013) for example, take only RCT's into consideration to formulate recommendations on the effectiveness of interventions. There are nevertheless important barriers to conducting a RCT. Because of ethical objections it is not desirable to postpone possibly effective treatments by randomly assigning children to a no treatment control group. For this reason many RCT's use a treatment as usual control group. These studies often provide very limited information on the specific contents of the interventions in the control group, which makes it difficult to evaluate the comparison. Moreover, also in treatment as usual good quality interventions may be provided, which poses a challenge to find an experimental effect. It is apparent that the NICE guidelines evaluate the majority of the RCT's as providing low quality evidence due to small sample sizes, lack of blinding of assessors, other types of bias, et cetera. This confirms the difficulty in conducting a RCT, which meets the standards of good methodology. Several authors have argued that experimental single-case studies could be a valuable alternative or complement to RCT's because of their flexibility and because they rely less on the availability of extensive resources (Byiers, Reichle, & Symons, 2012; Horner et al., 2005; Rhoda, Murray, Andridge, Pennell, & Hade, 2011).

Observational versus standardized assessment

In Chapters 2 and 3 we used standardized measures to assess social-communicative abilities, when these were available (only for joint attention this was not the case). This gave us the possibility to compare the scores to typical development. Moreover, using standardized assessments makes it easier to compare results with other studies. However, a disadvantage was that a substantial part of the children had bottom scores on these measures, which made it more difficult to assess whether and how much progress they made. The observational measures used in Chapters 4 and 5 are more representative of social-communicative interaction in daily life than the abilities assessed by the structured tests that also require some test-taking abilities. Assessing social-communicative abilities on a regular basis, as we did in Chapter 4, would not be feasible with standardized instruments because of test-retest effects.

CLINICAL IMPLICATIONS

Focus on imitation, joint attention and play in ASD intervention

The results of this dissertation confirm the importance of social-communicative abilities as intervention targets for preschoolers with ASD. Chapter 2 showed the unique associations of imitation, joint attention and pretend play with language, which is together with IQ the most important predictor for later outcome in childhood, adolescence and adulthood (Howlin & Moss, 2012). Especially developing some useful speech by the age of 5 is crucial. An early intervention programme focussing on several social-communicative abilities at once seems best suited to stimulate both receptive and expressive language in children with limited language abilities, given the unique contributions of each of these abilities. The great number of children who showed a mixed profile with good progress on some social-communicative abilities and limited progress on others (Chapter 3), implies that collateral effects of training one social-communicative ability (Kasari, Paparella, Freeman, & Jahromi, 2008; Whalen, Schreibman, & Ingersoll, 2006) are not self-evident for all children. Chapter 4 demonstrated the feasibility and efficacy of targeting social engagement as well as communication, imitation and play together in nonverbal children with ASD. Although a comprehensive social communication intervention seems the best choice, this may not be feasible in all children, especially when intensity of the available intervention is limited. Based on the results of Chapter 2, some guidelines can be provided to aid individual treatment planning. Children who are particularly delayed in receptive language, might benefit more from intervention targeting play than imitation, while the opposite could be true for children with a more pronounced deficit in expressive language. Training joint attention appears to be especially important in the early stages of language development, while children with more developed language abilities, might benefit the most from stimulating imitation and play, complementing a direct focus on language itself.

Treatment individualization

Chapter 3 showed that low intensive ABA or a specific training in imitation and joint attention, had on average the same effect as treatment as usual. This does however not imply that each individual child with ASD would benefit to the same amount of each of these methods, since there was also large heterogeneity in progress in each of the intervention groups. Children who made very good progress with one of these interventions, may not have made the same progress with a different type of intervention and children who failed to make progress may have been better off with a different type of intervention. When no method is on average better, it becomes especially important to find the right treatment for a particular child. This idea of a tailor-made treatment instead of a one-size-fits-all approach becomes also more widely accepted in the international literature, based on the findings that no method completely improves the symptoms of ASD or is efficacious for everyone (National Research Council, 2001; Stahmer, Schreibman, & Cunningham, 2011). During the last decade some programmes were developed that include this individualization of treatment methods directly in their curriculum. For example the Alexa's PLAYC (Playful Learning Academy for Young Children, formerly known as Children's Toddler School) programme starts with developmental techniques, but adds more structured techniques, such as behavioural techniques and visual supports, based on individual needs of the children (Stahmer, Akshoomoff, & Cunningham, 2011; Stahmer, Schreibman, et al., 2011). The ESDM even includes decision hierarchies into its manual to help determine which strategies to add to the current curriculum based on the children's progress and current abilities (Rogers & Dawson, 2009). Also Project ImPACT (Ingersoll & Dvortcsak, 2010) uses a combination of developmental and behavioural techniques. The manual describes how to choose which techniques are more appropriate in a given moment based on characteristics of child and setting. Moreover, as in the Alexa's PLAYC programme parents are taught to always use the interactive techniques first to give the opportunity to the child to show behaviour spontaneously and to add directive techniques only when necessary to increase the complexity of the child's behaviour. Although the main treatment goals are fixed, specific goals are determined individually, which further shows that this programme is well-adjusted to

the diversity within the group of preschoolers with ASD. Chapter 5 confirmed that therapists indeed adapt the strategies used to the individual child.

Evaluating progress

The need for a tailor-made intervention for children with ASD, also implicates the need for a regular evaluation of the treatment. By regularly assessing the progress of the children, changes to the treatment targets or techniques can be made when necessary. This could preclude the sustained use of an intervention method that may not be appropriate for a specific child and may lead to long periods without improvement. Chapter 5 suggests that filming and looking back at the interaction with the child during the session can provide therapists with valuable information about the progress children are making and how the intervention could be improved. Also looking back at a video of parents who implement the intervention and providing feedback on the use of the techniques could be a valuable practice, which is recommended by the NICE guidelines (2013). The development of instruments to evaluate the implementation of an intervention and possible signs associated with lack of progress, may be important to facilitate and structure evaluations. An evaluation of the treatment effect should not be limited to the child's abilities, but should include parent and family outcome measures, such as family functioning, parent-child relationship, parenting efficacy, parenting stress and parent mental health (Karst & Vaughan Van Hecke, 2012). Chapter 4 showed that there was a close relationship between the children's social engagement and parent synchronous communication, making this an important variable to monitor in clinical practice. Expanding the evaluation to include family variables is essential given the transactional nature of the parent-child-relationship and the effects of having a child with ASD on family and parent functioning (Karst & Vaughan Van Hecke, 2012). The ultimate goal of any ASD intervention should be to alter not only the child's functioning, but also affect the quality of life of its family in a positive way.

Increasing the intensity of the intervention

Chapter 3, which included a large sample of preschoolers with ASD in early intervention services in Flanders, showed that the average intervention intensity is not

more than 3 hours of 1:1 treatment, in some children supplemented with on average 1-2 hours of group intervention. Only 24% of these children received home guidance once or twice a month. In addition to these children who already have access to early intervention services, there is a subgroup that is still on a waiting list. However, since both the age at the start of the intervention and the treatment intensity are important predictors of the outcome (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009), it is recommended internationally to provide intervention for at least 25 hours a week, starting immediately after the child has received a diagnosis (National Research Council, 2001). In the Netherlands a study was conducted on the long term costs of early intensive behavioural intervention for three years compared to treatment as usual (Peters-Scheffer, Didden, Korzilius, & Matson, 2012). This study demonstrated that the first option costs far less to the society because children that have received intensive intervention in their preschool years will need less specialized services as they grow up than children that have received standard care. As was shown in Chapter 3, there is a substantial portion of the children who make hardly any progress with the intervention services they are currently receiving. Possibly they would benefit from a more intensive intervention.

An alternative to intensive 1:1 intervention provided by a therapist is parent training, because parents can stimulate the social-communicative abilities of their children on a daily basis in a range of situations. We showed that Project ImPACT is an effective intervention that can lead to clear progress in a short amount of time. Moreover the high satisfaction of the parents suggests that it is feasible for parents to incorporate intervention techniques in their daily routines. Offering this programme to parents on a waiting list for more intensive intervention could have a substantial impact on the quality of life of families with a child with ASD. Especially the short duration of the programme makes this a feasible way to improve current practices in Belgium. Furthermore, the programme can also be offered in a group format (with 6 individual and 6 group sessions), for which there is also some evidence of its effectiveness (Ingersoll & Dvortcsak, 2006). The advice of the National Superior Health Council (2013) already pointed to the need for more guidance of the parents, immediately after receiving a diagnosis. An expansion of the current availability of home guidance services

would help to realize the implementation of parent training soon after diagnosis on a large scale. In any case, this would be a more realistic short term goal for the improvement of early intervention services for children with ASD in Belgium than providing intensive therapist-implemented intervention for the majority of these children.

Adequate reinforcement

Chapter 5 showed that while therapists often use social rewards, these may not have a rewarding value for at least a part of the children with ASD. To effectively stimulate social-communicative behaviour it is important to find good rewards for each individual child. Regularly employing a *reinforcer assessment*, a procedure in which several possible reinforcers are offered to the child at once to observe which the child will choose could be beneficial (Mangum, Fredrick, Pabico, & Roane, 2012). However, for certain social-communicative behaviours, such as declarative joint attention, material reinforcers do not seem suitable because the behaviour is not maintained when the material reinforcer is no longer administered (Stavropoulos & Carver, 2013). To effectively teach declarative joint attention it seems essential to increase the rewarding value of social rewards. One way of achieving this is by consistently pairing social with non-social rewards (Dawson, 2008). Also making the social stimuli more noticeable, for example by using techniques such as heightened animation of gestures, voice and facial expression (one of the techniques of Project IMPACT) could be useful.

STRENGTHS AND LIMITATIONS

Strengths

Evaluation of community care in Flanders. This dissertation reported on the first study that evaluated community interventions for young children with ASD in Flanders. We demonstrated that a subgroup of children shows good progress on social-communicative abilities with the low-intensive intervention they are currently receiving. However, there is also a substantial number of children who make limited progress, for

which the current intervention may not be adequately meeting their needs. As we have discussed, this evaluation of current practice can help to formulate recommendations for improvement of the current organisation of intervention for children with ASD in Belgium. We showed that the Project ImPACT parent training could be a useful programme to supplement current practices.

Combination of different methodologies. The group studies were valuable to gain insight in the average effect of the intervention methods and factors related to progress. However, we have shown that it is important to supplement this information with data on the individual variability, since few children are average. The single-case studies of Chapters 4 and 5 provided a more detailed view on the process of change. The use of both standardized and observational measures appeared useful to obtain information on social-communicative abilities, both in comparison to typical development and in ecologically valid circumstances. Taken together, this dissertation presents a rich body of information on early intervention in preschoolers with ASD.

Detailed assessment of social-communicative abilities. In each of the chapters, we measured the social-communicative abilities with a higher level of detail, compared to the majority of previous studies on this topic. Former studies on the associations between social-communicative abilities and language had often measured several social-communicative abilities with parent report measures or on broad observation scales, computing total scores for a complex construct, such as imitation or play, based solely on a few items (e.g. Thurm, Lord, Lee, & Newschaffer, 2007; Weismer et al., 2010). In the present study we used more elaborate tests for the different constructs that measured several aspects of each of the social-communicative abilities and in that way yielded a total score, that took into account the complexity of the abilities.

Limitations

Limited follow-up data. Chapter 3 showed the progress of children after 6 months of intervention. It would have been useful to have follow-up data on the evolution of the children over a longer period. Testing the progress at more than two points in time would allow for analyses assessing different growth trajectories. Chapter 5 looked at the interaction between the child and the therapist during one intervention session.

However, an analysis of several intervention sessions of a group of children during the first year of intervention, may give even more insight in the mechanisms of change. Chapter 4 provided some follow-up data and showed that the successful implementation of the techniques and the frequency of some social-communicative behaviours decreased for two of the parents and one of the children. Research with a longer follow-up period and with booster sessions is necessary to obtain information on how to maintain progress made with intervention.

Sample size. Chapters 4 and 5 report on rather small samples. In Chapter 4 this was inherent to the design of the study. In an experimental single-case study a sample of four is considered adequate to reliably show the effect of an intervention (Beeson & Robey, 2006). Chapter 5 used a very detailed coding procedure, which would be less feasible to use in a large sample. However, this small sample precluded certain analyses, as was discussed in Chapter 4.

Related abilities. Because we chose for a detailed assessment of the social-communicative abilities, it was not feasible to include certain measures of related abilities. The most important limitation in this respect is the lack of a measure for cognitive abilities. We received information on the children's IQ from the treatment centres. However, the date when the IQ test was taken and the type of test used, varied. Because the IQ test was not taken at the same moment as the measures of the social-communicative abilities and because not all tests provided information on the developmental age, separately for nonverbal and verbal abilities, certain analyses were not possible. For example, in Chapter 2 it would have been useful to include nonverbal mental age as a predictor, because part of the variance explained by the social-communicative abilities will overlap with the variance explained by nonverbal mental age. In Chapter 3 IQ was used as a categorical variable (because part of the children had an IQ below 55), both to compare the different intervention groups, and as a predictor for the outcome. Including a continuous IQ variable would have been better. However, this dissertation focussed on social-communicative abilities. Adding an IQ test to the protocol would have required an additional test moment, which would only have been feasible in a smaller sample or with a less detailed measurement of the social-communicative abilities.

No information on how to adjust the intervention to the characteristics of the child. One of the conclusions of this dissertation is the need for a tailor-made intervention for young children with ASD. However, based on the data in this dissertation, we cannot provide information on what kind of methods work best for what type of children. This would have required an even larger sample than the one reported on in Chapter 3.

No RCT. The quasi-experimental design that was used in Chapter 3 posed a challenge in interpreting the findings. Because there was no random assignment we could not assure that pre-existing differences, other than the treatment method, were responsible for the results. However, the merit of this study is that it looks at interventions in the real world to provide more externally valid results, which would not have been feasible using a RCT.

DIRECTIONS FOR FUTURE RESEARCH

What works for whom?

Given the importance of a tailor-made treatment for children with ASD, more research is needed to evaluate the characteristics of responders and non-responders to different treatment methods. Detailed descriptions of the profiles of these two subgroups could be helpful to determine which factors should be studied further by comparing the effect of an intervention on children with a responder and non-responder profile. These profiles should be compared for different intervention methods, to find a good match for children with any kind of profile. For example, Vivanti, Dissanayake, Zierhut, and Rogers (2013) showed that functional object use, the ability to infer goal-directed actions of others and procedural imitation were associated with response to treatment with the ESDM. It would be of interest to know whether this is a specific responder profile for the ESDM, or whether these characteristics are more generally related to the outcome in different intervention methods. Yoder and Stone (2006) showed that children who responded to Picture Exchange Communication System (PECS) and Responsive education and Pre-linguistic Milieu Teaching (RPMT) indeed had

different profiles: Children with high levels of object exploration responded better to PECS, while children with low levels of object exploration benefitted more from RPMT. More research is needed to find behavioural profiles associated with good outcome in different intervention methods.

Parent training compared to treatment as usual in community settings

The positive findings on the Project ImPACT parent training require replication in community settings, where it is more difficult to rigorously follow the manual of the intervention. The focus group reported no problems in following the manual with regard to the structure of the programme and individual sessions and implementation of the techniques. However, the clinicians reported providing the sessions much less frequently and spreading the contents of one session as described in the manual over multiple sessions, thereby considerably increasing the total duration of the programme (minimum 1 year for the individual format and 6 months for the group format). Research is needed to evaluate the effect of these adaptations on the outcome, both in the individual and group format. Moreover, taken into account the recommendations mentioned in the previous paragraph, it would be of interest to study child and family characteristics related to the benefit of adding parent training to treatment as usual in community settings. Group design studies on parent training should also include standardized measures of for instance language, symptom severity and parental stress. A recent review concluded that there is still insufficient evidence of the effect of parent-mediated interventions on such measures, while the effect on parent-child interaction is well-established (Oono, Honey, & McConachie, 2013).

Involving other natural interaction partners

Possibly, for some children with ASD parent training is not creating sufficient opportunities to practice social-communicative abilities. Further expanding the natural interaction partners involved in the intervention could be beneficial for these children. Given the substantial amount of time children spend at school, teachers seem good candidates to stimulate social-communicative abilities of children with ASD in natural settings. Also in children who already benefit from parent training, adding teacher

training could help to further generalize the abilities in interaction with peers. Observational studies have shown that teachers provide only limited stimulation of joint attention and play in preschoolers with ASD (Wong & Kasari, 2012). Moreover, both eliciting communication (Chiang, 2009) and reacting to the spontaneous communication attempts of the children (Keen, Sigafos, & Woodyatt, 2005) may not be occurring frequently enough. Lawton and Kasari (2012) showed that teachers can effectively promote joint attention in children with ASD. Other studies (Freitag, Feineis-Matthews, Valerian, Teufel, & Wilker, 2012; Strain & Bovey, 2011) looked at combinations of parent and teacher training, which made it difficult to disentangle which factors contributed to the intervention success. Future studies could compare parent training, teacher training and the combination of both in promoting social-communicative abilities.

Another interesting line of research is peer and sibling mediation. There is limited evidence from single-case studies that siblings and peers can successfully learn to use intervention techniques, thereby stimulating imitation, joint attention and social reciprocity of children with ASD (Mcgee, Almeida, Sulzerazaroff, & Feldman, 1992; Pierce & Schreibman, 1995; Tsao & Odom, 2006; Walton & Ingersoll, 2012). Several questions for future research remain: At what age can siblings and peers effectively use techniques? How does the age difference with the child with ASD affect the results? Do abilities learnt in this way generalize to other interaction partners and situations? What is the effect on the siblings or peers?...

Follow-up effects of intervention

Chapter 3 showed no difference in progress between children who received ABA, imitation/joint attention training or treatment as usual. However, the duration between pre-and post assessment was relatively short (6 months), especially given the low intensity. Possibly, children in the different groups would have shown a differential outcome, when followed up over a longer period of time. Given that progress is not always linear, as was evident in Chapter 4, future studies should include assessment at more than two points in time. This would allow for a comparison of different developmental trajectories. Also follow-up, after completion of the intervention is important to see whether progress is maintained. Future research could for example

follow up children during a year after the completion of the Project ImPACT parent training. Comparing several groups that differ in the frequency of booster sessions (e.g. no, monthly or bimonthly booster sessions) could provide valuable information. A limited number of studies provided follow-up data of children receiving early intervention into their childhood years (Magiati, Moss, Charman, & Howlin, 2011; Mceachin, Smith, & Lovaas, 1993; Sallows & Graupner, 2005; Smith, Groen, & Wynn, 2000). A promising line of future research is the follow-up of children receiving targeted social communication intervention for a short period of time. Two studies on the same sample showed that a joint attention or pretend play intervention provided for 30 minutes daily during 6 weeks, had an effect on language 5 years later and that the joint attention training altered the joint attention developmental trajectories (Gulsrud, Helleman, Freeman, & Kasari, 2014; Kasari, Gulsrud, Freeman, Paparella, & Helleman, 2012). Future studies should look at the effect of comprehensive social communication interventions during preschool years on a range of childhood, adolescence and adult outcome measures, such as social skills with peers, educational placement and quality of life.

Intervention for children at risk for ASD

This dissertation focussed on young children with ASD. Although the youngest child in our community intervention sample was only 22 months, on average the children were already 4 years old. The average age of children in studies on early intervention has decreased substantially in the last decade, with more and more studies focussing on very young children with ASD. For example the ESDM study (Dawson et al., 2010), assessed a group of 48 toddlers of 18-30 months. Recently several authors have promoted the idea of intervention in even younger children who are at risk for ASD but have not yet received a diagnosis, such as siblings of children with ASD (Green et al., 2013; Steiner, Gengoux, Klin, & Chawarska, 2013; Webb, Jones, Kelly, & Dawson, 2014). It is hypothesized that intervening in the first two years of life, a period of maximal brain plasticity, could alter the brain circuitry in a way that influences developmental trajectories and reduces the manifestation of autism symptoms (Webb et al., 2014). When parents are already taught techniques to stimulate the social-communicative

abilities of their child with ASD, they could also implement these techniques with a younger sibling, without the need for extra resources. This makes parent training a feasible way to test whether intervention at a very young age, before full symptomatology of ASD arises can indeed alter the development of siblings with ASD.

Studying changes in moment-to-moment interactions in the course of intervention

A longitudinal study of the interaction between children with ASD and their therapists, would be useful to further study mechanisms of change. There appeared to be an immediate effect of rewarding social-communicative behaviours within a session (Chapter 5). A longitudinal study could look at effect of rewarding behaviour in one session, on the frequency of this behaviour in following sessions. The ultimate goal of intervention is to stimulate spontaneous social-communicative behaviour. This should be accomplished by gradually fading prompts until a prompt is no longer necessary (Fentress & Lerman, 2012). It would thus be of interest to see whether behaviours, for which prompts are necessary at first, become more spontaneous over time and how the therapist influences this process. As was evident in Chapter 4, the progress does often not follow a linear slope. Future studies could look for factors associated with regression and sudden improvements.

CONCLUSION

This doctoral research confirmed the importance of social-communicative abilities as targets for early intervention in children with ASD. We showed that imitation, imperative joint attention, declarative joint attention and pretend play all have their role in language development. On average there was no different effect on social-communicative abilities of low-intensive ABA, imitation/ joint attention training and treatment as usual in community settings. The project ImpACT parent training is an effective intervention programme for nonverbal children with ASD and has the potential to become a cost-effective alternative for intensive intervention programmes implemented by therapists. The different studies of this dissertation showed great

variability in the progress children make, which can be partially explained by child factors such as cognitive functioning and by factors that define the interaction between therapist and child during an intervention session.

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NEDERLANDSTALIGE SAMENVATTING

Autismespectrumstoornis (ASS) wordt gekenmerkt door beperkingen in sociale communicatie en sociale interactie en repetitief gedrag, interesses of activiteiten (American Psychiatric Association [APA], 2013). De prevalentie van ASS wordt geschat op 60-70 per 10.000 kinderen, wat impliceert dat dit één van de meest voorkomende ontwikkelingsstoornissen is bij kinderen (Elsabbagh et al., 2012; Fombonne, 2009). De diagnoseleeftijd van ASS is de laatste decennia gedaald. Reeds op de leeftijd van twee jaar is nu in de meeste gevallen een betrouwbare diagnose mogelijk (Turner, Stone, Pozdol, & Coonard, 2006). Dit is positief, aangezien een lagere diagnoseleeftijd ook de mogelijkheid geeft om vroeger een gepaste behandeling aan te bieden en op die manier de verdere ontwikkeling optimaal te stimuleren. Zeker bij jonge kinderen is het stimuleren van de vroege sociaalcommunicatieve vaardigheden, waaronder imitatie, gedeelde aandacht en doen-alsof-spel, essentieel om de ontwikkeling op vele gebieden gunstig te beïnvloeden. Beperkingen in deze vaardigheden zijn immers uitvoerig gedocumenteerd bij kinderen met een ASS (Bruinsma, Koegel, & Koegel, 2004; Jarrold, 2003; Vanvuchelen, Roeyers, & De Weerd, 2011). Bovendien vervullen deze vaardigheden essentiële functies in de ontwikkeling. Zowel imitatie, gedeelde aandacht als doen-alsof-spel zijn belangrijk omdat ze een faciliterende rol spelen in het leren over de wereld enerzijds en omwille van hun functie in de sociale, sociaal-cognitieve en taalontwikkeling anderzijds (Charman et al., 2000; Lewis, Boucher, Lupton, & Watson, 2000; Meltzoff & Williamson, 2013). Bij kinderen met een ASS werd een verband gevonden tussen de grootte van de beperking in de vroege sociaalcommunicatieve vaardigheden en de latere ontwikkeling van ondermeer taal en theory of mind (ToM; Charman et al., 2003; Luyster, Kadlec, Carter, & Tager-Flusberg, 2008; Schietecatte, Roeyers, & Warreyn, 2012). Verder blijken zowel trainingen in imitatie (o.a. Ingersoll & Schreibman, 2006; Walton & Ingersoll, 2012; Warreyn & Roeyers, 2013), gedeelde aandacht (zie White et al., 2011 voor een overzicht) als doen-alsof-spel (zie Jung & Sainato, 2013 voor een overzicht) een significant effect te hebben dat in bepaalde gevallen ook generaliseert naar andere settings en personen.

Aan de bovengenoemde doelen kan op verschillende manieren worden gewerkt. De behandelingsmethode die internationaal veruit het meest werd onderzocht, is de toegepaste gedragsanalyse, of Applied Behaviour Analysis, kortweg ABA. Hoewel deze naam verschillende ladingen dekt, hebben interventies volgens de ABA-methode gemeenschappelijk dat ze gericht zijn op het stapsgewijs aanleren van gedrag via bekrachtiging. Uit verschillende onderzoeken blijkt dat kinderen met een ASS die zeer intensief volgens deze methode worden behandeld, meer vooruitgang boeken op het vlak van cognitieve vaardigheden, taal en adaptief gedrag dan kinderen die een eclecticische behandeling krijgen (Reichow, 2012; Warren et al., 2011). Omdat er geen enkele methode bestaat waarnaar zo veel onderzoek is gedaan en waarbij het positieve effect meermaals werd bevestigd, wordt deze behandeling door velen gezien als de behandeling die de voorkeur verdient op dit moment (Eikeseth, 2009; Vismara & Rogers, 2010). Bij deze positieve resultaten moeten evenwel een paar kanttekeningen worden geplaatst. Ten eerste werd in het merendeel van deze studies 20 tot 40 uur ABA per week gegeven, meestal gedurende enkele jaren. Therapie aan een dergelijke intensiteit is in België op grote schaal moeilijk haalbaar. Bovendien werd het effect op de kernsymptomen van ASS nog nauwelijks onderzocht. Verder is de klassieke vorm van ABA zeer directief en laat ze zo weinig kans tot initiatief aan het kind. Ook bestaat het gevaar dat kinderen afhankelijk worden van prompts, wanneer die niet snel genoeg worden afgebouwd. Onder meer omwille van de bovenstaande redenen evolueerde de klassieke ABA-methode naar een interventie die minder directief is en die principes van zijn tegenhanger, de ontwikkelingsgerichte therapie, meer probeert te incorporeren (Ingersoll, 2010). Tegenwoordig worden in de meerderheid van de interventieprogramma's voor kinderen met een ASS zowel gedragstherapeutische als ontwikkelingsgerichte technieken gebruikt. Deze behandelingen hebben als doel om de generalisatie en het spontaan gebruik van vaardigheden te bevorderen door ze aan te leren in een natuurlijke omgeving.

DOELSTELLING DOCTORAATSONDERZOEK

Dit doctoraat had als doel om de kennis over de bevordering van sociaalcommunicatieve vaardigheden bij jonge kinderen met een ASS uit te breiden. Dit

algemene doel werd vertaald in verschillende specifieke onderzoeksvragen. Ten eerste wilden we meer inzicht krijgen in het belang van deze vaardigheden als doelen van interventie bij kinderen met een ASS. Hiervoor onderzochten we de associaties van imitatie, gedeelde aandacht en doen-alsof-spel met taal. De taalvaardigheid van kinderen met een ASS op jonge leeftijd is immers één van de belangrijkste voorspellers van hoe goed deze kinderen zullen functioneren op latere leeftijd (Howlin & Moss, 2012). Een tweede vraag was hoe sociaalcommunicatieve vaardigheden het best kunnen worden gestimuleerd bij deze kinderen. Om een antwoord te bieden op deze vraag werden twee studies uitgevoerd. In een eerste studie evalueerden we het effect van behandelingsmethoden die in de praktijk werden gebruikt op de sociaalcommunicatieve vaardigheden van kinderen met een ASS. Naast een evaluatie van het huidige behandelingsaanbod, wilden we ook op zoek gaan naar manieren om de interventie voor jonge kinderen met een ASS in Vlaanderen te verbeteren. Daarom onderzochten we het effect van een behandelingsprogramma dat ouders technieken aanleert om de sociaalcommunicatieve vaardigheden van hun kind te stimuleren. Een derde doel van dit doctoraat was het in kaart brengen van de individuele variabiliteit in de vooruitgang van kinderen met een ASS die therapie krijgen en op zoek te gaan naar factoren die samenhangen met deze variatie. Tot slot wilden we meer inzicht krijgen in de werkingsmechanismen van de behandeling. Hiervoor werden interacties van kinderen met een ASS en hun therapeut in een therapiesessie bestudeerd en werd gekeken naar de samenhang met de vooruitgang die de kinderen maakten.

OVERZICHT VAN DE BELANGRIJKSTE BEVINDINGEN

Belang van sociaalcommunicatieve vaardigheden als interventiedoelen

Dit doctoraatsonderzoek bevestigt de duidelijke beperkingen in sociaalcommunicatieve vaardigheden bij jonge kinderen met een ASS die al uit eerder onderzoek bleken (Bruinsma et al., 2004; Jarrold, 2003; Vanvuchelen et al., 2011). Imitatie, doen-alsof-spel en taal werden gemeten aan de hand van gestandaardiseerde testen. Aangezien we deze vaardigheden in een grote steekproef van peuters en kleuters met een ASS hebben onderzocht, was het relevant om de gemiddelde

achterstand ten opzicht van de normale ontwikkeling na te gaan. Voor kinderen met een ASS tussen 2 en 6 jaar die al enige vaardigheden hadden ontwikkeld op vlak van imitatie, doen-alsof-spel en taal lag die tussen de 15 en 17 maanden. Kinderen die nog geen imitatie of doen-alsof-spel lieten zien in de gestandaardiseerde testen hadden op gemiddeld 3-jarige leeftijd al een achterstand opgebouwd van minstens 2 jaar in deze vaardigheden.

Ook de trainbaarheid van sociaalcommunicatieve vaardigheden werd bevestigd door dit onderzoek. Kinderen met een ASS tussen 2 en 6 jaar die enkele uren interventie per week kregen, toonden significante vooruitgang op vlak van imitatie, doen-alsof-spel, gedeelde aandacht, receptieve en expressieve taal en adaptief gedrag na zes maanden. Bovendien was er een significante vermindering in de symptomen van ASS bij deze kinderen. Verder bleek dat ook kinderen die beperkte sociaalcommunicatieve vaardigheden lieten zien bij de start van de interventie een goede vooruitgang hadden in deze vaardigheden wanneer aan hun ouders gedurende 12 weken interventietechnieken werden aangeleerd met het ImPACT-programma (Ingersoll & Dvortcsak, 2010; Nederlandstalige bewerking door Roeyers, Van der Paelt & Warreyn, 2013).

Dit doctoraatsonderzoek bevestigt ook het belang van sociaalcommunicatieve vaardigheden voor de taalontwikkeling. We toonden aan dat imitatie, declaratieve en imperatieve gedeelde aandacht en doen-alsof-spel elk hun eigen rol hebben in de taalontwikkeling. Het bleek namelijk dat de associaties tussen deze vaardigheden en taal verschillend waren voor taalbegrip en taalproductie en dat ze ook afhankelijk waren van de taalleeftijd van de kinderen. Imitatie en doen-alsof-spel verklaarden elk een uniek deel van de variatie in taal, zowel in kinderen met een taalniveau onder als boven 2 jaar. Gedeelde aandacht bleek enkel een unieke associatie met taal te vertonen bij kinderen met de jongste taalleeftijd.

Hoe kunnen sociaalcommunicatieve vaardigheden gestimuleerd worden?

We voerden een studie uit waarin we 3 groepen kinderen met een ASS vergeleken die verschilden op het vlak van behandelingsmethode. Een eerste groep kreeg ABA, een tweede groep een specifieke training in imitatie en gedeelde aandacht

en een derde groep kreeg de gangbare behandeling. Deze studie vond plaats in de klinische praktijk om zo een maximale externe validiteit te garanderen en om tegemoet te komen aan de nood aan evaluaties van interventies die toegepast worden in de praktijk, en niet in onderzoekssettings. We vonden geen verschil in effect van deze behandelmethodes op de sociaalcommunicatieve vaardigheden van de kinderen. Één van de mogelijke redenen voor het ontbreken van een verschil was de lage intensiteit van de interventies. Eerdere studies hadden al aangetoond dat de hoeveelheid vooruitgang die kinderen met een ASS boeken, samenhangt met de intensiteit van de interventie (Mazurek, Kanne, & Miles, 2012; Virues-Ortega, Rodriguez, & Yu, 2013). De kinderen in ons onderzoek kregen echter slechts enkele uren interventie per week, waarvan gemiddeld maar een half uur tot een uur ABA of training in imitatie en gedeelde aandacht in de desbetreffende groepen. Dit is mogelijk onvoldoende om zich te onderscheiden van de gangbare behandeling. Een behandeling van ten minste 25 uur per week, zoals internationaal wordt aangeraden (National Research Council, 2001), lijkt niet mogelijk binnen de huidige organisatie van vroege interventie voor kinderen met een ASS in België. Een deel van de kinderen met een ASS zou misschien wel baat hebben bij een interventie van een dergelijke intensiteit, aangezien twintig procent van de kinderen met hun huidige behandelingsaanbod geen vooruitgang boeken op vlak van sociaalcommunicatieve vaardigheden. Vooral voor die kinderen is het belangrijk om te zoeken naar manieren om het huidige behandelingsaanbod te verbeteren.

In een tweede studie evalueerden we een alternatief voor intensieve interventie gegeven door een therapeut, namelijk het trainen van ouders zodat zij de sociaalcommunicatieve vaardigheden van hun kind in dagdagelijkse situaties kunnen bevorderen. We toonden aan dat een kortdurende interventie (12 weken) met het ImPACT-programma tot substantiële vooruitgang kan leiden in de sociale betrokkenheid, communicatie, imitatie en spel van kinderen met een ASS. Dit betrof een single-case studie met 4 gezinnen, wat impliceert dat replicatie van deze bevindingen in een grotere steekproef noodzakelijk is om de generalisatie naar de populatie van kinderen met een ASS na te gaan. Een eerste focusgroep met therapeuten en thuisbegeleiders leverde ook al enige evidentie voor de bruikbaarheid van dit programma in de Vlaamse praktijk.

Heterogeniteit in het succes van de behandeling

Uit de verschillende studies van dit doctoraat bleek een grote heterogeniteit in de hoeveelheid vooruitgang die de kinderen maakten. Een vierde van de kinderen uit de studie naar de verschillende therapiemethodes volgde een normaal ontwikkelingspad voor imitatie, doen-alsof-spel en taal. Er was echter ook een substantieel deel van de kinderen (ongeveer een vijfde) dat weinig of geen vooruitgang boekte in die vaardigheden. Bovendien was er ook een vrij grote groep (34%) die een gemengd profiel liet zien met goede vooruitgang op sommige maar geen vooruitgang op andere maten. Slechts een minderheid van de kinderen (21%) maakte vooral gemiddelde vooruitgang. Die variabiliteit was ook te zien in de resultaten van de studie naar het effect van de oudertraining. Door het gebruik van een single-case opzet met regelmatige metingen van de sociaalcommunicatieve vaardigheden, was het mogelijk om, naast verschillen in de hoeveelheid vooruitgang, ook verschillen in het veranderingsproces aan te tonen. Terwijl de vooruitgang bij sommige kinderen en voor bepaalde vaardigheden meer gradueel verliep, was dit voor andere kinderen en vaardigheden eerder met plotse sprongen en soms ook met een terugval. Uit de studie naar het effect van de verschillende therapiemethodes bleek dat de variabiliteit samenhang met het IQ van de kinderen en met het onderwijs dat ze volgden, meer dan met de intensiteit van de behandeling of de ernst van de symptomen. Vooral kinderen met een IQ beneden de 55 en kinderen die nog niet naar school gingen, maakten het minst vooruitgang. Verder bleek dat de vooruitgang die kinderen maakten, ook duidelijk samenhang met de interacties tussen kind en therapeut waarbij gedeelde aandacht en spel gestimuleerd werden.

Werkingsmechanismen van de behandeling

Naast de vraag of een interventie effectief is en voor wie is het van belang om inzicht te krijgen in waarom ze werkt. De sociale motivatie hypothese (Dawson, 2008; Dawson, Webb, & McPartland, 2005) associeert zowel het ontstaan van de eerste symptomen van ASS als de vatbaarheid voor interventie met de belonende waarde van sociale stimuli. Volgens deze hypothese zorgen genetische en andere risicofactoren voor een afwijkende manier van omgaan met de sociale omgeving, gekenmerkt door een

gebrek aan sociale aandacht. Dit zou resulteren in minder sociale ervaringen, een afwijkende ontwikkeling van het neurale circuit en een uitbreiding van de symptomen van ASS. Volgens Dawson (2008) zou gedragtherapeutische behandeling op jonge leeftijd dit proces kunnen tegengaan door de sociale aandacht en de gevoeligheid voor sociale beloningen te beïnvloeden. De bevindingen van de studie waarin we de interacties tussen de therapeut en het kind meer in detail hebben bestudeerd, zijn in overeenstemming met deze hypothese. Ten eerste bleek dat de interacties met de therapeut waarbij gedeelde aandacht en spel werd getoond door het kind, voorspellend waren voor de vooruitgang in gedeelde aandacht, doen-alsof-spel en taal. Dit impliceert dat kinderen die meer gemotiveerd waren om in interactie te gaan met de therapeut, mogelijks omdat die therapeut belonend was geworden voor hen, meer vooruitgang boekten. Ten tweede, onze resultaten bevestigden het idee dat aandacht voor het gedrag van de therapeut essentieel is, aangezien vooral de interacties waarin de therapeut een prompt gebruikte voorspellend waren voor de vooruitgang. Kinderen die meer aandacht hadden voor de prompts van de therapeut en die meer wilden opvolgen, toonden dus de meeste vooruitgang. Ten derde, in sommige gevallen waren de niet-beloonde gedragingen betere voorspellers voor de vooruitgang dan beloonde gedragingen. Dit bleek vooral het geval te zijn voor interacties waarin sociaalcommunicatief gedrag voorkwam dat gewoonlijk gevolgd werd door een sociale beloning (declaratieve gedeelde aandacht en spel). Deze bevinding is in overeenstemming met de verminderde beloningswaarde van sociale stimuli, die werd voorgesteld door de sociale motivatie hypothese en ook werd bevestigd in experimentele studies (Demurie, Roeyers, Baeyens, & Sonuga-Barke, 2011; Geurts, Luman, & van Meel, 2008; Scott-Van Zeeland, Dapretto, Ghahremani, Poldrack, & Bookheimer, 2010).

Naast sociale motivatie is ook de mate van synchroon gedrag van de interactiepartner voorgesteld als een mediator van het interventiesucces. Synchrone communicatie volgt de interessefocus van het kind en is tegengesteld aan asynchrone communicatie die de aandacht of het gedrag van het kind probeert te sturen. De resultaten van de studie naar het IMPACT-programma toonden een verband tussen de synchrone communicatie van de ouders en de sociale betrokkenheid bij het kind.

KLINISCHE IMPLICATIES

De resultaten van dit doctoraatsonderzoek tonen aan dat imitatie, gedeelde aandacht en doen-alsof-spel belangrijke therapiedoelen zijn voor jonge kinderen met een ASS. Een interventieprogramma dat al deze vaardigheden stimuleert lijkt het meest geschikt, vooral voor kinderen die nog weinig taalvaardigheden laten zien. Aangezien het aanpakken van verschillende doelen tegelijk niet altijd mogelijk is, zeker wanneer de intensiteit van de interventie beperkt is, kan het nuttig zijn om rekening te houden met de huidige vaardigheden van het kind om de meest essentiële doelen op een bepaald moment te kiezen. Zo kan eerder gekozen worden voor speltraining bij kinderen met beperkt taalbegrip en zal een training in imitatie mogelijks het meest nodig zijn voor kinderen met beperkte taalexpressie. Het trainen van de gedeelde aandacht lijkt vooral van belang in de vroegste stadia van de taalontwikkeling, terwijl kinderen met beter ontwikkelde taalvaardigheden mogelijks meer baat zullen hebben bij een training van imitatie en/of spel, naast een directe focus op taal zelf.

Uit het onderzoek naar het effect van verschillende interventies in de praktijk, bleek dat geen enkele methode gemiddeld gezien beter is dan de andere. Dit betekent niet dat elk individueel kind even veel vooruit zal gaan, ongeacht de methode. Er was immers een grote individuele variabiliteit binnen elk van de behandelingsmethodes. Deze resultaten wijzen op het belang van een behandeling op maat, die aangepast is aan de noden van het kind. Dit vraagt ook een regelmatige evaluatie van de vooruitgang, zodat andere strategieën kunnen worden geprobeerd wanneer vooruitgang uitblijft. Video-opnames maken van therapiesessies lijkt een goede methode te zijn om die vooruitgang te evalueren en na te gaan op welke manier de huidige aanpak kan worden verbeterd. Een evaluatie van de behandeling, mag niet gelimiteerd zijn tot een beoordeling van de vaardigheden van het kind. Ook gezins- en ouderfactoren, zoals de ouder-kind relatie, de mate van synchronie in omgang met het kind en stress bij de ouders moeten worden opgevolgd (Karst & Vaughan Van Hecke, 2012). Verder lijkt het belangrijk om geschikte beloningen te vinden voor elk kind. Sommige vaardigheden, zoals declaratieve gedeelde aandacht kunnen moeilijk aangeleerd worden met materiële bekrachtigers (Stavropoulos & Carver, 2013). Om deze vaardigheden optimaal te

stimuleren kan het systematisch koppelen van sociale aan niet-sociale bekrachtigers of het meer opvallend maken van sociale bekrachtigers nuttig zijn.

De meeste kinderen in Vlaanderen hebben slechts toegang tot enkele uren interventie per week. Slechts een vierde van de kinderen die gezien werden voor dit onderzoek kreeg thuisbegeleiding. Een deel van de kinderen met een ASS in België krijgt momenteel geen therapie omdat ze op een wachtlijst staan. Internationaal wordt echter 25 uur interventie per week aangeraden, die start vanaf dat het kind een diagnose gekregen heeft (National Research Council, 2001) omdat zowel de intensiteit als de leeftijd waarop de interventie start belangrijke voorspellers zijn voor de prognose op langere termijn. Dit doctoraatsonderzoek toonde aan dat het ImPACT-programma een waardevol alternatief zou kunnen zijn voor intensieve interventie gegeven door een therapeut. Ouders kunnen de sociaalcommunicatieve vaardigheden immers in veel dagelijkse situaties stimuleren, waardoor de intensiteit ook voldoende hoog kan zijn. Een bijkomend voordeel van interventie die door de ouders wordt gegeven, is dat het de generalisatie van vaardigheden kan bevorderen. Het ImPACT-programma zou ook kunnen aangeboden worden aan ouders van kinderen die op een wachtlijst staan voor intensievere vormen van interventie, wat een positieve invloed zou kunnen hebben op de verdere ontwikkeling van die kinderen.

CONCLUSIE

Dit doctoraatsonderzoek bevestigde het belang van sociaalcommunicatieve vaardigheden als interventiedoelen voor jonge kinderen met een ASS. Imitatie, imperatieve gedeelde aandacht, declaratieve gedeelde aandacht en doen-alsof-spel spelen allen een belangrijke rol in de taalontwikkeling. Om deze vaardigheden te stimuleren, blijkt er gemiddeld gezien geen verschillend effect van ABA, een training in imitatie en gedeelde aandacht of de gangbare behandeling. De ImPACT oudertraining is een effectief interventieprogramma voor jonge kinderen met een ASS met beperkte taalvaardigheden en heeft het potentieel om een waardevol alternatief te worden voor intensieve interventie gegeven door een therapeut. In de verschillende studies bleek een grote heterogeniteit in de vooruitgang die kinderen boekten. Deze variabiliteit hing

deels samen met kindfactoren zoals de cognitieve mogelijkheden en met de interactie tussen kind en therapeut tijdens een therapie sessie.

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