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The Relationship between CJA, IJA, RJA of Joint Attention and Language in Infancy

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Abstract

The Relationship between CJA, IJA, RJA of Joint Attention and Language in Infancy

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Joint attention is critical in the development of subsequent language ability during the infancy period. Past studies have shown that joint attention consolidates in the infancy period and is associated with subsequent language development in toddlerhood. However, previous studies have examined joint attention in a confined manner. While coordinated joint attentional engagement state is effective in reflecting the infant's joint attention ability, it is inefficacious in distinguishing the contribution between the mother and the infant. By comparison, structured assessments are able to differentiate whether the infant responds to other's social bids or whether the infant himself initiates bids to others.

Therefore, to evaluate a more representative and holistic picture of the infant's capacity in joint attention, the current study investigated joint attention in a multi-method approach by combining standardized measures and observational data. In order to measure infant's coordinated joint attentional engagement state (CJA), the free-play interaction paradigm was administered in which it examined interaction between the mother and the infant. For responding to joint attention (RJA) and initiating joint attention (IJA) behaviors, the Early Social Communication Scales (ESCS) was used in which the infant interacted with an experimenter in a structured setting. Lastly, the MacArthur-Bates Communicative Inventory-Korean (MCDI-K) was administered to assess infant's vocabulary production and comprehension abilities. All measures were taken longitudinally at 12, 15, and 18 months of age.

Results revealed that similar to previous studies, CJA, RJA, and IJA were related to both language comprehension and production, with RJA showing greater association with comprehension and IJA with production. Significant predictors of 12-month comprehension were 12-month CJA and RJA; 15-month CJA and IJA for same month comprehension; 12-month IJA and RJA for same month production; 12-month production for 15-month production; and 18-month CJA for same month production. Implications and limitations of the present study were also discussed.

Keywords: joint attention, RJA, IJA, early social communication scale, free-play, language development

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

Joint attention plays a critical role in early social, cognitive, and emotional development (Dunham & Moore, 1995). Previous studies have found that the ability to coordinate attention with someone else regarding a mutual object has fostered cognitive, social cognitive, and linguistic developments both concurrently and subsequently. More specifically, past studies have confirmed joint attention's association with social cognition (Carpenter, Nagell, & Tomasello, 1998; Tomasello, 1995), imitation (Carpenter, Tomasello, & Savage-Rumbaugh, 1995; Slaughter & McConnell, 2003), emotion regulation (Morales, Mundy, Crowson, Neal, & Delgado, 2005), mind theory (Charman et al., 2000; Kim, Jeong, & Kwak, 2009; Mundy, Sigman, & Kasari, 1994) and language abilities (Bak, 2014; Baldwin, 1995; Carpenter et al., 1998; Desrochers, Morissette, & Richard, 1995; Kim & Kwak, 2010; Markus, Mundy, Morales, Delgado, & Yale, 2000; Mundy & Gomes, 1998; Mundy et al., 2007). Of all the socio-cognitive skills, joint attention has been extensively studied with language abilities and has been viewed as a precursor to language development. Indeed, various studies have demonstrated that the lack of joint attention behaviors predicts poorer language outcomes in subsequent years (Charman, 2000; Murray et al., 2008). As a result, problems in joint attention capacity have been seen as

early identification for subsequent language and social-cognitive impairment (Sigman & Ruskin, 1999; Ulvund & Smith, 1996).

While various studies have confirmed the relationship between joint attention and subsequent language development, the infant's joint attention ability has been studied in a constrained manner. Joint attention was examined in a single approach method, which may have captured only a partial aspect of the joint attention capacity.

To address these issues found from previous studies, joint attention was measured in both the free-play interaction paradigm (Bakeman & Adamson, 1984) and the Early Social Communication Scales (ESCS; Mundy et al., 2003). The free-play interaction paradigm (Bakeman & Adamson, 1984) was used to measure the infant's coordinated joint attention engagement state, and the ESCS (Mundy et al., 2003) was administered to assess the infant's responding to joint attention (RJA) skill and initiating joint attention (IJA) skill. Finally, the MacArthur-Bates Communicative Development Inventory-Korean (MCDI-K; Bae & Kwak, 2011) was used to measure the infant's language production and comprehension skills. The current study examined the relationship between the joint attention factors and language skills.

1. Joint Attention

Joint attention is the ability to coordinate attention with a social partner regarding an object or event of mutual interest (Bakeman & Adamson, 1984). It is a triadic interaction in which the two individuals coordinate their attention to the same entity, object, or event (Dunham & Moore, 1995). In an episode where the coordination of attention is achieved between the infant-mother dyad, the infant gives attention towards the mother and object of interest. Simultaneously, the mother also gives attention to the infant and mutual object. In this episode, not only do the infant and the mother attend to the same object of mutual interest, but are also aware that they both are attending to the same object. Thus, in coordinated joint attentional state, sharing of both partners' knowledge that they are attending to the same object of mutual interest is of essential knowledge (Carpenter & Liebal, 2011). The critically important point about joint attention is the "coordination aspect of joint attention" and the "sharing" of attention (Carpenter & Liebal, 2011, p. 160). The engagement state in which the true joint attention is carried out is called the coordinated joint attentional engagement state or CJA (Bakeman & Adamson, 1984).

In order to establish joint attentional engagement state, three abilities are needed. According to Brune (2004), they are as follows: 1) comprehension of attentional relation; 2) attention regulation; and 3) social engagement.

Comprehension of attentional relation is the infant's ability to understand that the other person is focusing his attention to a particular object. In addition, attention regulation is the infant's ability to intentionally attend to both the social partner and object of interest, and to also shift or inhibit one's attention between the two. Lastly, social engagement is the infant's ability to follow other's attention to the object of interest, or to draw the social partner's attention toward one's object of interest. Thus, to be a truly 'joint' attention, it needs to encompass all of the above abilities stated by Brune (2004).

Furthermore to the three competences that Brune (2004) stated as mandatory for joint attention, both partners need to share something to be coordinately aware of an object or event. The optimal way to share something with the social partner is through direct communication. Communication itself provides an indication or an acknowledgement that the attention is being shared between oneself and the partner and consequently, eliminates any ambiguity about whether the partner is aware of the object or event. To communicate with social partners, infants display behaviors such as following the direction of the partner's eye-gaze, pointing, or showing. These behaviors emerge at different time points throughout infancy.

2. Development of Joint Attention

Joint attention capacity develops gradually across the infancy period (Bakeman & Adamson, 1984; Carpenter et al., 1998). Approximately until 4 months of age, infants mostly pay attention and interact in a face-to-face interaction with their caregiver (Eilan, 2005). Around 5 months, infants move away from the face-to-face interaction in which their attention is solely focused on the caregiver to the exploration of objects (Trevarthen & Hubley, 1978). Then around 6 months of age, infants are able to alternate their gaze between the caregiver and the object (Newson & Newson, 1975). Finally by about 13 months and onwards, the ability to coordinate attention becomes consolidated (Bates, 1979).

The first study that longitudinally examined coordinated joint engagement states of infants from 6 to 18 months was conducted by Bakeman and Adamson (1984). Joint engagement states were defined as periods that lasted at least 3 seconds in which both individuals were focused on the mutual object at the same time and the infant acknowledged that sharing was ongoing between them with behaviors such as looking at the mother's face. Results indicated that the frequency of occurrence of joint engagement, the percentage of time spent in joint engagement, and the mean duration that the mother-infant dyad spent in the joint-engagement states all increased with age. While 6-month-olds barely spent

about 2.3% in the joint engagement state, a general increase was evident throughout the period resulting with 18-month-olds spending about 26.6% in the joint engagement state. Similarly, the mean duration of joint engagement states elongated from 7.1 seconds at 6 months to 33.8 seconds at 18 months. Another study also reported comparable results on infants' joint attention capcity from 9 to 15 months (Carpenter et al., 1998). The time spent in the joint engagement state increased from an average of 13 seconds at 9 months to 44 seconds at 15 months. Correspondingly, the number of engagement episodes increased from an average of 1.6 to 4.3 episodes from 9 to 15 months. Furthermore, the average duration of joint-engagement episodes increased with an average of 4.89 seconds at 9 months to 9.17 seconds at 15 months. Moreover, results indicated that as infants became older, they were less involved in the engagement state in which they only focused their attention to the social partner, and engaged relatively more in the coordinated joint attentional state. Thus, this result reflects the development of the infant transitioning from the face-to-face interaction to a triadic interaction that involves the sharing of the attention with the social partner regarding an object of interest.

Likewise, similar results were also reported among Korean infants. According to Jeong and Kwak (2005), the frequency of coordinated joint engagement states showed an increasing trend across the period of 9 to 18

months. Coordinated joint attention showed significant increase from 9 to 12, 12 to 15, and 15 to 18 months, with the greatest increase evident from the 15 to 18 month period. Also, reports indicated that states of engagement with only the social partner decreased while coordinated joint engagement states increased. This finding corresponds to that of Bakeman and Adamson's (1984). Especially, the decrease in person engagement as age increases and the developmental pattern of the increase in coordinated joint attention supports the argument that the infant's face-to-face interaction progresses into a triadic interaction. Thus, the above studies demonstrate that infant's competence to engage in joint attentional engagement states develops steadily across the period of around 6 to 18 months of age.

Beyond joint attentional episodes, which are states of engagement, the infant's joint attention capacity can be classified into two types of behavior: responding to joint attention (RJA) and initiating joint attention (IJA). Responding to joint attention (RJA) refers to the infant's ability to follow other's attentional bid (Mundy et al., 2007; Seibert, Hogan, & Mundy, 1982). RJA skills may refer to the capacity of the infant to follow other's gaze, head turn, and pointing (Morales et al., 2000). Initiating joint attention (IJA) refers to the infant's ability to use eye contact, pointing, and other gestures to direct the attention of others to objects or events (Mundy et al., 2007; Seibert et al., 1982).

In comparison to the IJA behavior, RJA behavior emerges relatively earlier in the development.

One of the earliest joint attentional behavior that infants demonstrate is gaze following, the behavior of "looking where someone else is looking" (Butterworth, 1991, p. 2). According to Scaife and Bruner (1975) who conducted the first study of infant's gaze following behavior, the ability to control their gaze to match with the adult's focus of attention begin to develop in infants as young as 2 months of age with a mean age of 4 months. Another study indicated that a substantial number of 6-month-old infants demonstrated the capacity to match the adult direction of the gaze (Morales, Mundy, & Rojas, 1998). However, later study indicated that infants were not capable of truly gaze-following until the age of 10 months (Brooks & Meltzoff, 2005). In their study, Brooks and Meltzoff (2005) assessed gaze-following behavior by placing two identical targets at eye level on either side of the infant. Then accordingly to the condition, the experimenter either silently turned his or her head toward the target with either opened or closed eyes. Results indicated that the 10- to 11-months-old infants turned significantly more towards the direction of the experimenter when he or she had open eyes than closed eyes. However, infants 9 months of age were incapable of making such contrast and turned towards the direction of the experimenter regardless of whether he or she had open or closed eyes. In line

with this study, Carpenter et al. (1998) also reported that the mean age of emergence of attention following was much later than 2 or 6 months and was around 11.5 months of age.

With regards to the development of RJA, Morales and his colleagues (2000) examined the percentage of correct response of infant's behaviors of following gaze, head turn, and pointing across the age period of 8 to 24 months. Results indicated that there was a significant growth in precision of these behavioral skills from 8 to 10 and 10 to 12 months with the figures of 19% to 39% and 39% to 66%, respectively. Furthermore, Mundy et al. (2007) also reported similar findings. The precision of correctly accomplishing such behaviors increased from 23%, 48%, 63% to 68% at 9, 12, 15, and 18 months of age, respectively.

As for the development of IJA which is consisted of pointing and showing behaviors, such abilities emerge subsequent to the development of RJA (Dunham & Moore, 1995). Infants start to produce pointing behaviors as early as 3 to 4 months of age. However, the pointing gesture at this age is not produced in a joint-attentional manner. Pointing that occurs in a joint-attentional manner has the function of directing another person's attention to the referent that he or she is interested in for the sake of sharing experience. Infants start to produce the communicative gesture of pointing between the period of 7 to 15 months, with a

mean age around 11 to 12 months (Colonnesi, Stams, Koster, & Noom, 2010). Similarly, Carpenter et al. (1998) reported the mean age of the emergence of pointing was around 12.3 months.

Regarding the development of IJA, Mundy et al. (2007) reported that the infant's performance increased from 9 to 12 months, but showed a decreasing trend from 12 to 15 months and again an increase from 15 to 18 months. Apart from the general increasing pattern in the development of coordinated joint attentional engagement state and RJA skill, IJA skill showed a U-shaped pattern across the 9 to 18 months period. However, this is one of the few studies that examined and reported the developmental pattern of IJA. Therefore, it is uncertain whether the development of IJA pattern found in Mundy et al.'s (2007) study would be consistently demonstrated when replicated in other studies. Therefore, there is the need to longitudinally examine the development of IJA across age to confirm its developmental pattern that could be generalized to larger population. While previous studies have demonstrated that joint attention abilities consolidate around the period of 12 to 18 months (Carpenter et al., 1998; Bakeman & Adamson, 1984; Mundy et al., 2007; Morales et al., 2000), this may not be applied to all types of joint attention behaviors.

3. Joint Attention and Language

Joint attentional engagement states, which are episodes of shared attention with the caregiver, are important contexts during which infants learn and acquire early vocabularies. Early studies have investigated social routines between the mother and the child to document their interactions (Ninio & Bruner, 1978; Ratner & Bruner, 1978). By examining daily social routines such as book-reading (Ninio & Bruner, 1978) and clown game (Ratner & Bruner, 1978) interactions, researchers were able to find that the mother's role was to scaffold the child in the process of early language acquisition. Indeed, infants are yet incapable of initiating or being involved in the joint attentional episode alone without the support of someone else. The mother has the ability that is absent in her child and therefore scaffolds the experience by providing the appropriate form of what she thinks the child is intending to express. More specifically, the mother provides attentional cues such as pointing gestures toward the object of interest while labelling the object. Since their attentions are coordinated during this interaction, the infant is able to follow the correct object referred by the attentional cue and make a connection between the word that the mother spoke with the correct object or event in the immediate environment (Baldwin, 1995). Thus, the mapping process of the words identifying the object that the adult produces and the object of interest leads to and promotes language acquisition.

Hence, the joint attention episodes provide the foundation of shared experience essential for language acquisition by delimiting the referential context and making the intended referents of the mother's language more accurate for the infant (Baldwin, 1995; Bruner, 1983; Tomasello, 1995). Moreover, the child's experiences of sharing meanings in the episodes of joint attention further provides the context for the infant's understanding of the social environment (Adamson & Bakeman, 1991).

As a matter of fact, previous studies have shown that infants do acquire language better when joint attention episodes are established than when it is not (Tomasello, 1998). Tomasello and Todd (1983) have shown that the mother-child dyad's ability to establish and maintain a joint attentional episode was indeed related to infant's subsequent language development. In this study, joint attentional episodes were defined as periods in which both individuals were focused on the mutual object at the same time and the infant acknowledge that sharing is ongoing between them with behaviors such as looking at the mother's face. The amount of time that the mother-infant dyad spent in the joint attentional episodes was positively related to the infant's vocabulary size. Moreover, when mothers were not available to spend as much time with infants in joint attentional episodes such as in the case of twins, they showed a delay in language acquisition than those who spent more time in joint attentional episodes

with their caregiver (Tomasello, Mannle, & Barton, 1989).

In addition, when the mother-infant dyad spent more time in the joint attentional episode, the dyad communicated more and their conversation length became longer (Tomasello & Farrar, 1986). Moreover, when the mother made a reference to the object that the infant was already paying attention to and thus followed into the infant's attention, the infant's vocabulary size increased (Tomasello & Farrar, 1986). In this situation, the infant does not have to make an effort to shift his or her attention to focus what the caregiver is referring to. However, when the mother made an object reference by directing the child's attention to an object outside of his or her attention, the infant's vocabulary size rather decreased (Tomasello & Farrar, 1986). Thus, object references occurring outside of joint attentional episodes do not affect but actually hinders language acquisition, while object references occurring inside joint attentional episodes facilitate infant's language acquisition. Therefore, joint attentional episodes scaffold early language acquisition.

Furthermore, Carpenter and his colleagues (1998) examined joint attention in a similar manner with the previous studies. Joint attentional episodes were examined by observing interaction between the mother and the infant playing with toys in a natural environment. Results indicated that the capacity to engage in joint attentional episodes was related to subsequent language

vocabulary acquisition. More specifically, joint engagement in 11 to 13 months was related to vocabulary comprehension between 11 and 15 months, and joint engagement at 14 months was correlated with vocabulary production at 18 and 24 months.

As can be seen, the capacity to engage in joint attentional episodes with a social partner regarding an object or event of mutual interest is significantly related to subsequent language acquisition. However, as mentioned earlier, while joint attentional engagement state reflects the infant's ability to establish and maintain such engagement state, infant's joint attention capacity may also be evaluated by considering their RJA and IJA behaviors.

As regards to the measurement of the RJA and IJA behaviors, studies widely use the Early Social Communication Scales (ESCS; Mundy et al., 2003; Seibert et al., 1982) instead of the free-play interaction between the mother-infant dyad. This is because while the free-play interaction emphasizes the interactive episodes where both the caregiver and the infant are focused on the same object or event, this paradigm has difficulty discriminating the contribution of infants and that of the caregivers in the joint attentional episodes. In contrast, the ESCS is consisted of a set of structured tasks administered in the laboratory by testers to assess the infant's join attentional behaviors of RJA and IJA. By minimizing their movement, verbal behavior, and affect, the testers are able to

yield a clearer picture of the differences in the infant's behavior to spontaneously initiate joint attention bids and responds to the social bids of the tester (Mundy & Sigman, 2006).

While RJA and IJA are viewed as the behaviors under the larger topic of joint attention, the cognitive skills required to perform these behaviors may be different (Landry, Garner, Pirie, & Swank, 1994). That is, responding to joint attentional bid is a relatively easier behavior since the social partner has already constructed a frame of how one will act in the social interacting context. Thus, the infant's part in the interaction is to simply respond to the social partner's joint attentional bid. On the other hand, initiating joint attentional bid to a partner requires the infant to form a social goal and realize that expressing one's interest without the social partner's instruction is important (Landry, Smith, & Swank, 1997). Therefore, it could be seen that the execution of IJA behavior is relatively difficult and demands more cognitive abilities than that of RJA behavior.

Studies that investigated joint attentional behaviors of RJA and IJA and their relationship with language have found significant associations. Infant's RJA skills, the ability to follow the direction of other's gaze, head turn, and pointing, were investigated the most with subsequent language development. The earliest time point at which the infant's gaze following was investigated was at 6 months, and it showed significant association with vocabulary comprehension at 12

months and vocabulary production at 18, 21, and 24 months (Morales, Mundy, & Rojas, 1998). Another study that investigated RJA at 9 months found significant association with 24 months vocabulary comprehension (Vaughan Van Hecke et al., 2007) and production (Mundy et al., 2007), and 12 month RJA with language production at 18, 21, and 24 months (Markus et al., 2000). Another study that examined RJA at a longer period found that RJA at 6, 8, 10, and 18 months were significantly related to language outcome at 30 months, whereas RJA at 12 months was significantly related to language outcome at 24 months (Morales et al., 2000). Infant's comprehension of pointing behavior and RJA skills measured from the period of 14 to 17 months were significantly associated with vocabulary acquisition in the second year (Mundy, Kasari, Sigman, & Ruskin, 1995; Desrochers et al., 1995). While such studies have found significant relationships between the RJA and the overall language ability, findings are inconsistent when examining the association with RJA and language comprehension and production. However, RJA do seem to show more significant association with subsequent vocabulary comprehension (Mundy & Gomes, 1998). For example, the study that examined the behavior of gaze following at 10 and 11 months found association with only vocabulary comprehension at 14 and 18 months, but not with vocabulary production (Brooks & Meltzoff, 2005).

As with IJA skills, IJA at 12 months was significantly correlated with 24

months vocabulary production (Van Hecke et al., 2007). Mundy et al. (2007) also reported similar results with 18 months significantly positively correlated with 24 months vocabulary production. While numerous studies have investigated the relations between joint engagement episodes and RJA and language acquisition (Bak, 2014; Brooks & Meltzoff, 2005; Brooks & Meltzoff, 2008; Kim & Kwak, 2010; Morales et al., 2000; Mundy et al., 2007; Tomasello & Farrar, 1986; Tomasello & Todd, 1983), the association between IJA skill and language development has been relatively neglected or unreported. Therefore, this study also aims to investigate the relationship between IJA and language development.

As could be seen, past studies have extensively examined the relationship between joint attention and language ability and have concluded that joint attention predicts subsequent language development. However, while past studies have claimed the need to investigate joint attention in multiple approaches (Mundy & Gomes, 1998; Mundy et al., 2007), only single methodological approach was used in assessing joint attention. As mentioned earlier, RJA and IJA behaviors differ in the cognitive demands required to perform such behaviors. Furthermore, joint attentional episodes are states of engagement that focus on the interaction between the mother-infant dyad rather than discrete behaviors like RJA and IJA (Whalen & Schreibamn, 2003). Therefore, different aspects of joint attention capacities may reflect different

abilities of language development. Therefore, apart from past studies that have investigated joint attentional episodes and joint attentional behaviors (RJA and IJA) separately, the current study examines infant's capacity to maintain coordinated joint attentional episode as well as RJA and IJA behaviors.

Furthermore, multiple methodological approaches to measure joint attention may lead to an evaluation of a more representative picture of joint attention capacity. The free-play interaction which measures joint attentional episodes between the mother-infant dyad may provide data on the optimal capacity of the infant to participant in joint attentional episodes because of the familiarity of the interactive partner (Mundy & Sigman, 2006). The interactive partner who is the caregiver may be more successful in capturing the infant's joint attention capacities due to their everyday social interactions (Mateus, Martins, Osorio, Martins, & Soares, 2013). In addition, the caregiver may be more capable of providing optimal stimulation and arousal regulation by reading the infant's signals and personal preference. Moreover, since the observation is taking place in a naturalistic context, it is high in ecological validity (Muscara & Crowe, 2012). But as mentioned before, measurements from the free-play interaction assessment have difficulty in distinguishing the contribution of the infants and that of the caregivers in the joint attentional engagement episodes (Mundy & Sigman, 2006). Therefore, administering the assessment of ESCS

provides further measurements of the infant's RJA and IJA behavior capacities. In addition, the lack of familiarity between the infant and the tester and the need for establishing rapport between the child-tester dyad may be complemented by the familiarity of the caregiver aspect in the free-play interaction. Thus, integrating the multiple approaches of free-play interaction and ESCS assessments may complement each other and as a result produce a comprehensive evaluation of the infant's joint attention capacity. Therefore, to evaluate a more representative and holistic picture of the infant's capability in joint attention, the current study investigates joint attention in a multi-method approach.

In addition, while past studies have viewed joint attention in the early infancy period, most of the language measurements were assessed in the toddlerhood after 18 month. While infant's vocabulary acquisition expedites and grows rapidly from around 18 months and onward, critical skills for language comprehension and production are developing throughout the infancy period.

The Current Study

The present study examined the development of joint attention and its relation to language abilities during the period of 12 to 18 months. This age period was selected because it is during this period that joint attention competence consolidates and behaviors are frequently observed (Carpenter et al., 1998; Liszkowski, 2007). Furthermore, the period of 12 to 18 months is immediately before the period of vocabulary explosion (Benedict, 1979; Goldfield & Reznick, 1990; McMurray, 2007).

Despite that previous studies have scarcely assessed joint attention in various approaches, researchers have indeed recommended that multiple measures or combined paradigms be used to assess joint attention domain (Mundy & Gomes, 1998; Mundy et al., 2007). This is because one paradigm may capture only partial aspect of joint attention capacity which may provide different information about psychological processes at various points in early development than another aspect of joint attention capacity measured by a different paradigm (Mundy & Vaughan Van Hecke, 2007). Furthermore, different joint attention variables change as age increases and their stability of joint attention are different as well. Therefore, multiple measure approaches were made to evaluate a representative picture of joint attention capacity during the 12, 15, and 18 months of infancy.

Moreover, many studies have examined the relationship between joint attention capacity measured during infancy and subsequent language development during toddlerhood mostly after 18 months of age. While toddlers show rapid increase in vocabulary from around 18 months and onwards (Bloom, Lifter, & Broughton, 1985), the investigation of language development in relation to joint attention before this period should be made as well, since there are important development of language components ongoing during this period.

The present study attempted to address foregoing issues from past studies by measuring infant's joint attention in multiple approaches. Moreover, this study assessed joint attention of the same infants in both the free-play situation and the administration of Early Social Communication Scales to assess not only coordinated but also the abilities of responding to and initiating joint attention. Thus, a more representative and holistic picture of the infant's capability in joint attention may be evaluated.

The following research questions were the focus of this study:

1. A comprehensive picture of joint attention capacity in infancy:

1) What is the developmental pattern of coordinated joint attention, responding to joint attention, and initiating joint attention?
2) Are there significant relationships among the joint attention variables?

2. A representative picture of language abilities in infancy:
   1) What is the developmental pattern of comprehension and production skills?
   2) Is there a significant relationship between comprehension and production skills?

3. The relationship between joint attention and language abilities:
   1) Of the joint attention variables, which factors are significantly related with comprehension and production skill?
   2) Furthermore, of the related joint attention variables, which factors best predict comprehension and production skill?

Method

1. Participants

Fifty-nine mother-infant dyads participated in the current study. Of these, 27 (45.8%) were boys and 32 (54.2%) were girls. Participants were recruited from the Seoul and Gyeonggi province of the Republic of Korea via websites and distribution of flyers to licensed kindergartens. Infants' joint attention development and language development data were collected longitudinally at 12, 15, and 18 months of age. The mean chronological ages were 12.56 months (range: 12.04 months ~ 13.15 months), 15.71 months (15.06 months ~ 15.95 months), and 18.53 months (16.97 months ~ 19.03 months), respectively.

2. Procedures and Measures

Mothers who contacted the laboratory were briefly informed of the infant's involvement in the study. After receiving the brief explanations, mothers who were interested in the participation of the study were scheduled for an appointment to visit the laboratory.

The mother-infant dyad came into the laboratory and participated in the experiment which lasted approximately sixty minutes per session. The mothers

and infant were given explanations about their tasks by experimenters. Before beginning the experiment activities, the mothers were informed that their participation would be video-recorded and they were asked to read and sign a consent form.

The infants first participated in the free-play task with their mothers for assessment of the infant's joint attention skill. After the free-play period, the infants then participated in various tasks of the Early Social Communication Scales with an experimenter to assess their responding to joint attention (RJA) and initiating joint attention (IJA) skill. While the infant interacted with the experimenter in various tasks, mothers completed the MacArthur-Bates Communicative Development Inventories-Korean version questionnaire that assessed infant's language skills. After all assessments were completed, the session ended with the scheduling of the next visit. All assessments were conducted at all three time points: 12, 15, and 18 months.

2.1 Free-Play

The free-play task used in the current study followed the procedures of Bakeman and Adamson's (1984) free-play task. The infant and mother were observed while they played on the floor with a set of toys provided by the experimenter. The toys provided in the mother-infant dyad free-play interactions

consisted of a ball, a picture book, two toy telephones, a doll, and a playing house set; these were provided to instigate social interactions between the infant and the mother. Mothers were asked to play with their infants as they would as if they had few minutes to devote to a spontaneous play period.

The interaction between the mother and infant lasted for ten minutes and all play interactions were video-recorded. In order to minimize the effect on the natural interaction between the mother and infant, the video camera was set up outside the room where the interaction was taken place.

2.2 Early Social Communication Scales

After the free-play period, the infant participated in a series of social-cognitive tasks with the experimenter. The Early Social Communication Scales (ESCS; Mundy et al., 2003) is a 20-minute structured assessment that has been designed to measure development of nonverbal communication skills in children between 8 and 30 months of age. Assessments were conducted in a room where the experimenter and the infant sat face to face across each other with a small table in between. The infant sat in the mother's lap if it was necessary. Toys necessary for the assessment were placed on a small table to the right of the experimenter where it was visible but out of reach of the infant's arm. Four posters were hung on the walls. Two posters were placed 90 degrees to the

infant's right or left, and two were placed about 150 degrees behind the infant's right and left. A video-camera was placed outside of the room and recorded the interaction through a one-way mirror. It was placed so that 3/4 full-face view of the infant and 1/4 profile view of the experimenter was captured.

The experimenter presented the infant with a series of wind-up mechanical toys (3 trials), hand-held mechanical toys (3 trials), chances to play a tickle turn-taking game (2 trials), chances to play an object turn-taking game (2 trials), chances to take turns wearing a hat, comb, and glasses (3 trials), and a chance to look at a book with the experimenter (1 trial). The experimenter also presented the infant with gestural and verbal requests to give toys to the experimenter. Also, the experimenter presented the infant with two sets of three trials in which the experimenter attracted the infant's attention, and then turned to visually fixate a wall poster, while pointing at the poster and saying the infant's name three times. Trials to the left, right, and behind the infant were conducted in each set.

While the ESCS assessment measured Initiating Joint Attention (IJA), Responding to Joint Attention (RJA), Initiating Behavioral Requests (IBR), and Responding to Behavioral Requests (RBR) behaviors, only IJA and RJA data were examined in this study. This is because while RJA and IJA behaviors involve the coordination of attention to objects and events, IBR and RBR assess

turn-taking and interaction maintenance, but not coordination of attention to objects and events (Mundy & Gomes, 1998). The operationalized definition of IJA and RJA are as follow (see Table 1): IJA refers to the frequency with which the infant uses eye contact, pointing and showing to share the experience of an active mechanical toy with the experimenter; RJA refers to the percentage of six trails on which the infant correctly turns his or her visual regard in the direction of the experimenter's visual regard and pointing gesture.

Table 1. *Descriptions of the RJA and IJA Variables (Mundy & Gomes, 1998)*

Behavior	Description
Initiates Joint Attention (IJA)	LOW: 1) Makes eye contact while playing with toy 2) Alternates eye contact between the toy and tester HIGH: 1) Points to toy or close objects in testing room 2) Shows objects to the tester.
Responds to Joint Attention (RJA)	The percentage of trials the infant correctly makes head and eyes in direction of tester's point.

2.3 MacArthur-Bates Communicative Development Inventory-Korean

The MacArthur-Bates Communicative Development Inventory-Korean (MCDI-K; Bae & Kwak, 2011) is the Korean version of the MacArthur-Bates Communicative Development Inventory (Fenson et al., 1993). The MCDI-K evaluates language comprehension and production skills of infants age 8 to 36 months. While the infant participated in the ESCS assessment with the experimenter, mothers completed the MCDI-K. The MCDI-K has two forms: the Infant Form for infants age 8 to 17 months, and the Toddler Form for those age 18 to 36 months.

The MCDI-K Infant Form consists of two parts: (1) Vocabulary and (2) Actions and Gestures. The Vocabulary part lists 284 words that are separated into 19 semantic categories: sound effects and animal sounds (14), vehicles (7), animal names (21), body parts (20), clothing (10), toys (10), food and drink (35), small household items (16), furniture and rooms (9), places to go (6), outside things (12), people (17), games and routines (19), pronouns and question words (7), quantifiers (6), verbs (43), adjectives (20), and function words (12). Parents can mark each word as “understands” for comprehension or “understands and says” for production or can be left blank. For comprehension of language, mothers were instructed to include words that they felt their infant would

understand but does not say the word yet. Words that the infants understand may be cases when the infant points to or brings the pertinent object to a person. For example, the infant is incapable of producing the word 'car,' but is able to give a car toy when a person asks for it is evidence that demonstrates that the infant understands the word 'car.' However, just because the mother produced the word often to the infant or the relevant object is near the child is not considered as the infant understanding the word. For production of language, mothers were instructed to include only words that were used consistently by the infant. For example, if an infant says the word "eat" in an eating context consistently, then it can be inferred that the infant truly understands and produces the word "eat." Even if the infant's pronunciation of the word may be inaccurate, the word may be marked as "understands and says" as long as the mother perceives the word. However, cases when the infant doesn't understand the word but just imitates what the mother says are not considered as a true production of the word and thus "understand and say."

The Actions and Gestures part is consisted of 5 sections: first communicative gestures (12), games and routines (6), actions with objects (17), pretending to be a parent (12), and doll play (13). Sample items included in the 'first communicative gestures' section are such as "extends arm to show you something he/she is holding," "reaches out and gives you a toy or some object

that he/she is holding," etc. The items were rated according to a 3-point scale (i.e., *Not Yet*, *Sometimes*, and *Often*). Items of the other four sections were rated on a 2-point scale (i.e., *No*, *Yes*).

In addition, the Toddler Form of the MCDI assessed vocabulary and grammatical skills of children ages 18 months to 36 months. The Toddler Form measured vocabulary production only and not vocabulary comprehension. The Toddler Form is consisted of two parts: (1) Vocabulary and (2) Grammatical. The vocabulary section is consisted of 641 words that are separated into 24 semantic categories: sound effects and animal sounds (11), vehicles (13), toys and stationary (14), animal names (41), clothing (20), furniture and rooms (21), food and drink (58), body parts (31), small household items (36), outside things (26), games and routines (14), places to go (25), quantifiers (14), people (33), question words (11), verbs (150), adjectives (52), ending words (15), postpositional words (12), connecting words (6), location (8), words about time (17), pronouns (7), and helping words (6).

The Grammatical part is consisted of 4 parts to measure the child's grammatical skills. The Actions and Gestures part of the Toddler form and the Grammatical part of the Infant form were irrelevant to this study and therefore were not analyzed.

3. Coding and Analysis

3.1 Free-Play

Two trained researchers observed and coded the infant's engagement state that appeared in the mother-infant free-play interaction using Bakeman and Adamson's (1984) coding scheme.

Of the video-recorded ten-minute interaction, the first two and last three minutes of the interaction were excluded and only the mid five minutes were used to analyze the infant's engagement state. The reason that the first few minutes were excluded from the analysis was because the infants did not play in the usual manner due to the strange situation of the laboratory and the need to get familiarized to the setting. In addition, the purpose that the last few minutes were excluded was because the infants moved out of the camera frame more often due to their attention dispersing at the end of the interaction period.

The coders segmented the recording of the five-minute interaction every five seconds and considered the infant's attention as engagement state when it lasted at least three seconds. The infant's engagement state was defined in terms of objects and people and was divided into six different categories. The categories are as follows: *unengaged*, *onlooking*, *persons*, *objects*, *passive joint*,

and *coordinated joint*. The *unengaged* engagement state is when the infant is uninvolved with any person, object, or event while he or she may be looking around the environment; *onlooking* engagement state is when the infant is observing the other person's activity but is not actually involved in that activity; *persons* engagement state is when the infant is engaged with just the other person and not with an object or event; *objects* engagement state is when the infant is involved with the object alone and not attending to the person; *passive joint* engagement state is when the infant and the other person are actively involved in the same object or event, but the infant acknowledges little awareness of the other person's involvement or presence; *coordinated joint* engagement state is when the infant is actively involved with and coordinates his or her attention to both the person and the object that person is involved with. Of the various engagements states, the current study regarded the coordinated joint attention as the true joint attention. In addition, this study counted the frequency of coordinated joint engagement states that the infant showed in the free-play interaction as the infant's joint attention skill.

To check for inter-rater reliability, the second coder coded the data of ten infants that the first coder coded.

Table 2. *Categories of Engagement States in Free-Play Interaction (Bakeman & Adamson, 1984)*

Category	Definition
Unengaged	The infant is uninvolved with any person, object, or activity.
Onlooking	The infant observes the social partner's activity, but is not engaged in the activity.
Persons	The infant engages only with the social partner and not with an object or event.
Objects	The infant is only involved with objects, and not with the social partner.
Passive Joint	The infant and the social partner are actively engaged in the mutual object, but the infant does not seem to acknowledge the partner's presence.
Coordinated Joint	The infant is actively engaged with and coordinates his or her attention to both the social partner and the object of mutual interest.

3.2 Early Social Communication Scales

IJA and RJA were coded based on the coding scheme of Fenson et al. (1993). IJA is consisted of the infant's eye contact, alternate, point, point and eye contact, and showing behaviors. On each trial, if the infant showed any of the above behaviors, it was tallied on the coding sheet and the total frequency of IJA behavior score was computed for each infant. For RJA, the infant's following

point and line of regard behaviors was tallied if the infant showed such behaviors. The percentage of infant's correct response was computed for the RJA score.

3.3 MacArthur-Bates Communicative Development Inventory-Korean

The coding and analysis of the MacArthur-Bates Communicative Development Inventories-Korean was based on the Korean coding system by Bae & Kwak (2011). Mothers used the same CDI booklet when they visited the laboratory, and indicated new gestures and words that the infant acquired. After each session, the vocabularies indicated on the booklet were tallied. For both production and comprehension of the word, it was coded as '1' if the child produced (comprehended) the word, and '0' if the child did not produce (comprehended) the word. A total score for each production and comprehension of the word list was computed for each infant. In the Infant Form, the range score for production was from 0 to 279 and from 0 to 284 for comprehension, while in the Toddler Form, the range score for production was from 0 to 641. Production and comprehension scores were computed for all 12, 15, and 18 months.

Results

In the present study, infant's joint attention capacity was explored in relation to language development skills over the periods of 12 to 18 months of age. Correlation analyses were conducted to examine the relationship among coordinated joint attention, initiating joint attention, and responding to joint attention. Then correlation analyses between language production and language comprehension skills were conducted. Afterwards, correlation analyses between joint attention capacity and language skills were examined. Lastly, hierarchical multiple regression analyses were conducted to assess the unique relations and predictability of joint attention towards later language development skills.

1. Joint Attention

1.1 CJA

Growth of CJA. A repeated measures ANOVA was conducted to examine the effect of age on coordinated joint attention skills in infants. Result determined that the mean coordinated joint attention skills differed statistically significantly between time points, $F(1.54, 87.52) = 16.08$, $p < .01$. The results

show that the average coordinated joint attention demonstrated by infants as reported by the mothers increased with age, and this increase was significant, $F(1.54, 87.52) = 16.08$, $p < .01$ and had significant linear, $F(1, 57) = 20.34$, $p < .01$ and quadratic, $F(1, 57) = 7.97$, $p < .01$ trends.

Post hoc tests using the Bonferroni correction revealed that the increase in coordinated joint attention from 12 months ($M = 4.89$, $SD = 5.56$) to 15 months ($M = 5.60$, $SD = 5.98$) to 18 months ($M = 11.52$, $SD = 11.09$) was statistically significant ($p < .01$). Increase in coordinated joint attention from 12 months ($M = 4.89$, $SD = 5.56$) to 18 months ($M = 11.52$, $SD = 11.09$) was statistically significant ($p < .01$) as well. Therefore, we can conclude that infants are able to produce more words over the period of 12 to 18 months of age.

Table 3. *Descriptive Statistics for Coordinated Joint Attention Variables*

Variable	Age	N	Mean	SD	Minimum	Maximum
CJA	12m	58	4.89	5.56	0.00	24.00
CJA	15m	58	5.60	5.98	0.00	24.00
CJA	18m	58	11.52	11.09	0.00	42.00

Note:
CJA = coordinated joint attention.

Stability of CJA. To examine the stability of individual differences in CJA across the 12- to 18-month age period, Pearson's correlational analyzes

were conducted. Analyses indicated that CJA at 12 months was positively related to CJA at 15 months ($r(56) = .39$, $p < .01$; see Table 6), but not with CJA at 18 months. Findings also indicated that CJA at 15 months was positively related to CJA at 18 months ($r(56) = .29$, $p < .05$). Thus, evidence was found for stability in CJA skills across the 12- to 18-month age period.

1.2 IJA

Growth of IJA. A repeated measures ANOVA was conducted to examine the effect of age on initiating joint attention skills in infants. Result determined that the mean initiating joint attention skills did not differed statistically significantly between time points, $F(1.67, 92.05) = 2.89$, $p = .07$, and thus no significant growth was evident in the IJA skills during the period of 12 to 18 months of age.

Table 4. *Descriptive Statistics for Initiating Joint Attention Variables*

Variable	Age	N	Mean	SD	Minimum	Maximum
IJA	12m	56	7.66	3.10	4.00	19.00
IJA	15m	56	6.51	2.57	3.00	15.00
IJA	18m	56	6.73	3.21	3.00	17.00

Note:
IJA = initiating joint attention.

Stability of IJA. To examine the stability of individual differences in IJA across the 12- to 18-month age period, Pearson's correlational analyses were conducted. Analyses indicated that only IJA at 15 months and IJA at 18 months were positively related ($r(57) = .48$, $p < .01$; see Table 6). There being no association between 12 and 15 month IJA, we can conclude that the development of IJA skill is not stable at this age period. However, from 15 months and on the development of IJA seems to be stabilized and shows association with IJA at 18 months.

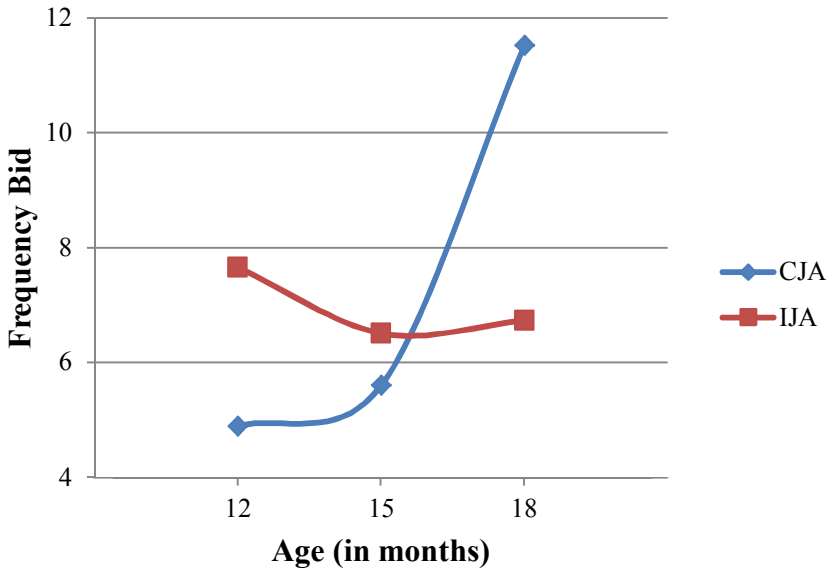

Figure 1. *Developmental Patterns for the Frequency of Coordinated Joint Attention (CJA) and Initiating Joint Attention (IJA)*

1.3 RJA

Growth of RJA. A repeated measures ANOVA was conducted to examine the effect of age on responding to joint attention skills in infants. Result determined that the mean responding to joint attention skills differed statistically significantly between time points, $F(1.64, 90.15) = 213.22$, $p < .01$. The results show that the average responding to joint attention demonstrated by infants as reported by the mothers increased with age, and this increase was significant, $F(1.64, 90.15) = 213.22$, $p < .01$ and had significant linear, $F(1, 55) = 306.99$, $p < .01$ and quadratic, $F(1, 55) = 20.40$, $p < .01$ trends.

Post hoc tests using the Bonferroni correction revealed that the increase in responding to joint attention from 12 months ($M = 0.23$, $SD = 0.10$) to 15 months ($M = 0.36$, $SD = 0.05$) to 18 months ($M = 0.59$, $SD = 0.16$) was statistically significant ($p < 0.05$). In addition, the increase in responding to joint attention from 12 months ($M = 0.23$, $SD = 0.10$) to 18 months ($M = 0.59$, $SD = 0.16$) was statistically significant as well. Therefore, we can conclude that infants' responding to joint attention skills increase significantly during the periods of 12 to 18 months.

Table 5. *Descriptive Statistics for Responding to Joint Attention Variables*

Variable	Age	N	Mean	SD	Minimum	Maximum
RJA	12m	56	0.23	0.10	0.00	12.00
RJA	15m	56	0.36	0.05	6.00	12.00
RJA	18m	56	0.59	0.16	8.00	25.00

Note:
RJA = responding to joint attention.

Stability of RJA. To examine the stability of individual differences in RJA across the 12- to 18-month age period, Pearson's correlational analyses were conducted. Analyses indicated that RJA at 12 months was positively related to RJA at 15 and 18 months ($r(54) = .41$, $p < .01$ and $r(54) = .39$, $p < .01$, respectively; see Table 6). Findings also indicated that RJA at 15 months and 18 months were also positively related ($r(54) = .50$, $p < .01$). Contrast to the instability of the development of IJA across the period of 12- to 18-month age period, the development of RJA shows early stability in this age period.

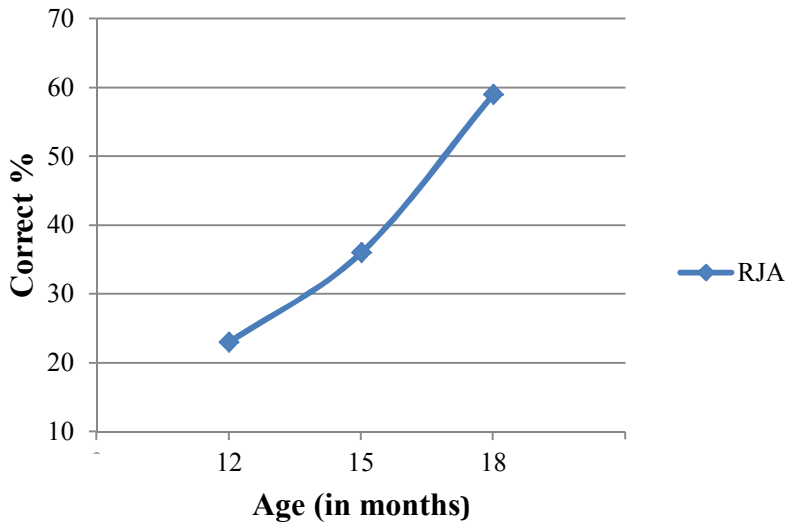

Figure 2. *Developmental Patterns for the Correct % of Responding to Joint Attention (RJA)*

1.4 Relations Among Joint Attention Measures

RJA did not show any association with either the CJA or the IJA variables. Only association that was evident was between IJA at 15 months and CJA at 18 months ($r(57) = .36$, $p < .01$; see Table 6).

Table 6. *Correlations between Joint Attention Measures*

	CJA12	IJA12	RJA12	CJA15	IJA15	RJA15	CJA18	IJA18	RJA18
CJA12	1								
IJA12	.04	1							
RJA12	.16	.23	1						
CJA15	**.39****	.03	.22	1					
IJA15	.21	.22	.06	.13	1				
RJA15	.06	.04	**.41****	.04	.03	1			
CJA18	.24	.17	.08	**.29***	**.36****	.02	1		
IJA18	.08	-.05	.09	.14	**.48****	.11	.09	1	
RJA18	-.24	.01	**.39****	-.01	.17	**.50****	.04	.10	1

* $p < .05$, two-tailed, **$p < .01$, two-tailed.

2. Language

2.1 Comprehension

Growth of Language Comprehension Skill. A paired-samples t-test was conducted to examine the effect of age on word comprehension skills in infants. Results indicated that word comprehension at 15 months (M = 121.28, SD = 55.64) was significantly higher than word comprehension at 12 months (M = 54.33, SD = 37.05), $t(45) = 8.21$, $p < .01$. Therefore, we can conclude that infants comprehend more words as age increase over the periods of 12 to 15 months of age.

Table 7. *Descriptive Statistics for Language Comprehension Variables*

Variable	Age	N	Mean	SD	Minimum	Maximum
Comprehension	12[a]	52	54.33	37.05	8.00	170.00
	15[a]	51	121.28	55.64	13.00	215.00

Note:
[a] Maximum score for the MCDI-K Infant form Comprehension is 284 words.

Stability of Language Comprehension Skill. To examine the stability of individual differences in language comprehension skill across the 12- to 15-month age period, Pearson's correlational analyses were conducted. Analyses indicated that language comprehension at 12 months was positively correlated with language comprehension at 15 months ($r(44) = .34$, $p < .05$; see Table 7). Language comprehension shows stability across the same age period.

2.2 Production

Growth of Language Production Skill. A repeated measures ANOVA was conducted to examine the effect of age on word production skills in infants. Result determined that the mean production of words differed statistically significantly between time points, $F(1.09, 44.64) = 31.13$, $p < .01$. The results show that the average number of words produced by infants as reported by the mothers increased with age, and this increase was significant, $F(1.09, 44.64) = 31.13$, $p < 0.05$ and had significant linear, $F(1, 41) = 33.33$, $p < .01$ and quadratic, $F(1, 41) = 20.56$, $p < .01$ trends.

Post hoc tests using the Bonferroni correction revealed that the increase in production of words from 12 months ($M = 9.24$, $SD = 6.46$) to 15 months ($M = 17.31$, $SD = 16.81$) was statistically significant ($p < .01$) as well as the increase from 15 months ($M = 17.31$, $SD = 16.81$) to 18 months ($M = 51.88$, $SD = 51.60$) was statistically significant ($p < .01$). In addition, the increase in production word from 12 months to 18 months was statistically significant ($p < .01$). Therefore, we can conclude that infants are able to produce more words over the period of 12 to 18 months of age.

Table 8. *Descriptive Statistics for Language Production Variables*

Variable	Age	N	Mean	SD	Minimum	Maximum
Production	12[a]	42	9.24	6.46	2.00	32.00
	15[a]	42	17.31	16.81	0.00	106.00
	18[b]	42	51.88	51.60	0.00	250.00

Note:
[a] Maximum score for the MCDI-K Infant form Production is 279 words.
[b] Maximum score for the MCDI-K Toddler form Production is 641 words.

Stability of Language Production Skill. To examine the stability of individual differences in language production skill across the 12- to 18-month age period, Pearson's correlational analyses were conducted. Analyses indicated that language production at 12 months was positively correlated with language production at 15 and 18 months ($r(41) = .74$, $p < .01$ and $r(44) = .62$, $p < .01$, respectively; see Table 7). Findings also indicated that language production at 15 months was positively related to language production at 18 months ($r(45) = .63$, $p < .01$). Thus, the development of language production skill shows stability across the age period of 12 to 18 months.

2.3 Relations Among Language Measures

Of the three age periods, significant association between measures of language comprehension skill and production skill was evident only at 12 months ($r(50) = .47$, $p < .01$; see Table 7).

Table 9. *Correlations between Language Measures*

	COM_12	PRO_12	COM_15	PRO_15	PRO_18
COM_12	1				
PRO_12	**.47****	1			
COM_15	**.34***	.05	1		
PRO_15	.14	**.74****	.21	1	
PRO_18	.24	**.62****	-.01	**.63****	1

Note:
COM_12 = Comprehension at 12 months, PRO_12 = Production at 12 months, COM_15 = Comprehension at 15 months, PRO_15 = Production at 15 months, PRO_18 = Production at 18 months.
* $p < .05$, two-tailed, **$p < .01$, two-tailed.

3. Joint Attention and Language

3.1 Relations Between Individual Differences in the Capacity of Joint Attention and Language Development

Pearson's correlational analyses were also conducted to examine the associations between individual differences in the capacity of joint attention and language development. Comprehension at 12 months was positively correlated with CJA at 12 months, RJA at 12 months, and RJA at 15 months ($r(50) = .65$, $p < .01$; $r(50) = .49$, $p < .01$; and $r(50) = .35$, $p < .05$, respectively; see Table 8). Comprehension at 15 months was positively correlated with RJA at 12 months, CJA at 15 months, IJA at 15 months, and IJA at 18 months ($r(48) = .31$, $p < .05$; $r(48) = .37$, $p < .01$; $r(49) = .50$, $p < .01$; and $r(49) = .41$, $p < .01$, respectively).

Production at 12 months was positively correlated with IJA at 12 months, RJA at 12 months, IJA at 15 months, RJA at 15 months, and RJA at 18 months ($r(50) = .30$, $p < .05$; $r(50) = .61$, $p < .01$; $r(50) = .31$, $p < .05$; $r(50) = .36$, $p < .01$; and $r(50) = .37$, $p < .01$, respectively). Production at 15 months was positively correlated with IJA at 15 months, CJA at 18 months, and RJA at 18 months ($r(46) = .34$, $p < .05$; $r(46) = .29$, $p < .05$; and $r(45) = .41$, $p < .01$, respectively). Production at 18 months was positively correlated with IJA at 12 months, CJA at 18 months, and RJA at 18 months ($r(48) = .39$, $p < .01$; $r(50) = .41$, $p < .01$; $r(48) = .39$, $p < .01$, respectively).

Table 10. *Correlations between Joint Attention and Language Measures*

	COM_12M	PRO_12M	COM_15M	PRO_15M	PRO_18M
CJA12	**.65****	.13	.26	-.18	.04
IJA12	.11	**.30***	.00	.28	**.39****
RJA12	**.49****	**.61****	**.31***	.09	.24
CJA15	.26	.04	**.37****	.01	.05
IJA15	.21	**.31***	**.50****	**.34***	.25
RJA15	**.35***	**.36****	.26	.19	.11
CJA18	.23	.05	.27	**.29***	**.41****
IJA18	.12	.24	**.41****	.15	.22
RJA18	.09	**.37****	.20	**.41***	**.39****

* $p < .05$, two-tailed, **$p < .01$, two-tailed.

3.2 Predictors of Language Comprehension Skill

Hierarchical multiple regression analyses were conducted to examine whether different types of joint attention variables displayed unique paths of association with language outcomes. The dependent measure in the first analysis was language comprehension at 12 months. In the first step of the equation, Production at 12 months was entered. In step 2, CJA at 12 months was entered. In step 3, RJA at 12 months was entered. Thus, this analysis was designed to test whether RJA shared a unique association with language comprehension apart from: a) variance associated with language skills in the same or previous month, and b) variance associated with CJA skill. Regression analyses for Comprehension at 12 months indicated that in Step 1, Production at 12 months accounted for 22% of the variance in Comprehension at 12 months, $R^2 = .22$, $F(1, 50) = 14.43$, $p < .01$ (see Table 9). Production at 12 months was a significant predictor of Comprehension at 12 months. In Step 2, CJA at 12 months was entered and results indicated that CJA at 12 months was a significant predictor of Comprehension at 12 months after controlling for Production at 12 months, $R^2 = .57$, $F(2, 49) = 32.40$, $p < .01$. Lastly, when RJA at 12 months was entered in Step 3, results indicated that RJA at 12 months was a significant predictor of Comprehension at 12 months. RJA at 12 months contributed to the prediction of Comprehension at 12 months above and beyond variance associated with

Production at 12 months and CJA at 12 months. Based on the ΔR^2, the RJA variable at 12 months accounted for 6.3% of the variance in Comprehension at 12 months. In addition, when RJA at 12 months was entered, only CJA at 12 months and RJA at 12 months remained as significant and unique predictors of Comprehension skill at 12 months. Production at 12 months was no longer a significant and unique contribution to this equation, $\beta = .20$, $p > .05$.

Table 11. *Hierarchical Multiple Regression for RJA 12 Predicting Comprehension at 12 Months*

Variable	B	SE	β	F	R^2	ΔR^2
Step 1				14.43	**.22****	
Pro_12	2.63	.69	**.47****			
Step 2				32.40	**.57****	**.35****
Pro_12	2.20	.53	.40			
CJA_12	3.83	.61	**.59****			
Step 3				27.41	**.63****	**.06****
Pro_12	1.13	.62	.20			
CJA_12	3.82	.57	**.59****			
RJA_12	5.01	1.76	**.32***			

* $p < .05$, two-tailed, ** $p < .01$, two-tailed.

RJA at 12 months, IJA at 15 months, and CJA at 15 months displayed significant associations with Comprehension at 15 months. Therefore, hierarchical multiple regression was conducted to examine the unique relations between joint attention and infant's Comprehension skills at 15 months. In Step 1, Comprehension at 12 months was entered to examine whether comprehension skills in the previous month displayed unique paths of association with later language outcomes. In step 1, Comprehension at 12 months was entered; in step 2, RJA at 12 months; in step 3, IJA at 15 months; and in step 4, CJA at 15 months was entered into the model to examine which joint attention measures showed significant paths of predictive association with 15-month Comprehension. Results indicated that Comprehension at 12 months made a unique and significant contribution to Comprehension at 15 months, $F(1, 43) = 5.29$, $p < .05$, $\beta = .33$ (see Table 10). Comprehension at 12 months accounted for 11% of the variance in Comprehension at 15 months. When RJA at 12 months was entered, both Comprehension at 12 months and RJA at 12 months did not make a unique contribution, $F(2, 42) = 3.42$, $p > .05$, $\beta = .23$ and .20, respectively. In Step 3, IJA at 15 months contributed to the prediction of Comprehension at 15 months measure above and beyond variance associated with Comprehension at 12 months and RJA at 12 months, $F(3, 41) = 6.47$, $p < .01$, $\beta = .44$. IJA at 15 months accounted for 18% of the variance in

Comprehension at 15 months. However, when CJA at 15 months was entered in Step 4, only IJA at 15 months and CJA at 15 months were significant and unique predictors of Comprehension at 15 months, β = .46, $p < .01$, β = .32, $p < .05$, respectively.

Table 12. *Hierarchical Multiple Regression for CJA 15 Predicting Comprehension at 15 months*

Variable	B	SE	β	F	R^2	ΔR^2
Step 1				5.29	**.11***	
Com_12	.49	.22	**.33***			
Step 2				3.42	.14	.03
Com_12	.34	.25	.23			
RJA_12	4.79	3.91	.20			
Step 3				6.47	**.32****	**.18****
Com_12	.16	.23	.11			
RJA_12	6.10	3.54	.26			
IJA_15	9.52	2.88	**.44****			
Step 4				7.02	**.41***	**.09***
Com_12	.05	.22	.04			
RJA_12	5.02	3.36	.21			
IJA_15	9.89	2.71	**.46****			
CJA_15	2.83	1.14	**.32***			

* $p < .05$, two-tailed, **$p < .01$, two-tailed.

3.3 Predictors of Language Production Skill

Hierarchical multiple regression analyses were conducted to examine whether different types of joint attention variables displayed unique paths of association with language production outcomes. The dependent measure in the first analysis was language production at 12 months. In Step 1 of the equation, Comprehension at 12 months was entered. In Step 2, RJA at 12 months was entered, and IJA at 12 months was entered in Step 3. Based on the ΔR^2, Comprehension at 12 months accounted for 22% of variance in Production at 12 months in the first step (see Table 11). However, when RJA at 12 months was entered in the second step, Comprehension at 12 months was no longer a unique and significant predictor of Production at 12 months, $F(1, 50) = 17.26$, $\beta = .23$, $p > .05$. Only RJA at 12 months remained as a unique and significant predictor, $F(1, 50) = 17.26$, $\beta = .50$, $p < .01$. When IJA at 12 months was entered in the last step, only RJA at 12 months and IJA at 12 months remained as a unique and significant predictor of Production at 12 months, $F(3, 48) = 13.47$, $\beta = .48$, $p < .01$, $\beta = .21$, $p < .05$.

Table 13. *Hierarchical Multiple Regression for IJA 12 Predicting Production at 12 Months*

Variable	B	SE	β	F	R^2	ΔR^2
Step 1				14.43	**.22****	
Com_12	.09	.02	**.47****			
Step 2				17.26	**.41****	**.19****
Com_12	.04	.02	.23			
RJA_12	1.43	.36	**.50****			
Step 3				13.47	**.46***	**.04***
Com_12	.04	.02	.22			
RJA_12	1.36	.35	**.48****			
IJA_12	.44	.22	**.21***			

* $p < .05$, two-tailed, ** $p < .01$, two-tailed.

For Production at 15 months, Production at 12 months and IJA at 15 months showed significant association. Therefore, in order to examine whether joint attention variable displayed unique paths of association with Production at 15 months after controlling production skills in the previous month, hierarchical multiple regression was analyzed. In step 1, Production at 12 months was entered. In step 2, IJA at 15 months was entered. Production at 12 months accounted for 54.1% of the variance in Production at 15 months and was the only unique and significant predictor of Production at 15 months, $F(1, 41) = 48.27$, $\beta = .74$, p

< .01, (see Table 12). IJA at 15 months was not a unique and significant predictor of Production at 15 months, $F(2, 40) = 24.95$, $\beta = .13$, $p > .05$.

Table 14. *Hierarchical Multiple Regression for IJA 15 Predicting Production at 15 Months*

Variable	B	SE	β	F	R^2	ΔR^2
Step 1				48.27	**.54****	
Pro_12	1.93	.28	**.74***			
Step 2				24.95	.56	.01
Pro_12	1.82	.29	**.70****			
IJA_15	.83	.73	.13			

* $p < .05$, two-tailed, **$p < .01$, two-tailed.

Production at 12 months, Production at 15 months, IJA at 12 months, RJA at 18 months, and CJA at 18 months all showed significant associations with Production at 18 months. In step 1, Production at 12 months and 15 months were entered. In step 2, IJA at 12 months, RJA at 18 months in step 3, and CJA at 18 months in step 4 was entered into the model. Results indicated that Production at 12 months and 15 months accounted for 54% of the variance in Production at 18 months, $F(2, 39) = 22.50$, $p < .01$ (see Table 13). While Production at 15 months was a significant predictor of Production at 18 months, Production at 12 months was not a significant predictor, $\beta = .20$, $p > .05$, and β

= .57, $p < .01$, respectively. The additions of IJA at 12 months in step 2 and RJA at 18 months in step 3 were not significant, $F(3, 38) = 15.52$, $p > .05$, and $F(4, 37) = 11.48$, $p > .05$, respectively. Only Production at 15 months was a significant predictor of Production at 18 months in both steps 2 and 3, $F(3, 38) = 15.52$, $p < .01$, $\beta = .49$, and $F(4, 37) = 11.48$, $p < .05$, $\beta = .47$, respectively. The analyses of Production at 18 months revealed that both Production at 15 months and CJA at 18 months contributed to the prediction of Production at 18 months above and beyond variance associated with Production at 12 months, Production at 15 months, IJA at 12 months, and RJA at 18 months.

Table 15. *Hierarchical Multiple Regression for CJA 18 Predicting Production at 18 Months*

Variable	B	SE	β	F	R^2	ΔR^2
Step 1				22.50	**.54****	
Pro_12	1.60	1.28	.20			
Pro_15	1.76	.49	**.57****			
Step 2				15.52	.55	.02
Pro_12	1.69	1.28	.21			
Pro_15	1.49	.54	**.49****			
IJA_12	2.36	2.09	.15			
Step 3				11.48	.55	.00
Pro_12	1.55	1.32	.19			
Pro_15	1.44	.56	**.47***			
IJA_12	2.70	2.22	.17			
RJA_18	.88	1.72	.06			
Step 4				13.87	**.66****	**.10****
Pro_12	1.45	1.18	.18			
Pro_15	1.30	.50	**.42***			
IJA_12	2.57	1.97	.16			
RJA_18	1.72	1.54	.12			
CJA_18	1.50	.45	**.33****			

* $p < .05$, two-tailed, **$p < .01$, two-tailed.

Discussion

The primary goals of this study were to examine the developmental pattern of coordinated joint attention (CJA), initiating joint attention (IJA), and responding to joint attention (RJA) in the infancy period of 12, 15, and 18 months. In addition, investigation was made to determine whether these joint attention variables were related to language abilities at all points of development or whether a specific period of development was optimal for the assessment of individual differences in this skill.

The joint attention was measured by using the coordinated joint attention, initiating joint attention, and responding to joint attention as independent variables. The coordinated joint attention was measured by assessing infant's ability to engage in a joint triadic interaction with their mother regarding an object of mutual interest. The more frequent the dyads engaged in a joint attentional engagement episode, the greater the infant's capacity of coordinated joint attention was tallied. While the free-play interaction measured infant's ability to engage in a coordinated joint attention engagement with his or her mother, the Early Social Communication Scales distinguished whether the infant responded to the social partner's bid or whether the infant himself or herself initiated the bid towards the social partner. The infant's vocabulary

production and comprehension skills that were measured by the mother's report were the dependent variables.

The first hypothesis was supported to some degree by the experiment, and it confirmed that some joint attention variables showed stable developmental patterns over the 12 to 18 months period of infancy. The second hypothesis was supported as well and confirmed that an increase in the developmental pattern was evident in both language comprehension and production skills. Lastly, the infant's joint attention capacities showed significant associations with language skills of both comprehension and production. The significant association and prediction of the different aspects of the joint attention variable on language abilities differed based on the time point and the language component it was going to predict.

1. Joint Attention Variables

Based on prior researches, it was expected that joint attention variables would show an increase in the developmental pattern as well as stability as age increased (Bak, 2014; Morales et al., 2000; Mundy et al., 2007; Jeong & Kwak, 2005; Carpenter et al., 1998). As expected, infants displayed systematic age-related changes in the joint attention variables. However, such significant age-related changes were seen in only some types of joint attention

behaviors and not all. With regard to CJA, developmental change increased steadily over the period of 12 to 18 months with significant changes occurring between 12 and 15 months and 15 and 18 months of age. Similar to CJA, RJA also showed steady increase with significant changes between 12 and 15 months, 15 and 18 months, and 12 and 18 months of age. These results were in agreement with findings of previous studies (Carpenter et al., 1998; Jeong & Kwak, 2005; Morales et al., 2000). However, of the joint attention variables, only IJA did not show either steady growth or stability over the same period of 12 to 18 months.

Stability in CJA skills was evidenced by significant correlations between CJA variables taken at different time points. In addition, the stability in RJA skills was evidenced by significant correlations between RJA variables. While RJA and CJA skills showed early stability from the beginning of the infancy period at 12 months and onwards, IJA showed a different developmental pattern. Only IJA skills did not show stability over the 12 to 18 months period. It may indicate that IJA is still in the process of developing and therefore shows instability over this period. Since the emergence of IJA capacity was shown to be later than that of RJA skills (Dunham & Moore, 1995), this may explain the early stability of RJA and CJA development in relation to that of IJA development. Thus, IJA demonstrates a different developmental pattern apart from CJA and RJA. The developmental pattern of the decrease in the frequency

of IJA from 12 to 15 months, and then a slight increase from 15 to 18 months is consistent with previous research findings (Mundy et al., 2007). This may reflect an important phase of consolidation in learning new and relatively complicated behaviors (Rogers, Rakinson, & McClelland, 2004; Touwen, 1998 as cited in Mundy et al., 2007).

There were no significant relationships between RJA and IJA variables among all three time points of 12, 15, and 18 months of age. This finding was similar to that of previous research (Mundy et al., 2007). The absence of significant association between the RJA and IJA variables may be explained by the multiple process model (MPM; Mundy, Card, & Fox, 2000). This model states that social executive processes, which are involved with the acquisition of social sharing capacity and subsequent social-cognitive development, influence the development of joint attention. Thus, this model assumes that social executive processes may contribute to different aspects of joint attention development, and thus different aspects of joint attention may reflect unique as well as common processes. In line with the MPM model, the result of the current study showed no significant association between the joint attention variables.

While the relationship between RJA and IJA is not yet clear (Whalen & Schreibamn, 2003), recent researches indicate that RJA and IJA may be two

separate skills under the larger skill of joint attention (Murray et al., 2008). For example, RJA and IJA show different neurological associations. The development of RJA is associated with parietal area of the brain which regulates the development of reflexive orienting to biological stimuli (Mundy et al., 2000). On the other hand, IJA is associated with the frontal system which is associated with intentional anterior attention system (Mundy et al., 2000). These two variables may also have different motivational parameters, with RJA maintained by extrinsic reinforcement such as physical rewards and IJA maintained by intrinsic rewards such as social sharing (Corkum & Moore, 1998; Mundy, 1995).

2. Language Variables

Both language comprehension and production skills showed an increase with age. Stability in comprehension skills was evidenced by significant correlations between comprehension variables at different time points as well as production skills over the 12 to 18 months period. The average words that 12-months-old infants comprehended were 54 words and increased dramatically to 121 words at 15 months. On the other hand, infants were able to produce an average of 9, 17, and 51 words at 12, 15, and 18 months of age, respectively. While comparing the amount of words that the infants were able to comprehend and produce at the same time point, infants were able to comprehend the same

words far greater than they were able to produce them. This finding was expected based on previous literatures (Slater & Bremner, 2011). One reason infants show slower production of the same words may be due to their difficulty in learning to control the vocal cords, mouth and tongue, all of which are involved in the production of speech sounds (Slater & Bremner, 2011). In addition, the infants' earlier experience of hearing sounds rather than speaking them may be another reason that contributes to the difference in the developmental pattern of language comprehension and production.

3. Joint Attention and Language

To examine the relationship between joint attention capacities and language development, correlation and hierarchical multiple regression were conducted.

3.1 Comprehension

Our results were consistent with expectations regarding the relations between joint attention variables and language outcomes. Findings indicated that CJA at 12 months and RJA at 12 months were significantly associated with Comprehension at 12 months. When production ability at the same month was

controlled, both CJA and RJA at the same month were significant predictors of comprehension skill. Hence, CJA and RJA maintained a unique path of association with language comprehension development.

Comprehension at 15 months showed significant association with RJA at 12 months, CJA at 15 months, IJA at 15 months, and IJA at 18 months. When Comprehension at 12 months was controlled, CJA and IJA at 15 months were significant predictors of Comprehension at 15 months. Contrary to the expectation that RJA would be a significant predictor of comprehension skills, RJA at 12 months did not remain as a significant predictor when CJA and IJA at 15 months were added.

Coordinated joint attention may be the most basic social ability that serves as a basis for the emergence of RJA and IJA behaviors. It may be possible to consider coordinated joint attentional engagement episode as the most primary basis of joint attention. Therefore, CJA at 12 months may be a significant predictor of Comprehension at 12 months and that joint attentional engagement episode may in early infancy serve as a foundation for the development of language. Another study stated that RJA may be related to syntax development, while IJA may be related to more sophisticated social communicative skills (Murray et al., 2008). This may be an explanation of the association between RJA at 12 months and Comprehension at 12 months. While RJA was a

significant predictor of Comprehension at 12 months, IJA was a significant predictor for Comprehension at 15 months. This may because as the infant becomes older, the social motivation and the enthusiasm to engage with others and to elicit attention may be more important in language acquisition than the sole behavior of responding to other's attention (Moore & Corkum, 1994). As infants get older, mothers used shorter sentences and more comments (Tomasello & Farrar, 1986). In other words, mothers are elaborating less and making more comments in response to the child's behavior as the child gets older. Thus, while it is sufficient for the infant to simply respond to the mother's sentence in the earlier period, mothers may have greater expectation for the infant to initiate and communicate more which requires greater motivation from the infant.

3.2 Production

For Production at 12 months, Comprehension at 12 months was a significant predictor. However, when RJA at 12 months was added, it remained as the only significant predictor while Comprehension at 12 months no longer contributed to the explanation. When IJA at 12 months was added, IJA and RJA at 12 months were significant predictors of Production at 12 months. For Production at 15 months, Production at 12 months was a significant predictor. When IJA at 15 months was added, only Production at 12 months remained as a

significant predictor. Lastly, Production at 15 months and CJA at 18 months was the two significant predictors of Production at 15 months.

In comparison to the predictors of comprehension ability, IJA and RJA at 12 months were significant predictors of Production at 12 months. This may be explained as production of language requiring greater social motivation than the comprehension of language. However, for Production at 15 and 18 months of age, neither the IJA nor RJA skills were significant predictors. Rather production skills of previous months were significant predictors of subsequent language production abilities. It could be possible that after infants have developed the ability to engage in coordinated joint engagement states with social partners, this ability serves as the most basic foundation for acquisition of early language. While the ability to engage in coordinated joint engagement state is established and infants are able to produce RJA and IJA behaviors, these may all come together and influence the infant's early language acquisition. Once, infants have acquired certain level of language development, subsequent language skills may rely more on the previous language abilities than initial joint attention abilities. It is not to say that joint attention abilities are poorer predictors of subsequent language abilities than previous language abilities. Rather, once the infant has learned some amount of language, the language then serves as a communicative tool for establishing and maintaining joint attention

with the social partner (Tomasello, 1988). And the joint attentional episode established by the acquired language scaffolds even further language growth. Thus, early joint attentional capacities may be better predictors of early language skills, while the early language skills acquired through the establishment of joint attentional episodes and behaviors may be better predictors of subsequent language development.

4. Implications and Limitations

The current study added meaningful values to the field of developmental psychology because it has examined joint attention capacity in multiple approaches that many studies did not examined. Therefore, developmental patterns of coordinated joint attention, initiating joint attention, and responding to joint attention capabilities were investigated using both the free-play interaction and the Early Social Communication Scales. Furthermore, by examining the period before vocabulary explosion which occurs around 18 months of age, the current study was able to examine the relationship between joint attention and language ability in the early infancy period.

Based on the findings from this study, specific aspects of joint attention variables can act as early predictors of subsequent language skill development. Especially in the early infancy period, CJA and RJA may be

accurate predictors of subsequent language skills. As a result, the lack of joint attentional capacity may indicate language issues. In fact, the lack of pointing ability is a significant indicator of problems in infant's language development (Goldin-Meadow & Alibali, 2013). For example, many autistic children who have delayed or problems in language development fail to engage in pointing behaviors. Therefore, the comprehensive evaluation of joint attention abilities may serve as an important index of the infant's subsequent language acquisition. As a result, the current data can be applied to the development of early detection and intervention programs for infants who are at risk for delayed language. Rather than intervene in the toddlerhood period when children talk more and therefore delay or problems in language may be more evident, joint attention capacity may be examined in the infancy period. The measurement of joint attention capacity in infancy may act as a screening tool and determine those who are at risk for language delay. Following the screening of children at risk for language delay, immediate intervention for enhancement of joint attention capacity may be implemented. Overall, this study added theoretical foundation to future studies focusing on the joint attention and language development of infants, especially at 12 to 18 months of age.

Nonetheless, the present study has few limitations. Previous studies indicate that joint attention abilities consolidate during the period of 12 to 18

months of age. However, this may not be applicable to all types of joint attention. While coordinated joint attentional engagement states and RJA showed significant growth as well as stability over the period of 12 to 18 months, IJA did not show either significant growth or stability over the same period of time. Rather than showing a linear or some type of increasing trend, IJA showed a U-shaped developmental pattern. Since the ability of IJA develops later than that of RJA, IJA may still be in the process of developing over the period of 12 to 18 months, and therefore show instability. Since IJA emerges later than RJA (Dumhan & Moore, 1995), the period of 12 to 18 months may have been too short to investigate the extensive development of the IJA competence. Therefore, examining the joint attention engagement state and behaviors longer than 18 months and into the period of toddlerhood may lead to a more comprehensive representation of the development of IJA behavior.

Also, the current study assessed infant's language comprehension and production skills based on the mother's report of their infant's language ability. Mother's report of their infant's language ability may have been biased or unreliable since it is based on the mother's memory. Using language assessments that is based on direct observation of the infant's language may resolve such issues. Furthermore, future studies may address these issues by investigating the joint attention capacity in a multiple-method approach from the early infancy to

later toddlerhood for even greater comprehensive representation of the joint attention development.

Regardless of these limitations, the results of the current study provided evidence that joint attention is associated with language ability in the infancy period. Furthermore, while early joint attention capacity may serve as a referential framework and promote language acquisition, this acquired language ability acts as a communicative tool to establish and maintain joint attentional episodes which leads to greater facilitation of language acquisition.

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국문초록

여러 연구에서 영아의 공동주의는 이후의 언어발달과 밀접한 관련이 있음이 보고되어 왔다. 기존 연구들은 공동주의가 영아기 전반에 걸쳐 발달되며, 유아기 언어와 정적 상관이 있음을 제시하였다. 그러나 기존 연구들은 공동주의를 제한적으로 살펴본 한계점이 있다. 즉, 자유놀이 상황에서 측정한 협응적 공동주의는 자연스러운 상황에서의 영아의 공동주의 능력을 반영하는 장점이 있으나 공동주의의 시도와 반응에 대한 정보는 상대적으로 부족하였다. 반면, 비언어적 의사소통 척도(ESCS)는 영아가 타인의 공동주의에 반응을 하는지 아니면 영아 스스로가 공동주의를 시도하는지에 대한 행동들을 직접적으로 측정하여 구분할 수 있다. 그러나 실험 상황에서 영아의 공동주의 시도와 반응을 측정하기 때문에, 자유놀이 상황보다 생태학적 타당도(ecological validity)가 낮은 단점이 있다.

그러므로, 더 종합적인 영아의 공동주의 능력을 평가하기 위해 본 연구에서는 엄마와의 자유놀이 상황과 더 구체화된 비언어적 의사소통 척도 모두를 사용하여 복합적인 방법 접근으로 공동주의를 살펴보았다. 영아의 협응적 공동주의를 측정하기 위해서, 엄마와의 상호작용을 살펴보는 자유놀이 상황을 사용하였다. 공동주의에 대한 반응하기와 공동주의

시도하기의 행동들을 측정하기 위해서는, 영아가 실험자와 상호작용하는 비언어적 의사소통 척도를 사용하였다. 그리고 마지막으로 MCDI-K 를 사용하여 영아의 표현언어와 이해언어를 측정하였다. 모든 변인들은 12 개월, 15 개월, 그리고 18 개월에 걸쳐 종단적으로 측정하였다.

그 결과, 협응적 공동주의, 공동주의에 반응하기, 그리고 공동주의 시도하기는 표현언어와 이해언어 모두와 정적 상관을 나타냈다. 위계적 회귀분석을 한 결과, 12 개월 협응적 공동주의와 반응하기가 12 개월 이해언어를 유의미하게 예측하였고, 15 개월 협응적 공동주의와 시도하기가 15 개월의 이해언어를, 12 개월 시도하기와 반응하기가 12 개월 표현언어를, 12 개월 표현언어가 15 개월 표현언어를, 그리고 18 개월 협응적 공동주의가 18 개월 표현언어를 유의미하게 예측하였다.

주요어: 공동주의, 공동주의에 대한 반응, 공동주의 시도하기, 비언어적 의사소통 척도, 자유놀이 상황, 언어능력 발달

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