LANGUAGE-SPECIFICITY AND YOUNG PRESCHOOLERS' SOCIAL-COGNITIVE DEVELOPMENT

by

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF LANCASTER UNIVERSITY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

LANCASTER UNIVERSITY

June 2016

Declaration

I declare that this thesis is my own work, and has not been submitted in substantially the same form for the award of a higher degree elsewhere.

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Abstract

This thesis investigated the role of linguistic access in reference to mental states in children's social understanding. The importance of access to, or an understanding of, mentalistic language has been stressed regarding the development of children's social understanding (e.g., Astington & Baird, 2005). It was predicted that the exposure to the mental-state terms using specific grammatically embedded forms specifying certainty and/or the origins of information would enhance Korean children's social understanding. There has been a vast body of research, showing the predictive role of executive function on the development of social understanding, in particular false-belief understanding (e.g., Carlson & Moses, 2001; Sabbagh, Xu, Carlson, Moses, & Lee, 2006). However, research on Korean children did not support the view on the general development between the two cognitive skills (e.g., Oh & Lewis; 2008). Thus, the current study explored the relationships between executive function and false belief understanding in response to the debate. Executive function, or higher-level self control, is necessary to fulfil goal-directed action inhibiting irrelevant alternatives (Welsh & Pennington, 1988). Children learning from adults, however, trust information selectively (Koenig & Sabbagh, 2013). As children are required to suppress distracting information for selective trust, it was expected that higher skills in executive function may predict performance on selective trust. Thus, the role of executive function on this social understanding was also examined (in Experiment 1 and 2 for false belief and 5 for selective trust).

In Experiments 1 and 2 (*N* = 175) when a protagonist in a false-belief task expressed either his uncertainty (i.e., -*keyss* (-*ul keya*) = may) or certainty (i.e., -*ci* = really), the linguistic markers influenced 3- and 4-year-olds' apparent grasp of false beliefs. The different levels of certainty (i.e., -*hata* = do or –*ya hata* = must do) were applied to the executive function measures. However, the effects of different linguistic markers on executive skills

were not observed.

Experiment 3 (*N* = 144) moved the focus from false-belief understanding to selective trust with the application of differential evidentiality in correct and incorrect speakers. Four types of tasks, presented within a 2 (certainty vs. uncertainty) x 2 (accuracy vs. inaccuracy) design, were administered (*N* = 36 for each task) to three age groups (3.6-4.5 years, 4.6-5.5 years and 5.6-6.5 years). In order to indicate direct access to information, -*te* (I saw) was used while –*napo* (It seems) was used for indirect information. The findings from the four tasks showed a crucial effect of accuracy over certainty in selective trust.

Following on from the results of Experiment 3, Experiments 4 and 5 compared the children's performance in epistemic trust experiments in which linguistic access to the protagonists' mental states was specified using either two evidential markers (i.e., -*te* vs. –*napo*) identifying both certainty and the origins of the protagonist's knowledge, or specific verb terms (i.e., *know* vs. *think*) that expressed certainty. In Experiment 4 (*N* = 59), the findings revealed different developmental patterns according to the use of the two types of linguistic references (evidential markers vs. explicit verb terms): sensitivity to speakers' epistemic states using mental-verb terms was in evidence at the age four and by evidentiality around the age six. The final experiment of this work employed a battery of executive function measures along with two selective trust tests, using the same contrasting means of identifying the protagonists' certainty and knowledge (evidential markers vs. different linguistic terms: *N* = 84). The findings replicated the different developmental patterns of selective trust found in Experiment 4. There were different associations between executive function and questions of two of the three levels of the standard selective trust measure. Verbal working memory predicted the children's performance in judging who is correct when the test question used included evidential markers. Visual working memory did the same job when verbal mental-state terms were used. Finally inhibitory control predicted selective learning when verbal terms were used.

Taken together, the findings suggest that (a) a grasp of certainty appears earlier than an understanding of evidentiality; (b) the grammaticalized forms of certainty and evidentiality are more likely to influence children's linguistic access to mental states than more explicit mental-verb terms (positively in false belief and negatively in epistemic trust). These lead to the conclusions that: (c) a mastery of semantics and syntactic forms is needed in developing social-cognitive skills; (d) specific language markers identifying the sources of a protagonist's knowledge may reduce demands of executive function in processing another's epistemic states.

Acknowledgements

I am grateful to the staff and children in the following preschools and kindergartens in Korea: Chukpok Children's House, Miso Children's Hose, Cenwen Kindergarten, Tholi Children's House, Kyenghuy Children's House, Orange Kindergarten, Hans Kindergarten, Cangan Children's House, Tanpi Children's Hose, Payhwa Children's House, Wukyeng Meyiseyn Children's House, Songpuk pyengsel Kindergarten, Yunse Children's House, Sethan pyengsel Kindergarten, Myengseng Children's House, Hwalang Children's House, Nokci Children's House (Phyengthak); Green Children's House; Cihyeyswuph Children's House (Suwen); Fairchild Children's House, Kemtan Children's House, Mansek Children's House (Inchen); Bewegung Kindergarten, Sayspyel Children's House (Hwaseng); Miyang Sengmo Kindergarten, Anpep Kindergarten (Anseng); Cenkung Montessori Children's House (Yongin).

I would like to thank my supervisor, Professor Charlie Lewis, my parents and my friends for their ongoing and invaluable support for this thesis.

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List of Symbols and Abbreviations

Symbol	Definition
ADCCS	Advanced Dimensional Change Card Sort
BDS	Backward Digit Span
BWS	Backward Word Span.
CC vs. CU	Correct Certain vs. Correct Uncertain
CC vs. IU	Correct Certain vs. Incorrect Uncertain
CL	Change Location
DCCS	Dimensional Change Card Sort
EF	Executive Function
EM	Evidential Markers
FB	False Belief
FDS	Forward Digit Span
IC vs. CU	Incorrect Certain vs. Correct Uncertain
IC vs. IU	Incorrect Certain vs. Incorrect Uncertain
KOSECT	Korean Oral Syntax Expression Comprehension Test
SE	Sentence Ending
ST	Selective Trust
UC	Unexpected Contents
VCR	Visually Cued Recall
VT	Verb Terms

Chapter One: **General Introduction**

Why study language-specificity and young preschoolers' social-cognitive development?

Does language acquisition provide a means of understanding the social world? There has been longstanding research on this issue in the area of developmental psychology, showing convincing evidence for the linkage with, in particular an understanding of the mind (Astington & Baird, 2005; Carpendale & Lewis, 2004). The ability to understand others' beliefs refers to theory of mind. The use of the term "theory of mind", however, has received criticism from some researchers regarding its limited implication in children's social understanding (for reviews, see Carpendale & Lewis, 2015). Thus, I will use the term of social understanding to refer to children's understanding of others' mental states. Returning to the association between language and social understanding, Astington and Baird (2005) pointed out the importance of social interaction in how children construct their own and others' knowledge, emphasising the role of language as the root of understanding epistemic states (knowledge and epistemic state indicate what a person knows or believes). That is to say, language is a fundamental aspect in a process that allows children to interact with others. Based on this perspective, this thesis looks at whether the linguistic terms (i.e., certainty/evidentiality) which are specially involved in certain languages play the formative role in Korean children's conceptual growth.

For more than two decades, children's social understanding has been researched with regard to the association with the ability to regulate thoughts and actions and, recently, researchers have expanded its relation to the ability to judge and trust others' knowledge. The former ability refers to executive function and the latter is regarded as selective trust.

Compared to vigorous research on the role of language in social understanding, effects of language on the two other cognitive processes have received less attention. However, it seems that understanding others in social interaction requires intertwined abilities of three domains of cognition (e.g., Carlson & Moses, 2001; Carlson, Moses, & Breton, 2002; Jaswal et al., 2014; Lucas, Lewis, Pala, Wong, & Berridge, 2013; Sabbagh et al.,, 2006). Thus, it is conceivable to speculate that language, in particular verbal input, the focus of this thesis, may facilitate performance on executive function and selective trust as well as social understanding.

Prior to proceeding to chapters outlining the details of a series of experiments, in this chapter I will explore existing research in false-belief understanding, executive function and selective trust in terms of how language is related to children's development of these skills. Research on children's understanding that others can have different beliefs from reality (false beliefs) has been at the centre of assessing their social understanding (e.g., Wellman, Cross, & Watson, 2001). As selective trust involves children's judgment on others' beliefs based on their knowledge (Koenig & Harris, 2007), it seems that selective trust would be in line with false belief understanding in terms of children's mentalistic appraisal of others. Thus, as mentioned above regarding the role of language on social understanding, the link between mentalistic language and false belief understanding/selective trust would be expected. According to Vygotsky (1978), language is a crucial factor which facilitates gaining self-control. Based on this view, the role of mentalistic language on executive function would be expected. Thus, the relationships between language and false belief understanding/selective trust/executive function will be explored in the subsequent sections. The relationships between executive function and false beliefs/selective trust will be discussed in Chapters Two and Six, respectively.

1.1. The relationships between language and social understanding

This thesis focused on the grammatical evidential/certainty markers regarding children's social understanding. These markers were adopted because the exposure to mental state terms by such markers may be related to an earlier understanding of others' minds and, in consequence, test questions in false-belief tasks involving such markers may heighten the child's awareness of the underlying construct that is being tested. It is necessary to look at a long history of this research area considering how linguistic access leads to children's understanding of mental states in order to situate the idea that linguistic markers may help children's performance. It is hoped that this will provide a cue to explain the use of evidentiality/certainty markers in this thesis. It will focus on the three major features of linguistic skills which are semantics, syntax and pragmatics, because research not only has shown evidence of contributions of the aspects to mental state understanding (Milligan, Astington, & Dack, 2007), but also the acquisition of evidentiality/certainty markers is bound to such language abilities (Choi, 2006). It seems that the syntactic structure of evidential/certainty markers might not be strongly addressed in the research literature. However, the importance of an understanding of syntax, in particular for the use of mental state verbs, will be discussed because it would demonstrate the complexity of a mentalistic understanding in terms of linguistic expressions. As noted above and mentioned in section 1.2, evidentiality is marked grammatically in some languages. It seems possible to speculate that an understanding of evidentiality would involve the acquisition of the syntax of a language. Thus, it would be worthwhile to explore the research literature regarding the relation between an understanding of syntax and children's acquisition of false beliefs.

The first source of evidence of influences of pragmatics in understanding of others comes from research on interactive discourse of caregiver-child, particularly placing an emphasis on talk about mental states (e.g., Adrian, Clemente, Villanueva, & Rieffe, 2005;

Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Pavarini, de Hollanda Souza, & Hawk, 2013; Ruffman, Slade, & Crowe, 2002). Pragmatic skills underlie the ability to use language appropriately in a communicative way (Milligan et al., 2007). Pragmatic ability relies on the ability to keep and track both listener and speaker's beliefs and intentions in communicative exchanges (Astington & Jenkins, 1999). Thus, it is closely related to social understanding. As pragmatics is connected to communication, it seems that various utterances such as feelings, emotions or beliefs would be interwoven with children's understanding of others' perspectives. However, this thesis focused on the importance of an understanding of epistemic markers with regard to the acquistion of social understanding, and this section will discuss the research concerned with mental terms and how these relate to pragmatics.

The research listed above suggests that language bridges social understanding through communication. In longitudinal research, it has been found that earlier measures of family conversations predicted children's later performance on false belief tasks. For instance, Ruffman et al. (2002) conducted a longitudinal study over a year with three time points on 3-year-old children at the beginning of the study, focusing on whether mothers' talk had facilitative effects on the development of children's understanding of beliefs. For their talk to the children, the mothers were given different types of pictures at the time points (e.g., a woman bathing a baby at Time 1 and a father scolding his son at Time 2 and 3 for more emotional or mentalistic conditions) and asked to describe the pictures to the children. The pictures were used to probe whether the mothers' utterances showed differences in terms of mentalistic expressions. Correlations were carried out between mothers' utterances at an earlier time and children's performance on theory-of-mind tasks at a later time taking account of children's understanding of mind at the earlier time. Consistent relationships between the two factors were found at different time points. That is, mothers' talk played a role in the development of children's social understanding. Importantly, modulations of assertion such as expressions of possibility or certainty and cognitive terms like *know* and *think* were more likely to show significant correlations among utterances. Thus, the findings suggest that input of mental state language in family interactions facilitates children's understanding of others' minds.

Further evidence of the correlations between conversational interactions and social understanding comes from studies on deaf children. In particular, comparison between deaf children from deaf parents and from hearing parents has shown evident relevance of the exposure to talk about thoughts in understanding of others (Peterson & Siegal, 1999, 2000; Schick, de Villiers, de Villiers, & Hoffmeister, 2007; Woolfe, Want, & Siegal, 2002). The deaf children from hearing families had received attention because they seemed to have relatively less frequent dyadic interactions by having inefficient means of communication compared to those from deaf parents, and this may constrain their development of linguistic skills (Meadow, Greenberg, Erting, & Carmichael, 1981). In line with this perspective, Woolfe et al. (2002) reported important research on children with a lag of language abilities and acquisition of social understanding. Due to the fact that the deaf children from hearing families are less likely to be sufficiently communicative, Woolfe et al. employed false-belief tasks which require minimal verbal skills (thought pictures) in order to determine whether the acquisition of language was related to the deaf children's understanding of minds. In their study (study 1), the children (deaf from both hearing and deaf parents and hearing children) were shown illustrations which depicted a story character's actions (e.g., a boy thinks he has caught a fish but his line actually held a boot) and asked to choose what the character thought and what a real object was among four possible alternatives. The results showed that the false-belief performance of the deaf children from deaf parents outperformed those from hearing parents even when controlling for their sign language skills, which assessed syntax, and was comparable to 4-year-old hearing children. That is, from the findings it is possible to speculate a crucial role of conversational exposure in respect of mental states in social interaction. This evidence supports the point of view that language, in particular conversational exchanges, allows children to enter their culture sharing concepts, beliefs and knowledge (Nelson, 2005).

The research described above suggested the critical role of mentalistic utterances in communication, and a vast body of research in this area has emphasized that the acquisition of the mind is inextricably related to the comprehension of cognitive words. That is, the second way by which children may acquire a grasp of mental states is that their ability to understand terms referring to the mind such as *think*, *know*, or *guess* provides them with access to others' psychological states. This perspective is supported by studies showing similar developmental patterns when children come to pass false-belief tasks and when they acquire semantics of such cognitive terms (e.g., Johnson & Maratsos, 1977; Johnson & Wellman, 1980; Moore, Bryant, & Furrow, 1989; Moore, Pure, & Furrow, 1990; Wellman, et al., 2001).

Regarding children's lexical competence, an early experimental study (Johnson & Maratsos, 1977) examined whether an understanding of the semantics of terms such as *know* and *think* is an indicator of a grasp of mental states in 3- and 4-year-olds. In the study, children were either told stories or witnessed events in which a speaker deceived a listener who was looking for an object. The children then were given questions asking for both speaker's and listener's knowledge and beliefs about the location of the object (e.g., "Does the seeker think/know it's under box B?). In order to perform the tasks successfully, the children had to be aware of notions that the speaker knows a location of a real object (A) whereas the listener has a false belief about the location (B). The researchers found that 4-year-olds, but not 3-year-olds, responded correctly on the tasks; that is, they understood that the listener thinks that the object is in Location B while she does not know that the object is really in Location A. However, 3-year-olds revealed mixed performance on know- and think-questions for the listener's and the speaker's epistemic states, indicating that they did not distinguish the uses of the words. The findings suggest a clear difference in understanding of mental state verbs between 3- and 4-year-olds, indicating that at 4-year-olds they begin to comprehend others' perspectives.

What is necessary to note here is that investigations of false belief understanding are largely based upon questions asking about a story character's thoughts or behaviours to assess children's understanding of concepts of beliefs (e.g., where does Maxi think the chocolate is / look for the chocolate? – in a change of location task, see Wimmer & Perner, 1983 for the detail). It is a necessary requirement to grasp cognitive terms in order to perform false-belief tasks. In other words, if this line of argument is correct, there are causal relationships between a grasp of social understanding and knowledge of mental state terms. Manipulation of the false belief test suggests a close link between the two factors. One criticism of the standard change of location task made by Siegal and Beattie (1991) was that the task may lead to a misinterpretation of the question rather than difficulty in understanding of beliefs. Siegal and Beattie found that children between 3- and 4-years of age failed the question for *look for* with a false belief while those in the other group responded successfully on a question involving *look first*, suggesting that children's understanding of beliefs might be influenced by the specificity of the test question. Similarly, Lewis and Osborne (1990) found that a suffix 'before I took the top off' was sufficient for 3-year-olds to respond correctly to the test question 'What did you (/will your friend) think was (/is) in the box?' Taking these studies together, the test question in false beliefs needs to be interpreted so as to ask where a story character should look first for success in retrieving an object which has been moved, whereas 'to look for' does not make this explicit. This line of analysis seemed to dwindle after Wellman et al.'s (2001) study meta-analysis seemed to cast doubt on the general success of manipulation of false-belief test questions.

A re-analysis of this claim comes from the evidence concerning lexical competition for mental state access, based on the principle that we can learn a lot about the acquisition of mental state verbs when children have to discriminate between closely related synonyms. One study showed how children's understanding of false beliefs was mediated by linguistic references which contrast semantically referring to actions taking account of mental states. In other words, the study showed that semantic differences of linguistic terms which indicate 'to look for' influenced differently Greek children's understanding of false beliefs. Maridaki-Kassotaki, Lewis, and Freeman (2003) demonstrated that the development of lexical knowledge influenced false belief understanding in Greek preschoolers in the use of one such verb. Along with Siegal and Beattie, Maridaki-Kassotaki et al. (2003) hold the view that the formulation of mentalistic or behavioural expressions may affect effective communication, and lead to conceptual understanding or the lack of it. In the research, they compared two Greek words of *psahno* and *kitazo* which represent *look for* in English. However, the two words vary in terms of their conversational implicature; that is, *kitazo* with the complement *na vro* signifies a person's mental state as does *look for* in terms of the viewer's (phenomenological) appreciation of a viewpoint, when translated into English. In contrast, *psahno* with the same complement implies actions *to search for* although literally it means *look for*. This term draws attention to the actions required to retrieve a missing object. So *psahno* also means to rummage, or engage in a vigorous search. That is, *kitazo na vro* implies a mentalistic understanding of a speaker to a listener while *psahno na vro* induces an overt action on the part of the listener. The uses of the two phrases were confirmed in questionnaires for mother-child interactions in their study, in which mothers suggested that they would normally use the term *psahno* when asking the false-belief test question. Greek children between three and five throughout two studies received false-belief tasks (change in location) in which questions consisted of one of the respective words. It was expected that children's performance by *kitazo na vro* might be competitive over *psahno na vro* as understanding of false beliefs require a mentalistic construal. Indeed, the findings showed that even the 5-year-olds' understanding was delayed with *psahno na vro* in a change of location task, while they performed successfully for both deceptive box and object tasks without the specific linguistic expression. On the other hand, children in the group where the word *kitazo na vro* was used passed the false-belief question with above-chance performance; even the expression appeared to be facilitative in the 3-year-olds' understanding. These findings suggest that young children's access to a mental state (the thinking that drives search activity) could be observed differently when items in the lexicons have competing yet alternative semantic implication.

So far the research has provided evidence of how children's acquisition of a lexicon referring to mental states is in line with their grasp of mind. However, it seems to be important to point out the grammatical (syntactical) feature of mental state terms. As shown above, words such as *know* and *think* in English and *kitazo* in Greek generally are followed by sentential complements in order to hold a belief. That is, some researchers have provided explanations of the associations between sentential complements allowing a false proposition in the embedded sentence and the acquisition of social understanding (de Villiers & de Villiers, 2000; de Villiers & Pyers, 2002; Schick et al., 2007), although there is also criticism on the linguistic determinism by which language takes the same complement for desire and beliefs (Perner, Sprung, Zauner, & Haider, 2003).

That is, the third proposition is that mastery of syntax, namely complementation, could lead to an understanding of representation of beliefs. The proponents of linguistic determinism contend that comprehension of a language structure which is fundamental to communication about mental states is crucial. For example, proponents of this view hold that children would be able to grasp that a statement “Sarah thought the earth was flat” (de Villiers & Pyers, 2002, p. 1038) is correct if they understood the embedded proposition refers to Sarah’s mind, even though the proposition conflicts with reality. This argument is supported from findings by correlational studies in typically developing and deaf children. For instance, de Villiers and Pyers (2002) conducted a longitudinal study in order to explore the role of complementation over a year with preschoolers. Children received language tasks to test their memory for complements, in which they were shown pictures and told about stories regarding the pictures through mental state (*think* and *believe*) and communication verbs (*say* and *tell*), and were asked what story characters think or say. In other language tasks, the children’s spontaneous speech (Index of Productive Syntas (IPSYN), see Scarborough, 1990 for the detail) during the tasks, MLU (mean length of utterance) and understanding of wh-questions were analysed with regard to standard false-belief tasks. The results showed significant correlations among memory for complementation (both mental and communication verbs), a measure assessing complementation within spontaneous speech and various tasks assessing false beliefs. However, production of other sentence types such as sentence score or complex sentences did not relate to false belief. Analogous patterns of correlations were also observed even in deaf children (e.g., Schick et al., 2007), suggesting that a grasp of complementation is important in accessing mental states.

Apart from the correlational studies, this view on the role of complementation has received support from studies in which children were trained in sentential complements; that is, children who failed false-belief tasks first showed increased performance after having trained on embedded complementation (e.g., Gola, 2012; Hale & Tager-Flusberg, 2003; Lohmann & Tomasello, 2003; Lohmann, Tomasello, & Meyer, 2005). For example, Lohmann and Tomasello (2003) conducted a training study with deceptive objects (e.g., an object looks like a flower but it is really a pen) concerning four perspectives of the roles of language on false-belief understanding. Children were administered one of four conditions: full training, discourse only, sentential complement or no language. Three-year-old German children who had not yet developed false belief reasoning participated in the study. In the full training condition, the experimenter used either mental-state or communication verbs in order to ask the child what s/he thought about the deceptive objects using the sentential complement construction (e.g., ‘What do you think/say this is?’ ‘You think/say this is an X’ ‘Right, it is really a Y’). In the discourse only condition, the experimenter asked the child about the nature of the objects while avoiding the use of complementation (e.g., “What is it?). In the no-language training condition, the experimenter used words in order to turn the child’s attention to the functions of the deceptive object from its appearance without linguistic implications (e.g., “look!” and “but now look!”). Finally, in the sentential complement only training condition, the experimenter referred to the deceptive object as normal, using mental or communication verbs with sentential complements (e.g., ‘What do you think this is?’ ‘You think this is a candle?’). This condition differed from full training in that the deceptive aspect of the objects was not highlighted. The greatest improvement was found in the full training group and the discourse and sentential complement groups. The no-language training group did not show increased performance on the false-belief tasks. The findings suggest that the acquired syntax and semantics of sentential complements, along with talking about others’ minds, may facilitate the development of beliefs. The study supports the perspective proposed by de Villiers (2005) that sentential complement constructions provide a scaffolding for the representation of beliefs.

To sum up, the research reviewed above shows that an understanding of others’ minds could be promoted by three mechanisms among the roles of language; reflective discourse of mental states, a comprehension of cognitive verbs and the acquisition of the underlying syntactic structure; each may have a facilitative role. This accumulating evidence of the multifaceted role of language is supported by the view that different accounts for the functions of language are to be complementary but not competing (Astington, 2001), along with a meta-analysis showing the significant relevance of the three language abilities, including general language and receptive vocabulary (Milligan et al., 2007).

So far, the chapter has reviewed the importance of cognitive terms which are not grammatically obligatory in their use. As mentioned earlier, this thesis focuses on the expressions of evidentiality/certainty to refer to one's mental states, and the relevant evidence appears to suggest relatively earlier use and understanding of mental terms by such markers. Hence, the use of the evidential/certainty markers in the test question for false belief tasks may provide insight into whether the experience in mental talk by these markers also promotes young Korean children's understanding of the mind.

1.2. Evidentiality/Certainty and cognitive development

Language, the quintessentially human form of communication, is a device for conveying what people are aware of. It serves purposes from statements of fact ('Bear!') to matters of opinion ('Yuk'). Within the flow of everyday conversation, people occasionally express their attitudes toward the status of their knowledge - for example, how they obtained a piece of information or how certain they are about it. The notion which refers to such functions of language that can be attached to verbs (usually) is called evidentiality. Evidentiality refers to grammatical forms which obligatorily provide sources of information in some languages, including direct and indirect evidence; therefore, it is possible to express one's epistemic stance on the information we are conveying using different levels of certainty, such as reliability, probability and possibility (Aikhenvald, 2004; Willett, 1988). Its markers have recently attracted researchers' attention in relation to children's social understanding, because the linguistic form provides a means for expressing one's attitudes toward a proposition. It is classified in general as a type of epistemic modality (Chafe & Nichols, 1986; Palmer, 1986). Yet at the same time its specific linguistic forms are usually expressed as suffixes attached to a verb and are distint from other epistemic expressions such as mental state verbs. Examples of evidentialtiy/certainty in different langauges will be presented in the following sections to illustrate how different forms vary one's knowledge status. It is necessary here to define terms of grammaticalized and non-grammaticalized markers used in this thesis. As evidentiality is defined as grammatical marking (Willett, 1988), the 'grammaticalized/grammatically embedded' term indicates evidentiality/certainty which is expressed by suffixes (inflectional markers). The 'embedded' term indicates that evidential/certianty markers are subordiate to a verb. On the other hand, the term of 'non-grammaticalized' refers to mental state verbs such as *think* or *know* throughout the thesis. Another term used in this thesis is 'language specific term (form)'. It seems that approxiamtly one qurter of languages have grammaticalized evidential markers (Aikhenvald, 2004). As some specific langauges utilise an evidential system, the 'language specific term' is used to refer to the grammaticalized evidential/certainty markers in this thesis and to distinguisch from other cogntive terms such as mental-state verbs.

Some researchers who place an emphasis on evidentiality argue that access to linguistic terms of epistemic states from a very early age may boost the conceptual acquisition of beliefs. A pioneering body of work on evidentiality and social understanding comes from research on Turkish children. As described above about the function of evidentiality, Turkish distinguishes how knowledge is acquired using inflectional markers (i.e., grammatical markers) (Aksu-Koç & Alici, 2000; Aksu-Koç, Ögel-Balaban, & Alp, 2009). In an empirical study, Aksu-Koç and Alici (2000) conducted research in order to investigate the relationships between Turkish children's understanding of grammatical markers (evidentiality) of sources of beliefs and social understanding. Children between 3-

and 6-years of age received typical false-belief tasks (unexpected contents) for Self and Other false beliefs and language tasks in which children were requested to judge whether a speaker knows/is certain/sees, in statements described by *–DI* and *–DIr*, respectively. That is, if children comprehended the implications of the markers, they would appreciate that *–DI* implies that the speaker has witnessed an event and is certain of it based on their direct experience while *–DIr* represents a non-witnessed event and non-certainty (or uncertain information). Aksu-Koç and Alici found that Turkish children's false-belief understanding was relatively advanced compared to that of their English peers (e.g., Carlson & Moses, 2001); in particular, they noted 3- and 4-year-olds' high performance on the Self (75% and 84% passing, respectively) false-belief questions. Furthermore, the general performance on three types of questions for sources of knowledge and certainty and access to information revealed that children across all age ranges showed an understanding that *–DI* indicated that the speaker was knowledgeable and certain with direct witness, which is inconsistent with the findings of English speaking 3-year-olds' difficulty in the use of *know* in Johnson and Maratsos's (1977) study. On the other hand, their understanding of *–DIr* for knowledge was similar across the age groups but with less successful performance than on *–DI*. Their findings signified that uncertainty and information access showed a gradual development with increase of age. With regard to the relationship between the use of the markers and false-belief understanding, Aksu-Koç and Alici found that children who passed the false-belief task used uncertainty markers significantly more than those who failed it. To sum up, the results seem to indicate that children who use markers of beliefs in their spontaneous speech might be exposed unconsciously to the concept of the mind from an earlier age than those using language without such markers, and the exposure might be positively related to the early social understanding.

The work by Aksu-Koç and Alici showed a parallel development between the use of evidential markers, which denote beliefs, and false-belief reasoning. However, there are limits to how much we can interpret the extent to which children profited from the use of grammaticalized markers. It seems that an understanding of uncertainty by an embedded marker was not particularly advanced compared to a non-grammaticalized expression such as *think*. In other words, it appears that children in a relatively later period of preschool development (age six) tended to understand epistemic meanings of evidential markers, while younger ones did not. Even though there was a discrepancy in acquiring the meanings of certainty and uncertainty, the research suggested the possibility that the use of evidentials may facilitate sensitivity to accessing others' mental states. Along with the case of Turkish children, a more recent study supports the view on the relationships between language specificity and the development of thought.

The research by Matsui, Rakoczy, Miura, and Tomasello (2009) provided further evidence that 3-year-olds, who are generally known to fail the standard false belief tasks, were able to appreciate others' mental states in communication on the basis of the use of Japanese inflection markers of beliefs. In an experiment (study 1), they employed an explicit false belief task in which a story character's belief is explicitly stated, i.e., 'Jane thinks her kitten is in the kitchen' (see Wellman & Bartsch, 1988). In order to probe the relationships between language specific expressions and children's social understanding, they revised the task substituting the mental state verb with Japanese un/certainty markers which are grammaticalized, and then compared German expressions for un/certainty which are not embedded in their grammar system. They used Japanese markers of *yo* and *kana* for semantic equivalence with *know* and *think*, respectively and German adverbial expressions of *sicher* and *vielleicht* which are analogous to *certainly* and *maybe* for certainty and uncertainty, respectively. There were a number of important differences between the Japanese and German samples. They found that there was a clear difference in performance by the linguistic expressions in Japanese, but not in German children. German 3-year-olds did not attribute the expressions according to a speaker's different degrees of certainty while those in Japan were more convinced by certainty than uncertainty. That is, Japanese children's performance was significantly improved by the certainty marker compared to a typical task without additional expressions, while their performance on the uncertainty marker was comparable to the same typical task. On the other hand, German children did not reveal significant differences between the standard and revised tasks irrespective of the degrees of certainty. Taken together, there seemed to be a clear effect of the grammatically embedded system on developing thinking even though uncertainty was still relatively more difficult to grasp than certainty. This view is consistent with the suggestion of Aksu-Koç and Alici that early use of the grammaticalized expressions for epistemic states is interrelated with children's cognitive development.

It is necessary here to point out why the use of evidential markers may be particularly important in terms of social understanding. Language is significantly intertwined with the development of social understanding. In particular, there is a general consensus that children develop the ability to understand mental-state verbs such as *know, think,* and *believe* etc (Astington & Baird, 2005). Most importantly, it has been found that the understanding of such mental verbs is acquired between the approximate ages of 4- and 5-years. Evidence from studies of children's acquisition of mental terms supports age-related mentalistic understanding and the ability to distinguish the degrees of certainty. For example, Moore and colleagues (Moore et al., 1989; Moore & Davidge, 1989; Moore et al., 1990) conducted research using a task in which children were to find a hidden object based on two conflicting statements (e.g., "I know/think/guess it's in the blue/red box."), while children were not allowed to search for a real object. That is, children had to rely on verbal utterances to judge informants' certainty. The linguistic references to indicate cognitive states were adverbial (i.e., *probably, possibly and maybe*), verbal (i.e., *know, think* and *guess*) and adjectival (i.e., *sure*), differentiating the degrees of certainty in a series of experiments. They also used modal verbs (i.e., *must, might* and *could*). The focus of the studies was to investigate when children come to understand that mental terms and discriminate different levels of certainty, and whether an understanding of certainty was related to the development of social understanding. It was found that by four to five years of age children were able to evaluate information expressed across different mental terms, and the ability to appreciate certainty was correlated with the development of beliefs. That is, this accumulating evidence described above suggests that children who are exposed to the system of evidentials might be more likely to go through a process to access others' mental representation, and the linguistic code might provide a means for developing children's social understanding at an earlier age.

Korean has the grammaticalized category to express one's knowledge status and sources of information by sentence-ending (SE) suffixes. The forms are called as SE suffixes because they generally take place at the end of a sentence with a verb final position (Choi, 1995). An early understanding of epistemic meanings by Korean evidentiality is in line with the findings in other samples such as in Turkey and Japan. That is, it appears that children acquire certain markers before they reach 3-years of age. For example, Choi (1991) conducted a longitudinal study observing three 2-year-old children's spontaneous speech and analysed their utterances in terms of the occurrence of SE suffixes, focusing on the most frequent seven expressions. It was found that the three children's use of markers, denoting different degrees of knowledge status, showed a similar developmental pattern. Importantly, their acquisition of the markers was relatively independent of their caregivers' input frequency. In other words, the understanding of the cognitive linguistic implications emerged at a relatively early age in Korean children. This research raised the possibility that Korean children might gain early social understanding when epistemic markers were used to express others' knowledge status.

However, in contrast to the findings of Choi (1991), more recent work by Papafragou, Li, Choi, and Han (2007) is critical of the view of the early development of Korean evidentiality. They found that young Korean children showed difficulties in comprehension of evidential markers although they successfully used such expressions. That is, they argue that mastery of evidential markers is not obtained in the preschool period, and the exposure to language with evidentials does not imply that children's epistemic reasoning is particularly aided by the linguistic system. In one of their experiments (Experiment 2), for example, children received tasks in which a puppet reported an event using Korean markers, i.e., either -*e* (e.g., *ecey cininun sakwalul mekesse* '(I saw) Yesterday, Jin ate an apple') for direct witness or –*tay* (e.g., *ecey cininun kangacilul palo chasstay* 'Jin said that she kicked a puppy yesterday') for hearsay. In order to examine children's acceptance of events and markers, half the statements were mismatched. That is, -*e* was conveyed for indirect (telling) events, while –*tay* was used for direct (looking) events. The children then were asked to judge whether the puppet looked or were told about events and the puppet's use of the markers was event-appropriate. For looking trials, a statement with –*e* would be a proper response, while –*tay* would be accepted for telling trials. These assumptions of the uses of markers were confirmed by adult participants. That is, -*e* statements were fully accepted for looking trials, while those with –*tay* were minor with 15 percent. On the other hand, adults comparably accepted both markers for telling events. In contrast to adults' use of such markers, the results showed that children of two age groups judged that –*e* and –*tay* both were acceptable for reporting witnessed events although 4-year-olds were more likely to take -*e* as appropriate than 3-year-olds. Similarly, their uses of the markers for telling events did not differ. Based on a series of experiments with modified tasks to probe children's comprehension of the markers, the researchers suggested that children between 3- and 4-year-olds did not develop a firm understanding of the implications of Korean evidentiality, although they were able to produce the markers appropriately; therefore, competency in evidentials seemed to have little to do with advanced mentalistic understanding.

In summary, a number of studies have suggested that the aspects of the grammatically embedded system for mental representation are related to children's cognitive process. However, it might be difficult to contend that the exposure to the linguistic expressions would be a potent cue for children to lead to insights into the understanding of the social world, as the contemporary body of research has been conducted in language learners without such a system, for example, English speakers. Korean studies have produced mixed evidence regarding a developmental period in acquiring evidentials. Furthermore, there is no study with Korean samples which has focused on the relations between the language specific term (grammaticalized evidentiality/certainty) and social understanding. Thus, the thesis will explore evidential/certainty markers in order to probe whether the exposure to the grammaticalized terms to express mental states facilitated Korean children's social understanding and executive skills.

In the next section, I will explore how language, in particular verbalization, is related to the early development of executive function. With regard to social understanding, research has focused on areas ranging from the vocabulary level to syntactic understanding. However, it seems that researchers' attention may be rather different when they consider executive function. That is, it seems that external verbalization, from mostly caregivers, plays a role in the regulation of behaviour (Carlson, 2003), and, in consequence, that cultural practice is bound to influence the formation of executive skills (Lewis et al., 2009). In this thesis, I will explore the role of verbalization in order to seek a possible explanation for recent research on Korean preschoolers' high performance on certain executive tasks (Oh & Lewis, 2008), speculating that the early exposure of the linguistic specific markers implying control might support a child’s performance in self-regulation tasks. Thus, reviewing a history of children’s self-regulation from an early age to the preschool period would help in explaining the objective of this thesis.

1.3. An influence of language on executive function?

Executive function is a cognitive construct which involves goal-directed behaviour along with self-control, regulation, planning, and flexible set shifting (Welsh, Pennington, & Groisser, 1991). The relationships between self-regulation and language abilities are shown from very early period of toddlerhood (Carlson, Mandell, & Williams, 2004; Kopp, 1982; Vaughn, Kopp, & Krakow, 1984). Research has shown that children’s ability to control behaviour is positively related with language abilities such as usage of vocabulary and mental state terms at between two and three (e.g., Carlson, Mandell, et al., 2004). In their longitudinal study, for example, Carlson, Mandell, et al. (2004) conducted a correlational study over 15 months regarding the relationships between executive function and theory of mind including linguistic abilities. Batteries of inhibitory control (both conflict and delay inhibition) were used. To measure linguistic abilities, parent questionnaires for the production of communicative and mental-state words, the levels of vocabulary and verbal ability were examined. The correlations showed that children’s use of mental state words (by parent report) was significantly related to inhibitory control at 24 months, and remained so at 39 months. Furthermore, verbal ability at 39 months also predicted performance of executive function skills. The study suggests that children’s own speech was correlated with the development of self-control. As the research shown and also mentioned earlier, it seems that execution of the executive skills may rely on verbalization at an early age. Thus, I will explore the development of executive function by verbalization in this section.

According to Luria (1961), young children show marked progress in self-control.

First, control of behaviour appears initially to be influenced by external environmental demands such as explicit verbal regulation from others, and then self-verbalization without understanding of semantics influences their behaviour. Then their control of behaviour is transited to the next step in which they use language for self-regulation; that is, meanings of vocabulary function to regulate motor behaviour. As an example of this view, Tinsley and Waters (1982) conducted an experimental study in order to determine whether self-regulation during early childhood (at the age of two) was mediated by verbal instructions. For a comparison of effects of verbalization, the children in the silent group were asked not to vocalize when they hit a peg once. In the overt verbalization group, three different instructions were given. In the one version, the children had to say ‘one’ simultaneously as they hit the peg, while in the toy version, instructions were to say ‘toy’. These differences in instructions were made to examine whether the semantics of the two words were related to control in the children’s act to hit the peg once. In the final version, the children were asked to verbalize one first and to act in order to probe whether verbalization played a role in regulating subsequent behaviour. The findings showed first that there was a significant difference between groups; children in the overt group outperformed those of the silent group. Secondly, children’s performance in the one and toy versions was parallel. However, children who received the one-then-hit instruction showed the decreased performance. The findings seem to suggest that explicit simultaneous verbalization tended to regulate motor behaviour and, importantly children’s self-regulation at the early age was merely influenced by vocalization regardless of an understanding of semantics.

A further example of the developmental progress in the use of verbalization comes from the research with preschool children by Kirkham, Cruess, and Diamond (2003). They conducted an analysis of a dimension-switching task with 3-year-old children who are known to show difficulty in sorting cards according to shape or colour. In a standard DCCS (dimensional change card sort), for example, children are presented with target cards (e.g., a yellow car and a green flower) and receive test cards (e.g., yellow flowers and green cars). They are asked to sort the test cards according to one dimension (e.g., shape or colour), and then after a number of trials they are told to do by the switched dimension. With regard to the procedure, 3-year-old children tend to make errors on the later dimension maintaining the former rules (Zelazo, Frye, & Rapus, 1996). In order to explain the 3-year-olds' difficulty, Kirkham et al. (2003) compared four conditions: standard, sleeve, label and face-up, testing whether redirection of children's attention and increased or decreased demands of inhibition were responsible for their responses. As this section focused on verbalization, the label condition and standard version will be discussed here. In the label condition, children were asked to pronounce the relevant dimension instead of an experimenter. For example, in the standard condition, the experimenter says, "Here is a red one, where does it go?" However, this labelling was pronounced by the children, such as "a truck" or "blue" when the experimenter asked "what's this one?", and before she asked "Where does it go?" That is, the relevant dimension was clarified by the children. It seems that this procedure may refocus children's attention to the dimension of the post-switch trials and increase their ability to suppress the old rule. The findings showed that 3-year-olds' performance on the label condition was significantly better than those on the standard task although the effect of labelling was not shown in 4-year-olds, as they showed no difficulty on the standard version (92% success). Kirkham et al. concluded that labelling by the children themselves for the relevant dimension had a facilitative effect on redirecting their focus, suggesting that verbalization may mediate young children's regulation (Barkley, 1997).

To my knowledge there is no research suggesting the link between the mentalistic language and executive function as shown from the research on social understanding. However, research with Japanese children showed the possibility of influences of mentalistic expressions on executive functioning. Moriguchi, Lee, and Itakura (2007) conducted a series of experiments focusing on whether young children's performance on the DCCS task was influenced by attitudes of an adult model. In Experiment 4, 3- and 4-year-old children and an adult model performed the DCCS task. First, the children observed the adult model's performance by either shape or colour (i.e., pre-switch trials); however, the model performed incorrectly throughout the trials. The adult model then was asked whether she sorted cards correctly. The adult model's response varied according to conditions. In the unconfident condition, the model expressed her uncertainty (i.e., 'I don't know. I am not sure.'), whereas the model responded with certainty (i.e., 'yes'). The children then sorted cards by the different dimension (i.e., post-switch trials). They found a significant difference in the 3-year-olds according to the conditions. When the model was confident, the 3-year-olds made perseverative errors using the old rule even though they did not perform the pre-switch trials. On the contrary, the children in the unconfident condition were more likely to perform using the new rule. The children in the unconfident condition were significantly better than those in the confident one. That is, the findings by Moriguchi et al. (2007) seemed to suggest that references to mental state guide to children's specific behaviour (Lewis & Carpendale, 2009). Therefore, this research suggests a need to look further at the relationship between mentalistic language and executive function.

In sum, the research on toddlers seems to suggest that verbal mediation, mostly their own speech, may contribute to their regulation of thoughts and action. However, as the evidence mentioned earlier showed, it appears that the research has focused on children's private speech, and there seems to be no sufficient evidence of the role of verbalization from others on children of the preschool age. Thus, this thesis explored whether verbal input in social interaction was a contributing factor supporting executive control. In the research on Eastern children, the researchers have reported that Northeast Asian preschoolers tended to show higher levels of self-control than Western children (e.g., Oh & Lewis, 2008; Sabbagh et al., 2006). For better self-control skills, the researchers suggested a cultural effect which might encourage their executive skills. In order to explore one reason for this effect of culture, which would be bound to adults' input to children, this thesis used linguistically specific suffixes which vary a speaker's certainty. In other words, it explored whether children's understanding of semantics to express mental states influenced their self-regulation.

This thesis also employed a relatively new paradigm, selective trust, which allows us to explore children's cognitive development in terms of their mental processes of others' epistemic states. Thus, in the next section, I will explore how and when children are selective in attending to and making judgments about others' testimony.

1.4. Children's selective trust in others' testimony

Over the past decade there has been much speculation on the issue that in advanced industrial cultures much of what we learn comes to a large extent from indirect sources, relying on what others say. It is important to distinguish for both children and adults what is reliable information for successful communication (Koenig & Harris, 2005a). It seems that what has been labelled as 'selective trust' has not been as closely defined and examined as the voluminous research on theory of mind or executive function. However, most researchers in this growing area consider children's capacity for assessing others' trustworthiness from testimony taking account of mental states as selective trust (Koenig & Harris, 2007). Thus, I will use the term of selective trust as children's ability to evaluate the reliability of another's statement or label. In this area, researchers use epistemic trust interchangeably with selective trust because it is regarded that children consider others' epistemic status when making judgments (Koenig & Harris, 2007). Some researchers have raised concern over the term of epistemic trust, holding the view that children may not make epistemic inferences about knowledge states (Lucas & Lewis, 2010; Nurmsoo & Robinson, 2009a). In this thesis, however, according to the perspective of Koenig and Harris (2007), I will use the two terms interchangeably.

In this section I will explore evidence of the relations between evidential markers and selective trust and proceed with research on the development of young children's epistemic trust regarding their ability to differentiate between reliable and unreliable sources. The classic paradigm for selective trust presents children with two speakers who are contrasting in reliability and they are then asked to assess conflicting verbal statements on unfamiliar objects (e.g., Koenig, Clément, & Harris, 2004). In this paradigm, children are considered to build trustworthiness based on the speaker's and their own beliefs and then to carry over the reliability for novel information. In terms of reliability, research has shown that children's ability to discriminate accurate over inaccurate speakers (e.g., Birch, Vauthier, & Bloom, 2008; Corriveau, Meints, & Harris, 2009; Koenig & Harris, 2005b; Pasquini, Corriveau, Koenig, & Harris, 2007) and to recognize the different degrees of confidence is a cue to credibility (e.g., Jaswal & Malone, 2007; Sabbagh & Baldwin, 2001). Although vigorous research has been conducted for more than a decade regarding what influences children's judgments on trustworthiness, I will explore research on accuracy and certainty to understand children's development of selectivity because grammatically embedded evidential markers function to indicate both speakers' perceptual access and the degrees of certainty. As mentioned earlier, verbal information is fundamental for communication, and there is evidence that children who are exposed to evidential markers tend to be more sensitive to reliability than those without such linguistic expressions (e.g., Lucas et al., 2013: see below). That is, it seems that children may develop a grasp of epistemic trust around 3- to 4-years of age. However, different verbal input may influence their judgement and it is hoped that looking at children's construction of trust will provide grounds for the examination of evidential markers in this thesis.

An empirical study of children learning different languages with/out obligatory linguistic markers for sources of information offers support for this assumption. For example, Lucas et al. (2013) conducted a comparative study focusing on whether linguistic (i.e., evidential markers) experience might lead to judgments of trustworthiness by mentalistic appraisals of others in Turkish-, Chinese- and English-speaking children. They employed the flexible trust task, which examined children’s ability to judge flexibility based on informants’ expertise in different domains of knowledge. For example, one informant expressed her knowledge accurately in one domain (e.g., animals); however, she was not expert for the other domain (e.g., toys) in the trust stage. On the other hand, the other informant showed her expertise in the other area of knowledge; that is she provided accurate information on toys but not on animals in the switch trust stage. The children then had to decide to endorse labels of novel objects of each domain. Finally, in the flexible trust stage, the children were asked to label names of novel objects from either domain taking into account the informants’ knowledge. The children were required to exercise flexible learning based on others’ epistemic states. They hypothesised that Turkish 3-4 year olds, who are exposed to a language that contains several evidential markers, would show more precocious judgments about an informant’s accuracy. They also examined the roles of false belief and executive function in these skills. They found relationships between the exposure to evidentiality and children’s development of beliefs. All children from the three cultures showed selectivity learning from the accurate informant in the trust and switch trust stages. However, there were significant differences in the flexible trust stage (i.e., moving from one informant’s area of expertise to the other informant’s area). English and Chinese children did not show preferences for the accurate informant regarding each domain of knowledge, whereas Turkish children correctly and flexibly endorsed the novel labels. Importantly, Turkish children’s selective learning was notably precise over the other groups. Furthermore, Turkish children's false-belief understanding was also better than that of children in the other two cultures. They suggested that the exposure to evidential markers, which reflect how speakers have obtained information, may sensitise children to others' knowledge states, and this may lead to sensitivity to reliable sources of information. That is, it seems that children who use evidential markers in their spontaneous speech might have more opportunity to evaluate others' states of knowledge.

Another source of evidence in favour of evidentiality for reliability comes from a study of children's suggestibility by testimony from Aydin and Ceci (2009) that compared an understanding of markings of different information sources in Turkish children. A difference from the study by Lucas et al. (2013) is that Aydin and Ceci manipulated the uses of evidential markers within a language, whereas Lucas et al. compared different cultures, in particular those which have the system of evidentiality, versus those that do not. Aydin and Ceci explored the role of evidential markers in access to knowledge focusing on whether the acquisition of evidentiality would assist children in judging information and drawing the correct inference. They claimed that evidential users of Turkish would be susceptible to proposed information which differed in the sources of knowledge and they would be prone to misinformation which was expressed by a marker of direct access with higher reliability. In their investigations, 3- to 6-year-old Turkish children heard a misleading story by two narrators who differed in their perspectives in telling the story. Two different evidential markers were used: *-DI* (I saw) and *–mIs* (I was told). The former was to indicate that a speaker had directly perceived an event and the latter was to state that the speaker had learned through hearsay. Once they were told the story, a different speaker told the same story using the other perspective from the first stage. This strategy of switching perspectives by evidential markers was used to examine whether the children's suggestibility of testimony was changed according to the reliability of the linguistic expressions. They found associations between the differential markers and the children's suggestibility. The 4-year-olds (on average) who heard the original story from the direct perspective tended to resist misleading information from the later story (i.e., the indirect perspective). On the other hand, those from the indirect perspective equally accepted misinformation regardless of the sources of the story. The 5-year-olds showed an understanding that the marker indicating the event had been directly witnessed reflected the higher degree of reliability than the hearsay marker. These findings would suggest that grammatical evidentiality may function to underline speaker credibility in young children. Thus, it would be appropriate to speculate that children who have been exposed to the grammatical system with evidentials might show sensitivity to the different degrees of reliability at a relatively early age. Considered together, the evidence suggests that children's construction of knowledge heavily relies on verbal input from others, but they do not accept information indiscriminately. Rather they become selective to people's assertions from visible objects to beliefs (Harris & Koenig, 2006). More importantly, language is an efficient way to highlight the credibility of what people say (Harris & Koenig, 2006).

Thus, it seems possible that expressions which stress sources of evidence may adjust the reliability of others' testimony. In order to probe this question Korean children will be exposed to two evidential markers which differentiate speakers' perceptual access to information and their degrees of certainty. Children's judgment on statements by evidential markers will be compared to those of relevant verbs which express speakers' knowledge status. This comparison will allow us to understand whether children's trust from different linguistic references would be in favour of evidentiality over the relevant verbs. As described earlier, children by the age of four come to understand differential beliefs by mental terms such as *know* and *think* (e.g., Moore et al., 1989). In contrast there is research suggesting children, who are familiar with evidential markers in their languages as mentioned earlier, are able to mark knowledge sources at a relatively earlier age (e.g.,Aksu-Koç, 1988; Choi, 1995), although the findings from Korean children by Papafragou et al. (2007) did not show that children's ability to distinguish reliability was attributed to language with the use of evidential markers. Therefore, this thesis examined whether markers of speakers' knowledge of the source of a label might have a role in young Korean children's judgment on reliability and influence their selective trust.

Evidence for when or how children become selective to what they are told comes from studies showing the age-related development. As mentioned above, the contemporary body of research in selective trust has shown that young children evaluate informants' past history of accuracy and prioritise information from a reliable person. But it seems that there is a developmental gap in selectivity. That is, 3-year-olds tend to be indiscriminate in their assessment of verbal information but 4-year-olds are more likely to differentiate speakers' reliability according to their in/accuracy. For example, Koenig and Harris (2005b) showed 3- and 4-year-olds three familiar and unfamiliar objects each (Experiment 1). In a series of video clips, one unfamiliar individual consistently provided names of the familiar objects correctly (e.g., calling a ball 'a ball'), while the other individual labelled incorrectly (e.g., calling a ball 'a shoe'). After three consecutive labelling trials, the children were asked to identify who provided wrong answers. Then they were shown three unfamiliar objects. In the film, the two informants supplied conflicting novel labels for the unfamiliar objects (e.g., 'a mido' or 'a loma'). Before and after each trial, the children had to point to whom they favoured for novel information and to endorse labels of the unfamiliar objects. They found that the 3- and 4-year-olds showed general accuracy in identifying who was inaccurate in labelling the familiar objects. However, there was a marked difference in seeking information and learning novel words. That is, the 4-year-olds, but not the 3-year-olds, preferred to ask and to endorse novel names from the previously accurate informant.

Similarly, in follow-up studies, Corriveau and Harris (2009a) explored whether children could trust selectively based on accuracy even when informants' familiarity had been already established. They examined whether the effects of accuracy were mediated by a familiar informant's errors. In this procedure half of 3- and 5-year olds watched a film in which a familiar individual was correct while an unfamiliar individual was incorrect. The rest watched a film in which the informants' accuracy was reversed. Prior to watching the informants' relative accuracy (accuracy trials), the children received tasks in which they needed to endorse labels and functions of novel objects (pre-test trials). They then received another set of tasks with novel objects (post-test trials) to identify who said the right or wrong things and who was a better informant. Corriveau and Harris found that at first children in three age groups tended to side with an informant who was familiar to them for the novel objects and functions before they watched the informants' correctness. Among them, the 3-year-olds were less accurate in judging who provided right answers than those in the older groups. Importantly, however, there was an age-related shift in selective trust after differential accuracy of the informants had been displayed. The 3-year-olds continued to endorse information from the familiar informant. In contrast, the 5-year-olds distinctively judged the informants' reliability based on the recent accuracy; that is, they regarded the unfamiliar informant as a reliable source of information when she was correct. Similarly, the 4-year-olds showed a tendency to take accuracy into account over familiarity when the familiar informant was incorrect. That is, these studies seem to suggest that accuracy is a critical factor on reliability based on children's beliefs and, by four years of age, they might be able to discriminate others' trustworthiness. It appears that 3-year-olds may have limited ability to differentiate sources of information.

Although the studies described above identified 3-year-olds' difficulty in selective trust, another source of evidence has shown that young children's selectivity can be differently observed by how information is conveyed. Three-year-olds were also able to learn words selectively when informants' beliefs or knowledge status were expressed differently. That is, 3-year-olds were more likely to receive information from confident over uncertain speakers. For instance, Jaswal and Malone (2007) showed that 3-year-olds were sceptical about a speaker's testimony which contained a linguistic hedge (Study 1). In the procedure, hybrid objects (e.g., a key-like object referred to as 'a spoon') were used in order to probe whether young children were robust in their trust in informants' assertions when they had a mere belief about the appearance of artefacts (i.e., children regarded a key-like object as a key but not a spoon). Regarding the informant's levels of confidence, in the standard condition, for example, she spoke with confidence as "this spoon" for the key-like object, whilst in the think condition, she used a linguistic expression of uncertainty, as "I think this is a spoon". The children then were asked to show a function of the object. Jaswal and Malone found that the 3-year-olds were more likely to infer functions of artefacts according to the informant's labelling when she was confident, whereas they tended to ignore her assertions when she expressed uncertainty. The findings were marked. Approximately two-thirds of the children in the standard condition performed the functions of the hybrid objects while only one-third of those in the think condition showed according to the statements of the speaker. That is, it is apparent that children's credulity was significantly dependent on the degrees of assertion of the speaker, and children were more likely to be receptive one's certainty rather than uncertainty. The findings seem to suggest that children as young as three might be capable of being critical in testimony taking account of the expressions of others' epistemic states.

Taken together, the studies on selective trust seem to suggest that under some circumstances young preschoolers, between 3- and 4-years old, might determine who provides relevant information and is a reliable source of information. Although the evidence suggested that 3-year-olds could be sensitive to verbal cues, it has been found that they were less likely to discriminate the credibility of a source than older preschoolers. Thus, it appears that it is important for young children to understand sources of information in order to exercise selective trust. In terms of this aspect of communication, evidential markers might play an important role in developing selective trust, providing an intensive way of how the source of knowledge originated (Robinson, 2009). Accordingly, it is expected that if the sources of information were obviously expressed in verbal cues, children's selective trust and learning would be facilitated by explicit linguistic expressions. That is, it explored whether linguistic differences contributed to young children's judgment on others' epistemic states.

In the following section, I will describe how a series of experiments was constructed in this thesis to investigate whether Korean certainty/evidential markers may play a role in shaping thoughts.

1.5. This work

A series of experiments presented in this thesis examines how language marking one's knowledge states is related to children's reasoning about what others think or know. For children's epistemic understanding, two frameworks in the developmental research are mainly explored: false beliefs and selective trust. There is a wealth of research on social understanding; however, there is only a handful of studies about specific effects of the grammatically embedded markers on social understanding. Selective trust would be in line with an understanding of beliefs, given that the paradigm is to demonstrate whether children gain perceptual access of others and judge their beliefs. For this reason that both frameworks are to understand children's mental state attribution (Koenig & Harris, 2005a), false beliefs and selective trust measures are included in this thesis. Executive function is also employed in this thesis in order to examine whether performance on key tasks is influenced by linguistic references. In addition, the use of executive function resides with the role in the development of social understanding. With regard to language, certainty by the grammaticalized markers is applied to social understanding and executive function to differentiate the role of each in preschoolers' grasp of beliefs. On the other hand, evidentiality, indicating sources of information such as direct witnessing of an event as opposed to inference or hearsay (Aikhenvald, 2004), is employed to distinguish why narrators provide different information for the same objects, particularly in the selective trust paradigm.

Language contributes to children's understanding of humans as mental beings (Astington & Baird, 2005), and is central to engaging higher cognitive processes, notably planning, memory, and inhibition (Vygotsky, 1978). Based on this view, this thesis explored the role of language on children's social-cognitive development, focusing on the specific linguistic form which is grammatically embedded and expresses one's epistemic states. There is a vast body of research on the facilitative role of language on children's social understanding as reviewed in the previous sections. As the research has been mostly conducted in Western society, in particular with English speaking children, English mental verb terms such as *think* or *know* have been at the centre of research. However, some languages which enable speakers to express their mental states by grammaticalized markers, apart from the mental verb terms, and the specific linguistic form has received little attention. Korean is one of the languages which have the grammaticalized system identifying certainty and evidentiality. Thus, this thesis employed grammatical certainty/evidential markers to investigate whether the use of the language form has a promoting role on children's cognitive development.

The major objective of this thesis is to examine whether the exposure to specific linguistic expressions connoting one's epistemic states facilitates young children's perceptual access and conceptual understanding of beliefs. In order to answer this question, as described above, the thesis involves three domains of the cognitive development in a series of experiments: false-belief understanding, executive function and selective trust. It is hoped that the findings will contribute to the role of language in children's cognition, providing insights into whether or not specific linguistic features which are bound to cultural experience might improve children's capacity to grasp an understanding of others' epistemic states. The first and second experiments (Chapters Two and Three) explore whether or not different degrees of certainty by Korean inflectional expressions influence children's understanding of false beliefs and the level of executive function. There is evidence that children, who are exposed to obligatory particles, acquire epistemic meanings at a relatively early age (e.g., Choi, 1991; Matsui, Yamamoto, & McCagg, 2006). Hence, it is hypothesised that mental-state expressions in communication by un/certainty inflectional particles would facilitate Korean 3-year-olds' access to beliefs (Chapter Two). This prediction is also based on existing research that has shown that the acquisition of epistemic expressions such as *think* or *know* is critical in the development of mental state understanding (Johnson, 1982; Lohmann & Tomasello, 2003; Moore et al., 1990; Olson, 1988). Regarding executive function, it is hypothesised that a linguistic expression marking higher certainty would facilitate children's performance. This hypothesis is based on empirical research showing that mentalistic expressions influenced young children's executive functioning (Moriguchi et al., 2007). With regard to the relationship between false-belief understanding and executive function, studies suggest that executive function predicts performance on measures of social understanding (Carlson & Moses, 2001; Carlson et al., 2002; Sabbagh et al., 2006). Thus, it is hypothesised that a role of executive function on false-belief understanding would be observed in Korean children if the relationship between the two skills reflects a general pattern.

It appears that children's understanding of beliefs varies depending on their exposure to either uncertainty or certainty, from the findings of the first experiment in this thesis (Chapter Two). Research has shown that children are sensitive to a speaker's knowledge status at an early age and they are more likely to take information from one with higher certainty (Jaswal & Malone, 2007; Sabbagh & Baldwin, 2001). Thus, it is hypothesised that children's understanding of beliefs would be related to the degrees of certainty rather than the exposure to mentalistic expressions, which were grammatical un/certainty markers used in false beliefs tasks in this study (Chapter Three). As mentioned earlier, this thesis used two types of measures for social understanding. One of the measures, false-belief understanding is used in the first two experiments, and the third experiment (Chapter Four) moves to the domain of selective trust, investigating children's discrimination on testimony in favour of certainty and accuracy which are expressed by Korean evidentiality. As noted earlier, children have shown sensitivity to others' confidence (Sabbagh & Baldwin, 2001) and correctness (Koenig et al., 2004; Pasquini et al., 2007). Hence, it is hypothesised that if Korean children appreciated evidential markers, they would selectively learn from certain over uncertain, and from accurate over inaccurate, informants.

This thesis set out to explore whether access to epistemic expressions by the grammaticalized system would facilitate children's early acquisition of social understanding. For this question, two different linguistic forms to mark epistemic states are used in Experiment 4 (Chapter Five). The performance of selective trust by evidential markers is compared with equivalent mental-state verbs which are not grammatically embedded in order to understand whether children's competence in selective trust is derived from the use of specific linguistic markers. It is hypothesised that if children's understanding of epistemic states varied with linguistic references and was sensitised by evidential markers, their demonstration of selective trust would be observed earlier by evidential markers than equivalent verbs. This prediction is based on research suggesting that children who learn to use a language with a grammaticalized evidential system are more likely to be sensitive to others' beliefs at an earlier age (Aksu-Koç & Alici, 2000). Finally, executive function is used as a measure to explain children's ability to assess speakers' reliability and learn from a reliable source along with the effects of linguistic expressions (Chapter Six). Executive function encompasses higher order cognitive skills which facilitate goal-directed behaviour by allowing planning, inhibition or cognitive flexibility (Welsh et al., 1991). As selective trust requires engaging with more reliable information inhibiting an irrelevant source, the role of executive function on selective trust would be expected. The selective trust paradigm used in this thesis mainly requires judging reliability and learning selectively. As questions of selective trust differ, the link with executive function would vary according to the nature of the questions. Thus, it is hypothesised that children's judgment on informants' accuracy would be related to their capacity to hold information. In addition, it is hypothesised that children's learning from a reliable informant would be related to the ability to switch between responses or to suppress irrelevant stimuli in the selective trust measure. Two experiments on certainty and three experiments on evidentiality are presented which vary in terms of the grammatical forms that are used to ask key test questions.

The title of this chapter asks if we should study the role of linguistic markers in social cognitive development. From the literature reviewed above the answer seems to be 'yes'. In each of the following studies, specific hypotheses are raised concerning the role of linguistic access in children's grasp of beliefs, speaker certainty and in their ability to exert control in executive function tasks. In Chapter Two, Three and Six, one aim is to explore the three-way relationship between social understanding [false belief or epistemic trust], executive function and the child's grasp of certainty.

Chapter Two: **Do certainty markers facilitate 3-year-olds' false-belief and executive function performance?**

2.1. Experiment 1

Chapter One reviewed how language acquisition is intertwined with the development of children's social understanding and executive function. In particular, it suggested a possible effect of certainty/evidentiality expressions by the grammatically embedded system in facilitating the cognitive development. In order to explore whether different degrees of certainty would promote or hamper Korean 3-year-old children's cognitive development, the first experiment used two false-belief and executive function tasks each. This experiment had two main objectives. First, as mentioned above and in Chapter One, it explored whether others' un/certain expressions about a belief in communication would lead to children's successful prediction of behaviour and advanced ability to regulate their thoughts and actions. The second aim was to explore the relationships between social understanding and executive function, focusing on whether findings by Oh and Lewis (2008) which showed a non-parallel development of the two cognitive abilities in Korean children would be replicated, as this experiment was performed in Korea. That is, the experiment explored two different effects on measures. First, it investigated whether certainty markers affected false-belief understanding and executive function, respectively. Secondly, the experimenter also explored effects of executive function on false-belief understanding. Thus, this chapter will explain the manipulation of a false-belief task and the uses of executive function tasks. Lastly, it will introduce the specific markers which were used in the measure in order to vary the degrees of certainty.

The study focused on 3-year-olds. There are consistent finding of 3-year-olds' failure in an understanding of mind (e.g., Carlson & Moses, 2001; Gopnik & Astington, 1988; Perner, Leekam, & Wimmer, 1987; Wellman et al., 2001; Wimmer & Perner, 1983). A meta-analysis from 178 studies with typically developing children by Wellman et al. (2001) showed a developmental pattern of understanding of false beliefs. The findings showed that there was a marked progression in the conceptual understanding of beliefs at around 4-years of age. Children's performance on false-belief tasks changed from below-chance at 3.5-years (and younger) to above-chance levels at 4-years (and older). That is, children younger than 3.5-years tended to err, whereas children older than 4 years were more likely to predict a protagonist's beliefs. Accordingly, it seems that 3-year-olds' difficulty in understanding of minds may be a universal trend. Along with such developmental change in social understanding, as mentioned in Chapter One, it has been argued that the development of social understanding is related to a grasp of mental verbs such as *think*, *know* and *believe*; that is, the mastery of such verbs and an understanding of false beliefs emerges at roughly the same age, around four years (Moore et al., 1989; Moore et al., 1990). In other words, the existing research has suggested that an understanding of minds is interwoven with the acquisition of linguistic expressions to identify beliefs.

As noted in Chapter One again, however, research has suggested children who learn a language which has a highly grammaticalized system to express certainty/evidentiality attributing to knowledge were more likely to acquire mental-state expressions at an earlier age than those without such a linguistic structure. Evidence of this view that the use of different linguistic references affects children's acquisition of false-belief understanding comes from research on Cantonese-speaking children. For example, Tardif, Wellman and Cheung (2004) conducted a study with Cantonese-speaking chilren varying words in test questions of false-belief tasks in order to discover whether lexical differences had effects. Two different verbs, *nam5* (to think/believe) and *ji5wai4* (to falsely think/believe), were used in the tasks as the verbs include neutral and false beliefs, respectively (*nam5* / *ji5wai4* as used in original). For example, children were asked what they ‘thought’ was inside a Smarties tube in the unexpected contents task. To differentiate implications of ‘thought’, either *nam5* or *ji5wai4* was used in the test question. They found a signficant difference in performance on a series of false-belief tasks. That is, when a verb for false beliefs (i.e., *ji5wai4*) was used, the children’s performance was significantly better than those who received the questions involving the neutral belief verb (i.e., *nam5*). For example,4-year-old children’s mean score was approximately 0.6 out of 1 when *ji5wai4* was used to refer to *think* in the unexpected contents task, whereas those in the *nam5* group scored zero. That is, the findings seemed to suggest that we may need to take another look at lexical marking beyond mental-state verbs. Thus, it seems possible to speculate that young children may attribute false beliefs to others when grammaticalized mental terms are used in a false-belief task, as such markers may be obtained earlier in Korean children. Thus, this experiment focused on 3-year-olds in order to investigate whether the use of the Korean specific markers for beliefs would evidence the view of the link between mentalistic language and false-belief understanding.

In order to apply Korean markers, the study manipulated a standard false-belief task. Recently, Matsui et al. (2009) conducted similar research to the current study, suggesting a facilitative role of Japanese certainty markers on false-belief understanding. They also modified the standard task for the uses of certainty expressions and showed improved performance compared to the task without expressions. Japanese, but not German, children showed a better understanding of another’s false beliefs, as Japanese epistemic terms which were used in the task were grammaticalized (see also Chapter One). However, it seems possible that the Japanese children’s improved understanding of false beliefs might have resulted from the fact that they had modified the task in two ways: by accentuating the protagonists’ conflicting beliefs as well as using specific linguistic expressions to mark location (e.g., The marble is in location A –*yo*, not in location B –*yo*). This contrasts with the standard procedure in which children have to infer a story character's belief (following Wellman & Bartsch, 1988). Wimmer and Perner (1983) suggested that children's difficulty in false beliefs stemmed from the fact that they had to consider two contrasting their own and others' beliefs. However, although the task which Matsui et al. used also required the 3-year-olds to take into account conflicting beliefs (Wellman & Bartsch, 1988), it seems possible that the conflicting belief against the child' own belief might be more explicitly expressed by a statement which included the negation of a location. A task which involves the original and new locations of a target object simultaneously might be relatively straightforward for children in predicting the story character's behaviour compared to the standard task. Thus, in order to rule out this possibility, this experiment employed an explicit false-belief task because in the task the protagonist explicitly states what he thinks, and this expression was necessary to probe the uses of Korean markers. Originally, the explicit task was devised to enhance the salience of the protagonist's belief; however, children's prediction was not improved by the task (Wellman et al., 2001). It is hoped that if Korean 3-year-olds showed an understanding of a mind in the explicit task with the specific markers, it would indicate that the use of markers facilitated the access to others' mental states.

Executive skills were measured by each inhibitory control and set shifting task. Prior to explaining the use of the tasks, it would be necessary to explore briefly the relationship between mental state understanding and executive skills. Perner and Lang (1999, 2000) explain the relations between the two cognitive skills with five theories. First, the development of executive function depends on theory of mind. Secondly, executive function is a prerequisite for developing theory of mind. Thirdly, both executive function and theory of mind require the reasoning ability with embedded conditionals. Fourthly, both cognitive skills are meditated by a common region of the brain. Lastly, the executive components involved in theory of mind tasks cause the difficulty of the tasks. Although the nature of the relationships can be explained by such theories, I will not explore the research literature behind each of the five theories, because it goes beyond the scope of this chapter – longitudinal research would be needed to tease apart the causal links. However, I will look at the explanations which emphasise the role of executive function on a mental state understanding because one existing study on Korean children showed distinctive findings with the relationships while studies on children in Western and Eastern countries offered support for the theory (e.g., Carlson & Moses, 2001; Carlson et al., 2002; Carlson, Moses, & Claxton, 2004; Frye, Zelazo, & Palfai, 1995; Oh & Lewis, 2008; Sabbagh et al., 2006). That is, the current experiment focused on the view that executive function supports children's ability to understand others' false beliefs. These studies listed above will explain the use of two components of executive function in this and next experiments.

The view which is argued by Russell (1996), that self control is essential to grasp a conceptual understanding of mind, has been well supported by Stephanie Carlson and her colleagues. Throughout a series of studies, they have suggested that conflicting inhibitory tasks (Carlson & Moses, 2001; Carlson et al., 2002; Carlson, Moses, et al., 2004) share variance with social understanding measures. That is, individuals who show better abilities in suppressing predominant responses are more likely to perform better on theory of mind tasks. For example, Carlson and Moses (2001) found that inhibitory control was strongly correlated (r = .66) with a battery of social understanding measures from 107 3- and 4-year-old children, and the correlations remained significant when age, gender and verbal skill were ruled out, suggesting that inhibitory skill is crucial to reasoning of beliefs. In a subsequent study, Carlson et al. (2002) examined a broad range of executive measures including inhibitory control and working memory in order to explore the contribution of such skills to a false-belief understanding. Again, they confirmed that conflict inhibitory control (i.e., to inhibit inappropriate prepotent responses), but not delay inhibition (i.e., simple delay control), and working memory was significantly related to false-belief measures controlling for the age and intelligence scores. That is, these studies seemed to suggest that the ability to inhibit a dominant response and to initiate an alternative perspective might be at the heart of a mental state understanding. Although there is evidence that working memory capacity also explains children’s development of social understanding (e.g., Davis & Pratt, 1995; Gordon & Olson, 1998; Hughes, 1998), this and following experiments used inhibitory control as the chapters aimed to explore influences of linguistic expressions on Korean children’s advanced executive skills but did not seek to find individual contributions of executive function to social understanding. Therefore, a conflicting inhibition task (i.e., a Day/Night task) was adopted in the current and following studies.

Another component of executive function used in this study was set shifting (or attentional flexibility) which requires flexible judgment. The argument according to the cognitive complexity and control (CCC) theory is that the ability to alter between rules is highly correlated with reasoning of minds (Frye et al., 1995). The switching task is generally administered by the dimensional change card sort (DCCS) task. A number of studies showed a close link with performance on this task with social understanding. For example, Müller, Zelazo, and Imrisek (2005) conducted correlational studies between an understanding of false beliefs and false photograph and performance on the DCCS task with children of three to six years. In the false photograph task, a picture of an object was taken and then the object was removed from a scene. They used the false photograph task in which the photograph represents a past state of affairs, assuming that the procedure does not include strong executive demands as in the standard false belief task; that is, the task may simply require children’s reasoning ability to describe the contents of a developing photograph rather than employing higher order rules required in the false belief task. Along with such tasks, the children’s understanding of the truth or falsity of a statement and verbal intelligence were evaluated. Müller et al. (2005) found significant correlations between false belief/false photograph and DCCS tasks. However, logistic regression analyses controlling age and verbal intelligence showed that performance on DCCS, but not on other tasks, predicted understanding of false beliefs, suggesting that the flexible use of complex rules might underlie the development of an understanding of a mind. The findings showing the relations between executive skills and false belief understanding are also congruent with research on other children in Western (e.g., Carlson & Moses, 2001; Perner, Lang, & Kloo, 2002) and Eastern (e.g., Sabbagh et al., 2006) countries. Taken together, the current study used two executive tasks, each of which is of inhibitory control and set switching (i.e., the Day/Night and DCCS tasks) based on empirical research showing the role of executive function on an understanding of mental states, in order to explore the relationships in Korean children along with effects of linguistic expressions.

Children were given just one of the two tests of executive function because Lewis (2008) found in an analysis of a test battery of executive tasks that there were carry-over effects between related tasks, even when they were administered a week apart. Given this potential influence of performance of one task on another it was decided in this and next studies to keep the executive function data as ‘clean’ as possible by administering only one measure to each child. A conflict inhibition task and the DCCS were chosen as these show clear developmental change at age 3-4 and have close links with false belief (e.g. Carlson & Moses, 2001; Kloo & Perner, 2003)

In what follows, I will describe implications of the Korean markers which were used in the measures of social understanding and executive function. As described above, the expressions which vary in the degrees of certainty were used in the change of location task for false belief understanding; that is, in one the protagonist expresses his belief with conviction with *–ci*, while in the other protagonist appears to be uncertain with *–keyss*. -C*i* is a suffix (marker) to express a speaker's beliefs, commitment to the truth of the proposition (Choi, 1995; Lee, 1999), although it should be noted that in the interrogative form it can mean to ask for confirmation, or even to make a suggestion in the imperative context. As the functions of *-ci* show, the marker conveys a number of implications according to contexts such as declarative, interrogative or imperative sentences. However, I will look at the meaning of *–ci* as to conviction because illustrations of the various interpretations of it will be out of the range of this chapter. *-Ci* puts emphasis on the truth of the proposition in which the speaker believes; therefore, it denotes that the speaker declares with confidence in his/her statement, and in this case of a high degree of certainty *–ci* can be understood, for example, "*for sure, definitely, obviously, of course, really, truly, indeed*", etc (Lee, 1999, p. 247). It seems that there are insufficient data to inform us about how often young children use the marker, *-ci*. One available study by Choi (1991), which analysed three young children's utterances regarding most frequently used markers, showed that they started to use the marker productively between 1:10 and 2:5. During the period, the use of *–ci* was observed from one to eight times in a session of 60-90 minutes. Then they produced the marker continuously. That is, the study indicates that children as young as two years start to use the marker appropriately in their own speech. This research supports the use of the marker in this experiment. Thus, *-ci* was used in the false belief task in order to highlight the protagonist's certain belief in the location of the moved object in the story.

In contrast to *-ci*, *-keyss* shows uncertainty. As *-keyss* conveys a speaker's conjecture, the speaker's certainty is relatively weaker than certainty expressions (Lee, 2010). It should be noted that *–keyss* does not convey only a speaker's reasoning but also may convey information about the future or volition (Lee, 2010; Sohn, 1999; Song, 2008). Again, this chapter used *-keyss* as a marker for uncertainty and in this case it may be expressed in English such as *perhaps, may, think, presume,* etc (Sohn, 1994, 1999). It seems that there is no research showing how frequently children produce this uncertainty marker. However, research by Kim (1989) showed that young children produced another uncertainty marker, -*kes kath* (it seems that), when they were between 2:3 and 2:5. Thus, it seems plausible that young Korean children might produce uncertainty markers around two years of age, although the data by Kim (1989) did not exactly provide support for the marker used in this thesis. As the two suffixes of –*ci* and –*keyss* were used, examples of the markers would be necessary to demonstrate how statements with them differentiate the levels of certainty of speakers. For example, the following two sentences identify the speakers' assertions: *Pi-ka oass-keyss-te-la* (It might have rained) and *Nun-i oass-ci* (It snowed definitely). In these sentences, both speakers' assertions are descriptions of their observations. The former assertion is inferred because it identifies that the incident occurred in his/her absence, so he/she cannot make a statement with conviction. In contrast, the latter is a statement that the speaker has direct evidence of what really happened; thus he or she emphasizes the certainty of his/her belief. Thus, although the two speakers convey their beliefs, the former's belief is relatively weaker than the latter's. As shown in the examples, a person's different levels of certainty can be delivered by the linguistic markers without using different verbs or adjuncts. Thus, the two suffixes –*ci* and –*keyss* were used in order to explore whether Korean children's access to the protagonist's belief was differently influenced in the false belief task.

Next, the markers used in the executive function measures will be described. As mentioned in the Introduction of the thesis, it seems that the use of mentalistic language is closely related to the process of self-regulation (Lewis & Carpendale, 2009). Based on this view, the current study explored the link between certainty expressions and executive function in order to probe whether Korean children's skilled performance on executive function (e.g., Oh & Lewis, 2008) was associated with their early exposure to the grammatical markers for epistemic states. In order to perform executive function tasks successfully, a child should understand the rules or instructions of the tasks. In general, the instructions are given in a declarative context (e.g., “You say “day” when you see the moon cards” in the Day/Night task). Thus, a deontic expression which emphasises an agent’s (the experimenter, here) certainty was used for variations of verbs such as say or do in the tasks. This is because a deontic expression such as *must* in English conveys the necessity and a speaker’s certainty, whereas a declarative statement does not necessarily mark with a speaker’s epistemic status (Palmer, 1986). For example, in a statement ‘It must be raining’ the speaker imposes the strong commitment to the truth of the proposition. Thus, the use of the deontic expression denotes the speaker’s certainty. On the other hand, a statement ‘It is raining’ conveys straightforwardly a fact and does not indicate the speaker’s commitment. Taken together, the deontic expression would convey a stronger level of certainty than the declarative expression. In this respect, for an expression of certainty, the present study used –*ya hata* (must) which expresses obligation, (Choi, 1995). The connective –*ya* is a suffix which emphasizes a speaker’s opinion (K. Lee, 1993). When -*ya* is followed by –*hata* (do), the term –*ya hata* indicates a deontic expression *have to* or *must* (Sohn, 1999). For a neutral mark of certainty in a declarative statement, -*hata* (do) was used in the way it was used in the standard executive function tasks. That is, it was expected that the expression –*ya hata* (must) would convey a speaker’s stronger epistemic state than –*hata* (do).

As mentioned earlier, one of the main objectives was to investigate whether language, in particular certainty expressions, would facilitate children’s social understanding and executive skills. In order to answer the question, one hundred and four Korean children between 36 and 48 months participated. It was hypothesized that 3-year-olds’ access to the protagonist’s beliefs with the certainty expressions would be more straightforward compared to the absence of them in the false-belief tasks. Next, it was hypothesized that if the agent’s verbal input enhanced children’s performance on executive function, the use of the more certain expression would lead to their skilled self-regulation and set shifting. As mentioned earlier, the experiment also aimed at discovering the link between social understanding and executive function along with the effects of language on the cognitive skills. Lastly, it was hypothesized that if the relationships between social understanding and executive function found in the research as described earlier were generalized, they would be expected to be replicated in Korean children.

2.2. Method

Participants

Typically developing Korean 3-year-old preschool children were tested (*N* = 104, *M* = 43.3 months, *SD* = 3.26 months, age range: 36.2 to 48.5 months). There were 52 girls and 52 boys. The children were divided into two groups roughly half of which received one of two executive function tasks. For a group with the Day/Night task, 57 children were tested, while 47 children in another group were administered with the DCCS task. For the statistical analyses, the children were divided into two groups in order to investigate age-related differences in performance: 3.0-year-old group (*N* = 30, *M* = 38.9 months, *SD* = 1.72 months, range = 36.2 to 41.6 months) and 3.5-year-old group (*N* = 74, *M* = 45.0 months, *SD* = 1.73 months, range = 42.1 months to 48.5 months). The children were recruited from nursery schools and kindergartens in Phyengthayk, Puchen, Suwon, Hwaseng in Korea, and were from lower-middle and middle-class areas. Following Ethical guidance of Lancaster University, information and consent forms which briefly described the purpose of the study and asked for consent were distributed to parents by head teachers, prior to the data collection using an opt-in procedure.

Measures

Procedure

The children were tested individually in an empty room of their nursery school or kindergarten. The measures consisted of two false-belief tests, one of the two executive function tasks and a vocabulary test. The verbal scale was administered first. One false belief (change-of-location) and one of the executive function (EF) tasks (either Day/Night or DCCS) were conducted in different sessions about a week apart, in order to avoid possible carryover effects from the previous experience on performance. The other false belief task (unexpected contents) was administered last in the second week for the reference of children's mental state understanding. The unexpected contents task did not include the grammatical certainty markers in order to compare performance with the change of location task; therefore, it would be possible to reveal whether there was a facilitative effect of the explicitly expressed belief on children's social understanding. The administration of the change of location and one of executive function tasks was counterbalanced. As linguistic manipulation was used for both change location (i.e., certainty vs. uncertainty) and executive function tasks (i.e., certainty vs. standard), each child was administered either type (i.e., between-subjects for false belief and executive function tasks, respectively).The use of markers between the change of location and one EF task was counterbalanced. For example, half of the children who were administered the certainty version received the EF task with certainty and the rest of children performed the EF task in standard form. Table 2.1 presents the order of tasks of this and the next experiment. It took approximately 10 minutes to administer a single session for each child.

Vocabulary

The subscale of Verbal terms, Information, in Korean-Wechsler Preschool and

Primary Scale of Intelligence (K-WPPSI; Park, Kwak, & Park, 1995) was administered in order to evaluate verbal intelligence. The subscale consisted of six picture and 21 verbal tests. For the picture tests, the child was required to select an appropriate image among six examples (e.g., to choose a gas stove for the question of what your mother uses when she cooks). For the remaining 21 questions, the child was to answer for questions on everyday life or things (e.g., how many legs does an elephant have?). The child was scored in each question following the system: 0 point = no understanding and 1 point = understanding, following clear instructions on each trial concerning criteria for success. The maximum raw score was 27.

Table 2.1

Description of the procedure between the tasks

	Week one		Week two	
	[1]	[2]	[3]	[4]
Task order	Vocabulary	CL (U)	One EF (C) or (S)	UC
		CL (C)	One EF (C) or (S)	

Note. The order of tasks was from [1] to [4]; however, the order between [2] and [3] was counterbalanced. CL: Change of Location. UC: Unexpected Contents. EF: Executive Function. U: uncertainty for CL. C: Certainty for either CL or EF. S: Standard. The UC task was administered without any certainty markers.

False belief measures

The Unexpected Contents task. This task followed the procedure of Perner et al. (1987), and reference was made to Gopnik and Astington (1988) for questions of Self and Other false beliefs. Materials were a familiar box (e.g., a chocolate box) and a pencil inside the box. The children were shown the chocolate box first, but some of the children did not recognize it. In such cases, children were shown anther chocolate box or a band-aid box, each containing a crayon. After the closed box had been identified as being familiar, the closed box was shown to the child. The first control question was given to the child, “What do you think is inside?” When the child showed a sign of not knowing, the box was replaced and the question was repeated. After the child’s response, the experimenter suggested to the child to open the box together. When the child discovered the content inside, the child was asked “What is this?” and she did not give feedback for this question. The child was counted as right when s/he said a pen, pencil or crayon for the object inside. After the child identified the object, she suggested the child to put it back into the box and she closed the box. Then Self (representational change) and Other false-belief questions were given to the child with the counterbalanced order. For the child’s representational change, the child was asked, “When you first saw this box, before we opened it, what did you think was inside?” A forced-choice question (i.e., giving a choice of chocolate or a pencil) was not provided. Prior to the Other false-belief question being given, a puppet named Anne was introduced to the child, and the child was asked, “Here is Anne. She has never seen this box before. If she sees the box closed up like this, what will she think is inside?” Finally, she asked the reality question, “You saw inside the box. What is inside the box?” The reality question was given last. The child was scored 1 point on correctly answering each false-belief question. The child was regarded as having passed either false-belief question, only when the reality question was correctly answered.

The Change of Location task. This task followed the procedure of Wellman and Bartsch's (1988) explicit false-belief task. In this procedure, novel manipulation was included to investigate whether the children can take a person's utterance as his/her expression of mental states, and whether this added information would facilitate children's understanding of others' minds. In order to differentiate certainty and uncertainty, two markers of *–ci* (for sure, really or indeed) and *–keyss* (perhaps or may) were used, respectively. In terms of the uses of the linguistic expressions, –c*i* was used without any further changes, whereas *–keyss* was changed for conversational tone. In order to complete speech, a sentence-ending suffix is required after *–keyss*. For example, one of the most frequently used suffixes, *-ta* (Choi, 1991), could follow *–keyss*. However, the use of *–ta* may make a statement descriptive (Sohn, 1999) rather than having a conversation. Thus, the form of -(*u*)*l ke-ya* (perhaps, may, or would probably) was finally used for an uncertainty statement in order to make the protagonist's speech intimate in conversation this is because –(*u*)*l ke(s)* is another form of *–keyss* which conveys the same meaning of *–keyss* in terms of indicating a speaker's conjecture (Ko, 1991; Suh & Kim, 1993). For that reason -(*u*)*l ke-ya* was expressed.

The child was shown a picture book which consisted of four pages which illustrated the story of the task. In the picture book, a boy named Max puts his chocolate in the box ('Max' is not typical Korean. However, it was assumed that children would be familiar with an English name because they might be frequently exposed to Western contents from an early age. Indeed, no child showed a sign of difficulty with the name). He goes to the play ground with a friend named Sally. While he is away, his mother transfers the chocolate from the box to the refrigerator. Max comes back with his friend to share the chocolate. The friend asks Max, "Where is the chocolate?" For the response in the certainty type, Max says with *–ci*, as in (1). On the other hand, Max says uncertainty using –(*u*)*l ke-ya*, as in (2). In this and the following examples of how I used certainty markers the aim is to show how the marker was used to convey information about the agent's action, rather than to identify particular subtleties in the grammatical structure of sentences. So, some of the elements of the syntax presented in the literal translations are simplifications.

(1) Chocolit-seun sangca ane iss-ci

Chocolate-seun box in be-ci

'The chocolate is really in the box'

(2) Chocolit-seun sangca ane iss-ul-ke-ya

Chocolate-seun box in be-ul-ke-ya

'The chocolate may be in the box'

As either an uncertainty or certainty marker was used when the story character expressed his belief, the marker was accordingly pronounced only once in the test. After the child was told the story, s/he was given the Other false-belief question first, as in (3).

(3) Max-nun chocolit-sul eti-ese cha-cul-kka?

Max-nun chocolate-sul where-ese look-will-kka?

'Where will Max look for the chocolate?'

Then the reality and memory questions were given to children as in (4) and (5), respectively. The reality and memory questions were counterbalanced.

(4) Chocolit-seun cinccalo eti-e iss-e?

Chocolate-seun really where-e be-e?

'Where is the chocolate really?

(5) Max-nun chocolit-i eti-e iss-ta-ko malha-yss-e?

Max-num chocolate-i where-e be-ta-that say-yss-e?

'Where did Max say the chocolate is?'

When the child did not seem to understand the story, the experimenter repeated the story. The child was regarded as having passed when both reality and test questions were correctly answered. To attribute false beliefs to others, it would be crucial that children understand that the story character does not know the real location of the transferred object. The false belief tasks were designed to probe whether children understand that others can hold beliefs which are different from reality (Wimmer & Perner, 1983). However, if children failed in responding to the actual location of the object, it would be difficult to state that they understood others' false beliefs. Thus, each reality question in the unexpected and change of location tasks was included in analyses along with the test question. The un/certainty markers were used to probe whether children's understanding of others' false beliefs was affected by lexical markers. Performance on each version of the change of location task was compared with the unexpected contents task.

Executive function measures

The Day/Night task. This task followed the procedure of Gerstadt, Hong, and Diamond (1994). The laminated 18 cards (dimensions – 11.8 X 11.8 cm) which were used depicted the sun and the moon with stars. Two cards were used to explain the task. The remaining 16 cards were used in practice and test trials. Half the cards were of the sun cards, and the rest depicted the moon. The sun and the moon cards are presented in Figure 2.1.

Practice trials. The experimenter started the practice trials by asking the child to confirm that s/he identified the cards. Showing the sun card, she said, "What is this? Right, this is the sun. You can see the sun in the daytime.", and said presenting the moon card, "What is this? Right, this is the moon and there are some stars around it. It is very dark. You can see the moon and stars at night." She then instructed the child by saying, "Now, we are going to play the card game" After saying this, instructions differed according to the expressions of certainty. In the standard version, the child was instructed, "When you see the moon (sun) card, you are to say 'day (night)'". In order to describe 'to say' in Korean, this would be translated literally as *mal-hanun kes-ita*. However, *kes-ita* was changed to *ke-ya* to make the utterance colloquial and, as described above, the implication of the colloquial form is the same with the written form. Then a sun card was presented to the child and s/he was asked, “What do you say when you see this card?” If the child answered correctly, she presented the moon card and repeated the question. On the other hand, in the certainty version, the child was instructed, “When you see the moon (sun), you must say ‘day (night)’” As was changed in the standard version, (mal) *hay-ya hay* (must say) was a colloquial expression of *hay-ya-hata* (must say). Regarding the use of *–ya hata* in this and the DCCS task, it would be necessary to state whether children acquired the implication of the expression. According to Choi (1995), who researched the development of epistemic markers in Korean, young children pronounced *–ya tway* productively which indicates obligation (*tway*: to become) between 2:6 and 3:1. Thus, it is possible to speculate that children at the age of three would understand the implication of *–ya hata*. For the question, the child was asked, “What do you have to say when you see this card?” If the child hesitated, she prompted the child by asking the question again, according to the versions. The expression of either *–hata* or *–ya hata* according to the versions of the tasks was used whenever the questions or instructions were given to the children. Translations of the test questions are shown in (6) and (7) for the standard and certainty versions, respectively.

(6)	I	khatu-lul	po-l-ttay	mwe-la-ko	(mal)ha-ci?
	This	card-lul	see-l-when	what-la-ko	say-ci?

‘What (do you) say when you see this card?

(7)	I	khatu-lul	po-l-ttay	mwe-la-ko	(mal)hay-ya-ha-ci?
	This	card-lul	see-l-when	what-la-ko	say-must-do-ci?

‘What (do you) have to say when you see this card?

For the practice trials, if the child answered incorrectly, she repeated rules and the child received the practice trials as necessary.

However, nine (4 3.0- and 5 3.5-year-old) children showed a sign of difficulty with no understanding of the task during the practice trials or did not seem to be interested in it for following reasons. One 3.0-year-olds did not seem to understand the rules. When the experimenter asked showing a card, he said ‘I don’t know’. Five children (3 3.0- and 2 3.5-year-old) made labelling errors; they labelled “Sun” for a sun card and “Moon” for a moon card. Two children (3.5-years) seemed to be nervous about video-recording and they were distracted by it; thus, it seemed that they could not focus on what she said. Finally, one 3.5-year-old did not seem to enjoy the task. He asked when the task would finish while the experimenter was explaining the rules, and said ‘moon’ for a moon card and ‘sun’ for a sun card without focusing the rules. Thus they were not administered the test trials. If the child correctly answered on both the moon and the sun cards, test trials were administered. Following Gerstadt et al.’s (1994) procedure, the last two practice trials correctly answered were regarded as the first two test trials.

In the Stroop-like Day/Night (Gerstadt et al., 1994), the instructions given to children were that they were to say “day” when the moon card was shown, and to say “night” when the sun card was shown. However, it seems rather difficult to say *nat* (day) for preschoolers because it does not seem that *nat* is used frequently in a preschooler-oriented speech to indicate day. In a pilot study with five children, they admitted that they did not understand the meaning of *nat* and their parents confirmed that their children did not know *nat*. Hence, in the present study, I used the word *achim* (morning/day) in place of *nat*. There was no change in saying *pam* (night).

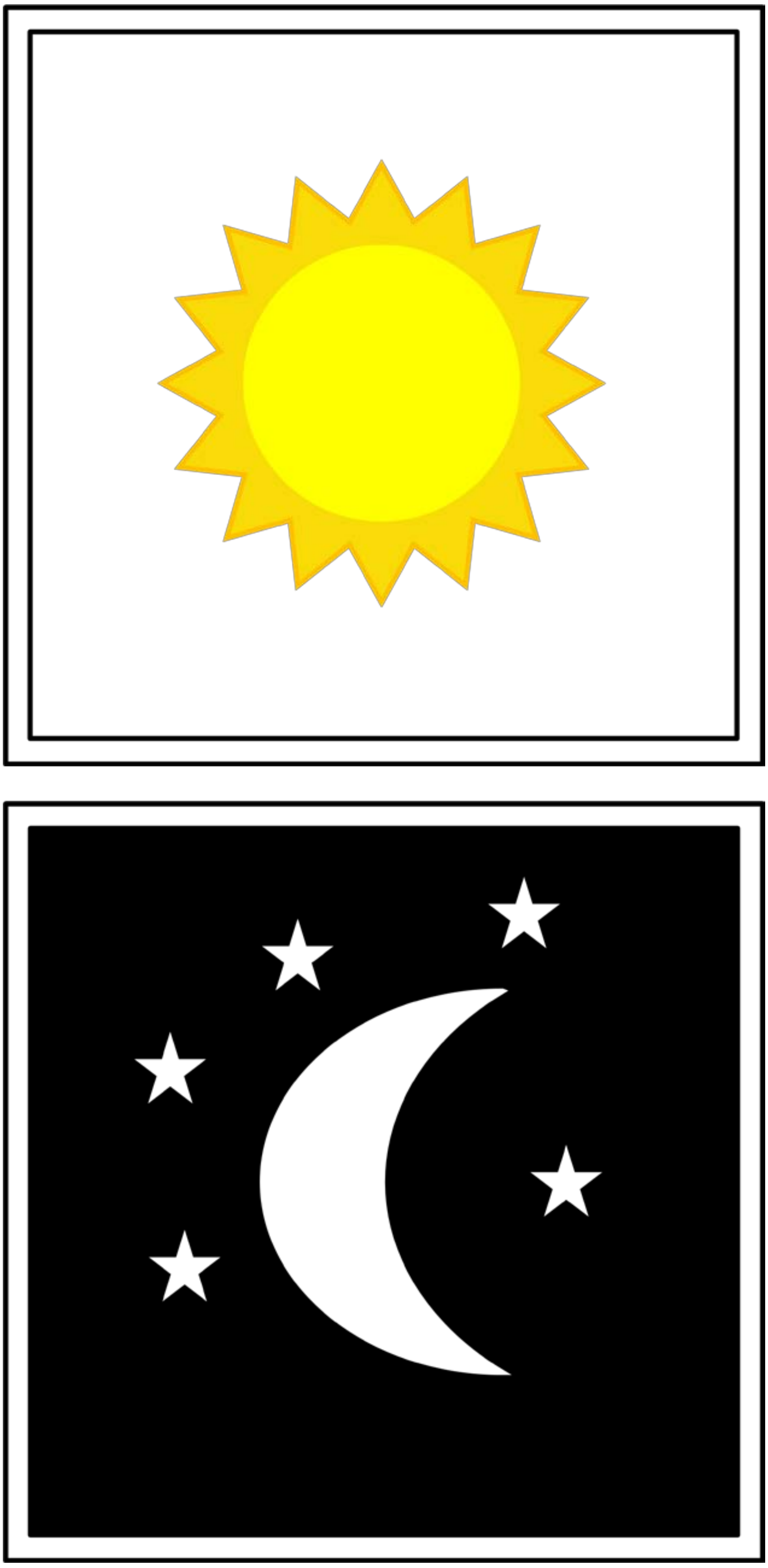

Figure 2.1. The sun and moon cards.

Test trials. Eight sun and eight moon cards were used in a fixed pseudorandom order. The cards were presented according to the following order: moon (m), sun (s), m, s, s, m, s, m, s, m, m, s, m, s, s, m. If the child corrected responses immediately, this was accepted (i.e., the child answered “morning” when seeing the sun card but immediately changed to “night”). During the 16 trials, no correction or feedback was given to the child. If the child showed hesitation or did not respond, she prompted the child repeating the question, “What do you (have to) say when you see this card?” She never said the words of responses when prompted the child.

The number of correct responses was counted as the dependent variable for analyses. Children who correctly answered 12 out of 16 trials were regarded as having passed according to the criterion of Carlson (2005); this categorization was also included for comparison with children’s performance in the literature as some studies classified performance as pass/fail.

The Dimensional Change Card Sort (DCCS) task. The DCCS task followed the procedure of Frye et al. (1995) and Kirkham et al. (2003). Sixteen laminated cards (two model cards and 14 sorting cards, dimensions – 11.4cm X 8.5cm) and two sorting trays (dimensions -11.7cm X 15cm with a wall of 11cm X 7cm) were used as materials. Figure 2.2 and 2.3 show the examples of the model and the sorting cards.

The model cards which were attached to the wall of the sorting trays were presented to the child. One model card depicted a red boat and the other depicted a blue star. The sorting cards depicted a blue boat or a red star. Thus, the sorting cards each matched the model card only by either colour or shape – not both. Prior to beginning the test trials, the experimenter confirmed whether the child identified the images and colours with the model cards by asking, “What is this shape?” and “What is this colour?” Some of children said "orange" but not "red" then she used "orange" to instruct the rules of the task.

As described in the Day/Night task, the two types of linguistic expressions were used in this task: certainty vs. standard. –*Kata* (go) and –*ka-ya hata* (must go) were used for the standard and the certainty types, respectively. Examples of test questions are shown in (8) and (9) for the standard and certainty versions, respectively. The declarative marker, -*ta*, was changed to –*yo* in interrogative contexts.

(8) Saykkkal keyim-ese motun phala-n kes-seun eti-lo ka-yo?
Colour game-ese all blue-n ones-seun where-lo go-yo?
'Where do all the blue ones go in the colour game?'

(9) Saykkkal keyim-ese motun phala-n kes-seun eti-lo ka-ya-hay-yo?
Colour game-ese all blue-n ones-seun where-lo go-must-do-yo?
'Where do the blue ones have to go in the colour game?'

Pre-switch trials. The experimenter started the task by saying, "We are going to play a card game. In the colour (shape) game, all the blue ones (boats) go (must go) in this tray, and all the red ones (stars) go (must go) in this tray. She put two sorting cards face-down into the sorting trays according to a relevant dimension. She asked two knowledge question to the child, "Can you show me where (do) all the blue ones (boats) go (have to go) in the colour (shape) game? If the child correctly pointed to the sorting tray, she asked again, "Can you show me where (do) all the red ones (stars) go (have to go) in the colour (shape) game? The two questions for colour or shape were given in a counterbalanced order. Following Kirkham et al.'s procedure, she used one relevant dimension with a randomly selected card to perform the task in each trial. For example, she said "a boat" in the shape game, but not "a blue boat". The trials were started by saying, "Here is a blue one (a boat)" and asked the child, "Where do all the blue ones (boats) go in the colour (shape) game?" for the standard version. "Where do all the blue ones (boats) have to go in the colour (shape) game?" was used in the certainty version. Then, the child sorted six cards in the pre-switch trials, and no child showed difficulty in sorting the cards. If the child sorted the card face-up, the child was instructed to place them face-down following her example.

Post-switch trials. When the child finished the pre-switch trials, the sorting dimension was altered by saying, “We finished the colour (shape) game. We are not going to play the colour (shape) game anymore. We are going to play a shape (colour) game. In the shape (colour) game, all the boats (blue ones) go (must go) in this tray, and all the stars (red ones) go (must go) in this tray.” In the post-switch trials, the experimenter did not demonstrate sorting the cards but pointed to the tray according to the relative dimension to explain the rules. As in the pre-switch trials, the two knowledge questions were given, and all children pointed to the correct trays according to the relevant dimension. No feedback was given during the post-switch trials. As described above, two levels of certainty were used. Each child was allocated the same certainty type as to the pre-switch trials for the post-switch trials.

The correct number of the post-switch trials sorted was counted and used as the dependent variable. Passing five out of six trials in the post-switch trials was regarded as passing the task following Kirkham et al.’s criterion; this criterion was also used for comparison with existing literature.

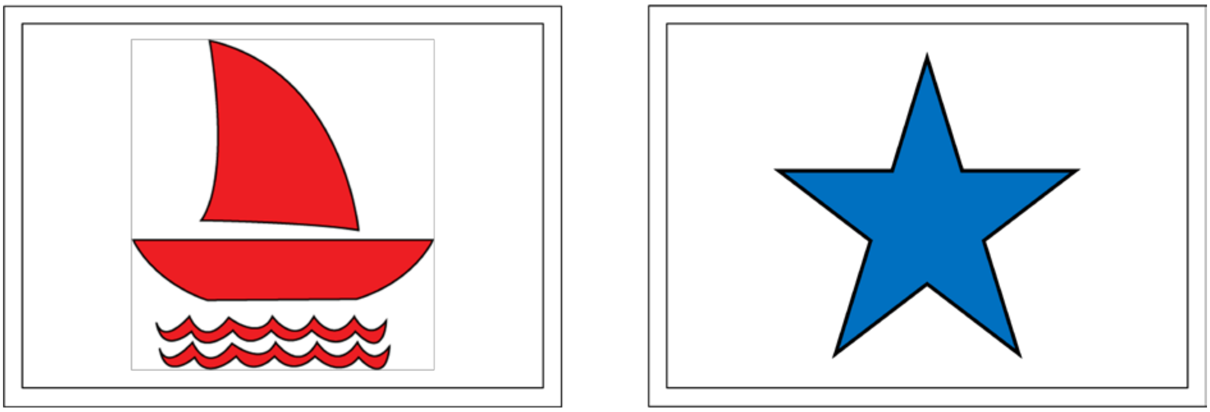

Figure 2.2. The model cards.

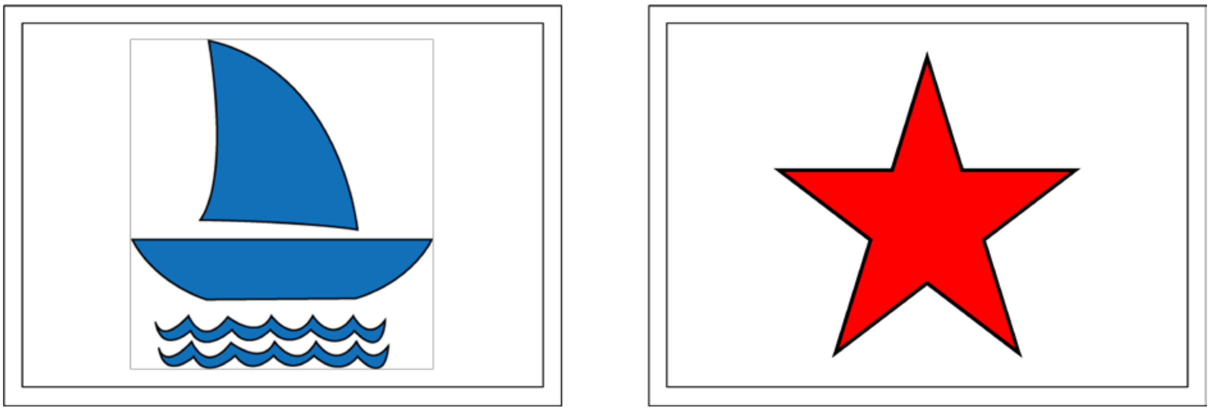

Figure 2.3. The sorting cards.

2.3. Results

2.3.1. Vocabulary

The scores of the vocabulary task were normally distributed, and ranged from 0 to 15 (*M* = 6.26, *SD* = 4.04). Figure A.1 in the Appendix shows the distributions of the scores. In order to explore age differences in the scores, an independent-samples t-test was carried out. As expected, it was found that the older 3-year-old children's level of verbal skill (*M* = 6.86, *SD* = 4.20) was significantly higher than the younger children's (*M* = 4.77, *SD* = 3.23), *t*(102) = -2.45, two-tailed (here and below) *p* = .02, *d* =.56.

2.3.2. False belief measures

The key research question of this study is whether a person’s expression of un/certainty for beliefs would promote young children’s mental state understanding. As the children were administered the change of location task with un/certainty first, their performance is presented by un/certainty. First, it found no age group differences in both un/certainty groups, Mann-Whitney tests U = 218, p = .93 and U = 279, p = .57, respectively; therefore, performance on the tasks was analysed regardless of age. Figure 2.4 shows the proportion of the 3-year-old children who passed three types of FB questions including the reality question: blue bars indicate the change of location task, while green and yellow bars represent the Self and Other questions of the unexpected contents task, respectively. As mentioned above, the reality and test questions were included in the analyses. Expected frequencies were based on a chance distribution of 1/4, 2/4, 1/4 for children who correctly responded to 0, 1, 2 questions, respectively. For this and following experiments, we classified children according to whether they correctly responded to both reality and test questions or not. Thus, the expected frequencies became 3/4 and 1/4. As Figure 2.4 shows in respect of children who made correct responses to both reality and test questions, the level of chance for them was .25. The distinguishing results were that children might be aware of the different degrees of certainty by the grammaticalized markers. As shown in Figure 2.4, there were changes in the opposite direction according to the use of un/certainty markers. The children in the uncertainty group were more likely to pass the Other FB when they had experienced the protagonist’s uncertainty, whereas those in the certainty group showed a tendency of decrease on the Other FB after having heard of the certain belief.

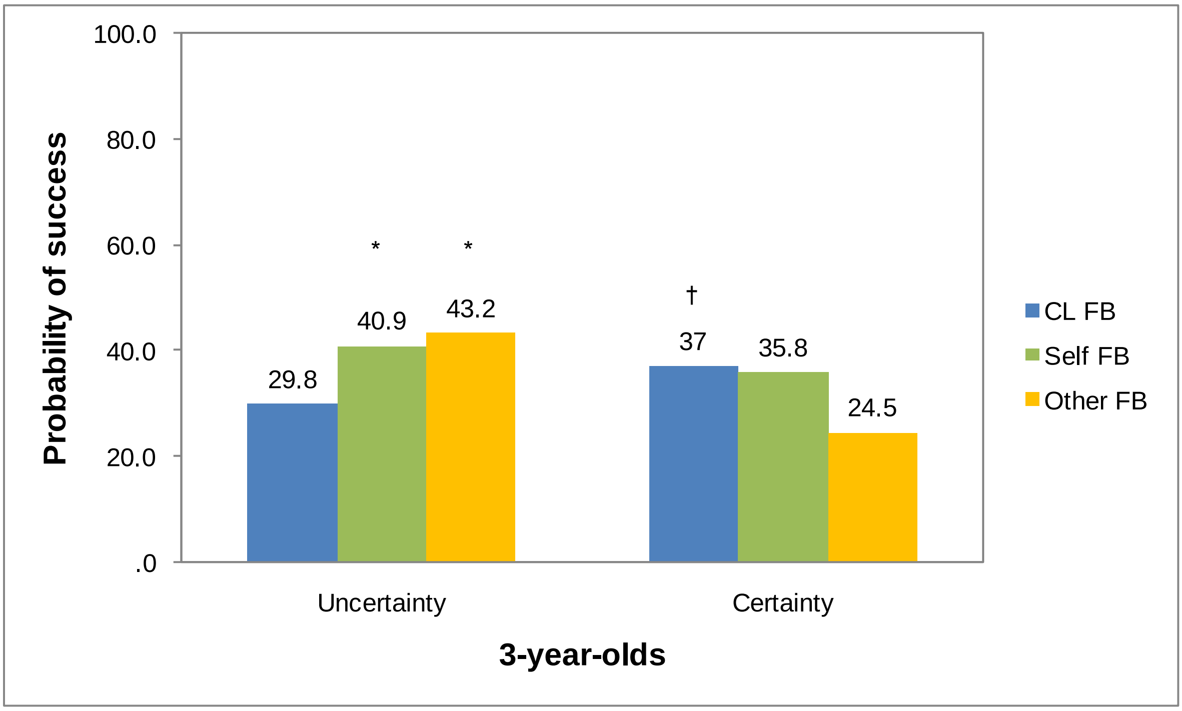

Figure 2.4. Children's performance on FB questions according to certainty groups. CL: Change location. FB: False belief. $^{\dagger}p < .10$, $^{*}p < .05$ in tests against chance (.25).[1]

Certainty and Uncertainty on false-belief understanding (CL)

Three children were excluded due to being absent from the second session. Hence, 47 and 54 children were used in analyses of the un/certainty task, respectively. Credits were given to the children when they correctly answered the false-belief test and control questions. Thus, the scores range from 0 to 1.

The task aimed to investigate whether the development of mental state understanding was influenced by the specific linguistic markers (i.e., *-ci* or *–keyss* ((*-u*)*l ke-ya*)); thus, the children's performance was analysed by each expression. As can be seen from Figure 2.4, the children's performance on the task showed possible influences of the linguistic markers. Binomial tests were administered in order to explore the distributions against chance levels (.25). As no age differences were observed, the tests were carried out for all the sample. The

[1] When the test question was only used for binomial test with .50, the results were different.

results showed that the children who heard the protagonist's confident belief (-*ci*) were more likely to pass the task, p = .067 (two-tailed and hereafter). Twenty out of 54 children passed the question. In contrast, those in the uncertainty group with –*keyss* (-(*u*)*l ke-ya*) did not perform significantly differently from random responses, p = .54. Fourteen out of 47 children passed the question with uncertainty.

In order to examine whether the un/certainty expressions had a significant effect on the children's understanding of beliefs, logistic regression was carried out with age and certainty (2X2). An interaction of age X certainty was also loaded controlling for vocabulary skills. That is, the dependent variable was performance on the change of location task and this logistic regression was explored to probe whether performance of the task was significantly different with the use of the linguistic markers. The results showed that the model was not significant, Nagelkerke R^2 = .02, χ^2 (4, N = 101) = 1.3, p = .86. Taken together, the findings seem to indicate that the expressions of beliefs of either certainty (trend of significance) or uncertainty (chance performance) might have a facilitative role in 3-year-olds' understanding compared to performance of 3-year-olds showing below chance (Wellman et al., 2001). However, it seems that differences in the degrees of certainty may be subtle. The possible effects by exposure to the different degrees of certainty on beliefs will be reported below.

Effects of certainty on Self and Other FBs (UC)

As the main objective of the study was to investigate the role of the linguistic expressions on social understanding, performance on the Self and Other FB questions was analysed to explore possible carry over effects of the use of certainty markers in the change location tasks (where the markers were manipulated) to the unexpected contents test (where there was no manipulation of the markers). As shown in Figure 2.4, it seems that the children's performance on the unexpected contents task might be influenced by the previous task; thus, the performance on the Self and Other FBs might have been influenced by the experimenter-child interaction in a previous trial. That is, the performance on Self and Other FBs was examined in terms of the certainty used by the protagonist in the previous test. Seven children (one and six from 3.0- and 3.5-year-olds, respectively) were excluded from analyses for not attending the task by reason of absence from the second-week session. Hence, 97 children were included in analyses. Credits (1 = pass test and control question; 0 = fail one of the two questions or both) were given as in the change of location task.

Performance on each FB was analysed by binomial tests against chance (.25). First, the children with uncertainty showed performance at levels of above-chance, $p = .03$ and $p = .01$ for the Self and Other FBs, respectively. Eighteen out of 44 children retrieved their past beliefs, while 19 out of 44 children predicted others' action. In contrast to the findings of uncertainty, children with certainty performed at chance on the Self and Other FBs, $p = .10$, and $p = 1.0$, respectively. Nineteen and 13 out of 53 children respectively passed the Self and Other FBs after the exposure to certainty. It is apparent that the performance on the FBs, in particular the Other FB, might be affected by the use of the un/certainty markers along with different directions of the effects. Table 2.2 shows the changes between the change of location and Other FBs. As the change of location FB was to evaluate others' beliefs, the comparison between Other FBs was carried out in Table 2.2. Again, the table revealed the differences in performance on the Other FB according to the levels of certainty in the previous experience: increase in the uncertainty group and decrease in the certainty group.

In summary, the finding showed that 3-year-old children's performance to predict the protagonist's behaviour might be dependent on the linguistic markers. The uncertainty expression *–keyss* might function in weakening one's attitude while the certainty marker *–ci* might express a stronger belief.

Table 2.2

Contingency patterns of between the Change Location and Other FBs

		Change Location FB			
		Uncertainty		Certainty	
		Fail	Pass	Fail	Pass
Other FB	Fail	17	8	25	15
	Pass	13	6	8	5

Note. N = 97. FB: False belief

In order to probe further for the influences of the un/certainty markers, logistic regression on the respective FBs with age, certainty and an interaction of age X certainty were carried out, simultaneously taking into account verbal skills. There were differences for the FB questions. It was found that the overall model on the Self FB was not significant, Nagelkerke R^2 = .03, χ^2 (4, N = 97) = 1.84, p = .77. In contrast, the model with the variables explained the variance of the Other FB, Nagelkerke R^2 = .16, χ^2 (4, N = 97) = 12.0, p = .02. However, none of the individual variances had significant effects on the model. Thus, further analysis was carried out without an interaction of age X certainty and vocabulary. The results found that the overall model with age and certainty was significant, Nagelkerke R^2 = .16, χ^2 (2, N = 97) = 11.6, p = .003. As the inclusion of the age X certainty interaction in the model with age and certainty did not lead to a significant increase in the deviance explained, the model with the two main effects is shown in Table 2.3. The results indicated that age and certainty expressions were significantly associated with children's understanding of others' minds. The older 3-year-olds were four times more likely to predict the protagonist's action than the younger children. The children who had heard the protagonist's uncertainty were more likely to understand others' minds than those who had been exposed to his certainty. As mentioned above, the findings from logistic regression seem to suggest that children' access to others' epistemic states is influenced not only by the mental-state terms but also by the degrees of certainty.

Table 2.3

Summary of logistic regression analysis for predicting the Other FB

Variable	B	*SE* B	Wald	Δ Odds
Age	1.53	0.60	6.40*	4.60
Certainty	-0.91	0.46	3.91*	0.40

Note. N = 97. FB: False belief. Nagelkerke R^2 = .16, Model χ^2 (2, N = 97) = 11.62, p = .003.

$^*p < .05$.

2.3.3. Executive function performance

In order to explore whether verbal input from others influenced children's executive skills, two different levels of certainty were examined (i.e., certainty vs. standard). Thus, performance on executive measures is shown as a function of age and certainty in Table 2.4. As can be seen in Table 2.4, no significant effects of linguistic manipulation were found in either measure. Age did not significantly contribute to differences in performance on either the Day/Night or DCCS task.

Table 2.4

Descriptive statistics for the EF tasks as a Function of Age

	Younger 3		Older 3		
Measures	Standard	Certainty	Standard	Certainty	Range
Day/Night					
No. of correct trials	12.6 (4.28)	10.6 (5.10)	11.8 (4.63)	12.2 (3.93)	2-16
DCCS					
No. of correct trials	1.14 (2.19)	1.20 (2.68)	3.25 (2.93)	3.50 (2.85)	0-6

Note. EF: Executive function. Day/Night: n = 5 and n = 9 in 3.0-year-olds, and n = 17 and n = 15 in 3.5-year-olds, for standard and certainty, respectively. DCCS: Dimensional Change Card Sort, n = 7 and n = 5 in 3.0-year-olds, and n = 16 and n = 16 in 3.5-year-olds, for standard and certainty, respectively. Standard deviations are in parentheses.

The Day/Night task

Among 57 children, 11 children were excluded from analysis due to being absent from the session (2 children) or not completing the task (9 children: see the method section). Therefore, 46 children were included in the analyses (22 = standard and 24 = certainty). The distribution of the correct trials was slightly negatively skewed with skewness of -2.67 (see Figure A.2 in the Appendix). Although the data were negatively skewed, the Explore function in SPSS did not show any outliers. Thus, two methods were used to meet normality. First, a square root data transformation was carried out; however, the transformation repeatedly produced outliers and did not meet normality. Hence, the second means was tried. Although the initial data did not show outliers, the lower scores were recoded until the data showed normality (see Tabachnick & Fidell, 1996). The scores under six were all changed to approximately six (5.65 to 5.95) and then the data were normally distributed. However, a preliminary analysis on the recoded data showed no difference in the results from an analysis with the initial data; thus the original data without any transformation were reported.

The main objective was to explore the effects of certainty on executive skills. In order to explore the effects, a two-way analysis of covariance (ANCOVA) with age and certainty as main effects and an interaction was conducted taking account of verbal skills. As would be expected, the results showed that the covariate, verbal skills, was significantly related to the levels of performance, $F(1, 41) = 7.19$, $p = .011$, $\eta_p^2 = .15$. However, there were no significant main effects of age, $F(1, 41) = .02$, $p = .88$, $\eta_p^2 = .001$, or certainty, $F(1, 41) = .000$, $p = 1.00$, $\eta_p^2 = .002$, or the interaction, $F(1, 41) = 1.00$, $p = .32$, $\eta_p^2 = .02$. That is, the children's inhibitory control by the Day/Night task was not significantly influenced by age or linguistic expressions.

Across the 16 trials, the correct responses ranged between 2 and 16, and 11 children, who accounted for 23.9%, performed correctly on all the test trials (2 children were from the younger group). Thirty out of 46 children correctly responded in more than 12 out of 16 trials (65.2% pass rate) in total. Compared to Korean 3-year-olds (3.0-years: 14.7 and 3.5-years: 14.9) in Oh and Lewis (2008) (Experiment 2), the participants in this study were less likely to perform the task (3.0-years: 11.3 and 3.5-years: 12.0). However, it seems that Korean children in this study performed better than English children (3.0-years: 5.63 and 3.5-years: 8.61) in Oh and Lewis. Similarly, it is apparent that the Korean 3-years' performance showed better levels than those of North American children (approximately 48% pass rate of 3-years) in Carlson (2005). Taken together, although the 3-year-olds in this study performed at a lower level than other Korean children, they tended to perform better than those in Western cultures.

The Dimensional Change Card Sort task

Forty-four children performed on the DCCS task (23 = standard and 21 = certainty), and three children were excluded due to being absent. The distribution of the correct number in the post-switch trials was platykurtic which was driven by binary performance either sorting cards successfully or making errors. The distribution of cards sorted correctly is shown in Figure A.3 in the Appendix. Any methods for data transformation did not meet normality; however, following the procedure of Frye et al. (1995), a univariate analysis was employed. Again, a two-way ANCOVA was conducted to test influences of linguistic expressions along with age as main effects including an interaction, and vocabulary loaded as a continuous covariate. The results showed that age had a trend towards significant effects, $F(1, 39) = 3.52$, $p = .068$, $\eta_p^2 = .08$. However, there was no significant main effect of the certainty expression, $F(1, 39) = .004$, $p = .95$, $\eta_p^2 = .00$. In contrast to the findings in Day/Night, verbal skills did not explain a variance of DCCS, $F(1, 39) = .92$, $p = .34$, $\eta_p^2 = .02$. Taken together, as found in the Day/Night task, the certainty expression did not contribute to enhance cognitive flexibility in performing the DCCS task.

According to the criteria of Kirkham et al. (2003) which regarded five out of six trials in the post-switch trials as having passed, 19 out of 44 children passed the task (two 3-year-olds and 17 3.5-year-olds). That is, 17% of 3.0-year-olds and 53% of 3.5-year-olds passed the task (43% pass in total). The performance was comparable to English children (3.0-years: 14% and 3.5-years: 58%) in Oh and Lewis (2008) and North American 3-year-olds (42% pass rate) in Kirkham et al. Taken together, it is apparent that Korean 3-year-olds' ability to suppress inappropriate responses tended to be better than those in other cultures, whereas their switching ability was comparable to their counterparts.

2.3.4. Influences of executive function on false beliefs

The general view of research on social understanding and executive function has been that the two cognitive skills show a parallel development. However, as mentioned in the Introduction of this chapter, a recent study by Oh and Lewis (2008) questioned whether the view could be regarded universally for an advanced conflict inhibitory control of Korean preschooler. Hence, the present study explored the relationships between the cognitive development in order to probe whether Oh and Lewis's findings were distinctive or replicated in Korean children. In order to explore influences the link between the measures, Spearman's correlations were carried out. Prior to conducting these correlations, efforts to aggregate the scores of FB questions were made. However, as the change of location and unexpected contents tasks were not significantly correlated (Spearman's rho $r(97) = .05$, $p = .66$ and $r(97) = -.01$, $p = .92$ for the Self and Other FBs, respectively), the two tasks were examined individually. The Self and Other FBs were combined and averaged, $r(97) = .49$ ($p < .001$). As the children performed one of EF tasks, the Day/Night and the DCCS tasks were loaded (i.e., the number of correct trials) respectively. The standardized scores of the measures were used for correlations. Table 2.5 presents the correlations among the measures. Verbal skills were significantly related to the Day/Night task but not the DCCS task. As might be expected, the relationships between FB and EF tasks were not significant. In summary, the findings were consistent with the research by Oh and Lewis, showing that although young Korean preschoolers held strong skills in inhibiting predominant responses, the ability was not related to predicting others' behaviour or beliefs.

Table 2.5

Spearman's rho correlations among age, vocabulary, false-belief and executive measures

	Vocabulary	CL FB	UC FB	Day/Night	DCCS
Age	.35**	.00	.20*	.17	.33*
Vocabulary		.08	.16	.35*	.19
CL FB			.03	.00	-.02
UC FB				.-14	.19

Note. n = 104 for age and vocabulary. CL FB: the change location false-belief (n = 101). UC FB: the unexpected contents false-belief (n = 97). n = 45 for Day/Night. DCCS: Dimensional Change Card Sort (n = 42).

$^{*}p < .05$, $^{**}p < .01$.

2.4. Discussion

This experiment set out to examine whether the 3-year-olds' ability to infer mental states and exercise executive skills was affected according to the use of linguistic references. It was hypothesised that children's understanding of others' beliefs would be promoted by the mental-state suffixes which expressed the protagonist's belief. Secondly, it was hypothesised that verbal input with a higher level of certainty would facilitate young children's levels of executive function. The findings showed that the effects of the mental-states markers varied from the degrees of certainty of the expressions in the social understanding measure. In contrast, the different levels of certainty did not affect the young children's performance on executive skills. I will discuss the role of un/certainty on the children's grasp on social understanding. Secondly, I will review influences of external verbal input on executive function in young children.

2.4.1. Un/certainty and social understanding

The findings showed that when children were exposed to the certainty marker (i.e., -*ci* - sure) they predicted the protagonist's action. The children's prediction of another's action was straightforward with a certain belief compared to a situation without it. In contrast, the children who heard the protagonist's uncertainty (i.e., -*keyss* – seems/think) responded randomly on the test question of his belief. However, experience in a belief of uncertainty strengthened their access to others' epistemic states without such uncertainty. First, it might be necessary to clarify wording or the use of certainty markers to distinguish from other linguistic forms although I briefly mentioned in the Introduction of this thesis. The un/certainty markers used in the thesis are grammaticalized forms and are attached to a verb. Thus, such markers could be used interchangeably with suffixes or verb-endings. On the other hand, it is also possible to express one's epistemic status, whether it is certain or uncertain by verb terms. Thus, 'markers' were generally used to indicate the grammaticalized epistemic terms and to differentiate from 'verb' forms in the thesis. Then what is the role of linguistic references in identifying epistemic states?

The role of the grammatically specific markers on beliefs

First, the results in the change of location task with the use of the uncertainty marker –*keyss* were similar to the findings in which the protagonist's uncertain belief was expressed regardless of whether the linguistic expression was grammatically embedded in a language, showing that young children performed less well when a speaker expressed uncertainty (e.g., Jaswal & Malone, 2007; Sabbagh & Baldwin, 2001; Wellman & Bartsch, 1988). Even though the explicit version of the change of location task in Wellman and Bartsch was originally considered to enhance children's reasoning ability with the explicitly expressed belief of the protagonist, it seems that the use of the uncertainty verb such as *think* might hinder 3-year-olds' ability to predict the speaker's intention. A possible explanation for the results might be the role of uncertainty on judgement. It seems that the uncertainty expressions in languages might weaken one's belief. Indeed, as noted in Chapter One, research has found that one's credibility varied based on the degrees of certainty in young children; that is, the uncertain source of information was regarded as having the lack of reliability in accepting the information in young children (e.g., Moore & Furrow, 1991). Thus, the findings were in line with the view that the lack of reliability of information may decrease its potential prediction about an event (Hogarth, 1987). Therefore, the Korean marker of uncertainty *–keyss* (*-(u)l ke-ya*) in the current study might have also lessened the 3-year-olds' ability to understand others' intention of where to look for an object, as their performance on the task which was enhanced without the expression indirectly evidenced.

However, the findings were also inconsistent with empirical research showing that children's performance with uncertainty expressions was at higher levels compared to the standard change of location task in the studies; for example, 10% pass of 3-year-olds in the standard false-belief task but 34% pass in the explicit false-belief task with a mental verb, *think* (*thought*) in Carlson and Moses (2001) and 4% pass of 3-year-olds in the standard task but 17% pass in the task with a grammaticalized uncertainty expression in Matsui et al. (2009). There might be two possible explanations for the findings of the increased performance in the studies listed above. It seems possible that the use of mental-state expressions in languages as stated in Chapter One or task differences in the study of Matsui et al., as mentioned in the Introduction of this chapter, might promote the children's understanding of minds. If the former explanation were applied to Korean children, they would show improved performance, unless there was evidence that young Korean children did not understand the implications of the uncertainty marker *–keyss*. Similarly, if the latter were applied, the increased performance in Carlson and Moses (2001) would not be simply explained as the researchers used the explicit task without any modifications. Thus, it appears that these two explanations might not be helpful to explain performance on the uncertainty task in the current study.

Thus, one possible reason for performance in the current study might be that the uncertainty marker implies a strong uncertainty. In Korean informal speech the most frequently used suffix is *–e* (Kim, 2005; Lee, 1999). For example, the sentence used in the explicit version could be expressed such as *Chocolit-seun sangca ane iss-e* (There is chocolate in the box) in a declarative utterance without un/certainty. Although the sentence does not specify a speaker's belief as shown in the un/certainty expressions, *-e* utterances still convey his/her knowledge as well as assertion (Kim, 2005; Lee, 1999). That is, it seems possible that even young Korean learners might expect that a speaker primarily addresses factual knowledge in everyday conversations with the frequent exposure to the maker *–e*. In contrast, however, the use of the uncertainty marker might degrade the primary expectation of factuality of information and lead to lack of reliability as mentioned above. Therefore, unlike the research showing the effects of the mental-sate expression of uncertainty, the children in the present study might have shown poorer performance by chance levels with the uncertainty marker compared to that without the expression.

On the other hand, the use of the certainty expression *–ci* showed that the marker might play a role in enhancing the saliency of what others think in the 3-year-olds. The findings seem to support the research by Choi (1995) that Korean children acquired epistemic meanings which were expressed by an utterance with a clear marker at a relatively early age, and it might have led to their tendency for successful performance in predicting the protagonist's action. In other words, young Korean children might understand that the certainty marker *–ci* conveyed a strong attitude of the protagonist's belief and his behaviour might be predictable relatively straightforwardly from his attitude. Research on relationships between attitude and behaviour supports this explanation. According to Ajzen and Fishbein (1977), an individual's favourable behaviour stems from his/her favourable attitude toward an object. Thus, when the protagonist expressed a certain belief rather than uncertainty about the location of the object, the likelihood of predicting where the protagonist would look for it might be increased by certainty. Hence, this seems to suggest that the use of the grammatically specific markers for others' epistemic states might influence the 3-year-olds' mental state understanding according to the degrees of certainty.

Having said that, the findings from comparisons indicated that the acquisition of un/certainty expressions might not be accomplished as young as the age of three, given the comparisons between the change of location and the unexpected contents tasks did not produce significant differences (McNemar's test p = .38 for uncertainty and p = .21 for certainty). The findings were consistent with the research, showing that comprehension of epistemic meanings of the grammaticalized morphemes did not develop even at the age of four or five (Aksu-Koç & Alici, 2000; Papafragou et al., 2007). In other words, it might be difficult to contend that young Korean children's understanding of the social world was elicited from the additional expressions by the grammatically embedded markers, although the development of the markers as expressions of beliefs cannot be ruled out. Therefore, the next study extended the age range in order to probe the effects of the markers.

In summary, the findings identified the possible roles of different mental-state expressions. There has been consensus that the exposure to the mental-state language such as *know* and *think* facilitates children's access to others' beliefs as mentioned in Chapter One of this thesis. However, it seems that the findings in the current study might tell a different story. It is conceivable that the mental-state language might function differently according to the degrees of certainty expressed. Yet, as noted above, it is still not clear about the effects of the Korean markers. Hence, the next study examined whether older Korean preschoolers were able to appreciate the different degrees of certainty as one's belief and make differences in understanding the mind.

2.4.2. Verbal input on executive function?

The hypothesis that verbal input with different degrees of certainty would influence young children's performance was not supported. The results were consistent with those of Oh and Lewis (2008) which showed relatively higher levels of inhibition in young Korean children irrespective of the means by which the instructions were given.

The expression of certainty on Executive Function

In order to vary the degrees of certainty, a deontic expression *–ya hata* was used. As stated earlier, it did not make any differences in performance on either the Day/Night procedure or the DCCS task. It seems possible that the results might be related to the age development in understanding the deontic expression. Some researchers have suggested that children by the age of four can understand that the deontic expression represents a higher degree of certainty (Hirst & Weil, 1982; Moore et al., 1990). For example, Moore et al. (1990) conducted experimental research in order to understand children's acquisition of implications of modals. Children between 3- and 6-years of age were told two sets of statements with the relative degrees by modals (e.g., It must (vs. might) in the red (blue) box), and asked to pick a box. They found a developmental change in distinguishing the differential certainty in terms of the modal expressions used. The children at the age of four began to differentiate that the deontic expression *must* denotes a relatively higher degree of certainty. This study was different from the current one in terms of the measure evaluating effects of certainty.

However, the point here is the age when children come to understand the deontic meanings. Although a longitudinal study by Choi (1995) showed 2-year-old children's appropriate uses of the Korean deontic expression, it seems possible that young children at the age of three might not understand the necessity of performing what a speaker says (Karmiloff-Smith, 1979).

Another possible explanation for the results could be drawn from cultural practices and early education in Korea. It is plausible that the traditional cultural values based on Confucian ideas of Korean society may affect children's characteristic responses. According to Bailey and Lee (1992), Korea forms a hierarchical structure in which status of individuals in society and the family is based on Confucian ideology, and differences in status influence the formation of social relationships. That is, authority and power are granted to individuals who are higher in status within the hierarchical structure, and such cultural practice is retained in the education system. Children are ranked in a lower status and, accordingly, they are subject to showing respect for authorities. As the Korean education system was established based on this Confucian legacy, children accept the authority of teachers from as young as the age of preschool, and their obedience is expected (Kwon, 2002). However, it does not seem that Korean children accept authority unquestioningly. They are also selective about who is regarded as responsible. Children are more likely to obey orders given by authorities, based on their judgment that the authorities are knowledgeable and morally right (Kim, 1998). Hence, it is conceivable that a hierarchical relationship between the experimenter and the child had been already established in a circumstance in which the experimenter was introduced as a teacher by the child's teacher, and the teacher told the child that she or he was going to learn from the experimenter. Furthermore, the children had no grounds for doubting her morality. In such a case, the child might consider that the experimenter was knowledgeable, and the child had to follow her directives in performing executive function tasks. Consequentially, it appears that the linguistic manipulation which emphasized necessity of performing the tasks might not have an influence over the relationship between her and the child. Another possible explanation for the failure to identify a discrimination of certainty is that the differences between the markers used in executive function might be very subtle. The false-belief measures did not reveal significant differences between the use of an expression and without one. Similarly, the 3-year-olds might not be skilled to differentiate the levels of certainty used in the executive function measures.

Taken together, it seems possible that there might be several explanations for the findings showing no effects of linguistic references in the 3-year-olds. In order to explore further, the next study employed the identical procedure in the older children as mentioned earlier.

2.5. Conclusion

This study raised the possibility that the grammatically embedded system to mark one's belief might influence children's access to others' epistemic states in the social understanding measure. It appears that the exposure of uncertainty *–keyss* might affect children's credibility to others in a way of lowering their performance. On the other hand, it seems that at an age when Western children have not mastered social understanding, children's prediction of others' behaviour might be assisted with the use of the certainty marker *–ci*. However, it is difficult to suggest the clear effects of the linguistic marker as performance between the tasks with/out did not produce significant differences. In addition, verbalization of others differentiating the degrees of certainty was not a contributory factor in enhancing executive skills in the 3-year-olds. As mentioned above, it seems possible that relatively late comprehension of the grammatically specific markers might be responsible for the lack of evidence of them in the relation with social understanding and executive function.

In order to explore this possibility, we decided to extend the age range of participants in the next experiment; thus, 4- and 5-year-old Korean preschoolers were administered identical tasks.

Chapter Three: **Can 4- and 5-year-olds be helped to access others' epistemic states or to exercise executive function from certainty markers?**

3.1. Experiment 2

In the previous chapter, the findings suggested the possibility that manipulation of grammatical expressions to indicate a speaker's beliefs might influence young children's understanding of another's mind although the results were neither clear cut nor conclusive in 3-year-olds. The interesting results were that the linguistic expressions for mental states did not seem to be consistent with the research in the area of social understanding. As described in Chapter One, it has been shown that the exposure to mental state expressions such as *know* and *think* plays a role in enhancing young children's development of social understanding (e.g., Astington & Baird, 2005). Chapter Two showed different effects of the linguistic markers according to the degrees of certainty which the markers imply. Three-year-olds who were exposed to a person's uncertainty about his belief were more likely to predict another's thoughts in a later experimental condition when the uncertain belief was not expressed. In contrast, those who had heard the speaker's confidence in his belief seemed to be more puzzled without marking of the certain belief showing random access to another's mind. That is to say, it seems plausible that the linguistic makers with different degrees of certainty might influence one's beliefs by either weakening or improving. And yet, as noted earlier the strength of the effects was not sufficient to contend advantages of the grammatically specific markers. Thus, the current study conducted an experiment with older preschoolers in Korea in order to probe whether the tendency which was shown in 3-year-olds was found with marked differences according to the levels of certainty as the research in this areas has shown that children understand mental-state expressions at the age of four (e.g., Johnson, 1982; Moore et al., 1989).

Thus, 4- and 5-year-old children participated in this experiment. It seems possible that the current study with 5-year-olds might not show the effects of the linguistic expressions regardless of whether the additional markers were grammaticalized or not by ceiling performance as children tend to develop social understanding before their fifth birthday (Wellman et al., 2001). Nevertheless, there were three reasons to include 5-year-olds in the current study. First, it is possible that the acquisition of the subtleness of the Korean markers might not be completed by the age of four (Papafragou et al., 2007). Secondly, along with variations of participants, it seems possible that Korean children might show relatively late understanding of false beliefs (Lee, 2011; Oh & Lewis, 2008); so inclusion of 5-year-olds would serve an understanding of Korean children's social development in terms of the period. Lastly, there is evidence that the acquisition of the deontic meaning such as *must* is not achieved at the age of five (see below). In Chapter Two, the finding showed the possible influences of the certainty markers (i.e., -*ci* (sure) or –*keyss* (may)) in social understanding but not any effects of the deontic marker (i.e., -*ya hata* (must do)). It is conceivable that comprehension of epistemic or deontic expressions might not have the same development pattern. As an example of this, Hirst and Weil (1982) reported that there was a developmental gap in understanding between epistemic and deontic meanings of modals with the relatively late understanding of the deontic sense. In their study, children from three and six years of age received two different tasks. In the epistemic condition, the children had to point to a cup or a box comparing two statements (e.g., The peanut must be under the cup vs. The peanut should be under the box. Similarly, in the deontic condition, they had to decide where a experimental character will go to (e.g., Andy should go to the green room vs. Andy must go to the red room). Hirst and Weil found that children at four years of age began to understand that *must* implies the relatively higher degree of certainty than *should* or *may* in the epistemic aspect. On the other hand, children at about 5- and 6-years tended to appreciate that *must* indicates the stronger strength than others in the deontic sense. Therefore, it seems possible that the Korean expression *–ya hata* used in executive function measures as either epistemic or deontic aspects may be understood at around 4- and 5-years. With regard to such reasons, 4- and 5-year-olds were included in the current study. However, a small number of 5-year-olds were included along with the possibility of their successful performance on false beliefs and executive function.

Taken together, 4- and 5-year-olds participated in the current study. The main purpose was in line with the previous experiment: whether the specific grammatical expressions for one's belief would induce a false-belief understanding and better skills in executive function. In order to reduce variations in participants, efforts to recruit children from the same preschools and kindergartens from Chapter Two were made. However, some preschools had children up to 3-years; thus, some children were from new places in areas with a similar socioeconomic status. This is because there is evidence showing a relation between children's cognitive development and socioeconomic circumstances (e.g., Cutting & Dunn, 1999; Holmes, Black, & Miller, 1996).

Based on the findings in Chapter Two, it was hypothesized that if the uncertainty expression *–keyss* (*-(u)l ke-ya* for colloquial speech) conveyed a strong uncertainty, children's access to others' beliefs by the uncertainty marker would lessen compared to performance without the expression. On the contrary, children's understanding would be promoted in the task with a speaker's confident statement *–ci* on his belief than without it. With regard to executive function, it was hypothesised that children's performance would be better in the task with certainty *–ya hata* as stated in the Introduction of Chapter Two according to Palmer (1986). A deontic meaning of obligation and epistemic certainty are closely related (Bybee, 1985). Furthermore, it seems that deontic obligation and epistemic certainty are marked by the same morpheme in many languages (Steele, 1975). Based on this view and as noted above, it would be appropriate to state that the marker of obligation used in this experiment expressed one's certainty along with a deontic implication. Alternatively, it was hypothesised that the performance on the task with the declarative expression –*hata* would be better if children recognized that the marker represents factuality and the indication of factuality would express the relatively higher degree of accretion (Hirst & Weil, 1982). The relationships between social understanding and executive function were not mentioned in the Introduction of the current study. However, it also aimed at exploring the role of executive function on social understanding with a broad range of participants. It was hypothesised that if the cognitive skills were developed in parallel, correlations would be observed. Alternatively, it was hypothesised that the correlations would not be shown in older children based on the empirical findings in Korean children.

3.2. Method

Participants

Typically developing 4- and 5-year-old Korean preschool children were tested (*N* = 71 (37 girls), *M* = 58.7 months, *SD* = 5.99 months, age range: 46.5 to 72.4 months). The children were divided into two groups in which executive function tasks differed, as in Chapter Two. For a group with the Day/Night task, 37 children were tested, while 34 children in another group were administered the DCCS task. In the statistical analyses, the children were divided into two groups in order to investigate age-related differences in performance: 4-year-old group (*N* = 46, *M* = 55.1 months, *SD* = 2.98 months, range = 46.5 to 59.8 months) and 5-year-old group (*N* = 25, *M* = 65.4 months, *SD* = 4.09 months, range = 60.4 to 72.4 months). The children were recruited from preschools and kindergartens in Anseng, Hwaseng, Pyeongtaek in Korea, and were from lower middle-, and middle-class areas. An opt-in procedure was used for data collection following Ethical guidance of Lancaster University:

information and consent sheets were distributed to parents by head teachers prior to data collection.

Measures

Procedure

The test procedure was equivalent to that used in Chapter Two. The measures were conducted through two sessions approximately one week apart. The children were administered the vocabulary task first. The use of un/certainty markers in the change of location task and certainty/neutral expressions in executive function were counterbalanced respectively by a between-subjects design. The change of location and one of executive function tasks (either the Day/Night or DCCS task) were administered in a counterbalanced order about a week later in order to minimize carryover effects. The unexpected contents task as a social understanding measure was given last in the second session (see also Table 2.1 for the procedure of the experiment). In total, each child performed four tasks. The two sessions lasted about 15 minutes.

Vocabulary

The subscale of the verbal term, Information, in Korean-Wechsler Preschool and Primary Scale of Intelligence (K-WPPSI; Park et al., 1995) was administered as in Chapter Two.

False belief measures

The Change of Location task. As used in Chapter Two, certainty (-*ci*) and uncertainty (-*(u)l ke-ya* which was a colloquial form of -*keyss*) expressions were used for the protagonist's epistemic states. In the task, the child had to answer the question for where the protagonist would look for in either certainty or uncertainty task (i.e., between-subjects). The false-belief question was given first, and the reality and memory questions followed with a counterbalanced order. Credits were given when children had correctly answered both false-belief and reality questions. The scores varied from 0 to 1 (1: pass both questions 0: fail either question or both questions).

The Unexpected Contents task. The same procedure with Chapter Two was administered. For the child's own representational change and predicting others' minds, Self and Other false-belief questions (FBs) were given to the child. The control question to confirm that the child recognized a content of a box was given first. The Self and Other FBs were given to the child with a counterbalanced order. The reality question for a real object inside the box was given last. Children who correctly answered each FB and control questions received one point. When children correctly responded each FB and control question received one point; otherwise they had 0 point.

Executive function measures

The two different levels of linguistic expressions were used. For certainty, -*hay-ya* (or *ka-ya*) *hata* and for the neutral expression, -*hata* were used. For a detailed explanation and changes in forms of the linguistic suffixes in colloquial speech, see the Method section in Chapter Two.

The Day/Night task. The test procedure was identical to Chapter Two. The dependent measure was the number of correct responses out of 16 trials. Carlson's (2005) categorization which regarded more than 12 out 16 trials as having passed was also used for comparison with the research literature.

The Dimensional Change Card Sort (DCCS) task. The equivalent procedure to Chapter Two was applied. The correct responses of the post-switch trials were counted. As used in Chapter Two, the dependent variable was also categorically divided by pass/fail for comparison, and children who correctly sorted cards in 5 out 6 trials were regarded as having passed.

3.3. Results

The current experiment was set up to probe whether un/certainty expressions facilitated older children's cognitive skills or whether the findings with 3-year-olds in the previous study were replicated. Table 3.1 presents a summary of the procedure of the statistical methods and results to support an understanding of analyses.

3.3.1. Vocabulary

The scores of the vocabulary test showed a normal distribution, and ranged from 1 to 23 (M = 13.7, SD = 4.35). Only one 4-year-old had 1 point, a score that was an outlier. However, its exclusion did not influence age-related performance. Hence, the initial data (including the outlier) were used for subsequent analyses. Differences between the two age groups were explored through an independent-samples t-test. As would be expected, the results indicated that 5-year-olds (M = 15.9, SD = 4.16) significantly outperformed 4-year-olds (M = 12.5, SD = 4.47), $t(69) = -3.35$, two-tailed $p = .001$, $d = .79$. The distribution of the scores is shown in Figure A.4 in the Appendix.

Table 3.1

Summary of the procedure and results of statistical analyses

Task	Test	Statistical methods	Results
1. False beliefs (CL)	Certainty/age	Logistic regression	ns
	Chance performance	Binomial test by .25	4-year-olds: ns in certainty (C) trend of sig. in uncertainty (U)
			5-year-olds: ns in C / sig. in U
2. False beliefs (UC)	Certainty/age	Logistic regression	Self/Other FB - ns
	Chance performance	Binomial test by .25	Self: 4-year-olds - sig. in C/U
			5-year-olds - sig. in C/U
			Other: 4-year-olds - ns in C, sig. in U
			5-year-olds - sig. in C/U
3. Day/Night, DCCS	Certainty/age/ verbal skills	ANCOVA	ns for both
4. EF - FB	Role of EF on FB	Correlation	ns

Note. FB: False beliefs, EF: Executive Function. CL: Change of location, UC: Unexpected contents, C: Certainty, U: Uncertainty. DCCS: Dimensional Change Card Sort. ns: non-significant. sig.: significant.

3.3.2. False beliefs measures

In order to test hypotheses that either the uncertainty expression –*keyss* would moderate or the certainty marker –*ci* would highlight a speaker's assertion, false-belief measures with/out the specific grammatical certainty markers were administered to 4- and 5-year olds. Interestingly, the patterns of performance were shown differently by age. The tendencies of the 4-year-olds were consistent with the findings with the 3-year-olds in

Chapter Two. It appears that the exposure to the uncertainty expression might lessen the degree of one's assertion, while the certainty expression might contribute to an understanding of others' epistemic states. Having said that, as shown in Chapter Two the effects of each linguistic marker did not make significant differences. As might be expected, it is apparent that the additional expressions for one's belief did not influence the 5-year-olds' mental-sate understanding with successful performance with/out the expressions apart from those of the certainty false-belief task.

Figure 3.1 indicates the proportion of the children in each group who correctly responded to false-belief and control questions in the three key test questions. As noted in the results section of Chapter Two, the inclusion of the control (reality) question would be crucial to probe children's understanding of false beliefs; thus, .25 of the chance level was used in the analyses. The blue bars indicate the change of location FB, while the Self and Other FBs in respective greens and yellows are of the unexpected contents task. The performance on un/certainty and effects of the linguistic markers will be reported in the subsequent sections.

Performance on false beliefs with un/certainty

Sixty seven children (32 for uncertainty and 35 for certainty) were included in analyses. As noted above, a between-subjects design was used in the experiment. Thus, children were randomly allocated to either uncertainty or certainty condition for the change of location task. Four 4-year-old children were excluded from analyses by being absent for the second-week session. Children were regarded as passing when they correctly answered both false-belief and reality questions, and the scores ranged from 0 to 1.

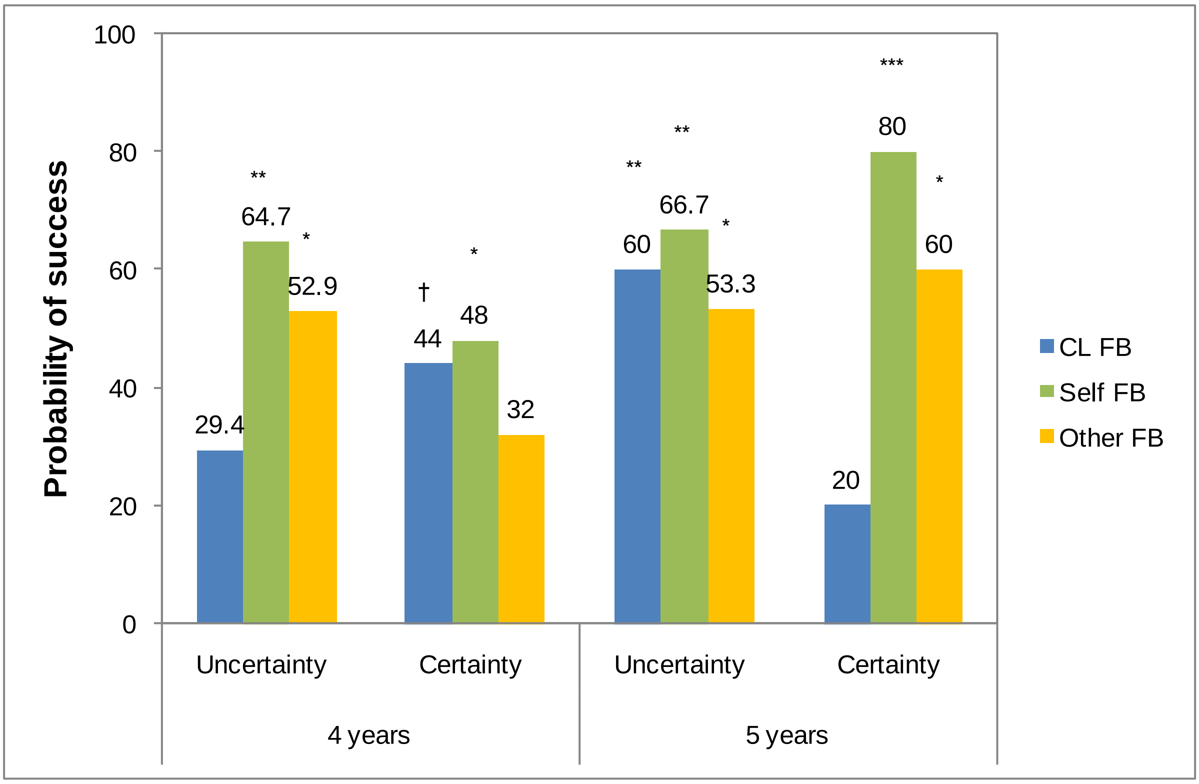

Figure 3.1. Percentages of children who passed the three types of false beliefs as a function of certainty. CL: Change location. FB: False belief.

$^{\dagger}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$ in tests against chance (.25).

First, age differences were explored between the two groups. Performance on the false-belief question had the binary distribution from pass/fail. Thus, a logistic regression test was carried out in order to explore age differences, taking into account certainty expressions. The results found that the model was not significant, Nagelkerke $R^2 = .01$, $\chi2\ (2, N = 67) = .45$, $p = .80$. Inclusion of the interaction of age X certainty and verbal skills did not make the model significant, Nagelkerke $R^2 = .10$, $\chi2\ (4, N = 67) = 5.25$, $p = .26$. Children's understanding of a mind was not significantly changed between 4- and 5-years. There were no significant effects of the different degrees of certainty. Although the results showed no significant differences in the two ages, performance on the FB question was analysed by each age and certainty group because it is possible that children by the age of five might show ceiling performance which might be different from four-years of age.

In order to examine children's understanding of beliefs, binomial tests were carried out against chance (.25). Chance of .25 came from the probability that children correctly answered both false-belief and reality questions. As can be seen in Figure 3.1, the children's levels of performance differed from certainty markers. The results found that the 4-year-olds were at chance on uncertainty, $p = .85$ (two-tailed and hereafter), while they showed a trend of significance on certainty, $p = .059$. Five out of 17 children with uncertainty and 11 out of 25 children with certainty passed the key test and reality questions. The patterns of linguistic effects replicated those of 3-years in Chapter Two. In contrast, however, the 5-year-olds showed different tendencies. As might be expected, the 5-year-olds with the uncertainty marker showed performance at a level of above-chance, $p = .008$. Nine out of 15 children predicted the protagonist's behaviour, suppressing the salience of reality. On the other hand, the 5-year-olds' performance on the certainty marker remained at chance, $p = 1.0$. Given the findings in 3- and 4-year-olds, a higher rate of passing in the certainty task would be expected. However, only two children passed both FB and reality questions and it seems to be difficult to elicit possible explanations from the data. Even at this age children appeared to have problems with both grasping the events in the procedure and inferring the protagonist's beliefs.

The influence of verbal input on Self and Other FBs

As stated in the earlier section, the main aim of the study was to explore whether the verbal input by the grammatically specific markers would contribute to older preschoolers' mental-state understanding. As mentioned earlier, 67 children were included in the analyses. First, effects of age and certainty in the Self and Other FBs were explored by logistic regression tests. Age and certainty were loaded as variables. An interaction of age X certainty and verbal skills was not included for the reason mentioned above. The results showed that the overall model did not significantly explain performance on the Self FB, Nagelkerke R^2 = .04, $\chi 2$ (2, N = 67) = 2.22, p = .32. Likewise, a logistic regression on the Other FB was carried out. The results found no significant effects of age and certainty, Nagelkerke R^2 = .05, $\chi 2$ (2, N = 67) = 2.27, p = .32.

Binomial analyses of the Self and Other FBs against chance .25 were carried out in order to reveal children's mental-state understanding. The 4-year-olds successfully retrieved their past belief (Self) at levels of above-chance, p = .001 and p = .02 for uncertainty and certainty, respectively. Eleven out of 17 children and 12 out of 25 children passed the test and reality questions after exposure to uncertain and certain expressions about beliefs, respectively. In contrast, the 4-year-olds' understanding of another's mind was relied on the degrees of certainty by which the protagonist's beliefs were expressed. The children in the uncertainty group performed significantly differently from chance, p = .02, whereas those in the certainty group randomly responded showing chance performance, p = .55. Nine out of 17 children with uncertainty and 8 out of 25 children with certainty passed the unexpected contents task. Again the results were consistent with Chapter Two.

It is apparent that the 5-year-olds might have grasped changes in their own beliefs and others' perspectives irrespective of previous experience in the linguistic markers. The results showed that the children's performance on the Self FBs was above chance, p = .002 and p <. 001 for uncertainty and certainty, respectively. Ten out of 15 children from uncertainty and 8 out of 10 children from certainty passed the task. Similarly, the children's performance on the Other FB was significantly different from chance, p = .03 and p = .04 for uncertainty and certainty, respectively. Eight out of 15 children and 6 out of 10 children from uncertainty and certainty groups, respectively, passed the question for others' false-beliefs. Taken together, the 4-year-olds showed that once they experienced the protagonist's ambiguity in the change location task, their access to another's mental-state was increased in the subsequent unexpected contents task (other) (from p =.85 to p = .02 of binomial tests). In contrast, the patterns of probabilities following a protagonist who used the certainty expression went in the opposite direction, from nearly significant to clearly NS (from p = .059 to p = .55 of binomial tests) in the 4-year-olds. Thus, the possible influences of the linguistic markers on children's beliefs might be very sensitive to their developmental level.

3.3.3. Executive function performance

It was sought to probe whether two linguistic expressions (-*hata* (do) for neutral and –*hay-ya hata* (must do) for certainty) might have different saliency in children's cognitive process. Regarding the marker, -*ya hata,* it was expressed as a form of obligation. However, as mentioned in the Introduction of this chapter, it seems possible that the marker may indicate one's certainty. Thus, it was used to different degrees of certainty in the previous and this study; so -*ya hata* and –*hata* were marked to indicate certainty or standard (or neutral) in this study. It was hypothesised that children's performance would be differently affected based on whether the children regarded the linguistic markers as either epistemic certainty or factuality. Contrary to expectations, the observed performance on both Day/Night and DCCS showed that the children did not appreciate the differences of certainty by the linguistic expression. Otherwise, it is conceivable that the children's performance approached ceiling, and this might lead to no differences between the tasks. Table 3.2 presents mean scores of children passing according to certainty and age.

Table 3.2

Descriptive statistics for Day/Night and DCCS tasks as a Function of Age and Certainty

	4 years		5 years	
Measures	Standard	Certainty	Standard	Certainty
Day/Night				
No. of correct trials	14.0 (3.12)	14.3 (2.61)	14.8 (1.39)	15.6 (0.89)
DCCS				
No. of correct trials	4.80 (2.53)	4.92 (2.45)	5.0 (2.45)	4.50 (2.51)

Note. Day/Night: n = 9 and n = 15 of 4-year-olds, and n = 8 and n = 5 of 5-year-olds for standard and certainty, respectively. DCCS: Dimensional Change Card Sort, n = 10 and n = 12 in 4-year-olds, and n = 6 and n = 6 in 5-year-olds for standard and certainty, respectively. Standard deviations are in parentheses.

The Day/Night task

Thirty-seven children (24 four-year-olds and 13 five-year-olds) were used in statistical analyses. Seventeen children performed the standard (neutral) type with the expression of *–hata* (do) and the rest of the children did the certainty type with the expression of *–hay-ya hata* (must do). The distribution of the Day/Night task, which is negatively skewed and leptokurtic, is shown in Figure A.5 in the Appendix. At first, normality of the data was examined by the Explore function of SPSS in order to analyse from the number of trials. The data were not normally distributed. Using Tabachnick and Fidell's (1996) method, the data were reflected and reversed, so that the distribution was more normal. However, the preliminary analyses with the transformed data did not differ from the analyses by the initial data. Thus, the initial data were used to illustrate the children's performance. A two-way analysis of covariance (ANCOVA) on Day/Night with age and certainty as main effects, an interaction between age and certainty, and verbal skills as a covariate was carried out. It observed no significant main effects of age, $F(1,32) = .49$, $p = .49$, $\eta_p^2 = .02$, certainty, $F(1,32) = .43$, $p = .52$, $\eta_p^2 = .01$, or an interaction, $F(1,32) = .06$, $p = .81$, $\eta_p^2 = .00$. The covariate (vocabulary skills) also did not significantly explain the variance, $F(1,32) = .38$, $p = .54$, $\eta_p^2 = .01$.

It is apparent that Korean children's inhibitory control by the Day/Night task was competent ($M = 14.2$ for the 4-year-olds and $M = 15.1$ for the 5-year-olds, respectively). Twenty-one out of 24 4-year-olds and 13 out of 13 5-year-olds accounting for 87.5% and 100%, of each group respectively, passed at least 12 out of 16 trials. Only three 4-year-olds who correctly responded in 6, 7 and 10 trials did not meet the criteria for passing the task. That is, the results seem to suggest that Korean children's inhibition was clearly more precocious than those in Western cultures. For example, in Carlson's (2005) study, which analysed data from nine studies and 194 children, the average percentage of the correct trials of 4-year-old American children was approximately 56%. Approximately 90% of British 5-year-old children in Simpson and Riggs's (2005a) study, and 78.1% of American 5.0-year-olds in Gerstadt et al.'s (1994) study performed correctly on the Day/Night task. As the present study did not compare cultural differences directly, it seems difficult to contend that Korean children showed statistically advanced skills in inhibiting. However, based on the figures mentioned above, it is apparent that the Korean children performed at a higher level on inhibition than their counterparts in other cultures.

The Dimensional Change Card Sort task

Thirty-four children performed on the DCCS task, and 16 children did the standard task with the expression of *–ka-ta* (go), while 18 children were administered the certainty task with the expression of *–ka-ya ha-ta* (must go). Figure A.6 in the Appendix shows the distribution of the children's performance on the DCCS task. The distribution showed eight outliers which identified less than five out of six trials as correct (6 0-, 1 3-, and 1 5-trials) in the post-switch trials. As the data were not normal, efforts for data transformation were made. Any data transformation was not able to reduce the outliers. However, following Frye et al. (1995), analysis of covariance (ANCOVA) was employed. There were two main effects of age and certainty and a covariate of verbal skills including an interaction of age X certainty, so that a two-way ANCOVA test was used. As shown in the Day/Night task, the results revealed no main effects of age, $F(1,29) = .18$, $p = .68$, $\eta_p^2 = .01$, certainty, $F(1,29) = .36$, $p = .56$, $\eta_p^2 = .01$, or an interaction of age X certainty, $F(1,29) = .03$, $p = .86$, $\eta_p^2 = .001$. Verbal skills as a covariate were not a significant factor, $F(1,29) = 2.51$, $p = .12$, $\eta_p^2 = .08$. Although the present study expected the effects of the linguistic expressions in the older preschoolers, perhaps not surprisingly, there were no differences in performance from certainty. A possible explanation for this might be that as the majority of children passed six out of six trials (81.3% and 72.2% for standard and certainty, respectively), it would be difficult to obtain discrimination between linguistic expressions.

The mean scores of correct trials regardless of certainty expressions were 4.86 and 4.75 for the 4- and 5-year-olds, respectively. Eighteen out of 22 4-year-olds (81.8%) and nine out of 12 5-year-olds (75%) sorted cards correctly in more than five out of six trials in the post-switch trials. Six (4 4- and 2 5-years) and one (5-years) children made errors sorting zero and three trials, respectively. In general, the 4-and 5-year-old Korean preschoolers revealed comparable performance on set shifting to those in Western cultures. For example, 92% of American 4-year-old children in Kirkham et al. (2003) and approximately 84% of British 4-years in Oh and Lewis (2008) passed the set shifting task by DCCS. Accordingly, the findings from the two executive tasks replicated those of Chapter Two. Therefore, it seems that Korean children's adept executive skills might be limited in conflict inhibitory control.

3.3.4. The roles of executive function in false-belief understanding

In the previous experiment, it was found that executive function did not significantly contribute to the development of social understanding. However, this might have been because children were before the 3-4 transition in terms of Western norms on the acquisition of false belief performance. In order to explore the link with the wide range of participants in age (4-5), the relationships between executive function and false beliefs were examined again. Prior to analysis, the relationships between false-belief measures were examined, and it was found that the change location task was not significantly related with both Self (Spearman's correlation r = -.03, p = .79) and Other FBs (r = -.03, p = .81). Thus, Self and Other FBs (r = .31, p = .01) were combined and averaged. In order to explore the relations, Spearman's correlations were conducted, given the negatively skewed and kurtotic distributions on false-belief and executive measures. For both Day/Night and DCCS tasks, the number of correct responses was loaded. Table 3.3 presents the correlations. As might be expected, it is apparent that the variables between social understanding and executive function were not significantly related. The partial correlations controlling chronological age and verbal skills remained non-significant (r = .10, p = .58 and r = -.07, p = .72 for respective CL FB and UC FB with Day/Night and r = .17, p = .36 and r = .29, p = .11 for each CL FB and UC FB with DCCS). The correlations showed differences from research in Western countries and consistent with those of Chapter Two, showing non-significant relationships between social understanding and executive function.

Table 3.3

Spearman's rho correlations among age, vocabulary, false-belief and executive measures

	Vocabulary	CL FB	UC FB	Day/Night	DCCS
Age	.44**	.04	.26*	.14	.14
Vocabulary		.03	.05	.26	.24
CL FB			-.04	-.04	.16
UC FB				.18	.21

Note. n = 71 for age and vocabulary. CL FB: Change of location false-belief (n = 67). UC FB: Unexpected contents false-belief (n = 67). n = 37 for Day/Night. DCCS: Dimensional Change Card Sort (n = 34).

$^{*}p < .05$, $^{**}p < .01$.

3.4. Discussion

The aim of the present study was to determine the effects of mental-states expressions by Korean suffixes (i.e., by grammaticalized markers) on 4- and 5-year-old children. In particular, this study aimed at probing whether the findings of the previous study were replicated in the older children. The current study showed consistent findings with the previous one in terms of the effects of linguistic markers on social understanding and executive function. As grammaticalized markers were used in the study, 'specific linguistic markers' or 'suffixes' were used to indicate epistemic terms by the grammatical system but not mental verbs. The effects of linguistic references identifying mental states differed from the levels of certainty in social understanding. In contrast, there was no significant influence of certainty on the children's executive function. In this section, I will discuss the relationship between mentalistic language and social understanding. I will then move onto executive function regarding the effects of language on it. Finally, I will consider the link between social understanding and executive function.

3.4.1. Children's social understanding and language

Does language facilitate young children's acquisition of a mental-state understanding and do the grammatically embedded expressions play a role in helping children to acquire these skills earlier than would be expected from data collected in other language groups? In order to answer the central questions, Chapters Two and Three reported two experiments conducted with Korean children between three and five years of age. First, it appears that Korean children's understanding of a mind was achieved at the age of five, if we can take false belief as a maker of such understanding (Wellman et al., 2001). Consequently, the role of the specific linguistic markers for un/certainty was observed in 3- and 4-year-olds. The most important finding was that the preschoolers' performance was influenced by the linguistic markers (i.e., certainty and uncertainty) used in the test questions and these appeared to be the same in the two younger age groups apart from the 5-year-olds as the oldest group children showed an understanding of a mind. It is apparent that the strength of certainty was a critical factor in facilitating performance on social understanding rather than the exposure of mental-state language. That is, the stronger certainty might have improved false-belief understanding at an early age. On the other hand, the weaker certainty (uncertainty) appeared to operate in lessening one's beliefs; therefore it may have undermined the children' access to another's mind. Thus, these results provide support for the hypotheses that children's false-belief attributions were closely related to the linguistic references made to them.

The findings were consistent with the view that mentalistic language referring to epistemic states is related to the development of social understanding (Astington & Baird, 2005). Furthermore, the results showing variations in the children's access to others' minds according to the levels of certainty support the account that young children's difficulty in false-belief understanding is bounded by linguistic demands (Lewis & Osborne, 1990). If this were the case, it would be possible to explain the 4-year-olds' late understanding of the mind in the current study. There is a general consensus that children attribute false belief to others at the age of four. However, as noted in the Introduction of this chapter, Korean children tended to provide underdeveloped patterns at the age of four. Similarly, the 4-year-olds in the present study showed influences of the linguistic markers as they did not firmly understand others' false beliefs whereas the 5-year-olds were able to do so regardless of linguistic manipulation. It seems that language demands might explain the performance witnessed here.

Researchers have highlighted the importance of mental-state talk of mothers to preschoolers. Children who are frequently exposed to productive conversation in reference to the mind tend to master the false-belief task earlier than those who do not (Dunn & Brophy, 2005; Dunn et al., 1991; Ensor & Hughes, 2008; Harris, de Rosnay, & Pons, 2005; Ruffman et al., 2002; Taumoepeau & Ruffman, 2008). It seems that Korean children might not have psychological discourse with their caregivers in an early age as those from Western cultures do. For example, Choi and Gopnik (1995) conducted a longitudinal study with Korean- and English-speaking children in their second year in order to investigate early semantic development. They analysed the talk of caregivers to the child and divided into two terms for nouns and verbs: object vs. non-objects nouns and action vs. non-action verbs. The non-action verbs include references to psychological attributes. They found significant differences in utterances between mothers of the two cultures. It was observed that Korean mothers yielded action verbs more than non-action verbs. In contrast, English-speaking mothers' utterances were the opposite. Thus, it seems possible that Korean children might have less experience in mentalistic conversations, and this might lead to relatively late understanding of mental terms such as *know* or *think* which is importantly related to the development of social understanding.

Furthermore, it seems plausible that the grammatical structure of Korean, which is SOV (Subject Object Verb), and the acquisition of semantics might impact Korean children's mental-state understanding. According to Lee and Kim (2009), in the SOV structure a verb completes the sentence and conveys salient information. Japanese has a similar structure and both languages can express a speaker's certainty or evidentiality not only by verbs but also by sentence-ending suffixes (Choi, 1991; Matsui et al., 2006). It seems possible that the acquisition of un/certainty might be acquired by grammatically encoded markers more than by mental-state verbs within languages which have the grammatical system for certainty/evidentiality. For example, Matsui et al. (2006) reported the frequency of certainty and evidentiality by particles and relevant verbs from mother-child utterances in Japan. They found clear differences between particles and verbs. That is, both mothers and children identified the nature of a person's knowledge by using certainty and evidentiality rather than selecting relevant verbs to perform the same function.

It seems that there are no data from Korean learners regarding their production of un/certainty comparing the grammatically embedded markers and mental-state verbs from mother-child utterances. However, it is conceivable that Korean learners may show a comparable pattern of the language acquisition to the Japanese samples given the same grammatical structure and the system marking certainty/evidentiality. Based on this similarity, it seems plausible that Korean learners might acquire un/certainty particles more easily than mental-state verbs. The test questions used in the false-belief measures generally use mental-verb terms as mentioned in the Introduction section of this thesis. However, young Korean children might not be exposed frequently to such mental-verb terms. This tendency of language exposure might have led to the 4-year-olds' late acquisition of social understanding. Taken together, although verbs in Korean convey important information, learners of this language might be less frequently exposed to mental-state verbs with low input frequency of them from mothers, and they might understand others' mental states by the grammaticalized expressions rather than verbs in an early age. Therefore, it is conceivable that the pattern of the language acquisition of Korean, with its particular language demands, might be related to the 4-year-olds' relatively late development of social understanding in the current study.

With regard to the children's performance, the findings replicated those of Chapter Two with the 3-year-olds, in particular from the 4-year-olds, but not the 5-year-olds. As stated above, the influences of the linguistic manipulation might be discovered from the population who did not develop a mental-state understanding. Although the differences in the tasks with/out the un/certainty markers were not statistically critical, the trend in the effects of the markers was replicated, suggesting that children's access to epistemic states could appear differently depending on a speaker's attitudes. The findings appeared to reflect that *–keyss* (-(*u*)*l kes*) (may) was regarded as an expression of one's conjecture, whereas *–ci* (sure) was considered to express one's truthful commitment to the proposition for the 3- and 4-year-olds throughout the two experiments. It seems also possible that certainty differentials might be recognized by the 5-year-olds; however, uncertainty might not influence when they were able to see from others' point of view. Regarding certainty, there seemed no clear clue to explain the performance at-chance on the certainty task of the 5-year-olds. One possible explanation for this is that they made errors in understanding even though the younger children understood appropriate use of the certainty marker (Strauss & Stavy, 1982). In the Discussion section of Chapter Two, I mentioned that the acquisition of the un/certainty markers might not be completed at the age of three as shown by the non-significant differences between the two markers. However, it seems possible that they might have acquired a distinction between certainty and uncertainty, but the non-significant differences might have resulted from subtleness of the markers used here.

In summary, the findings from the two experiments indicate that language identifying mental states influences the young children's access to others' thoughts. However, certainty is an important factor in facilitating their understanding of mind in this. One's confident attitude promotes the young children's acquisition, while uncertainty did not facilitate.

3.4.2. Do external verbal demands facilitate preschoolers' executive skills?

Performance of the 4- and 5-year-olds on self-regulation and set shifting did not produce evidence for the hypothesis that external verbal input with variations in certainty produced by language specific markers would vary in their cognitive salience and lead to performance differences on these cognitive measures. There are several possible explanations for the non-significant results. First, it seems plausible that a cognitive salience of tests might be on core dimensions rather than children's ability to appreciate others' epistemic states for their behaviour. It seems that once children recognized the rules of the tasks based on dimensions (i.e., shape or colour in DCCS and day or night in Day/Night), differential emphasis on verbs for subsequent action might not be salient. In other words, it is conceivable that prepotent information to perform such tasks might consist in labels. There is evidence that children's performance can be improved when reducing cognitive requirements by such as manipulating responses of labels for the Day/Night task (e.g., Diamond, Kirkham, & Amso, 2002; Montgomery, Anderson, & Uhl, 2008; Simpson & Riggs, 2005b; Simpson et al., 2012) or by identifying cards in the DCCS task (e.g., Kirkham et al., 2003; Towse, Redbond, Houston-Price, & Cook, 2000). The ability to inhibit incorrect responses (i.e., saying correct labels) is a key factor to perform the task such as Day/Night successfully. For example, Simpson and colleagues (Simpson & Riggs, 2005b; Simpson et al., 2012) found that when labelling responses (e.g., saying ‘dog’ for a day card and ‘pig’ for a night card) were not related to the stimuli (e.g., day and night cards), the inhibitory demands were lessened and this led to children’s improved ability to suppress predominant responses. The research seems to suggest that the capacity of inhibitory control evaluated by Day/Night may be relied on the relationships between responses and the stimuli. Hence, it seems possible that external verbal input for modulating behaviour might be overrode by the condition used in the present study which maintained the response-stimuli association that is salient.

Similarly, Towse et al. (2000) found that increased salience of the post-switch dimension in the DCCS task by asking children to identify the rule led to success in sorting cards. In their Experiment 4, 3-year-old children who failed the post-switch phase were given a knowledge question about salient features of the trials (e.g., “Is it a red or green card?”), and then they were asked to sort cards according to the rule of the post-switch phase. Towse et al. found that approximately one third children who previously failed were able to sort cards after they self-labelled the dimension of the post-switch trials. In line with findings from the research with the Day/Night test, studies using the DCCS task also seem to suggest that features of cards may be cognitively salient. Taken together, it appears that dissociation between responses and stimuli or highlighting features of cards may be crucial for improving inhibitory ability. Thus, if this were the case, expressions describing motor inhibition (i.e., do or must do) may have mere or no effects on changing cognitive salience in performing either the Day/Night or the DCCS tasks.

Another possible explanation is that influences of language (i.e., verbalization) on executive control might be dependent on the developmental levels. In other words, as stated in Chapter One, it is conceivable that the role of external verbal input might remain at an early age. According to the early developmental pattern of self-regulation by Kopp (1982), language functions as a mediator in relation to age relevant behaviours. Infants begin to respond the external verbal input such as a caregiver's signal at between 9- and 12-months. There is a shift in the directive role of language after the period. That is, reactions to external commands from adults are shown in the second year and children's regulation progresses to responses to their own speech at 3- and 4-years. It is more likely that the origin of control at the preschool period is from children themselves rather than from influences of others. Indeed, research has shown the role of children's own speech on self-regulation (e.g., Fernyhough & Fradley, 2005; Winsler, Abar, Feder, Schunn, & Rubio, 2007; Winsler, Manfra, & Diaz, 2007). For example, Fernyhough and Fradley (2005) conducted research on whether children's overt speech has a supportive role in executing a task which requires cognitive effort. In their study, 5-6-year-olds were asked to solve the Tower of London task in which wooden balls were set into three pegs with different lengths by moving the balls to make certain configurations (see Shallice, 1982 for Tower of London). Utterances the children made during the task were analysed in order to explore the relations between task performance and speech. Fernyhough and Fradley found that children who uttered overt task-relevant speech were more likely to perform the minimum number of moves to make the tower of balls, suggesting that a person's own speech has an adaptive function for goal-directed behaviours. This role of self-speech (more likely subvocal speech) in regulating one's behaviour is also observed in adulthood (e.g., Baddeley, Chincotta, & Adlam, 2001; Emerson & Miyake, 2003; Kray, Eber, & Lindenberger, 2004; Miyake, Emerson, Padilla, & Ahn, 2004). The evidence reviewed above seems to indicate that there is an age-related change in terms of effects of verbalization on performing executive function. It appears that speech plays a role in self-regulation but internal speech rather than external input may critically influence cognitive process after preschool age onward. Therefore, the linguistic markers used by the experimenter might not have made differences in the preschoolers' performance in the present study.

The other possible explanation might be that perceptual salience of the two linguistic terms might be comparable. Instructions given by the experimenter to perform the tasks by either *–ya hata* (must do) or *–hata* (do) might be equivalent in terms of quality. According to Grice (1975), the maxim of quality is that: (1) do not say what you believe to be false (2) do not say that for which you lack adequate evidence. That is, it seems possible that according to this cooperative principle and as there was no negation in the instructions, children would expect that the statements from the experimenter would be true. In addition, according to Palmer (1986) a declarative sentence conveys beliefs. It is conceivable that children might regard that the experimenter expressed her true belief in informing what they should perform in the tasks. Therefore, the deontic expression might not induce a special effect. Consequently, the lack of an influence of external verbal input used here on executive function might have been resulted from the structural aspects of the tasks carried out along with children's development of self-regulation in the preschool age.

So far, this section discussed the possibility of non-significant effects of linguistic markers. Taken explanations from the previous study together, there can be several reasons for the findings such as the nature of the executive measures, subtle differences of the linguistic markers, or cultural practice. However, it seems to be difficult to determine a critical factor. As the two experiments did not find the effects of language, no further research was conducted regarding linguistic manipulation in the test question for executive function measures. However, executive function was employed again in order to explore its role on social understanding, in particular selective trust in Chapter Six.

3.4.3. Performance on executive function and its links to social understanding

Korean 3-5-year-old preschoolers' executive skills were examined from one inhibitory control and one set shifting task by means of two experiments. The current study replicated findings from the previous experiment, showing relatively skilled performance on inhibitory control but not on set shifting used here compared to those from the previously published research in Western cultures. Regarding the relationships between executive function and social understanding from each study, it was found that there were no significant associations between two cognitive skills from either the 3-years-old or older children. Although Experiments 1 and 2 showed no role of executive function on social understanding, it might be necessary to explore the relationships as a whole. Spearman's rho found no significant associations either between the change of location and Day/Night ($r(78) = -.02$, $p = .87$) / DCCS ($r(76) = .10$, $p = .39$) or between the unexpected contents and Day/Night ($r(78) = .11$, $p = .35$) / DCCS ($r(76) = .19$, $p = .10$) before controlling for age and verbal skills. Although it was mentioned above about adept levels of the Day/Night tasks, the children's performance showed a wide range of correct trials from 2 to 16 out of 16 trials from the two experiments. That is, it appears that despite of wide variations in inhibitory control, the significant correlations with social understanding were not discovered. Hence, the findings seem to support the argument of Oh and Lewis (2008) questioning the fundamental role of executive function in the acquisition of social understanding.

On the other hand, it seems possible that the method which used a single measure of either social understanding or executive function may call into question the failure to find relationships because it may be critical to use aggregated data from multiple measures in relation to cognition-behaviour research as the aggregation of several measurements strengthens reliability of measures (Rushton, Brainerd, & Pressley, 1983). However, it might not be the case in the current study. There has been empirical research reporting correlations between single set shift measure and single false-belief test without aggregation (e.g., Frye et al., 1995; Perner et al., 2002). These studies also showed that the correlations remained significant after controlling age or verbal skills. Hence, the correlational method with single measure used in the study would be valid to question the developmental relation between executive control and children's understanding of mental perspective, at least in this particular cultural setting (Oh & Lewis, 2008; Sabbagh et al., 2006).

Taken together, the procedure using the single task of subcomponents of executive function would allow us to explore the relationship between executive skills and false-belief understanding. However, the findings did not show any significant associations between the two cognitive measures supporting the view of Oh and Lewis (2008). Although the role of executive function on social understanding was not observed in the two experiments, measures of executive skills were used again as mentioned above. This is because the role of executive function could differ according to the nature of questions in social understanding (see the Introduction section to Chapter Six).

3.5. Conclusion

The major findings in Chapters Two and Three were that beliefs could be differently understood according to a speaker's attitudes in young children. However, this was discovered in children's mental state understanding but not executive function. This discrepancy might be related to the relationship between language and cognitive development. It seems that linguistic influences on the development of self-regulation might be relatively straightforward with children's use of verbalization from external to self-speech. In other words, external verbal input did not seem to facilitate children's executive skills at the age when children utilize their own speech to control behaviours. On the other hand, it appears that an understanding of mental states is more closely intertwined with mentalistic language. The findings lend support to the claims that the use of mental terms through communication leads to an early understanding of beliefs or thoughts. Importantly, however, the results suggest another point of view on the role of mental terms. That is, children's mentalistic awareness of linguistic terms was differently related to their access to others' minds. This seemed to be a more important influence on performance than the use of specific mental terms. The exposure to the uncertainty marker –*keyss* (~ (*u*)*l kes*) boosted children's mental-state understanding whereas previous experience of the certainty marker –*ci* moderated the ability when a speaker's perception was not underlined. That is, it appears that such use of the grammaticalized linguistic expressions for certainty may increase sensitivity to beliefs in young children.

The two experiments reported so far examined how certainty was related to false-belief understanding and executive function. The next three studies employed the grammatically specific terms in order to explore whether linguistic markers indicating sources of knowledge (i.e., evidential markers) facilitate children's understanding of informational access and selective trust. Executive function is not examined again until Experiment 5 (Chapter Six) when it will be used as a measure to explain children's ability to exercise selective trust.

Chapter Four: **Do children exercise selective trust taking account of evidentiality and certainty?**

4.1. Experiment 3

Chapters Two and Three explored whether certainty by Korean inflectional particles facilitated young children's mental-state understanding and executive skills. The findings were intriguing. The facilitative effects of verbal expressions were found in social understanding but not in executive skills. Furthermore, the effects of mental-state expressions were observed differently according to the degrees of certainty in 3-4-year-olds but not in 5-year-olds. Once the children heard the protagonist's uncertain belief their success in prediction without the uncertain expression improved. In contrast, their access to others' beliefs showed difficulty when they were once exposed to an expression of confidence about his belief. It seems that un/certainty expressions were not influential in children who might have developed false-belief understanding. The findings support the view that an early acquisition of certainty identified in grammatically embedded markers allows easier access to mental-state understanding. However, the studies do not provide evidence as to whether the grammaticalized markers have advantages in understanding mental state attribution and evaluating what others know when they indicate evidentiality. There is evidence that evidentiality might be acquired later than the preschool age (e.g., Aksu-Koç & Alici, 2000; Fitneva, 2008; Papafragou et al., 2007).

This raises the strong possibility that it is not completely appropriate to use false-belief measures to explore the role of evidentiality, as according to this time frame children develop false-belief understanding prior to the acquisition of evidential meanings (e.g., Wellman et al., 2001). Hence, we decided to employ a new paradigm, selective trust, in developmental research which also assesses children's reasoning about others' knowledge based on testimony and what they know (Harris, 2007; Koenig et al., 2004). As selective trust assesses how children judge others' action taking account of their beliefs or knowledge status, this paradigm would be in line with false belief measures in terms of mentalistic appraisal. Moreover, the structure of selective trust allows us to manipulate linguistic information as the paradigm investigates children's judgment on others' testimony (e.g., Koenig et al., 2004). For this reason and the wider age range studied using this paradigm, selective trust was used in the current and the next studies in order to explore whether grammatical evidental markers facilitated children's mentalistic understanding within this context.

As mentioned in Chapter One, the research on selective trust has mainly used a framework in which two speakers provide conflicting information about common and unfamiliar objects. In test states, children are asked to label names of novel objects tracking the past history of the speakers' reliability based on information they provided for familiar objects. Although the research has shown mixed results in terms of age changes, children at the age of three or four showed the ability to demonstrate sensitivity to reliable information on accuracy (Corriveau & Harris, 2009b; Jaswal & Neely, 2006; Koenig et al., 2004). As the research has shown, accuracy is a critical factor in judging one's credibility. However, it appears that there are also weighing aspects influencing young children's judgment upon accuracy, such as preference for group membership (Harris & Corriveau, 2011; Kinzler, Corriveau, & Harris, 2011), expertise (Lucas et al., 2013; VanderBorght & Jaswal, 2009), age (i.e., adults over children) (Jaswal & Neely, 2006; Rakoczy, Hamann, Warneken, & Tomasello, 2010) and so on.

So far research has shown the importance of accuracy when children accept information. However, it seems that children also take a proposition from a previously inaccurate speaker when s/he has uninformative access to an object. For example, Nurmsoo and Robinson (2009b) conducted a study in order to investigate whether children understood the underlying causes of speakers' in/accuracy from access to relevant information. In their study, two different dimensions of objects were expressed by the speakers: colour or hardness. For task conditions, there was a difference in how well the speakers gained access to the object. In the puppet uninformed condition, the puppet touched a toy in a tunnel which was covered by a curtain, but identified the toy with the different dimension of colour (e.g., The puppet felt the toy and said, "the (blue) one"). That is, the puppet made errors in terms of the type of information that could be elicited. On the one hand, in the puppet informed condition, the puppet had adequate access to the toy; for example, it saw (felt) the toy and said its colour (hardness). However, the puppet provided wrong information about the toy. Importantly, the puppets in both conditions identified incorrectly, while children had informative access to the toy in the history trials. Thus, the children had an opportunity to judge the puppets' accuracy. In contrast, the children did not have informative access to the toy but were asked to address the dimension of the toy from irrelevant information (e.g., "The hard one" having only seen it) in the subsequent test trials. In contrast to the children's identification, the puppets were well informed and provided conflicting information (e.g., "the soft one" having felt it). Finally, the children were asked to identify the toy according to the dimensions. This final question was to examine whether the children maintained or switched their responses taking account of the puppets' knowledge status when they had no adequate information. Nurmsoo and Robinson found differences according to the conditions. Children were more likely to take the proposition from the puppet in the uninformed condition, whereas those in the informed condition showed random responses for the dimensions of the toy. In other words, children selectively accepted information, evaluating reasons for being inaccurate. Nurmsoo and Robinson (2009b) suggested that children did not simply rely on the output of the speakers but also interpreted given circumstances. Taken together, it appears that several factors may influence young children's selective trust. As shown, children trust accurate over inaccurate speakers. However, they also obtain information from an inaccurate speaker under certain circumstances.

Given that this is such a flourishing research area, it may seem a little unexpected that there is little evidence of linguistic effects on selectivity of trust. Therefore, the current study explored whether linguistic manipulation by evidentiality affected children's evaluation of trustworthiness. According to Willett (1988), evidentials deliver not only the origins of information but also the degrees of certainty. Thus, the current study was designed to investigate whether children exercised selective trust taking accuracy or certainty into account.

The conventional framework of selective trust has been criticised for its construction to evaluate epistemic understanding. Lucas and Lewis (2010) claimed that the conventional framework in which an inaccurate informant, in particular an adult, called a ball a shoe was unrealistic because it is highly unlikely that an adult would really make such an error of judgment. Thus, it is not reasonable to assume that the inaccurate informant was not knowledgeable about objects in the daily use in the paradigm. In response to this concern that there is no clue for children to regard that the inaccurate informant has misinformed knowledge, the current study modified the conventional paradigm. In the present procedure, one informant had direct knowledge looking at objects inside a box, while the other informant had indirect knowledge by hearsay from an actor. The informant expressed what she thought. This modified procedure would provide possibilities for children to make epistemic judgment about why an informant could be misled and allow us to understand how children consider the misinformed person's credibility.

Another criticism made is whether children's selective trust is based on mentalistic inferences (Birch et al., 2008). For example, Nurmsoo and Robinson (2009a) argued that young children may not reason about why errors are made, so that they may not excuse inaccuracy, but just make their judgment based on inaccurate information. They conducted a series of experiments in order to explore whether children interpreted a speaker's inaccuracy. In their study (Study 1), the procedure was consistent with the traditional method in which one speaker was accurate and the other speaker was inaccurate. However, in their studies, the inaccurate speaker wore a blindfold in history trials with familiar objects and s/he provided labels for novel objects without a blindfold in test trials. The labels from the previously inaccurate speaker differed from the previously accurate speaker in the test trials. It was expected that if children reasoned about errors, they would not show preference for either speaker. However, they found that children at the age of 4-5 years endorsed novel names according to the previously accurate speakers' hints, whereas 3-4 year-olds did not show any preference for either speaker. In contrast, children of both groups succeeded on the traditional version of the task. These findings do not suggest that young children selectively learn names considering speakers' mental states. As stated earlier, the modified tasks of the current study are consistent with the study of Nurmsoo and Robinson (2009a) in that the tasks included an appropriate reason for one speaker to make errors or to be uncertain about her belief. Hence, as noted above, the modified tasks would provide a means of understanding whether children engage in mentalistic reasoning to demonstrate selective trust. The detailed aspects of the tasks will be described in the Method section.

In Chapter One, I discussed possible differences in the acquisition of social understanding in children who either grasp or do not grasp specific evidential markers. However, I will state differences briefly here to remind the reader of the reason for the use of evidentiality. Research has indicated the close relationship between the language ability and the development of social understanding (e.g., Astington & Jenkins, 1999; Harris et al. 2005). In particular, Olson (1988) argued that an understanding of others' beliefs is dependent on the acquisition of linguistic terms such as *think* or *know* which are generally acquired at 4-years of age. However, research on children who have a grammatical system to express cognitive words has suggested a different tendency from those who do not have the system (e.g., Aksu-Koç & Alici, 2000, Matsui et al., 2009). That is, the research listed argued that children using grammatical certianty/evidential markers tended to acquire implications of mental terms at an early age and the use of such markers might promote their social understanding. It seems possible that the obligatory use of markers of epistemic terms might support children's development of social understanding. As mentioned in Chapter One, there was research showing conflicting evidence of effects of evidentiality on children's early acquistion of others' beliefs (e.g., Papafragou et al., 2007). However, based on the point of view of early access to epistemic states by the grammatical system, I decided to use evidentialtiy in this study in order to examime whether children's reasoning about others' trustworthiness was aided by evidentiality. It is hoped that this study which used evidentiality provided evidence to contribute to the current debate.

Two different evidential markers, which indicate different origins of information and are attached to a verb, were used in the current study: *-te* (I saw) for direct information and *–napo* (It seems / I guess or think) for indirect inference. *–Te* is a marker which refers to the visual or sensory evidence, and that indicates a speaker witnessed a past event (J. Song, 2009; K. Song, 2009). As the suffix, *-te* implies the speaker's past perception, *-te* can be translated in English with terms such as *saw* or *heard* for visual or sensory base, respectively (Lee, 2009; Lim, 2012). For example, the following sentence indicates a speaker's visual access to the event: *Mary-ka hakkyo-ey ka-te-la* ([I saw that] Mary was going to school). According to Willett (1988), direct evidence provides more reliable and stronger certainty than indirect evidence. Therefore, *-te* would rate the higher certainty than the marker of indirect evidence. Indeed, when the direct expression *–te* is marked by a single occurrence without the other evidential expression, it conveys the higher certainty (e.g., 95% of certainty) (Lee, 2010)

On the other hand, -*napo* is a marker for indirect evidence that delivers a speaker's inference, and consists of two morphemes –*na* and –*po* which indicate *whether* and *see*, respectively (Kwon, 2012). –*Napo* is related to indirect reasoning based on auditory, visual or other evidence, and can be translated in English in terms such as *think*, *guess* and *seems* (Kwon, 2012; K. Song, 2009). For example, the following sentence shows the use of –*napo* for inference: *Mary-ka hakkyo-ey ka-as-napo-a* ([It seems] Mary went to school). Without –*napo* in the example, the speaker's epistemic state could be neutral, direct or hearsay in terms of sources of evidence (Kwon, 2012). In the present study, -*napo* was used in order to show that an informant had indirect information and therefore to express her uncertainty about the contents in the box. As described above, the evidential markers were used to express both sources of information and degrees of certainty; that is, -*te* and –*napo* referred to certainty and uncertainty as the markers are for direct and indirect evidence, respectively.

It is necessary to explore whether the markers used here (i.e., -*te* and –*napo*) would be understood by young Korean children. It seems that there is little research on when or how often Korean children produce the evidential markers used in this study although the studies mentioned above investigated implications of the markers. According to one available study by Choi (1995)[2], -*napo*, between 2.8 and 3.0 and the use of the marker was context-appropriate. However, it seems that there is no data for the use of the direct marker, -*te*, in young children's spontaneous speech. Having said that, it appears that children tended to understand direct evidentiality before their acquisition of indirect evidential markers (Aksu-Koç & Alici, 2000). Thus, it seems plausible to speculate that Korean children might produce and understand both markers before three years of age.

[2] I mentioned her work in Chapter Two but cited here again because the marker, -*napo* was not explained in Chapter Two.

The main question of the present study was whether children exercised selective trust comparing speakers' epistemic differences which varied in their knowledge or certainty status. In order to explore the question with linguistic manipulation, a 2 (accuracy) X 2 (certainty) design was used. Therefore, four types of tasks were generated: correct certain vs. correct uncertain (CC vs. CU), incorrect certain vs. incorrect uncertain (IC vs. IU), correct certain vs. incorrect uncertain (CC vs. IU) and incorrect certain vs. correct uncertain (IC vs. CU). For the four various tasks, the basic procedure was maintained. One informant looked directly at the objects in the box and therefore expressed certainty. On the other hand, the other informant received information from an actor (i.e., a puppet) and therefore expressed uncertainty. It seems possible that the design which used linguistic expressions and showed speakers' access to information might call into question whether children's judgment on reliability is by linguistic expressions but not by physical sources of information. Findings from four conditions would allow us to interpret effects of mixed manipulation. For example, the IC vs. IU task would help in clarifying this combination. In this task, it does not make sense if a speaker expresses certainty with inaccuracy after she saw a real object. If children sided with an incorrect but certain speaker over an incorrect and uncertain one, it would indicate that children tend to put emphasis on access to information regardless of the degrees of certainty. Therefore, the four conditions varying accuracy and certainty along with access to information would provide information regarding which factor children use to discriminate the speaker's reliability.

In the CC vs. CU task, both speakers correctly labelled the names of the objects, whereas they expressed the differential degrees of certainty. As noted in Chapter One, young children understand the differences in certainty and they regard a speaker with certainty as a more reliable source of information (Moore et al., 1989; Sabbagh & Baldwin, 2001). Along with differences in certainty, the way in which speakers obtained information was also presented in the paradigm. According to Pratt and Bryant (1990), children as young as 3- and 4-years old understand that one can establish knowledge by seeing. They conducted research to investigate young children's understanding of the link between knowledge and sources of information. In their research (Experiment 1), children between three and four were presented with people who looked inside a box or lifted it up (The two assistants performed in front of the child). They then were asked who knew/could tell what was inside the box. Pratt and Bryant found that the majority of the children responded that the one who looked inside the box knows/can tell us about the contents of the box. The findings indicate children consider people who had direct experience as more knowledgeable than those with indirect experience. That is, it seems possible that children may distinguish reliability by both statements and access to information. Thus, it was hypothesised that if children understood the different degrees of certainty by Korean evidential markers and access to information, they would choose the names of the objects from the informant with confidence, in the case where correctness was equivalent. Alternatively, it was hypothesised that children would show no preference for either informant if they considered the access to information of the speakers.

In the IC vs. IU task, both speakers were incorrect about the objects, but their certainty was differential as in the CC vs. CU task. As noted earlier, young children were able to consider causes of errors and accept information from a previously incorrect speaker (e.g., Nurmsoo & Robinson, 2009b). Thus, it was hypothesised that if children appreciated the speaker's access to information, they would preferentially endorse novel names based on the informant with uncertainty as she had inadequate information. Alternatively, if they took account of output of the speakers, children would show no preference for either speaker as they were both inaccurate. In the CC vs. IU task, information was obviously conflicting: accurate vs. inaccurate. This task was consistent with the research using the conventional procedure. As stated in Chapter One, the research has shown that accuracy trumps inaccuracy.

Thus, it was hypothesised that children would show sensitivity to the speakers' knowledge states and prefer learning from an accurate informant. Finally, in the IC vs. CU task, it was hypothesised that if it was the case that accuracy was the most critical factor over other features, children's selective trust would be based on the accurate informant, even though she was not confident of her belief. Alternatively, it was hypothesised that if children took account of certainty over accuracy, children would regard the confident informant as a more reliable source of information.

In the current study, Korean children between three and six participated. In the two previous experiments, influences of certainty were observed in relatively younger children, i.e., 3-4-year-olds. However, as stated above, it appears that the acquisition of evidentiality might develop around 5-6-years of age. Hence, the current study employed a wide range of participants, including 6-year-olds.

4.2. Method

Participants

In total 144 typically developing Korean 3.6- to 6.5-year-old preschool children were tested (77 boys) in four types of the task. Thirty-six children (*M* = 60.5 months , *SD* = 9.17 months, range 42.1 to 75.3 months) in CC vs. CU, 36 children (*M* = 60.5 months , *SD* = 9.88 months, range 41.9 to 75.8 months) in IC vs. IU, 36 children (*M* = 60.6 months, *SD* = 9.16 months, range 43.7 to 76.0 months) in CC vs. IU, and 36 children (*M* = 60.6 months , *SD* = 8.96 months, range 44.2 to 75.2 months) in IC vs. CU. Children were recruited from preschools and kindergartens in Anseng, Inchen and Phyengthayk in Korea and were from lower middle-class areas. Following Ethical guidance of Lancaster University, an information sheet which briefly described the purpose of the study and a consent form for children's participation were distributed to parents by head teachers, prior to the data collection using an opt-in procedure.

Measures

Procedure

Tests were carried out individually in an empty room of the child's preschool or kindergarten. When an empty room was not available, a room which was shared with teachers was used for the experiment, but testing took place in a quiet corner so that the interaction was not disrupted. The children were assigned randomly to one of four tasks. The test took approximately 10 minutes for each child.

Selective trust measure

The measure of selective trust followed Koenig et al.'s (2004) procedure. A series of six video clips was used for the visual stimuli that included three familiarization and three novel trials. Two females and three hand puppets acted for the stimuli. In each video clip, a female actor used a bear hand puppet and the other female actor used a giraffe and a sheep hand puppet. The bear hand puppet appeared on the left of the screen, and the giraffe and the sheep hand puppets were in the middle and right of the screen, respectively. Their positions were maintained throughout trials. The video clips were played using a laptop. Throughout the trials, the puppets were emphasized as informants but the females were instructed not to draw the child's attention to the means of information obtained. A box with an object was placed on a table when the experiment was administered. This box and object were the same as on the screen of the laptop and used to show the child clearly what the object was. The object was changed for each trial. On familiarization trials, three familiar objects were used: a ball, a car and a camera. On novel trials, three unfamiliar objects were used: a) a brown, wooden object, b) a pink, plastic object, c) a yellow, steel object. Figure 4.1 and 4.2 show pictures of the familiar and novel objects, respectively. The order of the objects presented was maintained as follows: a ball, a car and a camera for familiarization trials, and a wooden, a plastic and a steel object for novel trials. Table 4.1 presents a list of familiar and novel labels used for the familiarization and novel trials, respectively.

Figure 4.1. Pictures of the familiar objects.

Figure 4.2. Pictures of the novel objects.

Table 4.1

A complete list of stimuli used in familiarization and novel trials

Familiar objects	Correct labels	Incorrect labels
Ball	Ball	Book
Car	Car	Cup
Camera	Camera	Shoe
Novel objects	Correct novel labels	Incorrect novel labels
Brown wooden object	Kapi	Soco
Pink plastic object	Imay	Lamu
Yellow steel object	Ceya	Tutha

As noted earlier, the task used a 2 X 2 design: informant certainty (certainty vs. uncertainty) and correctness (accuracy vs. inaccuracy). Table 4.2 shows examples of statements used in each condition. They are presented by certainty and uncertainty because the speakers' accuracy varied according to the conditions, while un/certainty was maintained (see Table 4.1 for the variations of accuracy of statements).

For the expression of certainty, the informant (the bear hand puppet) looked directly inside the box. For the expression of uncertainty, the actor (here, the giraffe hand puppet) whispered to the other informant (the sheep hand puppet). These actions were to display that the bear had direct experience of information; therefore, she had direct knowledge about the objects. In contrast, the sheep had no direct knowledge but indirect experience about the objects inside the box. When the informants conveyed information about what was inside the box, the bear and sheep were on the screen but the giraffe was not.

Table 4.2

Examples of statements with Korean evidential –te and –napo for each task

Task	Certainty (-*te*)	Uncertainty (-*napo*)
CC vs. CU	Kong-i sangca ane iss-te-la Ball-i box in be-te-la '(I saw that) there was a ball inside the box'	Kong-i sangca ane iss-napo-a Ball-i box in be-napo-a '(It seems that) there is a ball inside the box'
IC vs. IU	Chayk-i sangca ane iss-te-la Book-i box in be-te-la '(I saw that) there was a book inside the box'	Chayk-i sangca ane iss-napo-a Book-i box in be-napo-a '(It seems that) there is a book inside the box'
CC vs. CU	Kong-i sangca ane iss-te-la Ball-i box in be-te-la '(I saw that) there was a ball inside the box'	Chayk-i sangca ane iss-napo-a. Book-i box in be-napo-a '(It seems that) there is a book inside the box'
IC vs. CU	Kong-i sangca ane iss-te-la Ball-i box in be-te-la '(I saw that) there was a book inside a box'	Kong-i sangca ane iss-napo-a Ball-i box in be-napo-a '(It seems that) there is a ball inside the box'

Note. CC vs. CU: Correct certain vs. correct uncertain. IC vs. IU: Incorrect certain vs. incorrect uncertain. CC vs. CU: Correct certain vs. correct uncertain. IC vs. CU: Incorrect certain vs. correct uncertain. –*La* is used as a sentence-ending suffix instead of –*ta* following –*te* (Sohn, 1999). –*Napo* was followed by a sentence-ending suffix, -*a*, in the study.

To begin with, the experimenter presented two objects (a phone and an easel) to the child to describe the experiment. It was assumed that the child was familiar with a phone but not with an easel. She started by asking and showing the phone to the child, "Do you know what this is called?" After the child responded, she showed the easel to the child and asked again. As expected the majority of the children recognized the phone but did not know the easel. After the child responded to each object, she said "We are going to learn what some things that we do not know are called from my friends. Shall we learn together?" Then, she started familiarization trials. As the experiment took place in Korea, instructions were given in Korean. Sentences in quotation marks were originally in Korean but translated into English by the experimenter.

Familiarization trials. She started by saying, “There is a thing in this box (pointing to the box on the desk). This object is the same as the one in the box on the screen. Can you see? And there are a bear, a giraffe, and a sheep. By the way, the bear and the sheep do not know what is inside the box. They have never seen it. So they will find out what is inside the box and tell you. Shall we watch how they figure it out? Look carefully.” The objects were presented in case the child did not clearly recognize objects on the screen.

After she had played part of a video clip, in which the bear looked inside the box and the giraffe whispered to the sheep, she paused the video clip to instruct the child to ask the puppets a question, “What is inside the box?” This question was asked in order to lead the child’s attention to the trials. When the child had been asked the question, the rest of the video clip was played. In the video clip, both informants responded to the object corresponding to task types (e.g., in the CC vs. CU type, “There was a ball in the box *-te*” and “It seems that there is a ball in the box *-napo*”). The order of certainty, which was presented to the child, was maintained throughout the trials by the experimenter’s oversight; for example, correct certain information was provided first in the CC vs. CU type. Before the bear and the sheep reported, the giraffe was removed from the screen. The informants maintained their accuracy either correct or incorrect according to the task types throughout the trials. When the video clip finished she said, “Bear and Sheep said what was inside the box”, and she asked the child, “Who do you want to ask what is in the box? Is it ‘Bear’ or is it ‘Sheep’?” for selectivity, and “What is this?” pointing to the real object from the box for the reality question in order to confirm that the child identified the object. For the rest of the familiarization trials, before playing a video clip, she changed the object inside the box, and repeated the procedure. After three familiarization trials, children were given three selectivity and three reality questions. Each child was randomly given one of the four tasks presented in the examples above. Children received one point when they announced or pointed to an appropriate informant in the question, “Who do you want to ask what is in the box? Is it ‘Bear’ or is it ‘Sheep’?” On the CC vs. CU type, children had one point for the correct certain informant. On the IC vs. IU type, children received one point for the incorrect uncertain informant. For the CC vs. IU type, one point was given when children responded to the correct certain information. One point for the correct uncertain informant was given on the IC vs. CU.

Novel test trials. After the third familiarization trial, the experimenter put a novel object into the box, and asked the child, “Do you know what this is called?” When the child claimed s/he knew the objects, she said, “I don’t think that was the name of the object. And my friend will let you know. Bear and Sheep already knew this time what was inside the box. They found out what was inside box just a while ago.” And the child was instructed to ask the puppets, “What is inside the box?” Then she started a video clip, saying, “Look carefully” In the video clip, the two informants announced the names of the novel object without showing how they obtained information. For example, the reliable informant said “There was a Kapi –*te*”, and the unreliable informant said, “It seems that there is a Kapi -*napo*” in the CC vs. CU type. Again, -*te* indicated that the informant witnessed what was inside the box, whereas –*napo* was used for an inferential statement. On each novel trial, the child was asked two questions, “Can you tell me what this is called?” and “Who do you want to ask about this, ‘Bear’ or ‘Sheep’?” See Table 4.1 for the list of names used in familiarization and novel test trials. Children received one point for the question of informants in the CC vs. CU and IC vs. IU types, as accuracy/inaccuracy of labels was maintained the same. On the other hand, children received one point for the correct label in the other two types of task as the means of learning new words.

The experiment was conducted in a room in the child's care centre and lasted approximately 10 minutes.

4.3. Results

In order to investigate the hypotheses concerning whether young Korean children would exercise selective trust, appreciating differences of evidentials and accuracy of speakers, four different tasks were administered. Before turning to these analyses it is important, here, to consider the way in which each trial was scored. This exercise was complex and I will provide details of the scoring procedure that was constructed so that each of the trials could be compared. Table 4.3 presents a summary of the reasoning that went into the measure of correctness in each trial, and mean scores of novel trials. The scores were combined among age groups because there were no age differences by analysis of variance (ANOVA) tests: for CC vs. CU, $F(2,33) = .52$, $p = .60$, $\eta_p^2 = .03$, $F(2,33) = .03$, $p = .97$, $\eta_p^2 = .002$ for IC vs. IU, $F(2,33) = .25$, $p = .78$, $\eta_p^2 = .02$ for CC vs. IU, and $F(2,33) = .55$, $p = .58$, $\eta_p^2 = .03$ for IC vs. CU.

The analyses in Table 4.3 show that correctness trumped incorrectness (see the two lower rows). A higher score reflects better performance. When both protagonists are correct it is better to side with a certain protagonist than an uncertain one (row 1). When both are incorrect it is better to side with a cautious than a certain protagonist (row 2). For each of these trials a score of 1 was given to the 'correct' judgment in each of the three trials, so that the range was 0-3. As expected, the trials where one protagonist was correct and the other incorrect were easier to address. Given that each trial was scored in a different way to the others, most of the analyses below will examine individual trial types. Comparisons between tasks will follow in order to probe which aspect between accuracy and certainty was a critical cue to identify informants' reliability.

Table 4.3

The scoring system of the four tasks and average scores of novel test trials

Trial comparison	Which is correct?	Explanation of correctness	M (SD) on novel trials
CC vs. CU	CC	Both correct but one is certain	1.56 (0.61)
IC vs. IU	IU	It is better to express uncertainty when you are wrong	1.56 (0.84)
CC vs. IU	CC	Correctness is better than incorrectness (especially when consistent with certainty)	2.14 (0.87)
IC vs. CU	CU	Correctness is better than incorrectness even though the correct protagonist is uncertain.	2.08 (0.84)

Note. Mean. CC vs. CU: Correct certain vs. correct uncertain. IC vs. IU: Incorrect certain vs. incorrect uncertain. CC vs. IU: Correct certain vs. incorrect uncertain. IC vs. CU: Incorrect certain vs. correct uncertain.

4.3.1. CC vs. CU

This comparison placed emphasis on the different levels of certainty in conveying information. It was sought to investigate whether children distinguished between different speakers' credibility by relying on their attitudes in the absence of conflicting information. As both speakers' utterances were correct, children received one point when they stated they preferred to ask a confident speaker in both familiarization and novel trials (see also Table 4.3). Children's performance was analysed against chance because this analysis would allow us to understand whether children were responding randomly, or whether they distinguished reliability between the two speakers by chi-square goodness of fit test. It might have been the case that children prefer uncertainty as a sign of humility in a speaker, but this was considered only as an outside possibility.

Chance performance was calculated in terms of the likelihood of obtaining a score simply by guessing. Over three summed binary trials the expected frequencies should fit the pattern 1-3-3-1 for scores 0, 1, 2, and 3. The performance was examined across the age ranges because there were no significant age differences as stated above. This structure of analysis will be applied to the three other tasks in the following sections. Table 4.4 shows frequencies of responses on each familiarization and novel trial.

The results showed that children did not perform significantly differently from chance in the familiarization trials, χ^2 (3, N = 36) = 4.30, p = .23. On the novel trials, they performed differently from chance, χ^2 (3, N = 36) = 7.85, p = .049. However, it was not the case that children successfully judged informants' reliability, preferring the confident informant, as can be seen in Table 4.4. In other words, the significant output was more likely to result from the population who correctly responded in two out of three trials (binomial test, two-tailed p = .089) but not from those who succeeded in all trials (p = 1.00). As shown in Table 4.4, only one out of twelve children in the oldest group correctly responded to all three questions (chance performance, p = 1.0). Thus, the distribution in Table 4.4 also indicates that children in the two younger groups did not distinguish a reliable source of information. Taken together, the results showed that the children indicated no preference for either confident or uncertain informant, supporting the alternative hypothesis. As in previous research (e.g., Nurmsoo & Robinson, 2009b), the findings seem to suggest that children might reason the informant's inadequate access to information for uncertainty.

Figure A.7 in the Appendix presents the children's responses on each trial. Individual trials from the data in Figure A.7 seemed to suggest that the children go with certainty on the first question (p = .065) but thereafter they seemed to be at chance on the subsequent questions.

Table 4.4

Frequencies of responses on the CC vs. CU task

CC vs. CU (n = 36)	Number of correct responses			
	0	1	2	3
Familiarization	1 (4.5)	15 (13.5)	17 (13.5)	3 (4.5)
Novel test	1	15	19	1

Note. CC vs. CU: Correct certain vs. correct uncertain. Numbers in parentheses represent chance scores obtained by guessing.

4.3.2. IC vs. IU

As examined in the CC vs. CU comparison, this task was also designed to evaluate children's understanding of un/certainty. In contrast to the previous condition, it focused on the use of uncertainty; that is, if children considered the reason for an uncertain speaker who had insufficient access to information, they would be more favourably disposed towards her when both speakers were incorrect. Otherwise, they would show no preference for either informant when they were both unreliable. Again, the correctness of the speakers did not conflict; thus credits were given when children chose the uncertain speaker (see also Table 4.3). The children's responses on three familiarization and novel test trials are shown in Figure A.8 in the Appendix. The children performed at chance levels, χ^2 (3, N = 36) = 5.19, p = .16, and χ^2 (3, N = 36) = .74, p = .86 for the familiarization and novel test trials, respectively. Further analyses for the novel trials were carried out to determine whether we might have inadvertently underestimated possible age differences. There were two, two and one out of 10, 14 and 12 children, respectively, in each age group who responded correctly to all three novel questions. Binomial test by chance of .125 showed that the children performed at chance, $p = .72$, $p = 1.0$, and $p = 1.0$ for the youngest, middle and oldest age groups, respectively. Table 4.5 shows the frequencies of responses on the task. The findings support the alternative hypothesis showing the consistency of those of Jaswal and Neely (2006) that children did not put credit on inaccurate informants.

Table 4.5

Frequencies of responses on the IC vs. IU task

	Number of correct responses			
IC vs. IU (n = 36)	0	1	2	3
Familiarization	5 (4.5)	15 (13.5)	16 (13.5)	0 (4.5)
Novel test	3	15	13	5

Note. IC vs. IU: Incorrect certain vs. incorrect uncertain.

Interestingly, although the distribution of the three trials showed random responses, the children appeared to be less puzzled in the novel tests than familiarization trials, with increased levels of performance along with trials without switching answers, according to binomial tests as shown in Figure A.8. It seems conceivable that the children might have considered the implication of uncertainty over the novel test trials. Having said that, when speakers did not state the truth of the proposition, the children disregarded reasons for the speakers' errors and the use of uncertainty.

Taken together, the two conditions of the task in which the two protagonists were equally in/correct showed inconsistent results. It seems that children's reasoning for making errors might be limited to certain circumstances. When one provided correct information, children took account of her attitude to belief. In contrast, when one provided unreliable information, children discounted the information. Hence, in respect of the reasons for errors, accuracy appeared to be an important factor. The next two tasks will show whether children selectively showed learning based upon accuracy.

4.3.3. CC vs. IU

It was expected that children would give credit to an accurate speaker as a reliable source of information when the knowledge states of speakers were obviously distinctive as in the research literature (see, for example, the discussion of Koenig and Harris (2005b) in Chapter One). Contrary to the previous two conditions, the questions in novel test trials were given to assess children's learning of novel words made up by the experimenter in this and the IC vs. CU conditions. Hence, children scored one point when they asked for information and labelled names based upon the accurate speaker in the familiarization and novel test trials, respectively (see also Table 4.6). The children's responses on each trial (six questions) are shown in Figure A.9 of the Appendix. The findings indicated that the children's trust in speakers was straightforward, compared to the previous conditions in which children had to take into account certainty regardless of accuracy. Performance against chance by chi-square goodness-of-fit tests revealed that the children performed at a rate above chance, indicating that they were able to distinguish the speakers' reliability, χ^2 (3, N = 36) = 9.63, p = .02 for the familiarization trials, and they were more likely to learn novel names from an accurate speaker at levels above chance, χ^2 (3, N = 36) = 29.6, p < . 001 for the novel trials.

Table 4.6 shows the appropriate responses on both trials. It is apparent from Table 4.6 that the children in this condition showed a more solid tendency, in responses on an accurate speaker, than the two previous tasks in which children had to respond on certainty in the novel trials. Although the children showed above-chance performance on the familiarization trials, the distribution of responses did not seem to differ from the two previous tasks. In other words, the significant results did not indicate successful judgment of informants on the familiarization trials. However, as the selective trust experiment aims to explore whether children believe a person based on his/her past history, performance on the novel trials would be important. In summary, this condition in which children had to distinguish correct and incorrect speakers revealed consistency with the research (Birch et al., 2008; Koenig et al., 2004; Koenig & Harris, 2005b) that Korean children between 3.6 and 6.5 displayed trust in the accurate over inaccurate speaker.

Further analyses of performance for each age group were carried out in order to explore whether younger children were able to discriminate the speakers' credibility for this and the IC vs. CU task. This is because it would be important to understand whether younger children appreciated statements which used evidential markers. In all three trials, when children responded correctly, their performance was considered successful. As noted above regarding the pattern, a frequency of .125 was applied for binomial tests.

Table 4.6

Frequencies of responses on the CC vs. IU task

	Number of correct responses			
CC vs. IU (n = 36)	0	1	2	3
Familiarization	0 (4.5)	10 (13.5)	21 (13.5)	5 (4.5)
Novel test	1	8	12	15

Note. CC vs. IU: Correct certain vs. incorrect uncertain.

There were three age groups: 10 of 3.6~4.5, 13 of 4.6~5.5 and 13 of 5.6~6.5-year-olds. Each three, five and seven children from the age groups correctly responded in all three trials. Thus, the binomial tests were based on the group of people. The results found that the children in the youngest group performed at a chance-level, $p = .24$. On the other hand, the children in the middle and oldest groups showed successful performance with above-chance, $p = .03$ and $p < .001$, respectively. Based on individual performance regarding age groups, the findings revealed older children's (4-year-olds and onwards) selective trust.

4.3.4. IC vs. CU

This condition sought to understand where children put emphasis between accuracy and certainty. The criteria for success were equivalent to the CC vs. IU condition; that is, children were given credits when they named novel objects identified by a previously accurate speaker. If children considered certainty over accuracy, they would perform at below-chance levels. Figure A.10 in the Appendix shows the results of binomial tests on each familiarization and novel test trial. On the familiarization trials, the children's performance by a chi-square goodness-of-fit test did not differ from chance levels, χ^2 (3, $N = 36$) = 6.37, $p = .10$, indicating that they did not prefer to ask a speaker who was correct but less confident. On the contrary, they showed evident discrimination in favour of a correct speaker with performance above chance on the novel test trials, χ^2 (3, $N = 36$) = 21.0, $p < .001$. Table 4.7 presents the frequencies of the task across the combined trials. As seen in the CC vs. IU condition, children endorsed novel labels taking account of the speakers' correctness in the past. As noted earlier, performance on the novel test trials was taken into consideration. Hence, it appears that children mistrusted the inaccurate informant's testimony. In summary, the findings of the two tasks revealed that accuracy trumped inaccuracy despite variations of certainty.

Again, further analyses by binomial tests were carried out in order to explore whether the children in each age group replicated performance as shown in the CC vs. IU condition. Furthermore, there were interesting trends in the IC vs. CU condition; that is, the children's performance on average scores decreased slightly with each increase in age as 2.30, 2.08, and 1.92 for the 3.6~4.5-, 4.6~5.5-, and 5.6~6.5-year-olds, respectively, and 5 out of 10, 4 out of 13 and 4 out of 13 children in respective age groups correctly responded on all three trials. Thus, it might be worth exploring whether the older children's performance reflected an understanding of the variations of certainty. The results of the binomial tests showed that the youngest group preferentially endorsed the names of the novel objects from the previously correct speaker, $p = .009$. On the other hand, the two older groups performed at chance-levels, $p = .14$ for both groups. That is, the results seemed to indicate that successful performance as a whole on this task was more likely to be from the youngest children's preference for accuracy. However, it seems that children around four or five might begin to consider the implications of the uncertainty marker -*napo* as they showed no preference for either speaker. Furthermore, it seems possible to speculate that 4-6-year-olds might be more aware of conflicting associations between correctness and certainty that people convey accurate information avoiding ambiguity (Grice, 1975).

Taken together, it appears that judging reliability by correctness was more straightforward than by certainty, considering the findings from the four different conditions. For further analysis of differences between correctness and certainty, comparisons between the conditions will be reported in the subsequent section.

Table 4.7

Frequencies of responses on the IC vs. CU task

	Number of correct responses			
IC vs. CU (n = 36)	0	1	2	3
Familiarization	3 (4.5)	8 (13.5)	17 (13.5)	8 (4.5)
Novel test	1	8	14	13

Note. IC vs. CU: Incorrect certain and correct uncertain.

4.3.5. Comparisons between correctness and certainty

Throughout the previous sections, the findings suggested that correctness might be a crucial factor in distinguishing others' reliability rather than their certainty. In order to examine this assumption, two-way ANOVA tests on the novel test trials were conducted, with the four levels of the task and the age groups as between-subject factors (see Table 4.3 for the correct responses of the dependent measure). As described earlier, interpretations of the selective trust task were centred on performance in the novel test trials. Thus, the analysis of the novel trials was carried out.

As would be expected, the result showed that a significant effect was obtained for task, $F(3,132) = 5.88$, $p = .001$, $\eta_p^2 = .12$, but not for age, $F(2,132) = .05$, $p = .95$, $\eta_p^2 = .001$. There was no significant interaction of task X age, $F(6,132) = .39$, $p = .88$, $\eta_p^2 = .02$. Tukey tests revealed that performance on the conflicting accuracy was significantly better than on the relative certainty. Performance on CC vs. IU (M = 2.14, SD = 0.87) by accuracy was significantly better than CC vs. CU (M = 1.56, SD = 0.61) and IC vs. IU (M = 1.56, SD = 0.84) by certainty, p = .02 in both comparisons. Likewise, performance on IC vs. CU (M = 2.08, SD = 0.84) significantly differed from CC vs. CU and IC vs. IU, p = .03 in both comparisons. No significant difference between CC vs. CU and IC vs. IU (p = 1.0) nor between CC vs. IU and IC vs. CU (p = .99) was found. Thus, the findings based upon the novel trials suggested that correctness was considered more important than certainty in children's inference of selective trust.

4.4. Discussion

The present study set out to determine whether young Korean children would trust selectively others' testimony in which they differed in the use of either correctness or certainty by evidential markers. The findings showed that the young children exercised selective trust clearly when the speakers' accuracy, but not certainty, was contrasting. Thus, I will discuss which factor between correctness and certainty is crucial for children's selective trust based upon the findings from the four tasks. In the Introduction to this chapter, I reviewed criticism for children's selective trust concerning whether they exercise epistemic trust. Prior to discussing the children's selective trust I will consider their epistemic trust found here. I will then move on to the role of evidentiality on selective trust. Lastly, I will consider tendencies of the children's responses and methodological issues revealed in the current study.

4.4.1. Do children perform epistemic trust or mentalistic inference?

The study was also designed to explore whether children's selective trust would reflect mentalistic appraisals of speakers. The findings from the four tasks indicate that the children's mentalistic inferences from the underlying conditions were limited to the specific circumstances involved. In other words, children might consider reasons of uncertainty when two speakers were both reliable, and this might have led to no preference for either speaker as shown in the correct certainty vs. correct uncertain condition. It appears that the children excused how the speakers obtained information. It has been known that young children understand different states of knowledge on the basis of sources of information (Koenig, 2012). As discussed in the Introduction of this chapter, children tend to judge a person who has direct access to information (i.e., seeing an object) who is regarded as more reliable than those without seeing (e.g., Pratt & Bryant, 1990).

Similarly, Koenig (2012) investigated whether preschoolers evaluated speakers' reasons and chose a better reason. In her research (Study 1), there were three good reasons (i.e., teacher's testimony, looking and informative container) and three poor reasons (i.e., wanting, pretending and guessing). Preschool children watched a series of video clips in which two speakers, one with a good reason and the other with a poor one, told what they think to another actor about an object in a box. The children then were asked to decide which informant provided the best way of thinking about the objects. Koenig found that the children preferentially endorsed one speaker, suggesting that preschool children were able to judge the quality of reasons presented. Again, the study supports the view that looking is a more reliable source of information. In her subsequent investigation (Study 2), in which the comparable paradigm of selective trust was employed, she replicated the findings. Children between 3- and 4-years of age not only correctly assessed the reasonable informant but also preferentially sought information for good reason. Taken together, the accumulating evidence suggests that preschool children understand how others establish knowledge and which source of information is more reliable.

In this respect, it seems possible to speculate that Korean children at the age of 3.6-6.5 would be able to understand that an informant who looked at the contents of a box would be a more reliable source than the other informant who had information from another actor. This possibility might lead children to selecting the informant with direct access for further information. However, on the correct certain vs. correct uncertain task in the present study, the participants did not show a preference for the informant who looked at the contents. Again, it might not be the case that the children did not understand the differences in the origins of information, but they might rather reason or understand the informant's inadequate access to information. Thus, they might excuse the informant with less confidence leading to no preference for the other.

Having said that, this explanation for the children's reasoning might call into question the findings of the other three tasks which involved the speakers' inaccurate statements. It appears that the children did not use the reasons for making errors to distinguish others' reliability. Importantly, however, there were differences among the tasks in the present study in terms of correctness of information. In the CC vs. CU task, both speakers conveyed correct information, while those of the other three tasks were both incorrect (IC vs. IU) or differed in correctness (CC vs. IU and IC vs. CU). In other words, it seems conceivable that when children had opportunities to notice another's inaccuracy, they might disregard information from the incorrect speaker regardless of the origins of source. Indeed, in the research mentioned above (Koenig, 2012; Pratt & Bryant, 1990) which has shown young children's reasoning of others' mental states, children did not have access to determine the quality of information against what they know. Hence, such condition might help children's judgment on reliability on the basis of statements in their studies.

On the other hand, Nurmsoo and Robinson (2009b) argued that young children learn from a previously inaccurate speaker when they had access to information about an object as stated in the Introduction of this chapter. However, most importantly, the access to the object was not informative; that is, they had to guess the hardness of the object by seeing. They then were asked whether they would accept or reject the suggestion of the sole speaker who was previously incorrect that was contradictory to their own statement. In addition, they were not given any chance to confirm the speaker's accuracy. In this case, children were more likely to accept what the previously inaccurate speaker said. Again, the children did not have solid grounds to decline the suggestion and then excused the previous errors in Nurmsoo and Robinson’s (2009b) study. That is, it seems that young children’s epistemic reasoning and learning from an inaccurate speaker might be constrained from the circumstances investigated.

Returning to the current study, the children were exposed to contents inside a box, and they had to compare different information from two speakers in terms of either accuracy or certainty. Considering the findings from the four tasks and the evidence of the previous research taken together, the present study seem to indicate that Korean children showed epistemic trust taking account of reasons for making errors on the basis of the speakers’ accuracy.

4.4.2. Children’s selective learning

The present study used two factors to differentiate the speaker’s reliability: correctness and certainty. This section will discuss whether children take account of each factor for selective trust. There were four types of tasks. Thus, I will discuss the children’s selective learning with regard to the nature of the four tasks. First, the findings do not provide evidence that children place emphasis on certainty over uncertainty when they decide upon which is a more reliable source of information. However, the findings do not reflect young Korean children’s failure of an understanding of evidentiality. As stated in Chapter One, children distinguish different degrees of mental-state expressions by the age of four (Moore et al., 1989). However, in the CC vs. CU task in which the speakers expressed differential certainty, the children simply guessed about which speaker was correct. Even 5-6-year olds performed no differently on the task from chance distribution, $t(11) = .89$, $p = .39$. It seems unlikely that the older children did not understand the implications of un/certainty by evidential markers. This is because the findings from two tasks in which the speakers showed conflicting accuracy (i.e., CC vs. IU and IC and CU tasks) revealed that 4-6-year olds might consider the use of uncertainty. Thus, no preference for either speaker in the CC vs. CU task might be rather the case of mentalistic inferences taking account of reasons of uncertainty as stated in the previous section. Hence, although the results did not show the children's preference for the confident speaker along with the use of evidentiality, there is no obvious clue to state that they did not differentiate the different levels of certainty when information was correct. However, further research, for example, using mental-verbs such as *know* and *think* might help in clarifying young children's ability to discriminate certainty.

Secondly, the findings on the incorrect certain vs. incorrect uncertain task, in which two speakers were both incorrect, indicate that children do not learn from either speaker when sources of information are both unreliable. The findings are consistent with those of Jaswal and Neely (2006) that showed no selectivity from unreliable speakers. It seems possible that the participants regarded both speakers as providing false statements to deceive them. Hence, the children considered that the speakers were both unreliable; therefore, they might choose randomly one of the two. Indeed, it seems that preschoolers do not consider others' false beliefs when they judge trustworthiness. The research that was conducted on children's understanding of lying and trustworthiness (Wimmer, Gruber, & Perner, 1984, 1985) argues that young children's judgment on lying is dependent on a speaker's statement rather than intention. In their studies, children were told stories about a protagonist's false belief and asked to judge his trustworthiness. In the stories, the protagonist has a false belief about the location of an object as it has been unexpectedly moved, and he conveys information to a third person about the location of the object which is not correct. The children then were asked to judge whether the protagonist lied or not. The results revealed that children aged four and five tended to regard the protagonist's false statement as a lie and this tendency was also found in children between 6- and 12-years-old, although the protagonist's intention to deliver information correctly was explicitly stated. The findings seem to suggest that children make judgments based on statements when they involve falsity. It seems possible that if the children in the present study regarded the uncertain informant's statement as a lie, even though the informant was misinformed and did not have any thought of lying, the children might judge that the informant was untrustworthy. Therefore, the children might not excuse the use of the linguistic expressions of un/certainty for judgments in the case of both speakers being unreliable. Taken together, the findings from the IC vs. IU task seem to suggest that children might have difficulty to discriminate differential certainty when there was no accurate information.

Thirdly, the findings of the correct certain vs. incorrect uncertain task have confirmed the previously published research that young children around the age of four are critical of what people say and selectively accept information. The children appreciated differential accuracy, preferring the previously accurate informant. Furthermore, the particular findings of the incorrect certain vs. correct uncertain task suggest that children place emphasis on one's knowledge status over mental states when they have to consider two different aspects of sources of information such as between correctness and certainty. The results are consistent with prior research (e.g., Corriveau & Harris, 2009a; Jaswal & Neely, 2006), indicating that when two factors are placed together one aspect may override the other; that is, a speaker's accuracy is a stronger element in deciding trustworthiness over other sources such as certainty, familiarity or authority figure.

It seems necessary to consider why accuracy is a predominant factor for successful judgment or communication. Children may use their knowledge about the world when judging statements (Sobel & Kushnir, 2013). It would be obvious that preschool children have already established certain knowledge about objects based on their experience. There are two phases in the selective trust paradigm, and children encounter conventional objects in the first phase which are considered to be known by them as young as infancy. Therefore, it is possible that children intuitively favour a person who possesses information in accordance with their basic knowledge, rather than one who holds a different point of view. This established judgment on the person who shares knowledge with children may continue onto the next step when they endorse labels of novel objects. Indeed, there is evidence suggesting that young children develop sensitivity in favour of the ingroup (Corriveau, Fusaro, & Harris, 2009; Kinzler et al., 2011). They may show an initial preference for a speaker within a group among others or for a person within their own group. In contrast, however, children's development in understanding of others' or their own mental states or beliefs may not firmly develop at an early age (Wellman et al., 2001). Therefore, it is conceivable that preschoolers' selective trust strongly relies on accuracy over certainty, given children's early consensus about people according to their own knowledge.

So far, this section discussed implications of the four types of tasks. The findings indicate that the young children might have shown epistemic trust considering the speakers' certainty, but had difficulty in discriminating when two sources of information were unreliable. Finally, accuracy trumps inaccuracy and certainty in selective trust. In the next section, I will consider whether the use of evidential markers influenced the young children's selectivity to information.

4.4.3. Influences of evidentiality on young children's selective trust

It seems that the findings may not provide clear evidence whether the use of evidentiality prompted young children's selective trust although 4-6-year old children in CC vs. IU and 3-4-year old children in IC vs. CU showed critical judgment on others' reliability, as the tasks in the present study did not compare the different linguistic references to express mental states. Moreover, it seems difficult to discuss the findings of the other two tasks for advantages of evidentiality with no preference for either informant (i.e., CC vs. CU and IC vs. IU tasks), as mentioned earlier. However, the findings of the CC vs. IU and IC vs. CU tasks may allow us to explore the influence of evidentiality on children's selective trust. In particular, the IC vs. CU task in which there was a mismatch between certainty and correctness may allow us to grasp children's understanding of evidential markers and its relation to selective trust. As mentioned in the Introduction of the thesis, children at the age of four are able to distinguish a more reliable source of information when two speakers' accuracy is clearly conflicting (e.g., Koenig et al., 2004). The findings in the CC vs. IU task were in line with this previous research showing that children between 4- and 6-years of age chose to learn from a previously accurate informant. If there were no effects evidential markers on the IC vs. CU task, children might have shown a similar tendency as the speakers' accuracy was conflicting. However, 4-6-year old children in the IC vs. CU task did not perform differently from simply guessing responses. These random responses would not indicate that the older children were not able to discriminate the speakers' correctness but imply that they considered the use of evidentiality. That is, this discrepancy in older children's performance would evidence a link between evidentiality and selective trust.

Having said that, it might be necessary to consider the complexity of the selective trust paradigm used here as visual access to an object and linguistic information were combined as questioned in the Introduction of this chapter. The findings of four conditions might allow us to rule out the influence of visual access to information on selective trust. As mentioned previously, young children tended to regard a person who had access to an object as having knowledge about it. If this visual access was a more crucial factor regardless of verbal information in the selective trust tasks, children might have shown preference for a speaker who looked at objects directly in the four tasks. For example, children in the CC vs.

CU task might have shown above-chance performance preferring a speaker with visual access if they considered solely access to information. In the task, both speakers were accurate. In this case, correctness might be disregarded. They then might need to consider relative certainty and access to information. The children showed random responses and this might indicate that they reflected relative certainty to exercise selective trust. Moreover, children tended to weigh one factor over another when there is combined information upon them as mentioned in the previous section. Based on the findings in this study, it seems that children might have put emphasis on verbal information, accuracy/certainty, rather than visual access. Thus, it might be possible to state the effects of evidentiality on selective trust although the selective trust paradigm involved manipulation of experimental and linguistic information.

Turning back to evidentiality, consistent with the previously published findings (Aksu-Koç & Alici, 2000; Aksu-Koç & Slobin, 1986), this different performance of the older children in the CC vs. IU and IC vs. CU tasks might imply that an understanding of uncertainty by evidentiality might be acquired at a relatively later age of preschool. According to the view of Aksu-Koç and colleagues on Turkish children's development of evidentiality, as also discussed in Chapter One, the acquisition and differentiation of evidentiality gradually develop; in particular, children under the age of six are more likely to reveal better judgment on knowledge by direct evidence than indirect evidence. Children at 6-years begin to comprehend the use of indirect evidence indicating one's inference and uncertainty. That is, the findings from Korean children in the current study seem to support the view of a relatively later understanding of implications of uncertainty by evidentiality.

It might be helpful to compare the findings of the tasks with research from children who do not have grammaticalized markers prior to concluding the later understanding of uncertainty in Korean children. There is evidence that English speaking children comprehend uncertainty in verb terms such as *think* around the age of four (e.g., Johnson & Maratsos, 1977; Olson, 1988). As mentioned in the section 1.2, research by Moore et al., (1989) would be most analogous to the current study in terms of the test questions as children were asked to ditinguisch degrees of certainty of two mental terms. However, there were marked differences between these studies and the current study. In the current study, there was a mismatch between certainty and accuracy (in the IC vs. CU task) and children were allowed to confirm speakers' accuracy. For this discrepancy, it seems difficult to make precise comparison between an understanding of the grammaticalized uncertainty marker with another form. Based on the findings of the current study, in particular from the CC vs. IU and IC vs. CU tasks, it seems that Korean children might acquire an implication of uncertianty by a grammatical marker, -*napo*, than those who use a verb term.

Taken together, it appears that there were influences of evidential markers in the 3-6-years old children as a whole as they were able to judge based on differential accuracy (in the CC vs. IU and IC vs. CU tasks). Having said that, it is not clear whether the differential accuracy was highlighted by evidential markers and that this led to their sensitivity. Therefore, it would be necessary to conduct a comparative study between the grammatical system and other linguistic references to articulate how others know or think for further understanding in terms of effects of evidentiality.

4.4.4. The trend of children's responses

It appears that the children's responses showed particular patterns (i.e., switching responses) as shown in Figure A.7-10 in the Appendix. It might be worth reviewing the patterns in order to understand what could possibly affect their responses. The children on each of the four tasks tended to change their responses for the question of either who they want to ask or what an item is called. A possible explanation is that the children might misinterpret the experimenter's intention possibly considering that she asked them the same question because they provided wrong answers, and they might change from one to the other informant for each subsequent trial. Indeed, there is evidence to suggest that young children might be misled by particular types of questioning and use a strategy to switch answers in experimental research with repeated questioning (e.g., Rose & Blank, 1974; Siegal, Waters, & Dinwiddy, 1988).

For instance, Siegal et al. (1988) conducted four experiments with number and length tasks giving either two repeated or one question to children between four and six in order to explore whether their responses were affected by the different types of questions. In the task with numbers, the children were shown two rows of buttons with different colours which were symmetrically arranged in one trial and two rows in the other trial. In the standard procedure, the children were asked to compare the number of buttons in the two rows of each colour, and they were told to point and to take one (colour) button from a box which they thought that there were more buttons between the two rows. After the children had made a choice, the experimenter transformed the rows, and they were asked to point to the row which had more buttons. In the standard procedure, the questions were repeated prior to and after the transformation. Alternatively, in a one-question procedure, the children were shown two rows of buttons with different colours; however in this procedure, they were asked to think which row has more buttons and to take one sample button but without showing the button to the experimenter. The experimenter then transformed the rows and asked the children to compare the number of rows. The procedures were counterbalanced; half the children received the one-question procedure first, while the rest of them performed the standard (two-repeated question) procedure. Finally, the children’s performance on whether they kept the same button after the transformation was analysed (Experiment 1). Siegal et al. found that there were significant effects according to which procedure was given first. In other words, children who performed the one-question procedure first preserved the button more than those who did the standard-question procedure first. Furthermore, their performance on the other procedure was significantly different again. The children who had the standard task later provided more consistent responses than those who had the one-question later; that is, they were less affected by the previous task when children did not have a clue to cause a misinterpretation of the experimenter's repeated question. Similar results were found in the task with length in their subsequent experiment. Hence, the findings indicate that experimental procedure could affect children's responses and repeated questions could cause children's tendency to change answers. Accordingly, performance which changed a response after another might be generally found in young children rather than being specific to here.

4.4.5. Methodological issues

It appears that there might be two methodological issues to mention in the present study. In the selective learning phase (i.e., labelling new words in the novel test trials), it seems that a certain trial might be more straightforward than others. In the CC vs. IU and IC vs. CU tasks, the children's performance on the second novel trial was noticeably better, showing above-chance levels (p < .001 for both tasks). Even though the children in the IC vs. CU task also performed significantly on the third novel trial (p = .001), I will discuss performance on the second trial as shown in both tasks. It seems conceivable that there were effects of differences in novel words which consisted of either vowel or consonant sounds (i.e., *Imay* vs. *Lamu*). Furthermore, accuracy was brought out on the vowel word (i.e., *Imay*). Hence, it is possible to speculate that a difference in sounds between the two words might influence the children's performance. There is evidence that infants start learning an inventory of vowels around 6-months prior to learning of consonants (Best, McRoberts, & Sithole, 1988; Kuhl, Williams, Lacerda, Stevens, & Lindblom, 1992; Nazzi, 2005), suggesting that learning words from vowels is more straightforward than from consonants.

Thus, it seems possible that recalling *Imay* could be easier than *Lamu* as stress on accuracy was also on *Imay* at the same time. Consequently, this possibility might arise from the different constructions, and therefore it would be necessary to eliminate it in further research for a precise understanding regarding Korean children's selective trust.

Secondly, one issue should be mentioned regarding methodology. In the present study, the speakers' positions were fixed across the children by the experimenter's oversight as mentioned in the Method section. Therefore, the order of novel words given was also fixed for all the participants as the speaker who showed direct experience spoke first. In the CC vs. IU and IC vs. CU tasks, the children were asked to name the novel words. This methodology may raise a question whether the fixed order influenced the children's choices between the speakers. This is because, for instance, it is known that the order of information provided can influence responses in survey research. It has been found that there is a tendency to place weight on more recent information, presuming that the recent information is more salient (Krosnick & Alwin, 1987; Krosnick, Li, & Lehman, 1990). However, fortunately, such order effect was not observed in the present study. If the children regarded the saliency of recent information, performance would show a below-chance level on the first trial of a task as considering the informant with uncertainty as more reliable because of the order. However, the children in the current study did not show such tendency to select more recent information preferentially; therefore, it seems appropriate to consider that the fixed order did not impact the children's performance. Having said that, it would be necessary to consider the possible effects of the order in the next study.

4.5. Conclusion

Does evidentiality provide any benefits to children's selective trust and, do children appreciate the subtle difference of evidentiality in evaluating others' trustworthiness? In response to the questions, we conducted four types of selective trust in which speakers identified their epistemic states using evidential markers. Firstly, we found that Korean children between 4-6-years old successfully assess others' reliability from their statements and they showed selective learning from the previously accurate speaker when information from the two speakers was contrasted. Secondly, the findings suggest that comprehension of uncertainty might be acquired at the age of 4-6, although children's production of evidential markers might occur before three years of age as mentioned in the Introduction of this chapter. The other particular finding was that accuracy trumped certainty. Finally, we found that young Korean children performed epistemic trust considering reasons about how the speakers obtained information, in the case when they were both reliable. However, when at least one speaker was unreliable, children tended to disregard inaccuracy. As noted earlier, it seems to be difficult to state that the children's ability to judge was aided from the grammatically embedded markers indicating sources of information along with different degrees of certainty. Thus, in the next study it will be necessary to examine whether children would exhibit advanced performance on the statement with evidential markers compared to the other linguistic markers which are not grammaticalized. Hence, a comparative study within the Korean language was designed that included two types of selective trust in which evidentiality was employed, as used in the present study, and mental verbs such as *know* and *think* to reveal the effects of the evidential system on reliability.

Chapter Five: **Do evidential markers facilitate young children's selective trust? Comparison with mental-state verbs**

5.1. Experiment 4

The previous chapter explored four types of selective trust which differed in either accuracy or certainty. A series of experiments showed several findings. First, young children showed the capability to take into consideration how well-informed speakers were, in particular when they were both reliable. In other words, they did not prefer to seek further information from a more confident speaker when a less confident speaker had inadequate access to that information. Secondly, young Korean children took into consideration the speakers' inaccuracy. When testimony involved incorrect information, the children disregarded the inaccurate statement. Thirdly, accuracy trumped both inaccuracy and certainty. When the speakers' statements were explicitly contrasted, 4-5-year-olds were able to learn selectively, tracking the speakers' past credibility. It seems that the findings of the previous experiments might reflect a relatively early appreciation of evidentiality of Korean children, compared to the research suggesting the development of this understanding from six years of age in other languages as stated in the Introduction to this thesis. There is accumulated research suggesting 4-year-olds tended to demonstrate better judgment on the speakers' trustworthiness than 3-year-olds (e.g., Corriveau, Meints, et al., 2009; Koenig & Harris, 2005b; Sabbagh et al., 2006). However, it does not seem clear from the findings that Korean children's selective trust was supported by the use of evidential markers which indicated sources of information and different degrees of certainty, as the previous research did not investigate the children's understanding without evidentiality or with other linguistic references to mark the speakers' knowledge status. Thus, the present study included two different linguistic expressions (i.e., one with evidentiality and the other with belief verbs such as *know* and *think*) in the speaker's statements in order to investigate whether children's epistemic trust was influenced by linguistic differences.

As used in Chapter Four, two evidential markers, -*te* and –*napo* for direct and indirect access to information, respectively, were used in the present study. In this study, we employed two different linguistic references which are different in form but both express certainty: evidential markers (i.e., -*te* and –*napo*) and mental verb terms (i.e., *know* and *think*). –*Te* (I saw) literally indicates that a speaker saw an event in the past. The statement ending with –*te* implies the speakers' direct perception of the event (Yim, 2008). Therefore, the intended meaning of an utterance with –*te* would be *I know* from what I saw. In contrast, as stated in Chapter Four, the indirect evidential marker –*napo* conveys a speaker's inference and can be understood such as *I think/guess* or *It seems* (Kwon, 2012). Thus, two speakers' differential epistemic states in the selective trust paradigm were represented by comparisons between –*te* and –*napo* from evidential markers and between *I know* and *I think* from mental verbs in the present study. In consequence, it seems necessary to explore whether Korean children understand these mental verb terms. To my knowledge there is no available data analysing young Korean children's understanding of such verbs focusing *think* or *know* and frequency in their spontaneous speech. However, one study by Kim, Lee, and Gwon (2008) conducted research on the relationships among social understanding, emotion, language and social behaviour in 4- and 5-year-old Korean children. In their study, the children were given a series of complement questions involving *think* and *want* (e.g., What does the mother think kyungwoo (a name of a story character) is doing?). They found that the 4-5-year-old children's performance on complement was significantly better than chance. Thus, it seems possible to speculate that Korean children might acquire the implication of the mental verb terms at least around the age of four, although the study did not include the other mental verb terms, like *know*. Given this evidence, it was felt to be appropriate to use the mental verb terms that were included in this study.

In the previous experiment, the children showed successful judgment on reliability with above-chance performance when the speakers' testimony was clearly conflicting on accuracy with well-matched certainty. Children's performance on a task in which there was a mismatch between accuracy and certainty reflected that children's selective trust was also in favour of accuracy. However, we decided to employ the task in which a correct speaker was confident whereas an incorrect speaker expressed uncertainty. This is because there is a possibility that the mismatch between accuracy and certainty might influence older children's judgment on selectivity as shown in the previous experiment. For this comparative study, Korean children between 3- and 6-years of age participated. Younger 3-year-olds were included in order to explore age-related differences according to the uses of different linguistic markers.

As stated in Chapter One, there is well-documented evidence that the acquisition of mental-state verbs and its application to others' epistemic states developed around the age of four. However, there is also some empirical research showing 3-year-olds' sensitivity to others' attitudes to judge their testimony. For example, Jaswal and Malone (2007) showed that 3-year-olds were more likely to accept information when an informant spoke with confidence about his/her knowledge rather than in the task in which one expressed uncertainty (see Chapter One for details). Nevertheless, I side the view of Moore et al., (1989) that children's comprehension of differential certainty is acquired by 4-years of age, because children in the selective trust paradigm of the current study are also required to distinguish degrees of certainty rather than to consider mental terms independently. Indeed, in the work of Jaswal and Malon, children had to examine an informant's suggestion with an expression of uncertainty but were not required to distinguish between different states of knowledge. Thus, it would be more appropriate to suppose that Korean children's understanding of differential mental terms of verbs would be shown at the age of four.

It was hypothesised that children's selective trust would be shown at different stages if the access to linguistic references influenced their ability to perceive others' epistemic states. In detail, first, it was hypothesised that Korean children would demonstrate selective trust at the age of four when two speakers' utterances were conveyed by mental-state verbs showing preference for *know* over *think* if their understanding of these verbs developed in parallel with those in the research (e.g., Moore et al., 1989). Discrimination in favour of *know* over *think* was expected as *know* indicates a higher reliability based on possible evidence (Urmson, 1963), whereas *think* expresses a lower probability of knowing (Chafe, 1986). Secondly, it seems possible that early appreciation of the implications of evidential markers might be observed in the selective trust paradigm, given the findings of the three previous experiments in this thesis. Thus, it was hypothesised that children at the age of three would exhibit successful selective trust when the speakers' epistemic states were expressed by evidential markers such as *–te* and *–napo* for direct and indirect sources of information, respectively. Alternatively, it was hypothesised that older children around five or six would perform selectivity from the evidential markers based on assumptions from the research showing a relatively late understanding of evidentiality (e.g., Fitneva, 2008; Papafragou et al., 2007).

5.2. Method

Participants

Fifty-nine Korean preschool children participated (33 boys): 11 3-year-olds (M = 45.9 months, SD = 1.93 months and range = 40.4 to 47.8 months), 17 4-year-olds (M = 53.9 months, SD = 3.43 months and range = 48.2 to 59.3 months), 21 5-year-olds (M = 64.3 months, SD = 3.73 months and range = 60.2 to 70.8 months), 10 6-year-olds (M = 76.5

months, *SD* = 3.32 months and range = 72.0 to 80.0 months). Each child was administered two conditions of the selective trust task: EM (evidential markers: -*te* vs. –*napo*) and VT (verb terms: *I know* vs. *I think*). Children were recruited from preschools in Pyeongtaek in Korea, and were from a lower middle class area. Following Ethical guidance of Lancaster University, an opt-in procedure was used prior to the data collection; consent and information sheets were distributed to parents by head teachers

Measures

Procedure

The test was administered in either an empty room or a room shared by teachers in the child's preschool. The two conditions of the selective trust task were presented with a counterbalanced order. The test lasted approximately 15 ~ 20 minutes, and was video recorded.

Selective trust (ST) measures

Evidential Markers (EM). The selective trust paradigm followed the procedure of work by Koenig and Harris (2005b). The term EM refers to the ST task presented in which one correct speaker conveyed information with confidence using –*te* while the other who was incorrect expressed uncertainty with –*napo* in the present study. The identical materials to those used in Chapter Four were used in this task; that is, the same objects in the familiarization and novel trials and three puppets (a Bear, a Sheep and a Giraffe) as actors were used. The words used in familiarization and novel trials in the previous experiment were employed again, apart from the word of the second novel trial; that is, *imay* was replaced with *thopa*. A possible influence of a vowel word was reviewed in the Discussion section in Chapter Four. Thus, the new word *thopa*, which was made by the experimenter, was used for consistency with other trials. The labels and statements for the familiarization and novel trials are shown in Table 5.1 in order to restate the uses of markers. The two speakers' position (i.e., a Bear and a Sheep) on the screen was counterbalanced across the children, and the speakers' accuracy was also counterbalanced across the children. Thus, approximately half the children received the task in which a Bear conveyed correct information, while the rest were given performance in which a Sheep was correct. In order to show the means by which the speakers obtained information, two different ways were used. For the direct access, the speaker looked directly at an object inside a box, whereas one actor (a Giraffe, here) whispered information to the other speaker for the indirect access. The speaker with direct experience was always correct and certain while the other with the indirect access was always incorrect and uncertain. As the experiment was conducted in Korea, the instructions given to the children were in Korean but they were translated into English by the experimenter to describe the experiment here.

Familiarization trials. To begin with, the experimenter presented still images of two objects (a phone and an easel) to the child to describe the experiment. The two objects were used assuming that children could recognize the phone, but they might not know the easel. The majority of the children recognized the phone. When a child admitted that he or she did not know what the object was, the experimenter said that it was a thing that his or her parents use to make a phone call. In contrast, most of the children did not recognize the image of the easel. She explained about the easel saying, "This is an easel which is used for painting." Some of the children said that they knew the easel, explaining when it is used. However, they admitted that they did not know the name of it, when she asked what it is called. After she labelled the easel, she asked the child again, "What is this?" After the child responded, she explained about the task saying, "Now, we are going to play a game which learns the names of objects which we do not know. Can you do it?" The introductory trials were given once to start the test; that is, this step was not repeated for the following task, for example, prior to the VT task.

Table 5.1

The list of words and statements used in familiarization and novel trials of the EM task

Object	Accurate labels (-*te*)	Inaccurate labels (-*napo*)
Familiarization		
Ball	Kong-i sangca ane iss-te-la Ball-i box in be-te-la '(I saw that) there was a ball in the box'	Chayk-i sangca ane iss-napo-a Book-i box in be-napo-a '(It seems that) there is a book in the box'
Car	Catongcha-ka sangca ane iss-te-la Car-ka box in be-te-la '(I saw that) there was a car in the box'	Khep-i sangca ane iss-napo-a Cup-i box in be-napo-a '(It seems that) there is a cup in the box'
Camera	Khameyla-ka sangca ane iss-te-la Camera-ka box in be-te-la '(I saw that) there was a camera in the box'	Sinpal-i sangca ane iss-napo-a Shoe-i box in be-napo-a '(It seems that) there is a shoe in the box'
Novel test		
Kapi	Kapi-ka sangca ane iss-te-la Kapi-ka box in be-te-la '(I saw that) there was a kapi in the box'	Soco-ka sangca ane iss-napo-a Soco-ka box in be-napo-a '(It seems that) there is a soco in the box'
Thopa	Thopa-ka sangca ane iss-te-la Thopa -ka box in be-te-la '(I saw that) there was a thopa in the box'	Lamu-ka sangca ane iss-napo-a Lamu-ka box in be-napo-a '(It seems that) there is a lamu in the box'
Ceya	Ceya-ka sangca ane iss-te-la Ceya -ka box in be-te-la '(I saw that) there was a ceya in the box'	Tutha-ka sangca ane iss-napo-a Tutha-ka box in be-napo-a '(It seems that) there is a tutha in the box'

Presenting the images of a Bear and a Sheep, she said, “My friends, Bear and Sheep, will let you know what is inside a box (pointing to a screen). Listen carefully.” A laptop was used to play video clips. A Giraffe was on the middle of the screen along with the two puppets in order to convey information to one of the two puppets who was supposed to have indirect knowledge of the objects. There were two college-aged female students playing the puppets; however, they were never mentioned throughout the trials. Thus, only Bear and Sheep responded to the objects. The experimenter tried to lead the child’s attention to the task, instructing the child to ask a question to the informants, “What is in the box?” However, the majority of the children refused to say, and then she started the trials showing a video clip without asking the question again. When the video clip for one trial finished, she paused the clip and said, “Like this, Bear and Sheep said what was inside the box.” Then she showed a still image of the object, and asked “Can you tell me what this is called?”After the child responded, she loaded the next clip and said, “There will be a new object in the box. Listen carefully what Bear and Sheep say.” For three familiarization trials, she repeated the same procedure. When the third trial finished, she asked a question, “One of the two was not good at naming. Which one was not very good at naming?” When the child did not seem to understand the question or hesitated to respond, she prompted the child asking, “Who said the names incorrectly?” This question was used as an Explicit Judgment question.

Novel test trials. In the novel trials, three types of questions were given: Explicit Judgement, Ask, and Endorse questions. To begin with, the experimenter asked the child, showing a still image of a new object, to check whether the novel object was unknown to the child, “Do you know what this is called?” After the child admitted that she or he did not know the name, she administered the Ask question saying, “My friends, Bear and Sheep will help you. Who do you think would be better at naming between Bear and Sheep?” If the child hesitated, she prompted the child saying, “Who do you think would be right in naming?” In some cases (three children), children claimed that they knew the names of the novel objects. Then she said, “Actually, I don’t think that’s what this is called. I am sure that one of my friends can help you.”, and the Ask question was given. The Ask questions were presented for each trial. On each trial, the Endorse question was given after Bear and Sheep responded to the object by saying, “Can you tell me what this is called, (for example) a kapi or a soco?” When the child hesitated to answer, she said, for example, “Bear said this is a kapi, and sheep said this is a soco. Is this a kapi or a soco?” When the child responded to the last Endorse question, the second Explicit Judgement question was given by saying, “One of the two was not very good at naming the objects. Which one was not very good at naming? Who said the names incorrectly?”

The second ST task was administered immediately after the first task was completed.

Verb Terms (VT). The term VT refers to verb terms in the present study in which information was conveyed by mental-state verbs (i.e., *I know* and *I think*). The procedure of the VT task was identical to the EM task, which consisted of the three familiarization and novel trials. Figures 5.1 and 5.2 show the pictures of the objects in the familiarization and novel test trials, respectively. The objects were presented as follows: a spoon, a brush and a sock for the familiarization trials, and three objects made of, respectively, light brown wood, yellowish plastic and steel for the novel test trials.

Figure 5.1. Pictures of the familiar objects.

Figure 5.2. Pictures and descriptions of the familiar objects.

Table 5.2 shows accurate/inaccurate labels and statements for the VT task. As in the EM task, the statements were correct certain and incorrect uncertain. For the VT task, two puppets, a Duck and a Rabbit, conveyed information. A Giraffe was used as described in the EM task. Photographs of the six objects and the two puppets were used during the task. For the familiarization trials, one Explicit Judgment question was given after the third trial. Three Ask, and three Endorse and one Explicit Judgment questions were given as used in the EM task. One point was given when the child pointed to or named the incorrect uncertain informant for the Explicit Judgment questions, whilst one point was given for the correct certain informant for the Ask questions. When the child labelled the name of the novel object for the correct certain informant, one point was given for the Endorse questions. Thus, variables were the Explicit Judgment, Ask, and Endorse questions which had the maximum scores of 2, 3, and 3, respectively for each type of the questions.

Table 5.2

Stimuli and statements used in the VT task

Object	Accurate names (*I know*)	Inaccurate names (*I think*)
Familiarization		
Spoon	(Nanun) sutkalak-i sangca ane (I) spoon-i box in iss-ta-nun ke-sul al-a be-ta-nun that-sul know-a 'I know that there is a spoon in the box'	(Nanun) kapang-i sangca ane (I) bag-i box in iss-ta-ko sayngkakha-y be-ta-that think-y 'I think that there is a bag in the box'
Brush	(Nanun) pi-si sangca ane (I) brush-si box in iss-ta-nun ke-sul al-a be-ta-nun that-sul know-a 'I know that there is a brush in the box'	(Nanun) sikyey-ka sangca ane (I) watch-ka box in iss-ta-ko sayngkakha-y be-ta-that think-y 'I think that there is a watch in the box'
Sock	(Nanun) yangmal-i sangca ane (I) sock-i box in iss-ta-nun ke-sul al-a be-ta-nun that-sul know-a 'I know that there is a sock in the box'	(Nanun) uyca-ka sangca ane (I) chair-ka box in iss-ta-ko sayngkakha-y be-ta-that think-y 'I think that there is a chair in the box'
Novel test		
Phako	(Nanun) phako-ka sangca ane (I) phako-ka box in iss-ta-nun ke-sul al-a be-ta-nun that-sul know-a 'I know that there is a phako in the box'	(Nanun) micu-ka sangca ane (I) micu-ka box in iss-ta-ko sayngkakha-y be-ta-that think-y 'I think that there is a micu in the box'
Chatu	(Nanun) chatu-ka sangca ane (I) chatu-ka box in iss-ta-nun ke-sul al-a be-ta-nun that-sul know-a 'I know that there is a chatu in the box'	(Nanun) homa-ka sangca ane (I) homa-ka box in iss-ta-ko sayngkakha-y be-ta-that think-y 'I think that there is a homa in the box'
Noti	(Nanun) noti-ka sangca ane (I) noti-ka box in iss-ta-nun ke-sul al-a be-ta-nun that-sul know-a 'I know that there is a noti in the box'	(Nanun) khasay-ka sangca ane (I) khasay-ka box in iss-ta-ko sayngkakha-y be-ta-that think-y 'I think that there is a khasay in the box'

5.3. Results

This study set out with the aim of assessing whether children's access to others' epistemic states to exercise selective trust would be shown differently according to the different linguistic references. Analyses by chi-square goodness of fit tests showed that the children's performance on the tasks varied in the linguistic references. Their performance on the three types of question in the VT task was all above-chance levels, χ^2 (2, N = 59) = 41.1, p < .001, χ^2 (3, N = 59) = 31.5, p < .001, and χ^2 (3, N = 59) = 15.6, p = .001 for the Explicit Judgment, Ask, and Endorse questions, respectively. In contrast, the children showed relative difficulty with evidential markers showing random responses apart from Explicit Judgement, χ^2 (2, N = 59) = 27.0, p < .001, χ^2 (3, N = 59) = 7.22, p = .07, and χ^2 (3, N = 59) = 7.49, p = .06, for the Explicit Judgment, Ask, and Endorse questions, respectively.

I will examine differences between the two types of the tasks first as the main object of the current study was to explore whether children's selective trust was influenced by the linguistic differences. Repeated measures of analysis of variance (ANOVA) tests were conducted in order to explore whether performance between EM and VT tasks was significantly different. Next, the findings from the individual tasks will be reported in terms of when children begin to exercise selective trust successfully based on chance performance. Children's success at Explicit Judgment, Ask, and Endorse was explored by binomial tests, and their successful selective trust as a whole was examined by one-sample t-tests.

5.3.1. Comparisons between EM and VT

In order to explore the levels of performance on each question and overall scores of EM and VT tasks, the summary of responses as a function of the task is shown in Table 5.3. As it found no age differences, apart from Explicit Judgment in each task and question, the average scores across age groups are shown in Table 5.3. The statistical results of age effects will be reported below. As the children were administered two tasks, the results of repeated measures analysis of variance tests were included in the data in order to indicate whether there were significant differences between children's selective trust by two different linguistic expressions. In contrast to expectations, however, there were no statistically significant differences between EM and VT tasks.

Table 5.3

Mean number (SD in parentheses) of responses as a function conditions and question types

	EM	VT	Repeated measure (language effect)
Explicit Judgement (Max. = 2)	1.41 (0.72)	1.51 (0.68)	$F(1, 55) = 3.09$, *ns*
Ask (Max. = 3)	1.75 (0.92)	1.81 (1.03)	$F(1, 55) = .04$, *ns*
Endorse (Max. = 3)	1.76 (0.92)	1.86 (0.94)	$F(1, 55) = 1.0$, *ns*
Total (Max. = 8)	4.92 (2.12)	5.19 (2.0)	$F(1, 55) = .98$, *ns*

Note. N = 59. EM: Evidential markers. VT: Verb terms. *ns*: non-significant.

In the first the difference between the overall scores of the tasks was analysed in order to understand children's selective trust as a whole by a repeated measures ANOVA test with age (in months) and task order (EM or VT first) as between-subjects factors. Chronological age was loaded in order to explore whether there was a gradual change in understanding selective trust. As the two selective trust tasks were administered, it is plausible that there was a carryover effect; thus, task order was taken into account. The results found no significant difference between the tasks, $F(1, 55) = .98$, $p = .33$, $\eta_p^2 = .02$, an interaction of the tasks X age, $F(1, 55) = .75$, $p = .39$, $\eta_p^2 = .01$, or an interaction of the tasks

X order, $F(1, 55) = 1.34$, $p = .25$, $\eta_p^2 = .02$. There was no significant three-way interaction of the tasks X age X order, $F(1, 55) = 1.74$, $p = .19$, $\eta_p^2 = .03$. There were no significant effects of age, $F(1, 55) = 2.63$, $p = .11$, $\eta_p^2 = .05$, or task order, $F(1, 55) = .08$, $p = .78$, $\eta_p^2 = .001$, or an interaction of age X task order, $F(1, 55) = .07$, $p = .79$, $\eta_p^2 = .001$.

Three further analyses were carried out to examine whether differences between each question were underestimated by the overall performance. The results on the Explicit Judgment questions with age and task order as between-subject factors found no significant main effect of the tasks, $F(1, 55) = 3.09$, $p = .09$, $\eta_p^2 = .05$, an interaction of the tasks X age, $F(1, 55) = 2.70$, $p = .11$, $\eta_p^2 = .05$, or an interaction of the tasks X order, $F(1, 55) = .10$, $p = .75$, $\eta_p^2 = .002$. No significant three-way interaction of the tasks X age X order was observed, $F(1, 55) = .22$, $p = .64$, $\eta_p^2 = .004$. It was found that there was a significant effect of age, $F(1, 55) = 5.82$, $p = .02$, $\eta_p^2 = .10$, indicating that the children with an increase in age showed better judgment on the speakers' reliability. No significant effect of task order, $F(1, 55) = .36$, $p = .55$, $\eta_p^2 = .01$, or an interaction task order X age, $F(1, 55) = .35$, $p = .55$, $\eta_p^2 = .01$, was found. The findings showed that the children's judgment on others' reliability was not significantly affected by the linguistic differences.

Likewise, the results on the Ask questions did not find a significant effect of the tasks, $F(1, 55) = .04$, $p = .84$, $\eta_p^2 = .001$. Neither an interaction of the tasks X age, $F(1, 55) = .08$, $p = .78$, $\eta_p^2 = .001$, nor of the tasks X order, $F(1, 55) = .45$, $p = .49$, $\eta_p^2 = .01$ was significant. Again, there was no significant three-way interaction of the tasks X age X order, $F(1, 55) = .67$, $p = .42$, $\eta_p^2 = .01$. It was found that there was a trend of effects of age, $F(1, 55) = .3.78$, $p = .057$, $\eta_p^2 = .06$. However, It did not find other significant effects of between-subject factors: task order, $F(1, 55) = .009$, $p = .93$, $\eta_p^2 = .000$, an interaction of task order X age, $F(1, 55) = .02$, $p = .89$, $\eta_p^2 = .000$. Lastly, on the Endorse questions, no significant effect of the tasks was observed, $F(1, 55) = 1.0$, $p = .32$, $\eta_p^2 = .02$. As shown in other questions, interactions of the tasks X age, $F(1, 55) = .80$, $p = .39$, $\eta_p^2 = .01$, of the tasks X order, $F(1, 55) = 2.70$, $p = .11$, $\eta_p^2 = .05$ or of the tasks X age X order, $F(1, 55) = 3.09$, $p = .09$, $\eta_p^2 = .05$ were not significant. Again, there were no significant effects of age, $F(1, 55) = .00$, $p = .99$, $\eta_p^2 = .00$, task order, $F(1, 55) = .75$, $p = .39$, $\eta_p^2 = .01$, or an interaction of age X task order, $F(1, 55) = .65$, $p = .42$, $\eta_p^2 = .01$.

Taken together, the findings seem to suggest that children's understanding of the history of being either accurate or inaccurate was not significantly influenced by the use of the different linguistic terms. Accordingly, the different linguistic references did not make a significant difference in learning novel words tracking the past history of accuracy. It seems that the non-significant differences might be needed to reconsider regarding the distributions of the tasks. The children showed higher scores in the VT task than in the EM task. However, the distribution of the questions showed drop in performance in older children in the VT task (e.g., all above chance performance in 4-year-old children but chance performance in 6-year-old children) as presented in Table 5.5. It seems possible that this tendency might have reduced the effects of linguistic references on comparison. Thus, it would be worth exploring performance on individual tasks to understand the developmental pattern of selective trust. In the following sections, analyses on each EM and VT task were carried out by chance performance.

5.3.2. Selective trust tasks

The selective trust paradigm consisted of three types of questions and the questions involved different functions for selective trust. Thus, performance was analysed by each question. As selective trust indicates children's ability to trust selectively tracking speakers' past reliability, performance on the total scores was also examined to confirm children's development of selective trust for each EM and VT task.

The EM task

The Explicit Judgment questions were given in order to assess whether children evaluated a speaker's inaccuracy in providing labels for the familiar objects. One point was given if the child pointed to, or verbally indicated a speaker who was previously incorrect with *–napo* (It seems), for the question, "Which one was not very good at naming?" The maximum score was 2. For the Ask questions, when the child regarded the previously accurate speaker with *–te* (I saw) as a better source of information, he or she received one point. Similarly, for the Endorse questions, when the child labelled the names of the novel objects based on the previously correct speaker, he or she received one point. For both Ask and Endorse trials, the maximum scores were 3. Performance on each Ask and Endorse question is shown in Figure A.11 in the Appendix. The distributions of Explicit Judgment, Ask and Endorse questions of the EM task are shown in Table 5.4. The data are presented as a function of age in order to understand at what age the children become able to judge accuracy and learn selectively. Over the two questions of the Explicit Judgment trials the expected frequencies would be a pattern of 1-2-1 (.25-.50-.25 for the proportion), while a pattern of 1-3-3-1 (.125-.375-.375-.125 for the proportion) would be applied for both Ask and Endorse questions over the three trials. These patterns were applied to the VT task.

In the present study, performance on the maximum scores (either two out of two or three out of three trials) was reported on each question because it would indicate whether the children of each age successfully judged others' testimony. First, it appears that judgment on the speaker's inaccuracy might be relatively easier among three types of the questions. Asterisks in Table 5.4 show binomial probabilities against the number by simply guessing in each question. According to analyses by the binomial tests, the children of older age correctly judged who was inaccurate in providing the labels of the familiar objects, $p < .001$ (two-tailed and hereafter) for both 5- and 6-year-olds. On the other hand, the younger children did not distinguish the speakers' in/accuracy, $p = 1.0$ for the 3-year-olds and $p = .08$ for the 4-year-olds. For the proportion, 27.3% of the 3- year-olds, 47.1% of the 4- year-olds, 61.9% of the 5-year-olds and 80% of the 6- year-olds correctly responded on both Explicit Judgment questions; that is, the children's precise appraisal of others' reliability significantly increased with age as also shown above.

Similarly, the younger children did not correctly predict who would provide better information on the Ask questions, $p = .82$, and $p = .31$ for the 3- and 4-year olds, respectively. In contrast to the successful judgment of the older children, the 5-year-olds showed random choices, $p = .53$. On the other hand, the 6-year-olds' performance was at significance, $p = .05$. Apart from the 6- year-olds, the children showed no preference in asking for information considering the differences between the speakers. On the Endorse questions, it appears that the children across all age group had difficulties in labelling the novel objects taking account of the past history of reliability of the speakers, $p = .30$, $p = .72$, $p = .08$, $p = .24$ for the 3-, 4-, 5-, and 6- year-olds, respectively. Although the 6-year-olds did not exercise selective learning on the Endorse questions, it seems that only they showed selective trust considering the performance as a whole including the three types of questions. In order to confirm this possible interpretation, one-sample t-tests on the total score were carried out for each age group. The results confirmed that only 6-year-olds performed at a level of above-chance, $t(9) = 3.67$, $p = .005$. The findings seemed to suggest that the 6-year-olds, but not the younger children, were able to judge the speakers' credibility and learn tracking their past in/accuracy, when information was identified by evidential markers.

Table 5.4

Frequencies on three types of questions on the EM task according to age groups

	Explicit Judgment			Ask				Endorse			
Age groups	0	1	2	0	1	2	3	0	1	2	3
3-years (*n* = 11)	3	5	3	0	3	6	2	0	4	4	3
4-years (*n* = 17)	2	7	$8^{\dagger}$	3	4	6	4	3	4	7	3
5-years (*n* = 21)	3	5	13^{***}	2	10	5	4	2	6	7	$6^{\dagger}$
6-years (*n*= 10)	0	2	8^{***}	0	2	4	$4^{\dagger}$	0	4	4	2

Note. EM: Evidential markers. $^{\dagger}p < .10$. $^{***}p < .001$.

Taken together, it is somewhat surprising that the children by the age of six were able to perform selective trust, which was inconsistent with the previous findings from Chapter Four showing 4-year-olds' and onwards' preference for the previously accurate speaker. Accordingly, the findings seem to support the alternative hypothesis assuming older preschoolers' understanding of selectivity.

The VT task

In the VT task, the speakers conveyed information using the mental-state verbs: *I know* vs. *I think*. One speaker with *I know* was always correct, while the other with *I think* always provided incorrect information. The scores on the each question of the VT task were given as mentioned above. The children's performance on each question of the Ask and Endorse trials are shown in Figure A.12 in the Appendix. The children's responses on the three types of questions across all children in the VT task are shown in Table 5.5. Inspections of Table 5.5 indicated several distinctive findings from those of evidential markers, according to the responses of the maximum score of each question. It appears that the children's relatively early understanding of selective judgment was shown when information was conveyed by the mental-state verbs. First, on the Explicit Judgment, binomial probability tests against the expected frequency of the maximum score (i.e., 2) found that the children of all age groups apart from the 6- year-olds responded correctly on the question of who was being inaccurate naming the objects, $p = .07$, $p < .001$, $p < .001$, and $p = .16$ for the 3-, 4-, 5-, and 6- year-olds, respectively. Compared to performance on the EM task, the 3-year-old children's correct responses on both questions increased by 100%; that is, 54.5% of them judged correctly. For other groups, 70.6%, 61.9% and 50% of the 4-, 5-, 6- year-olds, respectively had both questions correct.

Table 5.5

Frequencies on three types of questions on the VT task according to age groups

	Explicit Judgment			Ask				Endorse			
Age groups	0	1	2	0	1	2	3	0	1	2	3
3-years (n = 11)	4	1	$6^{\dagger}$	2	6	1	2	0	3	6	2
4-years (n = 17)	0	5	12^{***}	1	4	5	7^{**}	0	4	6	7^{**}
5-years (n = 21)	1	7	13^{***}	1	10	3	7^{*}	4	3	9	5
6-years (n= 10)	1	4	5	1	2	2	5^{**}	1	5	1	3

Note. VT: Verb terms. $^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Secondly, the 4-year-olds chose to ask the previously accurate speaker for new information in the Ask question, p = .007 (for three out of three trials), but the 3-year-olds' performance did not significantly differ from guessing, p = .82. The 5-, and 6-year-olds also preferentially selected the accurate speaker, p = .02, and p = .009, respectively. Selective learning appeared to be more difficult than predicting who would be a more reliable source. Only 4-year-olds supplied the names of the novel objects by the previously accurate speaker at a level of above chance, p = .006. On the other hand, the children of the other three groups did not differ from chance, p = .82, p = .22, and p = .24 for the 3-, 5-, and 6- year-olds. Even though the 3-year-olds tended to show judgment of others' in/accuracy, their performance on the subsequent test trials remained at chance levels. Although the 6-year-olds' performance was at chance, it does not seem to indicate that they were not able to judge in/accuracy. The 6-year-olds' performance will be reviewed in the Discussion section of this chapter. In general, the findings seem to indicate that the children by the age of four became aware of the speakers' trustworthiness and this led to their selective learning when the mental-state verbs were the means of communication. In order to support these findings, further analyses by one-sample t-tests, as done for the EM task, were carried out for each age group. As would be expected, the 4-, and 5-year-olds performed significantly differently from chance levels, $t(16) = 5.00$, $p < .001$, and $t(20) = 2.36$, $p = .03$, respectively, indicating their understanding of selective trust. On the other hand, the 3- and 6-year-olds did not differ from chance performance, $t(10) = .69$, $p = .51$, and $t(9) = 1.34$, $p = .21$, respectively.

In summary, the findings seemed to suggest that the children's access to others' epistemic states might be influenced by the means of how information was conveyed. It appears that the children's ability to exercise selective trust emerged by the age of six from the evidential markers and by the age of four from the mental-state verbs. However, as earlier analyses by the repeated measures ANOVA tests showed the differences in the scores of the questions were not significantly different from each linguistic reference. Hence, it seems that the linguistic differences between the grammatically embedded evidential markers and explicit mental verb terms might be very subtle.

5.4. Discussion

The aim of the present study was to examine whether young children's ability to show selective trust was affected by verbal input with different linguistic markers. For the differences in linguistic access, evidential markers (i.e., -*te* (I saw) vs. -*napo* (It seems/I think) and mental state verbs (i.e., *I know* vs. *I think*) were used in order to differentiate two speakers' status of knowledge. The findings were consistent with the previous research showing young children's preference for a speaker with a past history of being accurate. What was distinctive from those findings is that the children's judgment on reliability and selective learning is dependent here on how the speakers express their in/accuracy. When the speakers' in/accuracy was stated by the mental-state verbs the children by the age of four performed selective trust, whereas the children at 6-years tended to understand differential credibility. That is, the findings indicate that they also consider the speaker's attitudes along with knowledge status. Importantly, it appears that the means by which the attitudes were conveyed within a language system is also critical, along with differential accuracy. In this section, I will discuss performance of selective trust according to each linguistic marker (i.e., belief verbs and evidentials) in order to review how or why children performed selective trust at different ages in the following two sections. I will then discuss comparison between selective trust tasks by the two types of linguistic expressions. Finally, I will review a methodological issue raised in the previous chapter.

5.4.1. Selective trust with mental-verb terms

First, regarding the children's evaluation of the mental-state verbs, the findings are consistent with the research (e.g., Abbeduto & Rosenberg, 1985; Johnson & Maratsos, 1977; Moore et al., 1989), suggesting that young children's acquisition of different implications of cognitive verbs such as *know*, *guess*, or *think* is mastered at 4-years of age, and the ability to make the differentiation between such verbs leads to their consideration of others' knowledge states. That is, as noted in the Introduction of this chapter, the Korean children's distinction of the speakers with the two mental verbs might reflect their understanding that the different levels of certainty expressions distinguish others' credibility. The children's selective trust by the age of four would not just indicate their understanding of the linguistic terms. This would also be related to the period when they are able to integrate different perspectives in mind. How were the children by the age of four able to exercise selective trust with the belief verbs?

By the age of four, children begin to represent others' beliefs which can be different from their own and grasp different perspectives between people, but children under that age fail to understand (Flavell, 1999; Perner, 1991). In the selective trust paradigm in which the speakers' accuracy was conflicting and they possessed different levels of certainty, the children might be required to understand two different types of perspectives. The first perspective is that one speaker held the same knowledge as they had (i.e., the correct names of the objects), whereas the other possessed different views from them. The other perspective to understand in the paradigm might be that beliefs between others were different from each other in terms of their strength. In other words, selective trust in the current study required the ability to appreciate others' minds as well as their own. There is a wealth of research showing the developmental pattern of children's understanding of their own and others' beliefs (e.g., Wellman et al., 2001).The findings with the mental-verb terms by the age of four seem to indicate that Korean children's understanding of selective trust may parrellel the findings of the acqustion of beliefs from previoulsy published research. In other words, the ability to grasp beliefs might support 4-year-olds' comprehension of different states of knowledge by various sources of information, as children at this age may be able to coordinate different perspectives and develop a conceptual understanding of a mind (Aksu-Koç, 2009).

5.4.2. Selective trust with evidential markers

The findings with evidential markers are inconsistent with those of the previous experiment (Chapter Four). In the previous experiment, relatively younger children (around 4-years of age) showed preference for a speaker with an expression of direct witness (i.e., *-te*) in a task in which the speakers stated conflicting information. Although the children also showed selectivity, it was revealed at a relatively later age (at six) in the current study. Consequently, the results of evidential markers support the alternative hypothesis of the current study and the view that the acquisition of evidential markers might not be mastered until some years later than their use of such markers (Aksu-Koç & Alici, 2000; de Villiers, Garfield, Gernet-Girard, Roeper, & Speas, 2009; Pasquini et al., 2007). Having said that, it is not clear yet that the discrepancy between the previous and current experiments resulted from variations, for example, in children or task differences. However, it seems possible that variations in populations could be ruled out. As noted in the Introduction of Chapter Three, the differences in socioeconomic circumstances could make a difference in children's cognitive development. However, the children in both experiments were from areas of similar socioeconomic status. Moreover, the children in the current study showed a similar trajectory of an understanding of verbs identifying mental states such as *know* and *think* as mentioned above. Put together, it is possible to discount the possibility of the variations in participants to consider differences in the levels of performance on selective trust with evidential markers between Chapter Four and Five. Another possible explanation is that there are differences in the tasks between the two experiments. The task in the current study included more questions to judge, ask and endorse, while the previous study had only endorse question. Thus, it seems conceivable that a more complex procedure might have resulted in the differences between the two experiments. However, to rule out this possibility of task differences further investigation is needed.

It seems that there may be several possibilities to influence the children's performance on selective trust as discussed in the above part. However, I will consider difficulty in grasping evidentiality as a reason for the relatively later understanding of selectivity. Evidentiality marks two functions: sources of information and certainty. Sources distinguish whether information is from first- or second-hand evidence, while certainty conveys how strong a speaker's belief is (Willett, 1988). However, I will consider certainty to explain the differences between the tasks in the present study. This is because it seems possible that the linguistic meaning of how information is obtained by either direct or indirect access might be overridden by the speakers' behaviour. In other words, the speakers' actions in which one had direct visual access and the other did not might have had stronger effects than linguistic expressions for information access. This interpretation might be applied to an understanding of evidential markers but not to mental verbs. This is because mental verb terms do not include implications of direct or indirect access to information; thus, children may need to comprehend relative certainty for mental verb terms. Indeed, there is evidence suggesting that visual access has more impact than verbal input in the language acquisition (Andersen, Dunlea, & Kekelis, 1993). The researchers listed showed that children who are visually constrained often lag in language learning than those without such limits. Hence, it might be possible that the children might consider the different ways of obtaining information from two speakers by the actions of visual access in the current study. That is to say, it seems possible to disregard the implications of different sources of information (i.e., direct or indirect access). Then, it would be necessary to explore a timetable for the acquisition of certainty.

The research suggests that Korean children's discrimination of certainty between direct and indirect sources of information is acquired by the age of six. For example, Choi, Lee, and Jang (2010) examined whether Korean children between 3- and 6-years of age understood differential degrees of certainty using four evidential markers (i.e., *-e* (I saw/I know) for direct evidence, *-napo* (It seems) for inference, *~kes kathta* (It seems) for conjecture, *-tay* (I heard) for hearsay) and their performance (i.e., *-e* vs. *–tay*, *-e* vs. *–kes kathta*, and *–e* vs. *–napo*) was compared with verb terms (i.e., *I saw* vs. *I heard*). The children's understanding of certainty was tested by a task in which two speakers suggested conflicting information (e.g., (I saw/I know that) the thief was wearing glasses vs. (It seems that) the thief was not wearing glasses for differential evidentiality). The children were asked to choose whose information would be right for an event. Source monitoring and working memory tasks were also administered in order to explore relations between cognitive skills and an understanding of certainty. Choi et al. (2010) found that the 6-year-olds' performance was significantly better than the younger children on the task with evidential; however, their understanding did not reach adults' levels for three comparisons of evidentiality. Performance on the verb terms was significantly better than differential evidentiality for both *–e* vs. *–kes kathta* and *–e* vs. *–tay*. Importantly, the 3-year-olds tended to distinguish the statements by the verb terms but not by evidential markers. These findings seem to indicate that Korean children's ability to judge reliable information from different degrees of certainty might develop at the age of six, in particular when the information was conveyed by the grammaticalized terms. Hence, the findings of Choi et al. would support the findings of the relatively late exhibition of selective trust with evidential markers in the present study.

Taken together, the findings of the current study showed how young children's linguistic access affected their grasp of social cognitive understanding. It seems that Korean children may develop an understanding of beliefs at the age of four. However, different linguistic expressions of beliefs influenced performance on a certain task designed to reveal their social understanding. The current study and previously published findings showed that children under the age of six did not fully comprehend the implications of evidential markers. Thus, it is conceivable that a lack of understanding of evidentiality might also explain variations in the current and previous experiments.

It might call into question whether the selective trust paradigm used here provided precise ways to explore children's selectivity as the task combined experimental and linguistic manipulation. First, I discussed possible explanations that children may consider relative certainty by linguistic information over visual access to an object in the section of 4.4.3 in the previous chapter. Secondly, comparison with previously published research would confirm that the tasks used here demonstrated effects of language on children's selective trust. As mentioned in Chapter One, research has shown that children between 3- and 4-years of age are able to judge reliability of others' testimony and learn from a previously accurate speaker (e.g., Birch et al., 2008; Corriveau & Harris, 2009b; Jaswal & Neely, 2006). Based on this accumulating evidence, it seems possible to speculate that Korean children may show selectivity around 3-4-years of age if two speakers' testimony differed in accuracy. The findings from the selective trust task with evidential markers were inconsistent with this accuracy-based selectivity in young children with regard to the developmental pattern. However, this does not indicate that Korean children had difficulty distinguishing a reliable source of information as the findings by mental verb terms showed a consistent tendency with the studies mentioned above. Therefore, the discrepancies between the selective trust tasks in this study would indicate that children might have taken linguistic references into consideration over visual access to information when they judged reliability of others. As mentioned in Chapter One, success in selective trust requires children to assess belief status of others. According to Johnson (1982), a grasp of implications of mentalistic language and a concept of a mind may be acquired simultaneously in children. That is, the findings in the selective trust questions which included evidential markers might suggest the role of the language (particularly the demands of unpacking the meaning of a protagonist's utterance) in social understanding. In summary, the findings of the present study imply that young children's social-cognitive skills were closely related to linguistic references.

5.4.3. Comparison between selective trust tasks with linguistic markers

The findings showed that there was a difference in the age when the children began to exercise selective trust, based upon how information was conveyed. However, it did not find statistically significant differences in the questions between the tasks. There might be three possible explanations. As mentioned earlier, it seems conceivable that the differences in differential certainty from the different linguistic markers by being either grammaticalized or not might be subtle. However, it does not seem possible to verify how subtle the differences are from the previously published research. Another possible explanation for the results might be related to older children's performance on the task with verb terms. In the evidential task, the children's performance was more likely to increase with age. In contrast, the children at the age of four showed the best performance on the types of questions in the VT task (*M* = 5.94 and *SD* = 1.6 for the total score); that is, the 5- and 6-year-olds' performance was worse (*M* = 5.05 and *SD* = 2.04 and *M* = 5.1 and *SD* = 2.0 for the total scores, respectively). These patterns might be explained by U-shaped developmental growth in children which indicates their incorrect performance appearing after correct performance (Strauss & Stavy, 1982). According to them, children's judgment of quantity or language acquisition shows an apparent drop in performance and recovery (i.e., correct at Phase 1, incorrect at Phase 2 and correct at Phase 3 – so U-shaped curve). For example, English-speaking children tend to make errors in rules for nouns (e.g., plural) and verbs (e.g., irregular forms) (Bowerman, 1982). According to Bowerman, children at Phase 2 overregularize English rules making errors such as feet to foots or went to goed. Children make such errors as they generally apply the rules for nouns or verbs - for example shoe to shoes for the plural or jump to jumped for the past tense. It seems that an incorrect judgment is not constrained to acquistion of words. U-shaped developmental phenomena have been obserbed when children interpret various systems such as quality or quanty (Strauss & Stavy, 1982). That is, the 5-6-year-old children in the current study were at the stage that they have gone through the same developmental shifts in the use of the mental-verb terms, *know* and *think*.

For this U-shape performance in older children, it seems conceivable that they might think that the experimental task had an artificial structure to express knowledge status, in particular for the use of the verb terms. This explanation might be related to children's understanding of sentences rather than implications of vocabulary. Korean has a system which expresses the status of knowledge of a speaker by obligatory suffixes, and the use of such markers emerges in young children' spontaneous speech (Choi, 1991). Thus, it seems possible that communication by suffixes including evidential meanings would be more natural in everyday conversations for Korean speakers. In particular, it seems rather odd to say "I know/think that there is a ball in the box" for the question, "What is in the box?" than to say "(I saw/It seems that) there is a ball in the box *-te*" because Korean speakers tend to encode epistemic suffixes with their obligatory use in spontaneous dialogue. Thus, older children might think that the statements with the verbs for the certain question might be unusual while younger children did not fully understand the use of evidentiality and they accepted the use of verb terms. However, Korean adults could distinguish such statements by the verb terms appropriately in light of what a speaker implies. Consequently, this might have led to the older children's drop in performance in the *know-think* sentences.

As mentoined earlier, a drop in performance might not indicate children's lack of knowledge about semantic differences in vocabulary. This is because there is evidence showing children's developmental pattern for the *know-think* contrast between 3- and 8-year-olds in English-speaking children (e.g., Moore & Davidge, 1989; Moore & Furrow, 1991). Moore and colleagues found that an understanding that a *know* statement expresses stronger certainty than a *think* proposition appeared at the age of four and the older children's performance (i.e., 6- and 8-year-olds) was significantly better than the 4-year -olds' performance. Hence, it seems that it might not be the case that the older children in the current study made semantic errors after a period that they understood the differences between *know* and *think*.

Put together, this section discussed the intriguing performance on the task with verb terms in the older children. Further research will be required to probe whether this tendency to decrease in the older children is replicated or is unique in the current study.

5.4.4. Review of a methodological issue

In the previous experiment (Chapter Four), we posed a methodological issue that in the matter of a novel word, it might be relatively straightforward to recall the word from a vowel sound. In the present study, the novel word was replaced by a word from a consonant sound in order to remove this possibility. Thus, it would be necessary to explore whether the performance in the previous chapter resulted from the fact that it was a word rather than a vowel modification. In the second Endorse question, the children were asked to choose a label from the *thopa-lamu* contrast. A binomial test found that the children's performance was at a level of above-chance, p = .004, preferentially choosing *thopa* over *lamu*, and 41 out of 59 children (69%) passed the task. Thus, it appears that the vowel-consonant contrast in the previous chapter did not affect the levels of performance that showed the 4-year-olds' successful selective trust.

5.5. Conclusion

The current study argued that children's language acquisition would be related to their social skills at accessing others' epistemic aspects. The findings appeared to support this claim. In response to the hypothesis that language differences influence children's selective trust, we employed two different types of linguistic markers to indicate one's knowledge status. One type of the linguistic marker was derived from the grammatically embedded evidentiality in Korean. The other type was verbs identifying mental states. The children's selective learning varied from the linguistic cues. The exposure to evidentiality which marks sources of information and different degrees of certainty did not facilitate the children's understanding of trustworthiness. In contrast, their understanding of the mental terms by verbs showed a trend following a general trajectory shown in the research and this led to their judgment on a reliable source of information. In general, the children preferred to ask a previously accurate speaker and to gain knowledge from her. Importantly, they also consider beliefs of speakers. The current research extends our knowledge regarding how different linguistic references might affect the children's understanding of credibility and word learning in terms of strength of beliefs. These findings suggesting a relation between children's social cognition and selective trust lead to the next study in terms of what other cognitive skills are related to their judgment and learning ability. In order to explore this question, the next study employed executive function as a measure of selective trust.

Chapter Six: **Does executive function predict the ability to exercise selective trust in young children?**

6.1. Experiment 5

In Chapter Five, we explored whether children's epistemic judgment on reliability differed by linguistic input. For variations in linguistic references, two types of epistemic mental expressions were used: evidentiality (-*te* (I saw) vs. -*napo* (It seems)) and verb terms (*I know* vs. *I think*). A speaker who had visual access conveyed correct information with a stronger state of a belief using –*te* or *I know*. On the other hand, another speaker with indirect information was incorrect and expressed uncertainty using –*napo* or *I think*. The study found that young children judged the speaker with a past history of accuracy as a more reliable source of information regardless of linguistic differences. Importantly, however, there were marked differences by linguistic input. When the speakers' epistemic states were contrasted by the verb terms, children of 4-years of age showed successful judgment on trustworthiness and selective learning. On the other hand, 6-year-olds exercised selective trust when the speakers' utterances were expressed using evidential markers. The findings seem to suggest that the development of the children's social-cognitive skills could be dependent on their linguistic access.

Along with the findings suggesting the effects of language on selective trust, we decided to examine which other factors might also influence children's ability to distinguish others' testimony. The previously published research has shown little attention to the role of executive skills on selective trust except for Lucas et al. (2013) (see Chapter One). However, it seems possible that executive function might support performance on selective trust. Selective trust assesses children's mentalistic appraisal of others' testimony (Koenig & Harris, 2007). A traditional selective trust paradigm which was used in this study involves children's judgement of speakers' reliability and selective learning from conflicting information. It is crucial to discriminate the speakers' statements and choose selectively rather than simply to accept information. Therefore, the ability to attend to information flexibly between the speakers and to respond to a more reliable statement suppressing irrelevant testimony would be required for successfully making a judgement based on selective trust. As the selective trust task progresses so too do the executive demands upon children. In other words, the ability to remember who said what and who was right (i.e., working memory) and to inhibit a dominant response with flexible shifting between speakers (i.e., inhibitory control and set-shifting, respectively) would be required in selective trust. As the nature of this interpretative skill might invlove exeutive demands, the relationships between selective trust and executive function would be expected. For this reason I examined three sub-components of executive function: inhibitory control, working memory and set-shifting. Thus, I will explore below how executive function might be related to selective trust.

As noted above, the selective trust paradigm mainly includes two stages: judgment between accurate and inaccurate information and word learning. The relation between word learning / judgment and executive skills will be discussed. Working memory refers to a system which contributes to the temporary storage and processing of information to perform cognitive tasks such as language acquisition, learning and reasoning (Baddeley, 1992). There are three subsystems in working memory: phonological loop, concerning verbal and acoustic information, visuospatial sketchpad for visual equivalent and central executive of an attention control system (Baddeley, 2003). The fundamentals of the subsystems will not be discussed because they go beyond the scope of the current study, but I will explore how the subsystems are related to learning ability. According to recent research, it seems that the phonological loop in working memory is divided into two types: verbal short-term memory and verbal working memory (e.g., Kidd, 2013). It seems that the two types of working memory play a role in language acquisition. However, I will focus on the role of verbal short-term memory rather than verbal working memory in this study. This is because it seems that tasks for verbal short-term memory have been used to measure young children's working memory capacity (e.g., Carlson et al., 2002; Oh & Lewis, 2008; Willis & Gathercole, 2001), whereas measures of verbal working memory have been applied to adults (e.g., Daneman & Carpenter, 1980; Just & Carpenter, 1992).

The phonological loop, in particular short-term memory, plays a crucial role in language acquisition by maintaining acoustic information (Baddeley, Gathercole, & Papagno, 1998). There is accumulating evidence for the role of working memory in word learning, in particular between phonological short-term memory capacity and language development in both adults and children (e.g., Baddeley, 2003; Baddeley et al., 1998; Gathercole, Hitch, Service, & Martin, 1997; Gathercole, Service, Hitch, Adams, & Martin, 1999; Papagno & Vallar, 1995). For example, Papagno and Vallar (1995) conducted a study with Italian adults who were either fluent in various languages or spoke only their native language, in order to examine the hypothesis that the phonological short-term memory would be an important factor in the acquisition of a foreign language. Memory-span tasks were used to test the capacity of verbal and visuospatial memory. For the test of new words, word-word and word-nonword pairs of Russian words were used. They found that there was a significant difference between the participants in word learning; that is, for word-nonword pairs, but not word-word combinations, polyglots' performance was significantly better than non-polyglots'. The polyglots' levels on digit span and nonword repetition tasks for short-term memory were significantly better than the non-polyglots'. Importantly, they found significant correlations between two phonological memory tasks and non-word learning, suggesting a close link between the capacity to store verbal information and the acquisition of language. Another source of evidence for the role of short-term memory in word learning comes from children.

Gathercole and her colleagues (Gathercole et al., 1997; Gathercole et al., 1999; Gathercole, Willis, Emslie, & Baddeley, 1992) have indicated an association between the phonological memory and vocabulary learning in cross-sectional studies as well as in a longitudinal study. Consistent with the findings in adults, they found that the phonological loop contributed to preschoolers' word learning ability and a significant association between the two skills was also observed in school-aged children. Hence, these findings suggest that the phonological storage capacity predicts the ability to hold unfamiliar sounds in mind (Baddeley, Papagno, & Vallar, 1988).

Along with the role of working memory in language acquisition, it seems that the capacity of memory is also related to judgment. Memory plays a role in judgment in ways, by providing the cues for prediction and the rules for information-processing (Hogarth, 1987). Thus, dependence of selective judgment on working memory might be expected. For example, in the Explicit Judgment trials used here, children are asked to judge more reliable information between conflicting utterances from two speakers. In this case, the children's judgment on the speaker might be based on the similarity in which one speaker possessed the same knowledge with them about objects. Furthermore, certain information which is obtained by observation of events or direct experience remains salient in memory (Hogarth, 1987). Thus, it is possible that children's observation of how speakers obtain information might influence their judgment along with the storage capacity for verbal sounds in the selective trust paradigm. In other words, the ability to identify the sources of information would be critical for selective trust as the process of information which is visually perceived is probably related to visual working memory (Baddeley, 1992, 2003).

Indeed, it seems that visual working memory is used to store integrated visual information. Luck and Vogel (1997) conducted research focusing on whether the capacity of visual working memory constrained the storage of visual information for a single-feature or for integrated conjunctions of objects. For the capacity of working memory, arrays of coloured squares were used with variations in the size of a set. Participants were presented with a sample array and then received a test array following a short-term delay. The participants were then asked whether there were changes between the arrays. Luck and Vogel found that the capacity for accuracy in the single-feature declined from a set of four features. This capacity was compared with conditions in which both colour and orientation were integrated using four features. Thus, it was necessary for the participants to retain eight features by four colours and four orientations in a conjunction condition with four features. The findings in the conjunction condition were comparable to the initial condition, suggesting that visual working memory stores information of integrated objects rather than individual features. This capacity of visual working memory to integrate visual information might be crucial in selective trust as visual working memory is related to attentional processes (Treisman, 1996). Hence, working memory tasks which evaluate both verbal and visual capacity were used in the current study in relation to children's word learning and judgment on sources of information.

Returning to selective learning and executive skills, it seems that children's selective learning might be related to inhibitory control or selective attention (or cognitive flexibility). It would be necessary to attend relevant information and to reject a false suggestion in order to learn novel words from a more reliable source of information in testimony. Evidence for the role of inhibitory control in resistance to irrelevant information comes from the empirical research with young toddlers aged 2.5 and 3.5 by Jaswal et al. (2014). They hypothesised that children who had better skills in inhibitory control would be more sceptical about testimony that conflicted with their first-hand experience than those with difficulty in such control. For young children's inhibitory control, the spatial conflict task was used, while children's selectivity on testimony was examined by the misleading testimony task. In the spatial conflict task, the children were asked to touch a target on a screen to help a character find a way back home. Over the trials, the target appeared above either the character's house (compatible trials) or the opposite house (incompatible trials). The children were expected to touch the right house for the character. In particular, as the target appeared on the opposite house (for incompatible trials), the children were required to inhibit the prepotent response based on the location of the target. The misleading testimony task was used to examine the children's ability to reject others' testimony. In this procedure, an apparatus involved three clear tubes connected to three opaque cups at the bottom but the tubes were not vertically linked to the cups. With warm-up trials, the children had opportunities to notice how each tube was coupled to each cup. In test trials, the experimenter dropped a cracker through a tube. The children then were asked to identify where the cracker would fall. The experimenter asked another actor (an adult) the same question who always responded with misleading testimony throughout the trials. After the children heard the false testimony of the adult actor, the experimenter asked them again where to look. That is, this task assessed whether the children changed their responses according to the actor's testimony, even though it was wrong, or they maintained their original response. Jaswal et al. found that there was a significant difference between the tasks. That is, the children who tended to accept the actor's false testimony performed less proficiently on the incompatible condition of the spatial conflict task rather than the compatible condition, as the former required inhibition. The findings seemed to suggest that children who had skills in inhibiting prepotent responses were more likely to be sceptical about what they were told. Hence, this empirical study may provide support for the role of inhibitory control in selectivity by facilitating children's ability to suppress inappropriate responses.

Similarly, it has been suggested that the capacity to attend stimuli flexibly would lead to children's better ability to evaluate irrelevant information (Lane & Pearson, 1982). This view that children who possess a better capacity to process information efficiently are better learners is supported by diverse sources of evidence such as clinical children (e.g., Biederman et al., 2004; Mayes & Calhoun, 2007; Mundy, Sigman, & Kasari, 1990), children with bilingualism (e.g., Bialystok, 1999; Carlson & Meltzoff, 2008) or children with academic achievement (e.g., Dobbs, Doctoroff, Fisher, & Arnold, 2006; Lan, Legare, Ponitz, Li, & Morrison, 2011; McClelland et al., 2007). For example, Lan et al. (2011) examined Chinese and American preschoolers' executive function and its relation to academic achievement based on reading and mathematics. It has been reported that Asian children's levels of executive skills are different from those in Western countries (Oh & Lewis, 2008; Sabbagh et al., 2006). Lan et al. aimed at investigating whether variations in executive function would be shown and whether there were cultural differences in relation to academic achievement based upon executive function. A battery of executive function tasks including inhibition, working memory and attention control and two assessments of mathematics and reading for academic achievement were used in their study. They found that Chinese children's performance on inhibition and attention control, but not working memory, was significantly better than that of American children. It was found that attention control was a salient factor in predicting academic achievement for all areas regardless of cultural differences although inhibitory and working memory also were related to each aspect of achievement. These findings seem to suggest that executive function is significantly related to learning ability in early childhood.

Regarding the measures used in this study, tasks to assess children's linguistic skills were used. It has been suggested that children's understanding of others' behaviour and beliefs is closely related to their verbal ability as language is used to reveal one's mental representation (e.g., Milligan et al., 2007). As the previous findings have revealed influences of linguistic references in selective trust, this study included two langauge tasks which assessed children's general knowledge of topics and comprehension of Korean grammar. The task for general knowlege was involved as a predictive role of such ability on social understanding has been shown (e.g., Milligan et al., 2007). The task for Korean grammar was included considering that information of selective trust was conveyed as sentences and evidential markers were in the grammaticalized form (see the Method section for details). This inclusion of the language tasks may allow the exploration of the role of language in seletive trust.

Taken together, the research reviewed above showed how executive function is correlated to children’s judgment and learning. Research has shown that executive skills are associated with children’s ability to judge others’ beliefs and action (e.g., Carlson et al., 2002; Sabbagh et al., 2006). As selective trust assesses children’s ability to distinguish others’ differential knowledge or belief status, executive skills might be required. Thus, the present study employed three components of executive function (i.e., inhibitory control, working memory and selective attention) in order to explore whether it predicted children’s ability to exercise selective trust. There were two research questions: (1) Does executive function support performance on children’s selective trust? (2) Do linguistic demands on children influence their exercise of selective trust as shown in the previous experiment? Based on the previous research, we hypothesised that [1] working memory would predict children’ ability to judge a reliable source of information; [2] working memory would predict the children’s word learning if the phonological capacity to hold unfamiliar utterances were salient. Alternatively, we hypothesised that [3] inhibitory control or selective attention would predict the performance on word learning if the ability to inhibit irrelevant information or to attend appropriate responses flexibly were salient in the selective trust paradigm. The second research question was concerned with the effects of linguistic references on children’s selective trust, focusing on the findings from the previous experiment. Based on the empirical findings, we hypothesised that children’s selective trust was shown around the age of four when information was conveyed by mental-verb terms, whereas a relatively later exercise of selective trust would be observed by evidential markers.

6.2. Method

Participants

Eighty-four Korean preschool and kindergarten children participated (43 boys): 18 3-year-olds (*M* = 41.1 months, *SD* = 3.56 months and range = 35.0 to 46.9 months), 25 4-year-olds (*M* = 53.9 months, *SD* = 3.92 months and range 48.0 to 59.6 months), 20 5-year-olds (*M* = 66.3 months, *SD* = 3.18 months and range 60.8 to 70.8 months), and 21 6-year-olds (*M* = 77.9 months, *SD* = 3.69 months and range 72.0 to 84.1 months). Children were recruited from preschools and kindergartens in Anseng, Pyeongtaek, and Yongin in Korea, and were from lower middle class areas. According to the guidance of Lancaster University, an information sheet explaining the experiment and a consent form were distributed to parents by head teachers.

Measures

Procedure

Children were tested individually in a quiet place in their preschool or kindergarten. Measures were two vocabulary scales, two selective trust and seven executive function tasks: Korean-Wechsler Preschool and Primary Scale of Intelligence (K-WPPSI), Korean Oral Syntax Expression Comprehension Test (KOSECT), selective trust with evidential markers (ST-EM) and with verb terms (ST-VT), Day/Night, Simon Says, Backward Digit Span (BDS), Backward Word Span (BWS), Visually Cued Recall (VCR) and standard and advanced dimensional change card sort (DCCS). The two vocabulary tasks, K-WPPSI and KOSECT, were always administered first in a fixed order. The selective trust and executive function tasks were administered by a Latin square design. The order of the tasks was as follows: ST-EM, Day/Night, BDS, VCR, ST-VT, standard and advanced DCCS, BWS, and Simon Says. Each measure is described in detail in the following sections. In total, there were 11 tasks and the entire session lasted approximately 50 to 60 minutes. The test was administered within one session for each child, except when head teachers asked for it to be divided into two sessions. The test was completed in the same day even though the sessions were separated. A total of 32 children were given the test in two sessions.

Language measures

Children’s language skills were measured using vocabulary and sentence comprehension tasks.

Korean-Wechsler Preschool and Primary Scale of Intelligence (K-WPPSI; Park et al., 1995). The subscale of verbal terms, Information, was administered for the measuring of vocabulary. The scale consisted of six picture tests and 21 verbal tests. The task was stopped when a child failed five consecutive questions. One score was given when the child pointed to, or responded verbally to, an appropriate answer. The maximum raw score was 27.

Korean Oral Syntax Expression Comprehension Test (KOSECT; Pae, Lim, Lee, & Chang, 2004). The task consisted of 57 questions which require understanding of morphology, syntax, and semantics. In detail, 10, 28, and 19 questions were allocated to each area of the three, respectively. For each question, there were three pictures depicting actions. One of the three drawings corresponded to a given sentence. The child was awarded one point when he or she pointed to an appropriate picture. When the child failed three consecutive trials, the task was discontinued. The maximum score was 57.

Selective trust (ST) measures

The framework was identical to the tasks in Chapter Five with an inclusion of a source-reporting question in novel test trials. There were two conditions of the task with evidential markers (i.e., *-te* vs. *-napo*) and verb terms (i.e., *I know* vs. *I think*). The same materials for familiarization and novel trials in each type of the tasks were used as in Chapters Four and Five (see Figure 4.1 and 4.2 for EM and Figure 5.1 and 5.2 for VT). The wording for accurate/inaccurate information was identical with the previous experiment (see Table 5.1 for EM and Table 5.2 for VT).

Familiarization trials. Two hand puppets (a Bear and a Sheep for EM, and a Duck and a Rabbit for VT) were used as informants and a Giraffe puppet acted as a messenger. As described in Chapter Five, the experimenter used still images of objects at the start of the test. When each familiarization trial was given, she asked the child to label an object, saying, for example, "This is what is inside the box (showing a photograph of an object). Bear says there is a ball (using the suffix–*te* to indicate certainty). A ball. Sheep says there is a book (using the suffix *–napo* to show uncertainty). A book. What is it really – a ball or a book?" Her statements were changed by the linguistic expressions. After the three familiarization trials were completed, an Explicit Judgment question was given, "Who was always right about the things?" This question was altered from Chapter Five for the consistency within the task which assessed the child's awareness of the informants' accuracy. In other words, the selective trust task was designed here to investigate whether children would seek information (Ask questions) and learn novel words (Endorse questions) from a reliable informant. However, the Explicit Judgment questions in Chapter Five were to judge the informants' inaccuracy. Thus, the questions were modified to ask about accuracy, in order to maintain coherence of judgment throughout the trials.

The Explicit Judgment questions were given twice after the familiarization trials and the novel trials; thus, the scores ranged from 0 to 2.

Novel test trials. In the novel trials, four types of questions were given: Ask, Endorse, Explicit judgment and Source-reporting. For Ask questions, the experimenter asked, “I think one of my friends can help. Who do you think would be right about this?” For Endorse questions, she said in the EM task, for example, “Bear said there is a kapi (using –*te* to indicate knowledge). A kapi. Sheep said there is a soco (using –*napo* to indicate less certainty). A soco. Can you tell me what this is called? A kapi or a soco” After the third trial, an Explicit Judgment question was given, for instance, “Bear and Sheep said what was inside the box. Who was always right about what was inside the box?” As mentioned above, the linguistic expressions were used differently according to the types of the selective trust tasks. Finally, a source-reporting question was given, “Why (do you think) was she always wrong (referring to the other puppet the child did not indicate for the second Explicit Judgment question)?” If the child failed to respond or say, “I don’t know”, then she prompted the child with a forced-choice question saying, “Was it because she did not see what was inside the box, or was it because she said she did not know?” The two choices were counterbalanced across children.

Executive function (EF) measures

Three components of executive function were administered: two inhibitory control, three working memory and two set shifting tasks.

The Day/Night task. The procedure of the task was equivalent to that used in Chapter Two, except that the practice trials were administered with up to six trials (see Figure 2.1). If the child did not pass the practice trials, the task was discontinued. In Chapter Two, 3-year-olds were given approximately 10 practice trials; however, children who did not understand the rules showed signs of difficulty in exercising the task, as practice trials were increased and some of them could not complete the task. Thus, the practice trials were limited to a maximum of six trials in order to maintain the child's interest without forcing him/her to perform the task. This is because it seemed important to make the test enjoyable for young children, as there were 11 tasks in total lasting approximately one hour. The experimenter said to the child, "When you see the moon (the sun), you are to say *achim* (*pam*) – day (night)." and asked showing a card, "What do you say when you see this card?" The 8 moon and 8 sun cards were presented in a fixed pseudorandom order: moon (m), sun (s), m, s, s, m, s, m, s, m, m, s, m, s, s, m. The child was given a total of 16 trials and the number of trials was used as a dependent variable. Performance of 12 and more out of 16 trials was also regarded as having passed the task following the criteria of Carlson (2005), for comparison with the previously published research.

The Simon Says task. In the game of Simon Says by Strommen (1973), the child was required to inhibit actions selectively according to commands employed. The procedure and criteria followed Carlson and Wang's (2007) work. The experimenter first asked the child to stand up and imitate her for 10 simplified motions: 1) arms up 2) touch your ears, 3) touch your knees, 4) touch your eyes, 5) clap your hands, 6) touch your feet, 7) touch your head, 8) touch your tummy, 9) touch your nose, and 10) wave your hands. She then explained the rules of the game. The child was told to imitate her instructions when she prefaced the command with Simon Says: "When I say 'Simon Says', you do what I say. But when I don't say 'Simon says', you shouldn't do anything at all". There was a maximum of 10 practice trials except for one three-year-old participant who was given 11 trials to ensure that the child understood the rules and the child was corrected as needed. There were 10 test trials (five imitation and five anti-imitation trials) in a fixed order without feedback: Simon, no Simon, no Simon, Simon, no Simon, rule reminder, no Simon, Simon, Simon, no Simon, Simon. After half the trials, the rules were presented as a reminder. For the trials, scores were encoded according to whether it was a Simon/anti-imitation trial as follows: 0 = no movement/full commanded movement; 1 = flinch/partial commanded movement; 2 = partial commanded movement/flinch; 3 = full commanded movement/no movement. The total scores across the five anti-imitation trials were analysed (the maximum score = 15).

The Backward Digit Span (BDS) task. The task was administered following Carlson et al.'s (2002) procedure. The experimenter asked the child to repeat a list of single-digit numbers in reverse order. She asked the child to pronounce numbers from 0 to 9 in order to explain that they were going to play the number game. When the child did not say the numbers, she prompted by saying the numbers first and then asked to do together. Then she introduced a Sheep puppet to demonstrate the task saying, "There is a sheep. She's being naughty. So when I say numbers, she says backward. Like this, if I say numbers '1, 2', she says '2, 1.'" Then she asked the child "Can you repeat backward like the sheep said?", and pronounced numbers for practice trials. The child was given a 2-digit practice trial, and was corrected if wrong. When the child did not seem to understand the rules very well, she presented a laminated card which depicted numbers from 0 to 9 for the practice trials, and explained rules again pointing to the numbers. The 2-digit practice trials were given up to five times. If the child failed the five practice trials, the test trials were not administered. That is, when the children passed one of the five practice trials, he / she performed the test trials. The list of numbers was increased with each successful trial (2, 3, 4 or more digits up to 6), and the test trials lasted until the child made three consecutive trials. Table 6.1 shows the list of numbers for the practice and test trials. The highest level children achieved was recorded (maximum = 6); however, none of children reached the maximum score. Children who failed either the practice trials or the 2-digit list were given one point.

Table 6.1

The list of numbers of the Backward Digit Span task

Digits					
Practice	2-digits	3-digits	4-digits	5-digits	6-digits
1, 5	9, 5	1, 7, 2	8, 6, 3, 4	5, 2, 9, 7, 1	4, 5, 6, 2, 8, 1
3, 6	2, 7	2, 9, 3	2, 4, 5, 9	7, 3, 2, 8, 6	2, 5, 1, 4, 3, 7
6, 2	1, 6	6, 1, 4	1, 3, 6, 5	4, 1, 9, 6, 7	5, 9, 3, 1, 4, 6
8, 4					
2, 7					

The Backward Word Span (BWS) task

The procedure of Carlson et al. (2002) was adopted. Prior to explaining the task, the experimenter asked the child saying, “Do you know what ‘saying backward’ is?” (This question was asked when this task was administered prior to the Backward Digit Span task). The majority of children admitted that they did not know the meaning. Then she asked again, “Then do you know about saying a name backward? If you say your name backward, what do you say?” She asked this question because it was assumed that older preschoolers or kindergarteners might say their names in reverse order although they did not understand the meaning of backward. This is because Korean names mostly consist of 3-words, and some children might have experience of the game according to their preschool’s or kindergarten’s education system. If the child was not able to say their name backward, then she pronounced the name backward instead and proceeded with the task. She instructed a Sheep puppet to demonstrate the task, saying, “This sheep’s being naughty. When I say words, she says them backward. If I say words, ‘ball, cup’, she says, ‘cup, ball’” Then she asked the child, “Can you say backward as the Sheep said?” After the child responded, the practice trials were given with 2-word lists. For the first practice trial, if the child did not understand the rules, she showed a laminated card, which depicted pictures and words (i.e., pictures of nose and sheep).Then she repeated the rules pointing to the pictures. The rest of the practice trials were given. The child was corrected when it was necessary, and was given explanations for the rules. If the child failed up to five practice trials, the test trials were not administered. The word lists were increased with each successful trial from 2- to 5-word lists until the child made errors on the three consecutive trials within a word list. The maximum score of five was given. Following Carlson et al. (2002) children who failed either the practice trial or the first 2-word list obtained one point. Thirty-five single-syllable words were used based on productive vocabulary which can be acquired by Korean infants under 24-months-old (Kim, McGregor, & Thompson, 2000). The list of the words is shown below. Some words were used more than once.

For practice trials,

1) Kho (nose), yang (sheep)

2) Ton (money), say (bird)

3) Pul (light), kkot (flower)

4) Nun (eye), Pi (rain)

5) Pay (pear), Pyel (star)

For 2-words,

1) Ip (mouth), yak (medicine)

2) Kwi (ear), kam (persimmon)

3) Pal (foot), mul (water)

For 3-words,

1) Kkem (chewing gum), i (tooth), kom (bear)

2) Pap (rice), hay (sun), phul (glue)

3) Kim (seaweed), kyul (tangerine), bit (comb)

For 4-words,

1) Chayk (book), ot (clothes), ppang (bread), son (hand)

2) Kong (ball), char (car), ppin (hairpin), mal (horse)

3) Cup (cup), yang (sheep), pi (rain), tal (moon)

For 5-words,

1) Kkot (flower), pal (foot), kom (bear), mul (water), phul (glue)

2) Yak (medicine), hay (sun), pul (light), kwi (ear), pap (rice)

3) Say (bird), kho (nose), pyel (star), kim (seaweed), pis (comb)

The Visually Cued Recall (VCR) task. The task followed the procedure of Zelazo, Jacques, Burack, and Frye (2002). Materials were 10 different posters with 3 X 4 arrays of 12 pictures which were familiar to young children and a puppet. The 12 pictures are shown in Figure 6.1, and consisted of six animals and six objects. The random arrays were generated by using Microsoft Office Excel 2007. The experimenter presented one poster at a time. She started the task saying, “Now, we are playing a picture game. Can you tell me what these pictures are?” All children correctly labelled the pictures. When the child responded, she instructed him/her to point to items following what the puppet indicated, saying “You know all these pictures. There is a giraffe. In this game, the giraffe will say what she likes. You then point to the pictures following what she likes. Can you do that?” She started one item for a practice trial, “The giraffe says something like this, ‘I like the banana (simultaneously pointing to the item).’ Can you point to the one that the giraffe likes?” Another practice trial proceeded with 2-pictures using the giraffe, “I like the cat and the tree (pointing to the items)” and asked the child, “Can you point to the things that the giraffe likes?” For the practice trial with 2-pictures, she repeated several times when it was necessary. For the test trials, the number of items was increased from 2 to 10 on each display, and a new array was presented for each trial. When the child either failed two consecutive trials or reached a maximum of 10 items, the task was discontinued. The arrays presented and the items selected on each array were maintained across all children. The number of items that the child identified on the last correct trial or the maximum was scored; however, none of the children reached the maximum in the trial. The arrays are shown in Table 6.2. The number 1 was for the practice trials, and the test arrays were the number from 2 to 13 in the table. If the child failed the first two items, then he or she obtained one score. The maximum score would be 10.

Figure 6.1. Twelve pictures of animals and objects used in the Visually Cued Recall task.

(Source: http://pngimg.com)

Table 6.2

The arrays for the Visually Cued Recall task

	Arrays											
	1st line			2nd line			3rd line			4th line		
1	App.	Bear	Cat	Car	Tree	Ban.	Duck	Pup.	Ball	Fish	Rab.	Cap
2	Ban.	Fish	Car	Cat	Duck	App.	Tree	Pup.	Cap	Rab.	Bear	Ball
3	Cap	Fish	Cat	App.	Duck	Ban.	Pup.	Bear	Ball	Car	Tree	Rab.
4	Ball	Bear	Car	Ban.	Tree	App.	Rab.	Fish	Cap	Cat	Pup.	Duck
5	Rab.	Cat	App.	Pup.	Fish	Cap	Car	Ball	Tree	Ban.	Duck	Bear
6	Cat	Cap	Car	Ban.	Rab.	App.	Bear	Pup.	Tree	Ball	Fish	Duck
7	Pup.	Cap	Bear	Ban.	Ball	Cat	Tree	Car	Duck	App.	Fish	Rab.
8	Ban.	Ball	Duck	Rab.	Cap	Tree	Bear	App.	Car	Fish	Cat	Pup.
9	Rab.	Car	Fish	Tree	Ball	Pup.	Duck	Ban.	App.	Bear	Cap	Cat
10	Tree	Fish	Duck	Rab.	Bear	Cat	Pup.	App.	Ball	Ban.	Car	Cap
11	Ball	Pup.	Bear	App.	Car	Tree	Ban.	Rab.	Fish	Cat	Cap	Duck
12	Duck	Rab.	Ball	Tree	Ban.	Cap	Fish	Pup.	Bear	Car	Cat	App.
13	App.	Ball	Fish	Duck	Cap	Ban.	Pup.	Bear	Car	Cat	Tree	Rab.

Note. App.: Apple, Ban.: Banana, Pup.: Puppy, Rab.: Rabbit.

The items which were labelled for the practice and test trials are shown in Table 6.3. The number 1 was for the practice trial. The items for the test trials were from 2 to 10 in the table.

Table 6.3

The items labelled for the Visually Cued Recall task

	Items									
1	Cat	Tree								
2	Rab.	Ban.								
3	Fish	Ball	App.							
4	Cap	Ban.	Bear	Ball						
5	Car	Bear	Tree	Pup.	Rab.					
6	App.	Tree	Bear	Cat	Duck	Car				
7	Ban.	Fish	Cat	Bear	Pup.	Ball	App.			
8	Ball	Tree	Fish	Cap	Bear	Car	Ban.	Cat		
9	Pup.	Rab.	Cap	Tree	Duck	App.	Fish	Car	Bear	
10	Ball	Fish	Ban.	Cap	Pup.	Rab.	Duck	App.	Bear	Tree

Note. App.: Apple, Ban.: Banana, Pup.: Puppy, Rab.: Rabbit.

The standard Dimensional Change Card Sort (DCCS) task. The test procedure of the standard DCCS task was the same as in Chapter Two, but materials were altered because it seemed that a picture of a boat in the model card was not easily recognized by some children. The apple cards were used instead. Twenty laminated cards (two model cards, 12 sorting cards without a border, and six sorting cards with a border – for the standard and advanced tasks) and two sorting trays were used. The model cards were a red apple and a blue star, and the sorting cards were blue apples and red stars without a border. The sorting cards with a border were used in the advanced DCCS task. Figure 6.2 – 6.4 show the examples of the model and the sorting cards for the standard and advanced tasks. The child received the standard DCCS task first. The order in which dimensions were presented (either colour or shape first) was counterbalanced across the children. In the pre-switch trials, the experimenter explained relevant rules if this was necessary, and responded to the child in a neutral fashion. Prior to the post-switch trials, she stated rules pointing to the trays, and asked the child to point to the trays according to the relevant rules. Then the post-switch trials were administered without feedback. The number of trials was used as a variable. Again, as in Chapters Two and Three, five or six out of six trials was regarded as having passed for the standard procedure and this categorization was also used for comparison.

The advanced Dimensional Change Card Sort (DCCS) task. The advanced DCCS task followed the procedure of Hongwanishkul, Happaney, Lee, and Zelazo (2005). When the child finished the post-switch trials of the standard task, the ADCCS task was given immediately. Prior to administering the advanced task, the cards remaining in the trays from the standard task were removed. She explained that a black border indicated that the child play a particular game, saying “If you see cards with a black border, you play the colour (or shape) game. If you see cards without a black border, you play the shape (or colour) game.” She demonstrated with both cards with/out the border, and asked the child to point to the relevant trays with two other cards with/out the border. The dimensions indicated by the black border were counterbalanced across the children. The ADCCS task consisted of 12 trials. On each trial, she repeated the rules. The same type of the test cards (with or without a border) was not presented for more than two consecutive trials. No feedback was given. The number of the trials was used as a dependent variable. The child was considered to have passed the advanced task when she or he correctly sorted 9 out of 12 trials. This categorization for pass was also used for comparison.

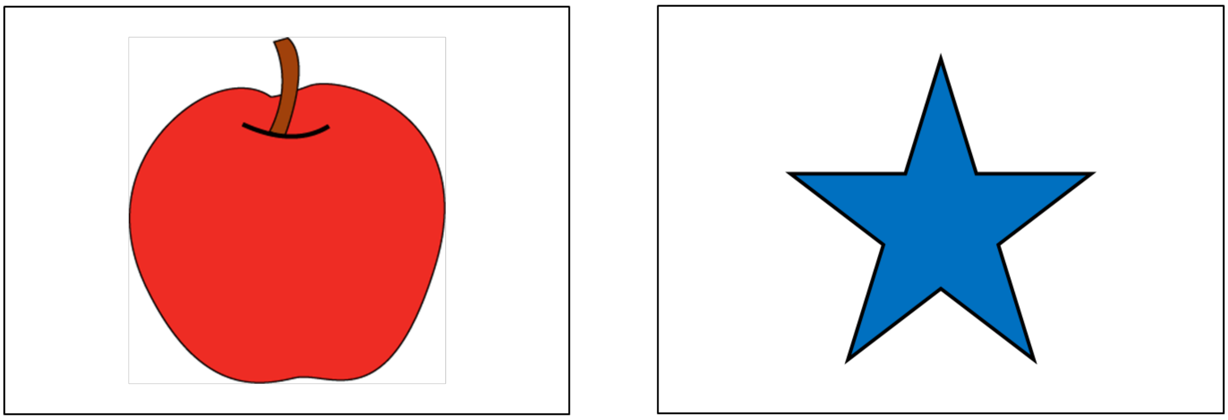

Figure 6.2. The model cards.

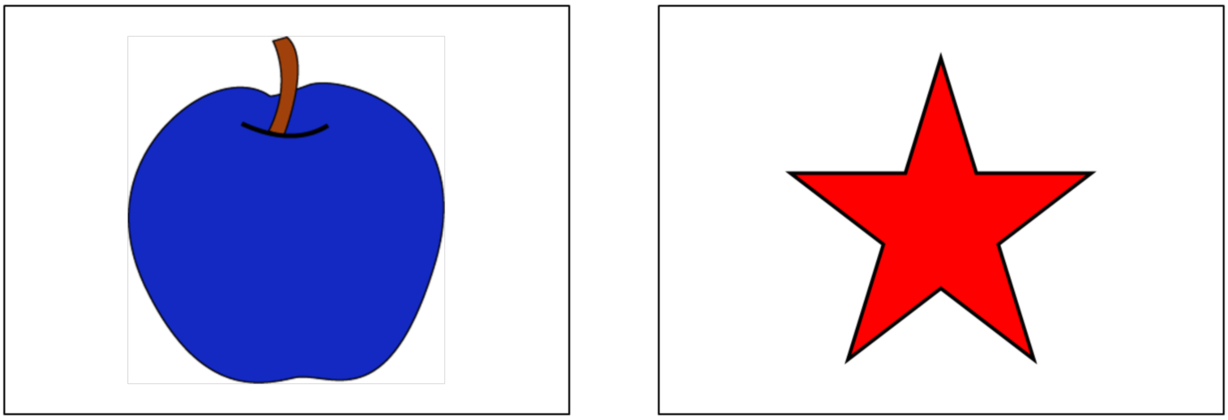

Figure 6.3. The sorting cards without borders of the standard and advanced DCCS task.

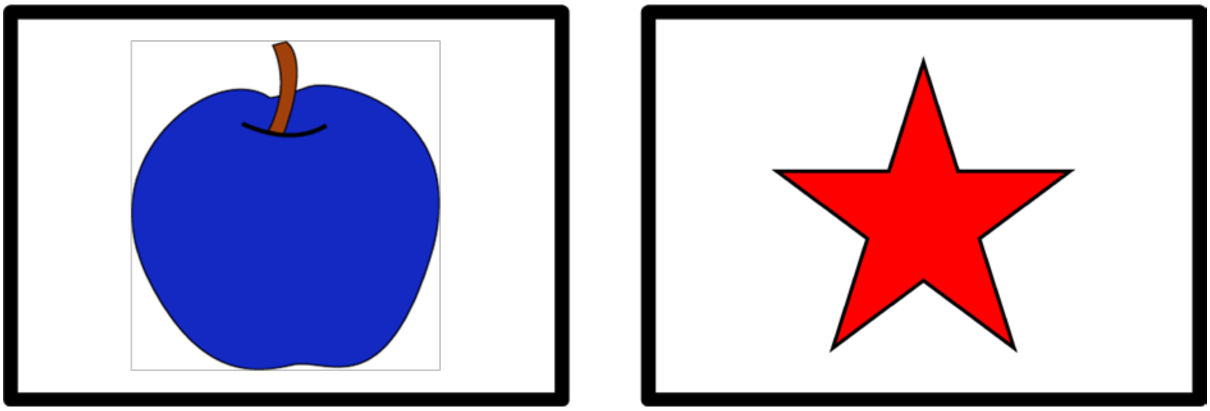

Figure 6.4. The sorting cards with borders of the advanced DCCS task.

6.3. Results

The current study was set up to determine whether influences of language on selective trust were replicated and whether executive function predicted performance on the epistemic trust questions. For that, the study employed vocabulary, selective trust and executive function tasks. Thus, this section is divided into four parts according to the measures. In the first part, descriptive analyses of verbal skills are reported. For selective trust, preliminary analyses and, as it aimed to find differences by linguistic expressions, comparisons between evidential markers and verb terms were shown. Analyses of performance on individual tasks on selective trust were conducted. Next, descriptive analyses of individual executive measures were displayed. Lastly, the relationships between selective trust and executive function were examined by correlation and regression.

A summary of the statistical methods of analyses to perform the tasks listed above is presented in Table 6.4 to simply support an understanding of the results, as the procedure was long and complicated.

6.3.1. Language measures

The Vocabulary task

The scores of the Vocabulary task ranged from 0 to 26, showing a normal distribution (see Figure A.13 in the Appendix). The mean scores of the 3-, 4- 5-, and 6-year-old groups were 3.83 (*SD* = 3.85), 13.1, (*SD* = 4.10), 13.2 (*SD* = 4.70), and 17.5 (*SD* = 4.20), respectively. A one-way ANOVA was conducted in order to examine age effects. As would be expected the results found a significance difference among age groups, $F(3, 80) = 35.4$, $p < .001$ (two-tailed and hereafter), $\eta_p^2 = .57$. Following Tukey tests (with the Tukey-Kramer formula here and below) revealed that the 3-year-olds' performance was significantly lower than the other three groups, $p < .001$ for all age comparisons. The vocabulary skills of the 6-

year-olds were significantly better than those of the 4- and 5-year-olds, p = .004 and p = .008, respectively.

Table 6.4

Summary of the procedure of statistical analyses

Order	Measures /Dependent variables	Statistical methods
1. Verbal skills	Vocabulary / KOSECT	Analysis of variance (ANOVA)
2. Selective trust (ST)		
2.1. Preliminary analyses for task order between EM and VT	Explicit Judgment	Logistic regression
	Ask / Endorse	Standard linear regression
2.2. Comparison by task types and age (in months)	Overall (EM vs. VT)	General linear model (GLM)
	Explicit Judgment (EM vs. VT)	Logistic regression
	Ask / Endorse (EM vs. VT)	GLM
2.3. EM – against chance	Each question	Binomial test
2.4.VT – against chance	Each question	Binomial test
3. Executive function (EF)	Each task	Kruskal-Wallis or ANOVA
4. Relationships between ST and EF	Correlations (All measures)	Pearson correlation
	Regression	Logistic (for Explicit Judgment)/ Linear regression (for Ask /Endorse)

Note. KOSECT: Korean Oral Syntax Expression Comprehension Test task. EM: Evidential markers. VT: Verb terms. Task order indicates the order between VT or EM tasks which was administered first.

The Korean Oral Syntax Expression Comprehension Test (KOSECT) task

The scores of the KOSECT task ranged from 0 to 48 and distributions are shown in the Appendix (see Figure A.14). The mean scores of the 3-, 4- 5-, and 6-year-old groups were 2.94 (*SD* = 2.92), 19.0, (*SD* = 11.4), 23.0 (*SD* = 12.3), and 37.4 (*SD* = 10.1), respectively. A one-way ANOVA analysis was carried out to examine age differences, and found that the scores differed significantly according to age groups, $F(3, 80) = 38.1$, $p < .001$, $\eta_p^2 = .59$. As shown in the Vocabulary task, Tukey tests found that the 3-year-old children's performance was significantly lower than the other three groups of children, $p < .001$ for all age comparisons. There was no significant difference between the 4- and 5-year-old groups, $p = .56$. The 6-year-olds' syntax comprehension differed significantly from the 4- and 5-year-olds, with $p < .001$ for both groups.

6.3.2. Selective trust measures

Preliminary analyses: Effects of test order on the two types of linguistic references

Prior to the analyses, order effects of the two types of selective trust were examined. It was expected there would be no significant order effects (selective trust) based upon findings in Chapter Five; however, it would be necessary to verify the influences in the present study. First, it seems necessary to remind the reader about the questions of selective trust as analyses of the results are complicated (see Table 6.5 for a summary).

The order effects (between the two selective trust tasks) were first carried out on three questions (Explicit Judgment, Ask, and Endorse) of evidential markers (EM). A logistic regression on Explicit Judgment was carried out because the scores did not meet normality with negative skewness in spite of data transformations. Following Tabachnick and Fidell (1996), the data were recoded in a binomial distribution: pass (score 2) and fail (score 0 or 1). Chronological age and task order were loaded on the logistic regression model.

Table 6.5

Summary of the three questions in selective trust

Questions	Assessments
Explicit Judgment	The ability to judge informants' accuracy
Ask	Children's preference to seek information based on accuracy
Endorse	The ability to learn novel names selectively from informants' past history of accuracy

In general, models without vocabulary and syntax skills explained the three types of questions better than the one which included them; thus the linguistic levels were excluded for the preliminary analyses. The results of the logistic regression found that the overall model was significant, Nagelkerke R^2 = .19, χ^2 (2, N = 84) = 11.1, p = .004. Table 6.6 shows a summary of the regression. No order effect on Explicit Judgment of EM was observed. Children showed significantly better performance with an increase of age.

Table 6.6

Summary of logistic regression on the Explicit Judgment questions in the EM task

Variable	B (*SE* B)	Wald	*p*	Δ Odds
Age (in months)	0.07 (0.02)	8.97	.003	1.07
Task order	0.06 (0.57)	0.01	.91	1.07

Note: N = 84. EM: Evidential markers. Nagelkerke R^2 = 0.19, Model χ^2 (2, N = 84) = 11.1, p = .004.

Standard linear regression tests were carried out with age (in months) and task order (as a binary, dummy variable) on Ask and End questions. In contrast to the findings of

Explicit Judgment, there was a significant order effect on Ask, $F(2, 81) = 3.94$, $p = .02$, adjusted $R^2 = .07$ (see Table 6.7). The negative value of task order indicates that performance of children who did the EM task first was poorer than of those who did the VT first. Age (in months) did not significantly contribute to the model.

Table 6.7

Summary of linear regression on the Ask questions in the EM task

	B	S.E.	ß	t
Age (in months)	0.01	0.01	0.16	1.49
Task order	-0.52	0.21	-0.27	-2.52^{*}

Note. $N = 84$. EM: Evidential markers. Multiple $R = 0.30$, $R^2 = 0.09$, adjusted $R^2 = 0.07$.

$^{*}p < .05$.

Similarly, the linear regression model on Endorse with age (in months) and task order was significant, $F(2, 81) = 6.24$, $p = .003$, adjusted $R^2 = .12$. Table 6.8 shows the values of the predictor variable in the linear regression. Again, there was a significant effect of task order, as mentioned above. The children's performance also increased with age.

Table 6.8

Summary of linear regression on the Endorse questions in the EM task

	B	S.E.	ß	t
Age (in months)	0.02	0.01	0.28	2.72^{**}
Task order	-0.50	0.20	-0.26	-2.52^{*}

Note. $N = 84$. EM: Evidential markers. Multiple $R = 0.36$, $R^2 = 0.13$, adjusted $R^2 = 0.12$.

$^{**}p < .01$. $^{*}p < .05$.

The same procedure for the same three questions (Explicit Judgment, Ask, and Endorse) of the VT task was adopted with two (age in months and task order) variables. First, a logistic regression model on Explicit Judgment was significant, Nagelkerke $R^2 = .21$, χ^2 (2, $N = 84$) = 14.1, $p = .001$ (see Table 6.9). Significant effects of the variables were observed. The children who performed the EM task first showed 3.02 times better performance than those who did the VT task first. Again, the children showed critical judgment on the speakers' reliability with increase of age. Table 6.9 shows the results of the logistic regression on Explicit Judgment.

Table 6.9

Summary of logistic regression on the Explicit Judgment questions in the VT task

Variable	B (*SE* B)	Wald	*p*	Δ Odds
Age (in months)	0.05 (0.02)	7.44	.006	1.06
Task order	1.11 (0.51)	4.67	.03	3.02

Note: $N = 84$. VT: Verb terms. Nagelkerke $R^2 = 0.21$, Model χ^2 (2, $N = 84$) = 14.1, $p = .001$.

The results of the Ask question in a linear regression showed that the overall model was not significant, $F(2, 81) = 2.56$, $p = .08$, adjusted $R^2 = .04$. Finally, one more inspection on Endorse was conducted. The overall model of the linear regression was significant, $F(2, 81) = 6.30$, $p = .003$, adjusted $R^2 = .11$. The summary of the linear regression on Endorse is presented in Table 6.10. It was found that task order had a significant effect on the ability to learn novel words from a previously accurate speaker; that is, experience of a task with evidential markers seemed to boost later performance on verb terms.

Taken together, although not all questions showed influences of order effects, it seems important to consider the effects in carrying out further analyses for comparisons between the tasks and individual performance. Therefore, it was decided to use the scores of selective trust questions by performance on the task which the children were administered first. That is, approximately half of the children for each EM and VT task were used in analyses.

Table 6.10

Summary of linear regression on the Endorse questions in the VT task

	B	S.E.	ß	t
Age (in months)	0.01	0.01	0.09	0.90
Task order	0.72	0.22	0.35	3.32^{**}

Note. N = 84. VT: Verb terms. Multiple R = 0.37, R^2 = 0.14, adjusted R^2 = 0.11. $^{**}p < .01$.

Comparison between EM and VT tasks

In order to compare performance between EM and VT tasks, more fine-grained analyses of each question type were performed. As mentioned above, tasks which children performed first (EM or VT) were examined; that is, performance on the EM first group for the EM task (41 children) and performance on the VT first group for the VT task (43 children) were used in analyses. The responses obtained from each question and overall scores as a function of task and age based on the first task performed are shown in Table 6.11.

Table 6.11

The mean number (SD in parentheses) of the responses as a function of age and trials of the tasks

	3-year-olds	4-year-olds	5-year-olds	6-year-olds	Mean scores
EM					
Explicit Judgment (Max. = 2)	1.50 (0.76)	1.67 (0.65)	1.89 (0.33)	1.83 (0.58)	1.73 (0.59)
Ask (Max. = 3)	2.13 (0.84)	1.67 (0.89)	2.00 (1.32)	2.17 (0.84)	1.98 (0.96)
Endorse (Max. = 3)	1.75 (1.17)	1.75 (1.06)	2.11 (1.17)	2.17 (0.94)	1.95 (1.05)
Total (Max. = 8)	5.38 (2.26)	5.08 (2.15)	6.00 (2.60)	6.17 (1.64)	5.66 (2.12)
VT					
Explicit Judgment (Max. = 2)	0.80 (0.80)	1.77 (0.44)	1.55 (0.69)	1.33 (0.71)	1.40 (0.73)
Ask (Max. = 3)	1.70 (0.95)	2.00 (1.00)	2.36 (1.12)	1.89 (1.17)	2.00 (1.05)
Endorse (Max. = 3)	1.30 (0.82)	2.00 (1.00)	1.73 (1.42)	1.44 (1.01)	1.65 (1.09)
Total (Max. = 8)	3.80 (2.15)	5.77 (2.05)	5.64 (2.91)	4.67 (2.45)	5.05 (2.45)

Note. EM: Evidential markers; n = 41 (8, 12, 9, 12 for the 3-, 4-, 5- and 6-year-olds, respectively). VT: Verb terms; n = 43, (10, 13, 11, 9 for the 3-, 4-, 5- and 6-year-olds, respectively).

First, the comparison on the overall scores was carried out by a general liner model (GLM) with linguistic markers (evidential markers vs. verb terms) as a factor and age (in months) as a continuous covariate. Verbal skills (aggregated and averaged) were also loaded as a covariate. The measures of EF were not included in the analyses as this comparison was to probe differences between selective trust tasks, but not for the role of EF on selective trust. To test children's general grasp of selective trust a measure of overall performance was constructed by summing the three types of questions, as the paradigm requires children to judge and track the past history of reliability. The results found no significant effect of age, $F(1, 79) = .27$, $p = .61$, $\eta_p^2 = .003$. There were no significant effects of linguistic markers, $F(1, 79) = .14$, $p = .71$, $\eta_p^2 = .002$ or an interaction of age X linguistic markers, $F(1, 79) = .04$, $p = .84$, $\eta_p^2 = .000$. Verbal ability did not have significant effects, $F(1, 79) = .95$, $p = .33$, $\eta_p^2 = .012$.

Three further analyses on each type of question were conducted to determine whether differences by language markers might have been underestimated by the aggregated scores. For Explicit Judgment, a logistic regression with age (in months) and linguistic markers was carried out on pass/fail because the scores were not normally distributed. The results showed that the overall model was significant, Nagelkerke $R^2 = .21$, χ^2 (2, $N = 84$) = 13.6, $p = .001$. When the interaction of age x linguistic markers and verbal ability were included, the overall model did not show a better model than without them, Nagelkerke $R^2 = .23$, χ^2 (4, $N = 84$) = 15.2, $p = .004$. This can be inferred by the fact that the change in deviance between the two models is 15.2 – 13.6 = 1.6 with 2df and this is NS. Furthermore, there were no significant individual variables predicting the model. Table 6.12 shows variables of a logistic regression on Explicit Judgment. The results showed that age (in months) and linguistic markers made significant unique contributions to the model. That is, the children showed improvement in judging the speakers' accuracy with increase of age (p =.02). As shown in Table 6.11, performance on EM was significantly better (3.51 times) than VT (p =.02).

Table 6.12

Summary of logistic regression on the Explicit Judgment questions between EM and VT tasks

Variable	B (*SE* B)	Wald	*p*	Δ Odds
Age (in months)	0.05 (0.02)	5.95	.02	1.05
Linguistic markers (EM)	1.26 (0.52)	5.85	.02	3.51

Note: N = 84. Nagelkerke R^2 = 0.21, Model χ^2 (2, N = 84) = 13.6, p = .001. EM: Evidential markers. VT: Verb terms.

The results of a GLM test on Ask questions with linguistic markers, age (in months) and verbal ability showed that linguistic markers did not make a significant difference, F(1, 79) = .16, p = .70, η_p^2 = .002. Similarly, there were no effects of age, F(1, 79) = .79, p = .38, η_p^2 = .01 or interaction of age X linguistic markers, F(1, 79) = .22, p = .64, η_p^2 = .003. Again, verbal ability did not show a significant effects, F(1, 79) = .003, p = .95, η_p^2 = .000. Likewise, an analysis on the Endorse questions found no effect of linguistic markers, F(1, 79) = .01, p = .93, η_p^2 = .00. There were no significant differences in age, F(1, 79) = .08, p = .77, η_p^2 = .00. The results found no effect of an interaction of age X linguistic markers, F(1, 79) = .09, p = .77, η_p^2 = .001, or verbal ability, F(1, 79) = .1.87, p = .18, η_p^2 = .02

In general, the different linguistic expressions did not make significant differences on either overall or individual trial performance of selective trust questions. The findings appeared to indicate that children's judgment of the speakers' trustworthiness and learning ability were not significantly influenced by how their knowledge status was expressed. The findings were consistent with the previous experiment (Chapter Five). However, the previous study found that children's understanding of selective trust was comparable according to the linguistic differences (i.e., no statistically significant differences between the EM and VT tasks), but the period when they began to demonstrate selective trust differed according to language expressions used (i.e., 4-years for VT and 6-years for EM). Thus, we decided to examine individual performance of selective trust tasks.

Selective trust with EM

In order to reveal when children' selective trust emerged, analyses against chance for each question were carried out. Frequencies of each question are shown in Table 6.13. Again, trials performed first between EM and VT tasks were applied for order effects in here and for the VT task. One point was given if the child verbally answered or pointed to an informant, who was previously correct with *–te* (I saw) for both Explicit Judgment and Ask questions or if the child labelled a novel object from the speaker with *–te* for the Endorse questions. Asterisks in the table indicate that children performed at levels of above-chance.

For chance performance on Explicit Judgment, probabilities of 1-2-1 (0.25-0.5-0.25) for two responses were used in binomial tests. The children tended to judge the speakers' accuracy correctly from an early age, based on the children who correctly answered two out of two questions p = .055 (two-tailed and hereafter) for the 3-year-olds and p < .001 for the three older groups. For the Ask and Endorse questions, probabilities of 1-3-3-1 (0.125-0.375-0.375-0.125) were used for three trials. Performance on each Ask and Endorse question is presented in Figure A.15 in the Appendix. For the Ask questions, the older children, but not the younger children, recognized that the previously accurate speaker might be a reliable source for a novel object, p = .13, p = .91, p = .005, and p = .02 for the 3-, 4-, 5-, 6-years old, respectively, from the correct responses in all three trials. Similarly, by the age of five, children successfully labelled the novel objects tracking the speakers' history of accuracy (p = .13, p = .11, p = .005, and p = .02 for the 3-, 4-, 5-, 6-year-olds, respectively).

Apart from Explicit Judgment (which is passed at age 3-4), it appears that children showed selective trust at the age of five. In order to complement this interpretation, one further analysis by one-sample t-tests (4 out of 8 is taken as test value) on the overall scores for each age group was carried out. The results supported the assumption that children seemed to perform selective trust at the age five, as mentioned above. The children at 3-4-years performed at chance, $t(7) = 1.72$, $p = .13$, and $t(11) = 1.74$, $p = .11$, respectively. By contrast, the older children's performance was successful at levels of above-chance, $t(8) = 2.31$, $p = .049$ for 5-years of age, and $t(11) = 4.57$, $p < .001$ for 6-years of age. Taken together, the findings seem to suggest that a critical view on others' suggestions might develop at the age of 5-6 when evidential markers were the means of communication.

One forced-choice question ("Was it because she did not see what was inside the box, or was it because she said she did not know?") for reports of sources was given in order to investigate whether the children appreciated the reasons for inaccuracy of a speaker. The question was not affected by task order so that it was analysed using the whole sample. Eighteen (24%) of 84 children (8 3-, 4 4-, 4 5- and 2 6-year-olds) answered 'don't know' for the question and were excluded from the analysis. Binomial tests were conducted to examine whether the children's responses between two forced questions were biased. The children in the three younger groups responded randomly, $p = .10$, $p = .08$, and $p = .45$, for the 3-, 4-, and 5-year-olds, respectively. The 6-year-olds (79%) tended to judge that an informant could be inaccurate due to a lack of witnessing an event rather than depending on what she said about the objects, $p = .02$. The findings seem to indicate that the children might consider both the speakers' verbal information and informational access to the objects simultaneously. In other words, if the children were predominately influenced by the process of seeing leading to knowing, their performance on the three types of questions might be interpreted as consequences of the informants' access to the objects.

Table 6.13

Frequencies on three types of questions on the EM task according to age groups

	Explicit Judgment			Ask				Endorse			
Age groups	0	1	2	0	1	2	3	0	1	2	3
3-years (n = 8)	1	2	$5^{\dagger}$	0	2	3	3	1	3	1	3
4-years (n = 12)	1	2	9^{***}	1	4	5	2	1	5	2	4
5-years (n = 9)	0	1	8^{***}	2	1	1	5^{**}	1	2	1	5^{**}
6-years (n= 12)	1	0	11^{***}	0	3	4	5^{*}	1	1	5	5^{*}

Note. EM: Evidential markers. $^{\dagger}p < .10.$ $^{*}p < .05.$ $^{**}p < .01.$ $^{***}p < .001.$

Selective trust with VT

The procedure and analyses for selective trust with the verb terms were identical to those of the EM task. One point was given when the child selected information from a speaker who said *I know*. Table 6.14 presents frequencies of the responses from the VT task for each type of questions given order effects reported above. The data in Table 6.14 seem to indicate that children by the age of four appear to be able to assess others' epistemic states with a critical view when information is conveyed by mental-verb terms which are not grammatically embedded.

As shown above, performance against chance using binomial analyses on the VT task will be reported based on the maximum scores of three questions (i.e., 2 for Explicit Judgment and 3 for Ask and Endorse). First, the results of the binomial tests against chance of 0.25 on the Explicit Judgment questions found that the children's performance at the age of four and five was significantly better than chance, $p < .001$ and $p = .02$, respectively, while the children of 3- and 6-years of age remained at chance-performance, $p = 1.0$ and $p = .33$, respectively.

Table 6.14

Frequencies on three types of questions on the VT task according to age groups

	Explicit Judgment			Ask				Endorse			
Age groups	0	1	2	0	1	2	3	0	1	2	3
3-years (n = 10)	4	4	2	1	3	4	2	1	6	2	1
4-years (n = 13)	0	3	10^{***}	1	3	4	5^{*}	1	3	4	5^{*}
5-years (n = 11)	1	3	7^{*}	1	2	0	8^{***}	4	0	2	5^{*}
6-years (n= 9)	1	4	4	2	0	4	3	2	2	4	1

Note. VT: Verb terms. $^{*}p < .05$. $^{***}p < .001$.

It should be noted that the sample size at age six was small. Yet the children did not show a steady development of judgment and the oldest children's performance was unexpected. At the same time, the findings perhaps not so surprising given performance on the previous experiment, showed a tendency, which was more or less identical, of a sharp increase at the age of four and drop afterwards. Apart from the results of the 6-year olds, the findings seem to indicate that Korean children's ability to understand the implication and to differentiate the relative certainty of *know* and *think* might be developed by the age of four as in shown in the research.

Again, the binomial tests against chance of 0.125 on the Ask and Endorse questions (for the score 3) were analysed. Performance on each Ask and Endorse question is shown in Figure A.16 in the Appendix. As shown in the Explicit Judgment questions, the results found that the youngest children did not show a preference for asking the previously accurate speaker, $p = .72$. Similarly, the 4- and 5-year-olds performed at greater levels than chance, $p < .001$. Again, the 6-year-olds did not show a preference for the confident speaker, $p = .18$. Performance on the Endorse questions was consistent with the Ask questions. That is, the 3-year-olds responded randomly to labelling the novel words, $p = 1.0$, whereas the 4- and 5-year-old children successfully endorsed names accepting suggestions of the previously correct speaker, $p = .03$ and $p = .01$, respectively. Again, the 6-year-olds did not show a preference for either speaker, $p = 1.0$. In general, the findings from the three types of questions indicated that children's selectivity was exhibited at the age of four when the speakers' accuracy/inaccuracy was communicated along with their confidence or uncertainty by mental-state verbs. One-sample t-tests on the overall score (4 for test value) complemented the interpretation: $t(9) = -0.29$, $p = .78$, $t(12) = 3.11$, $p = .009$, $t(10) = 1.87$, $p = .09$, and $t(8) = 0.82$, $p = .43$ for the 3-, 4-, 5-, and 6-year-olds, respectively. Taken together, the experimental evidence replicated the previous findings from Chapter Five and confirmed that children's social-cognitive understanding might show different patterns of development within a language. However, the grammatically embedded markers which are expected to be used frequently in everyday conversations did not provide advantages over other mental expressions.

Regarding reports of sources in the VT task, 19 children (22.6%) (10 3-, 4 5-, and 3 5- and 1 6-years) provided 'don't know' responses. The children in all age groups responded randomly between 'look' and 'say' questions, $p = 1.00$, $p = .50$, $p = .14$, and $p = .50$ for the 3-, 4-, 5-, and 6-year-olds, respectively. Although children at the age four exercised selective trust, inferring the informants' errors by either behavioural or verbal information might not be straightforward. Otherwise, it seems possible that the children might have chosen the forced question randomly without considering the meanings of choices.

6.3.3. Executive function performance

In order to explore the relationships between selective trust and executive function, seven measures including inhibitory control, working memory and set shifting were administered. The descriptive statistics of the measures are presented in Table 6.15. Performance of practice trials was not included in Table 6.15 as this study did not aim at exploring individual differences in executive functioning. As seen in Chapters Two and Three, Korean children showed skilled performance on the day/night task compared to those of Western cultures (e.g., Carlson, 2005; Gerstadt et al., 1994). On the other hand, one of inhibitory control tasks, Simon Says, showed relatively lower levels of performance than English speaking children (e.g., Carlson & Meltzoff, 2008; Carlson & Wang, 2007). Similarly, working memory of the participants measured by BDS and BWS showed less developed capacity than their counterparts (e.g., Carlson et al., 2002). Of interest in the findings on set shifting was that the children revealed floor effects in the advanced DCCS while they performed comparably in the standard DCCS task.

Conflict Inhibition

The Day/Night task

For the Day/Night task, a maximum of six practice trials was given to each child and if the child failed five or more practice trials, the test trials were not administered. Eight and three of the 3- and 4-year-olds, respectively, performed a maximum of six practice trials, and five of the 3-year-old children and one of the 4-year-old children did not complete the test trials. A possible reason for the large number of exclusion for 3-year-olds might have resulted from the relatively fewer practice trials compared to previous literature in which the practice trials were given up to 10 times (e.g., Carlson & Moses, 2001).

Table 6.15

Descriptive statistics of executive skills as a function of age

Executive Function	3-year-olds (n = 18)	4-year-olds (n = 25)	5-year-olds (n = 20)	6-year-olds (n = 21)	Age difference
Day/Night					
No. test trials	12.1 (4.68)	13.8 (3.56)	13.8 (2.86)	15.1 (1.95)	ns
Simon Says					
No. test trials (anti-imitation)	1.06 (1.77)	2.80 (3.83)	4.45 (4.42)	9.19 (4.70)	χ^2 (3, N = 84) = 29.2***
No. total trials	11.9 (5.01)	15.1 (6.22)	17.9 (5.39)	24.0 (5.04)	F(3, 80) = 17.3***
BDS					
No. span	1.00 (0.0)	1.72 (0.79)	2.55 (0.95)	3.10 (0.44)	F(2, 63) = 19.5***
BWS					
No. span	1.00 (0.0)	1.84 (0.55)	2.35 (0.81)	2.81 (0.68)	F(2, 63) = 11.7***
VCR					
No. correct trials	2.94 (1.06)	3.96 (1.10)	4.20 (1.01)	5.14 (0.57)	F(3, 80) = 17.2***
DCCS					
No. correct trials	1.17 (2. 28)	4.72 (2.42)	4.40 (2.64)	5.9 (0.44)	χ^2(3, N = 84) = 29.6***
ADCCS					
No. correct trials	6.33 (2.03)	6.56 (1.53)	6.60 (2.09)	7.43 (2.21)	ns

Note. N = 84. Standard deviations are shown in parentheses. The number of 3-year-olds was 18 except on for the Day/Night test trials (13). BDS: Backward digit span. BWS: Backward word span. N = 66 for BDS and BWS owing to exclusions of 3-year-olds for floor effects. VCR: Visually cued recall. DCCS: Dimensional Change Card Sort. ADCCS: Advanced DCCS. ns: non-significant. $^{***}p < .001$.

The children's performance on the test trials showed a negatively skewed pattern, with nine outliers responding correctly in less than 10 out of 16 trials. Performance is shown in Figure A.17 in the Appendix. It is likely that the distribution showed outliers due to the possibility of missing data caused by a failure to complete the trials. Since the data were not normally distributed and transformations did not meet a normal pattern, a Kruskal-Wallis test – the alternative to one-way analysis of variance (ANOVA) - was carried out for tests of age differences. As might be expected from the negative skew, the children's performance was not significantly differentiated by age group on the test trials, χ^2 (3, N = 78) = 5.21, p = .16.

The Simon Says task

Analyses of the children's performance on Simon Says were conducted with the scores of the anti-imitation trials as the task was to investigate children's sensitivity in inhibitory self-control (Carlson & Wang, 2007). That is, when the child did not show any reaction to an experimenter's commands in anti-trials, she/he received points according to categories. For the practice trials, the children had a maximum of 10 trials, except for one 3-year-old who had 11 practice trials to ensure that the child understood anti-imitation trials. Across five anti-imitation trials, 39.3 % (33 out of 84 children) imitated all five trials; that is they made errors on all trials. Four children (4.8%) performed successfully on the five trials. The distribution of the anti-imitation trials is presented in Figure A.18 in the Appendix. In order to probe age effects, a Kruskal-Wallis test was carried out due to a positively skewed pattern. As would be expected, there was a significant difference between age groups χ^2 (3, N = 84) = 29.2, p < .001. In order to explore age differences in detail, Mann-Whitney U tests were carried out. The 6-year-olds' anti-imitation levels were significantly better than the three younger groups, U = 25.0, p < .001 (two-tailed and hereafter), U = 82.0, p <.001 and U = 96.5, p = .003 in comparison with the 3-, 4-, and 5-year-olds, respectively. The 5-year-olds also performed significantly differently from the 3-year-olds, $U = 99.0$, $p = .01$. The results indicated that the children's inhibitory control by an anti-imitation skill showed a developmental shift between 3- and 5-year-olds.

In summary, it seems surprising that Korean children's inhibitory control showed inconsistent results within the measures. That is, the levels of Day/Night were relatively better than Western children while inhibitory control by Simon task was not.
Along with the discrepancy, a developmental pattern of inhibitory control was observed only in Simon Says.

Working Memory

The Backward Digit Span (BDS) task

The children obtained points following the scoring system of Carlson et al. (2002); a score of 1 was given to those at floor, 2 was given to those who could recall 2-digits and the score increased by one for each additional digit remembered in sequence on one of the three trials. Despite the fact that the 3-year-olds were administered all five practice trials, none of them proceeded with the test trials; thus they received one point. The children's performance is presented in Figure A.19 in the Appendix. Thirty-two out of 84 children (accounting for 38.1%) did not pass the practice trials, and one 5-year-olds failed the first 2-digit test after passing the practice trials; thus, 33 children received one point. Six out of 84 children (7%) succeeded in the 4-digit test which was the maximum span in the task.

In order to ascertain age effects, a one-way ANOVA was carried out in order to examine age effects. The scores showed normal distributions using the SPSS *Explore* function as the 3-year-olds were excluded owing to floor effects. The results revealed significant age effects, $F(2, 63) = 19.5$, $p < .001$, $\eta_p^2 = .38$. Tukey tests found that the 4-year-olds'recall was significantly poorer than the two older groups', $p = .001$ and $p < .001$ for the

5- and 6-year-olds, respectively.

The Backward Word Span (BWS) task

The children were scored as in the Backward Digit Span task. The children's performance is shown in Figure A.20 in the Appendix. There were similarities between BWS and BDS. Approximately one third (25 out of 84 children) failed the practice trials, and four 4- and three 5-year-olds among them were included. None of the 3-year-olds performed the 2-word test trial as observed in BDS; therefore they were excluded in analyses for floor effects. Two 5-year-olds failed the 2-word list after passing the practice trials; thus, 27 children obtained one point. The 4-word list was the maximum span, and four children showed the best performance. For normal distribution, a one-way ANOVA was carried out in order to examine age effects. A significant effect for age was observed, $F(2, 63) = 11.7$, $p < .001$, $\eta_p^2 = .27$. Tukey tests revealed that the children recalled longer words in reverse order with an increase of age; the 6-year-olds were significantly better than the 4-year-olds, $p < .001$. Similarly, the 5-year-olds' performance differed significantly from the 4-year-olds', $p = .04$.

The Visually Cued Recall (VCR) task

Children who failed the first two items received one point, and were scored according to the number of the last correct trial following Zelazo et al. (2002). A distribution of the VCR task is presented in Figure A.21 in the Appendix. One 3-year-old and one 4-year-old child did not pass the two items; thus, they received one point. Approximately two thirds of the children (53 out of 84) retrieved correctly either four or five items. Eight children (9.5%) recalled the largest number of items which was six. For age differences, a one-way ANOVA test was conducted. Again, the results revealed a significant main effect of age, F(3,

80) = 17.2, $p < .001$, $\eta_p^2 = .39$. Tukey tests revealed better performance in the 6-year-olds than the younger groups, $p < .001$ for both 3-and 4-year-olds, and $p = .01$, for the 5-year-olds. The 5-year-olds' recall was not significantly different from the 4-year-olds, $p = .84$, but it differed from the 3-year-olds', $p = .001$. Again, the 4-year-olds performed significantly better than the 3-year-olds, $p = .005$.

Overall, the children's ability to store and process information developed significantly with age. It seems striking that none of the 3-year-olds was able to recall either words or numbers in reverse order (or grasp the instructions to do so), and the children across all ages performed at relatively poorer levels than Western children.

Cognitive Flexibility

The standard Dimensional Change Card Sort (DCCS) task

The children across all age groups passed the pre-switch trials. Performance on the standard DCCS is presented in Figure A.22 in the Appendix. From Table 6.15, it is apparent that the 3-year-olds had difficulty in sorting cards after the dimension had changed, and it seems that their performance was relatively poorer than those of Chapter Two and of previously published research as well. On the other hand, the 6-year-olds showed ceiling performance; that is, 20 out of 21 children correctly sorted all the cards. We can see that the results of the 4- and 5-year-olds were comparable to Experiment 2. As we can see from the data in Table 6.15, it is apparent that there was a significant difference between the age groups. In order to test this possibility, a Kruskal-Wallis test on the number of correct trials was carried out for the distribution which was not normally distributed. A significant effect of age was found, χ^2 (3, $N = 84$) = 29.6, $p < .001$. The older children were significantly better than the 3-year-olds, $U = 90.5$, $p < .001$, $U = 81.5$, $p = .001$ and $U = 33.0$, $p < .001$, for the 4-, 5-, 6-year-olds, respectively, from a series of Mann-Whitney U tests. The 4-year-olds differed significantly from the 6-year-olds (*U* = 200, *p* = .04) but not from the 5-year-olds (*U* = 242, *p* = .81). The 6-year-olds' performance was significantly better than at 5-years, *U* = 155, *p* =.03.

The advanced Dimensional Change Card Sort task

Distribution on the advanced DCCS task is shown in Figure A.23 in the Appendix. The advanced DCCS task was administered immediately after the children completed the standard task irrespective of performance on it. Compared to the performance on the standard DCCS task, it was rather surprising the levels in this task showed that the children demonstrated floor effects (see Table 6.15). It appears that the children across all age ranges had difficulty in performing the task with borderlines. Thirteen out of 84 children, accounting for 15.6%, sorted 9 out of 12 cards correctly which was regarded as having passed. A Kruskal-Wallis test was conducted for age differences. As might be expected, in respect of the distribution of the data, the results found no significant main effect of age, χ^2 (3, *N* = 84) = 3.36, *p* = .34.

6.3.4. Relationships between ST and EF

Correlations

The relationships between selective trust and executive function were explored according to the versions of selective trust tasks presented here in order to tease apart influences of order in which the task was presented. The relationships are shown in Table 6.16 and divided into two diagonals according to the selective trust tasks which children performed first. The relationships between selective trust tasks by verb terms (i.e., *I know* vs. *I think*) and executive function are shown above the diagonal, while selective trust tasks by evidential markers (i.e., *-te* vs. *–napo*) are presented below the diagonal in the table. The selective trust tasks consisted of three different types of questions; thus, both individual questions and total scores were used in correlations. Two measures, Day/Night and advanced DCCS, were excluded in the analyses because of near ceiling performance and floor effects, respectively. For correlations, EF measures apart from the two measures mentioned above were aggregated. This is because the use of individual measures might make the correlations complicated as there were many factors to explore separately. Moreover, the aggregated measure has been used in the previous research which explored the relationships between executive function and social understanding (e.g., Sabbagh et al., 2006). Thus, aggregation of executive function measures would be appropriate to explore correlations in this study. The standardized and averaged scores were used for the rest of the measures of executive function (Chronbach's α = .87 for five measures). For the vocabulary skills, the two tasks were aggregated and averaged (Chronbach's α = .83).As mentioned earlier in analyses for each measure of selective trust and executive function, some measures are not normally distributed; however, the distributions without outliers seem to be acceptable. Therefore, Pearson correlations were applied.

From the data below the diagonal in Table 6.16, it is apparent that there were significant differences in correlations according to the linguistic expressions, considering selective trust trials which performed first. That is, the executive function measures were not significantly related to the trust test questions when the task with the evidential markers were asked first (below the diagonal) even before controlling age and vocabulary skills. On the other hand, selective trust tasks showed relations with the executive function measures when the mental verb terms were asked first (above the diagonal). It seems that responding to the Explicit Judgment questions and learning words tracking others' history demanded all subcomponents of executive function when the children performed selective trust with verb terms first. Partial correlations controlling for age and language skills remained significant for the relation between the endorse questions with the mental verb terms and EF ($r(39) = .35$,

p = .24). The judgment questions of the VT task became non-significant ($r(39) = .25$, p = .12 when age and verbal skills were partialled out. The total scores of the VT task showed a trend of significance ($r(39) = .29$, p = .063) in partial correlations.

Table 6.16

Pearson correlations among vocabulary skills, selective trust and executive function measures in VT first (above the diagonal) and EM first (below the diagonal)

	Age	Voc.	Jug.	Ask	End	ST_Total	EF
Age		$.79^{**}$	$.32^{**}$	.21	.11	.23	$.81^{**}$
Voc.	$.77^{**}$		$.47^{**}$	.25	.28	$.37^{*}$	$.80^{**}$
Jug.	.28	.09		$.47^{**}$	$.60^{**}$	$.76^{**}$	$.46^{**}$
Ask	.12	-.00	.25		$.67^{**}$	$.86^{**}$	.27
End.	.17	.11	$.38^{*}$	$.67^{**}$		$.91^{**}$	$.35^{*}$
ST_Total	.22	.08	$.58^{**}$	$.86^{**}$	$.91^{**}$		$.41^{**}$
EF	$.85^{**}$	$.80^{**}$	.18	.10	.14	.17	

Note. $n = 43$ for above the diagonal with VT. n = 41 for below the diagonal with EM. VT: Verb terms. EM: Evidential markers. Jud.: Judgment. End.: Endorse. ST_Total: The total scores of the selective trust task. EF: Executive function.

Regression Analyses

In the previous section, the relationships between selective trust and executive function were examined, and it was found that there were different correlations by the linguistic term used when explored by the selective trust task which children performed first. Although the correlation analysis found relations between selective trust and executive function, further analyses to assess the unique contributions of inhibitory control, working memory and set shifting were carried out. In order to investigate predictors on selective trust, logistic (for Explicit Judgment and see section 6.3.2 for category) and standard linear regression (for Ask and Endorse) analyses were carried out. As stated in the Introduction of the chapter, it was expected that different questions of selective trust may be differently related to the subcomponents of executive function, according to the nature of the questions. It seems that working memory may be related to both children's judgment and selective learning, while inhibitory control may play a role on learning new words. Therefore, regression was conducted on each question; hence, the dependent variables were Explicit Judgment, Ask and Endorse questions of the selective trust tasks. Independent variables were language skills (two tasks aggregated) and executive function measures. Day/Night and advanced DCCS were not included as mentioned above. Standardized scores of the independent variables were used.

In the EM task, the overall model of logistic regression on the Explicit Judgment questions was significant, Nagelkerke $R^2 = .42$, $\chi^2\,(7, N = 84) = 26.2$, $p < .001$ (see Table 6.17). Regarding working memory, this construct might have been examined as one scale with the three measures. However, VCR and two span tasks (BWS and BDS) measured visual and verbal working memory, respectively. As reviewed in the Introduction of this chapter, it seems that the two different types of working memory would be differently associated with different sources of information. Thus, individual measures of working memory were loaded taking account of their different functions. Among executive skills, working memory predicted the Judgment ability. Of interest was that BWS contributed negatively, whereas BDS was predicted positively. It seems that the negative contribution of BWS might stem from the strong correlation between BWS and BDS ($r = .82$). In contrast, the results of a standard linear regression on Ask were not significant, $F(7, 76) = .62$, $p = .74$, adjusted R^2 = -

.03. Likewise, the overall equation of the Endorse questions was not highly significant, $F(7, 76) = 1.17$, $p = .33$, adjusted $R^2 = .01$.

Table 6.17

Logistic regression for variables predicting the Explicit Judgment questions in the EM task

Variable	B (*SE* B)	Wald	*p*	Δ Odds
Age (in months)	0.13 (0.07)	3.97	.046	1.14
Verbal skills	-0.90 (0.81)	1.24	.27	0.41
Simon Says	0.12 (0.56)	0.05	.83	1.13
BDS	1.98 (0.85)	5.34	.02	7.21
BWS	-2.42 (0.83)	8.59	.003	0.09
VCR	0.64 (0.46)	1.97	.16	1.90
DCCS	0.48 (0.44)	1.18	.28	1.61

Note. $N = 84$. Nagelkerke $R^2 = .42$, $\chi^2 (7, N = 84) = 26.2$, $p < .001$. EM: Evidential markers. BDS: Backward digit span. BWS: Backward word span. VCR: Visually cued recall. DCCS: Dimensional Change Card Sort.

The same analyses were carried out on the selective trust questions by verb terms. First, the overall equation of logistic regression on the Explicit Judgment questions was highly significant, Nagelkerke $R^2 = .39$, $\chi^2 (7, N = 84) = 28.2$, $p < .001$ (see Table 6.18). Working memory was a significant component. In contrast to the findings with evidential markers, only VCR was a significant predictor. As shown in the EM task, the overall model of linear regression on Ask was not significant, $F(7, 76) = 1.75$, $p = .11$, adjusted $R^2 = .06$.

Table 6.18

Logistic regression for variables predicting the Explicit Judgment questions in the VT task

Variable	B (*SE* B)	Wald	*p*	Δ Odds
Age (in months)	-0.06 (0.05)	1.97	.16	0.94
Verbal skills	1.10 (0.58)	3.62	.057	3.0
Simon Says	0.55 (0.42)	1.72	.19	1.73
BDS	0.25 (0.61)	0.17	.68	1.29
BWS	-0.50 (0.57)	0.79	.38	0.60
VCR	1.01 (0.40)	6.28	.01	2.75
DCCS	0.19 (0.35)	0.29	.59	1.21

Note. N = 84. Nagelkerke R^2 = .39, χ^2 (7, N = 84) = 28.2, p < .001.VT: Verb terms. BDS: Backward digit span. BWS: Backward word span. VCR: Visually cued recall. DCCS: Dimensional Change Card Sort.

By contrast, the model of the Endorse questions was highly significant, $F(7, 76)$ = 3.23, p = .005, adjusted R^2 = .23 (see Table 6.19). Age (in months) was significant but contributed negatively (ß = -.54, p = .007), whereas language skills were a positive predictor (ß = .41, p = .03). The negative association of age might result from a tendency of deterioration after the age of four (see also Table 6.11). Apart from the control variables, a conflict inhibitory control, Simon Says, made a significant and positive contribution (ß = .28, p = .04). Overall, the findings in the VT task showed that different subcomponents of executive function predicted selective trust differently.

Table 6.19

A regression for variables predicting the Endorse questions in the VT task

	B	S.E.	ß	t
Age (in months)	-0.04	0.02	-0.54	-2.75**
Verbal skills	0.46	0.21	0.41	2.20*
Simon Says	0.30	0.14	0.28	2.11*
BDS	0.14	0.21	0.14	0.68
BWS	-0.07	0.20	-0.06	-0.33
VCR	0.02	0.14	0.02	0.17
DCCS	0.19	0.15	0.18	1.26

Note. N = 83. Multiple R = 0.48, R^2 = 0.23, adjusted R^2 = 0.15. $^{*}p < .05$. $^{**}p < .01$. VT: Verb terms. BDS: Backward digit span. BWS: Backward word span. VCR: Visually cued recall. DCCS: Dimensional Change Card Sort.

Taken together, this section examined how executive function was related to the children's ability to judge whether an individual had reliable knowledge and to learn novel words based on the history of reliability. The analyses revealed important findings that subcomponents of executive function were differently related to each trial of selective trust. That is, working memory functioned in judging and monitoring one's accuracy, whereas inhibitory control to suppress irrelevant sources impacted on learning new words. When evidential markers were a means of communication, auditory short-term memory was required, whereas visual working memory was activated when verb terms were used for information. Based on findings from regression analyses, it seems that not only the nature of questions of selective trust but also linguistic references might require different executive skills. Hence, it can be seen that the specific grammatical system of Korean was influential in formulating and developing concepts of selective trust.

6.4. Discussion

The current study showed consistent findings with the previous experiment regarding selective trust according to different linguistic markers. Children by the age of four began to exercise selective trust when speakers' epistemic states were simply stated by mental-verb terms, whereas 5-6-year-olds showed the ability from evidential markers. It was found that one working memory task, VCR, predicted the ability to judge the speakers' accuracy, while a single inhibitory control measure, Simon Says, was related to children's word learning when information was conveyed by mental-state verb terms. In contrast, a role of executive function was only found on judgment when information was conveyed by evidential markers. The two auditory short-term memory tasks, BDS (positively) and BWS (negatively), predicted the ability to judge the speakers' reliability. First, I will discuss linguistic influences on selective trust. The present study found a carryover effect between the two selective trust measures. Thus, I will discuss possible explanations of the effect between the selective trust measures. I will then move to discuss performance on the children's reports on the sources of knowledge. Next, I will review the predictive roles of executive function on selective trust. Selective trust consists of different types of questions such as judgment and selective learning. Thus, I will discuss the roles of executive skills on selective trust according to the types of the questions. Lastly, I will consider individual performance of executive skills.

6.4.1. Influences of linguistic differences on selective trust

One of the main objectives of the current study was to probe whether the findings in the previous chapter which showed children's selective trust at different ages according to the use of two different linguistic references were replicated. Overall, the findings of the current study were consistent with the previous one with slight variations probably on account of sample differences. First, there were no significant differences in performance between evidential markers and verb terms apart from on Explicit Judgment. Secondly, although the younger children aged three were able to discriminate the speakers' reliability by evidential markers, general performance levels revealed that the children at the age of 5-6-years made a trust decision selectively between conflicting information from two speakers. On the other hand, the children's use of linguistic information of mental terms by mental verbs was shown at the younger age; that is, the discrimination of others was revealed at the age of four. It appears that there was a discrepancy between statistical analyses between performance on the two sets of selective trust tasks. That is, there were different developmental patterns by the linguistic references, although the difference between the tasks was not significant. Thus, it seems that it might be difficult to state that there were effects of linguistic references based on analyses using the general linear model. However, it seems conceivable that the non-significant difference might be driven by performance of the VT task which showed errors in older children (see Table 6.11 and also the Discussion of Chapter Five for U-shaped growth). Thus, the findings in the individual tasks might be appropriate to explain children's understanding of selective trust. Accordingly, the findings seem to indicate that the use of different types of language might allow us to understand young children's cognitive skills. In other words, it seems possible that young children's cognitive development could be concealed or revealed according to linguistic references. This view about the influence of language on selective trust was discussed in more detail in Chapter Five. The results of the current study were consistent with the findings in Chapter Five, showing the different developmental patterns in selective trust according to the use of linguistic references. It seems that this view and discussion regarding the effects of language on social understanding were convincing with consistent findings. That is, it is conceivable that language might provide the means of discovering levels of the children's social-cognitive skills rather than facilitating at least in the selective trust paradigm used here. Performance on the two different types of selective trust seemed to indicate that linguistic demands on children may influence the acquisition of social understanding.

Another consistent finding of the current study was revealed from performance on the mental-verb term task. Once the children exhibited successful selective trust at the age of four, they became less sensitive to others' reliability afterwards. For this tendency, we suggested the possibility of errors of growth as discussed in Chapter Five. With regard to consistent findings, it seems possible that the explanation of children's shift in the language acquisition (i.e., errors of growth) might be appropriate for the tendency of children. Having said that, there is no clear clue to explain the reason for drops in performance at 5-6-years of age. For a possible reason of U-shaped growth, we discussed in Chapter Five that the statements with mental verb terms for certain questions might not be appropriate. Utterances of speakers in the current study were identical with the previous experiment and children's language ability to understand mental verb terms were not assessed in the previous and current studies. Thus, further research which can probe Korean children's acquisition of mental verb terms might be required to support the possibility explained above.

6.4.2. Carryover effects on the selective trust measures

One different pattern of the current study was that there was a carryover effect between the selective trust tasks which was not observed in the previous experiment. A difference between the two studies was that there was a temporal term between the tasks and that the experimenter used the prompt (e.g., "Do you remember that you did this task with Bear and Sheep?") to evoke previous experience for a later task in the current study, whereas the two types of the selective trust measures were administered continuously without any prompt in the previous study. There are several explanations for the carryover effect. First, it seems possible that the verbal prompt by the experimenter facilitated the children's performance by recalling the procedure of selective trust. Secondly, one possible explanation is that the procedure of the current study might provide a training effect. There is evidence that training improves children's performance on cognitive tasks (e.g., Dowsett & Livesey, 2000; Lohmann & Tomasello, 2003). For example, Rueda, Rothbart, McCandliss, Saccomanno, and Posner (2005) conducted a comparative study to demonstrate influences of training on the development of executive attention and intelligence in 4-6-year old children. They examined the nature of attention in tasks in which children were required to respond to either the direction (i.e., congruent trials) or the opposite direction (i.e., incongruent trials) to where a fish at the centre of an array points. The children in a training condition received five training sessions on a Stroop-like exercise and were compared with those in a control group. The training sessions were considered to be related to executive attention. Rueda et al. (2005) found that there were significant reductions in the overall reaction time, errors and conflict scores (i.e., differences between incongruent and congruent trials) of the attention tasks due to training across the age groups. The findings seem to indicate that experience with related tasks may have benefits to the specific domain of cognitive development under investigation.

With regard to children's performance on selective trust in the present study, effects of task order were asymmetrical. That is, performance on Ask and Endorse questions in the EM task and Judgment and Endorse questions in the VT task showed order effects. Given the order effects found in both tasks, children who correctly answered three out of three questions showed increased performance from 41% to 58% in the EM task. On the other hand, children's performance in the second task increased from 27.9% to 61% in the VT task. As mentioned in the Introduction of the thesis with regard to research by Lohmann & Tomasello, (2003), it is plausible that linguistic experience such as syntax or perspective discourse could enhance children's understanding of mental states. Thus, it seems conceivable that the exposure to linguistic markers of mental states might have sensitised to speakers' knowledge status, suggesting training effects. Having said that, it seems difficult to contend that the exposure to mentalistic language solely influenced children's performance on selective trust. Taken together, it is conceivable that the repeated tasks might have influenced the children's recall of the procedure their confidence in attending the tasks even though the interval between the tasks was brief in the current study.

It also seems possible that children simply tend to change their answers as a result of being asked repeated questions (e.g., Hartwig & Wilson, 2002; Krähenbühl & Blades, 2006; Rose & Blank, 1974; Siegal et al., 1988). The references cited identify that when children switch responses on the second time of questions, they are less likely to consider accuracy of their answers in relation to the individual question posed. For example, Rose and Blank (1974) found that 6-year-old children made more errors on the repeated question formation than the one question task when they were asked about the numerical equality of two arrays in Piaget's conservation task. Siegal et al. (1988) also found that children gave inconsistent responses on repeated questions (see the Discussion section of Chapter Four for the procedure). They also found that children considered that a puppet changed answers to please an experimenter. The evidence seems to suggest that repeated questioning may not reflect children's understanding of the tasks in the first trial and/or not facilitate performance on the second one. This assumption may be particularly applicable when children's responses on the second trial were less accurate, and they made more errors. However, the findings from the current study showed improved performance on the second task. Thus, it seems possible to disregard this explanation for children's misunderstanding of tasks or an experimenter's intention.

Another possible explanation for carryover is that there might be an issue of test-retest reliability. The question on the validity of the test has been raised in children's cognitive performance (e.g., Carpendale & Lewis, 2006). For example, Hughes et al. (2000) examined test-retest reliability in a broad range of false-belief tasks with an interval of 4-weeks in 4- and 5-year old children. First, they found a significant correlation between test and retest within the first-order false-belief questions (r = .77). Secondly, they found that children's performance on the false-belief questions was generally improved on the second time of periods compared to the first trial. This study seems to suggest that children may have learned during the first trial and this learning effect may facilitate performance on the later one with good reliability of test-retest. Indeed, reliability of measures used in the current study was fairly good (Cronbach's α = .78 for six questions from two selective trust measures). The children's performance on the second task was better than the first one regardless of which type of selective trust was administered first. In line with the point of the view of learning effects, it seems possible that previous learning might have promoted the children's understanding of selective trust in the second task in the present study.

Contrary to the procedure of the current study, it was more likely to be a single-questioning task in Experiment 4. The instructions of the previous study were identical to the current one. The experimenter informed the child about the changes of speakers (i.e., different puppets from one task to the other). However, there was no interval between tasks and the experimenter did not use any verbal prompt mentioned above (e.g., "Do you remember that you did this task with Bear and Sheep?"). Thus, it is highly plausible that the children in the previous study might not have had an opportunity to realize differences between the tasks or to recall previous performance, as materials such as pictures of familiar or unfamiliar objects were continuously provided. It is possible that carryover effects might have been observed in the current study, but not in the previous experiment, with the different procedure. Taken together, it appears that the children's performance on the second measure of selective trust may have been improved by either training or learning effects in the current study. It seems plausible that the verbal prompt noted above might have also affected such effects. Thus, analyses by performance which the children were administered first regardless of types of linguistic markers may be appropriate in the current study.

6.4.3. Young children's source reporting

Each question regarding reporting of sources on the EM and VT tasks was given to explore whether young children were able to consider the reason for a speaker's inaccuracy in responding to the objects of the box. On average, 50% of the 3-year-olds and 18% of the 4-year-olds answered 'don't know' and these rates are comparable to those of who failed to provide explanations in Koenig and Harris (2005b). It appears that 3-year-olds are poor at reporting or considering how others know about their beliefs. There is research suggesting a positive link between children's memory and their recognition about the origin of beliefs (e.g., Gopnik & Graf, 1988; O'Neill & Gopnik, 1991; Perner & Ruffman, 1995). The studies listed above seem to indicate that 3-year-olds' difficulty in identifying sources of beliefs might stem from their insufficient capacity to remember events. For example, Perner and Ruffman (1995) conducted research to demonstrate whether there was a relationship between children's ability to trace information and their knowledge state in children aged three to six. The children were given memory (i.e., free recall and cued recall) and see-know tasks which examined the children's understanding of an association between informational access and consequent knowledge state (Experiment 1). For example, the children were asked to identify their knowledge or ignorance about objects in the how-do-you-know task which was a subtask of the see-know procedure mentioned above. Perner and Ruffman found that the children's performance on tasks to examine their awareness of experiences was significantly correlated to memory tasks. They found that children with better performance on recalling events were more knowledgeable about how they know. As children develop an understanding of their own and others' beliefs in parallel (Wellman et al., 2001), it is plausible that children's understanding of the source of others' beliefs would also show a similar trajectory with a grasp of their belief state. Thus, it seems that children who had lower memory capacity might be poor at reporting the sources of others' knowledge state in the current study. However, this assumption does not support the poor performance (50% of 'don't know') of the 3-year-olds in the present study. This is because the 3-year-olds showed all floor effects (no success) on both BDS and BWS tasks regardless of how they responded on the source question. In other words, an explanation for reliance on the memory capacity might not be appropriate for the 3-year-olds' performance of the current study.

Another plausible explanation is that poor performance of the 3-year-olds might be dependent on their ability to understand the question which consisted of dual sources. In other words, the form of the question given to children may hinder their understanding of others' knowledge state (Pratt & Bryant, 1990). Pratt and Bryant conducted experimental studies in order to probe whether young children aged 3- and 4-years did not understand the causal connection between informational access and the gaining of knowledge or whether the form of the question was a source of their difficulty. They assumed that 3-4-year-old children would understand that seeing leads to knowing but the double-barrelled question (e.g., does s/he know what is in the box or does s/he not know that?) would confuse children. In their experiment, a pair of children participated in tasks at the same time to ask his/her own (Self) and another's (Other) knowledge status. One of the pairs was shown a box which involved coloured contents and the other was not. The children then were asked the Self and Other questions. There were two types of questions for comparison: single-barrelled (e.g., Do (does) you (Lucy) know what is in the box?) and double-barrelled questions as noted earlier. Pratt and Bryant found that there were significant differences according to the types of questions

(Experiment 3). Even the 3-year-olds showed high levels of performance for single-barrelled questions (i.e., 80% and 75% of correct responses for Self and Other, respectively). In contrast, their correct responses were poor when double-barrelled questions were given (i.e., 61.5% and 42.9% for Self and Other, respectively). The findings seem to suggest that children by 3-years of age were able to understand that individuals can gain knowledge from visual access. However, a simpler question might be required to elicit the same information from such young children. Hence, as the evidence suggested, it seems possible that high rates of responses of ‘don’t know’ in the 3-year-olds might stem from the complex form of the question used in the current study.

Evidence has accumulated for more than three decades that children by the age of four become able to infer their own and others’ beliefs (see Wellman et al., 2001). In line with this ability, the source-reporting question was given in order to explore whether children can consider sources of others’ beliefs and which source between visual and verbal information they preferred. In general, the children in the current study did not show any preference for either source, although the 6-year-olds in the EM task frequently responded that a speaker was incorrect because of a lack of direct access to objects. These overall random responses seemed to suggest that the children who participated in this study might weight informativeness of seeing and telling similarly. It seems that direct access by seeing to information might be relatively more salient than being told about contents of a box in young children. For example, Whitcombe and Robinson (2000) conducted research to explore whether the origins of information influenced young children’s decision and whether they were able to identify the source of their beliefs. In their experiment, children between three and five were given tasks in which either they saw pictures or they were told about them by an adult. Either the child or the adult experimenter had a partial or complete view of the pictures (in dual source trials in Experiment 1). The children then were asked questions to identify the pictures (e.g., banana or cheese) and the source of beliefs (i.e., how they know about objects). Whitcombe and Robinson found that children across the age groups were fairly accurate at identifying the objects and there were no significant differences between the seeing and being told conditions. In contrast, their performance on responses to source reporting was poorer than on recognizing the objects. Of interest was that the children's performance on the seeing condition was significantly better than on the being told trial. That is, it seems plausible that the source of visual access might remain more salient than verbal information in young children when the sources were independently provided. In contrast, however, the children of the current study did not show any difference or preference for either source of information when they reported the incorrect speaker's belief. In other words, it seems conceivable that the children might consider both sources of information simultaneously. As the question was posed to uncover the reason for the lack of accuracy of one speaker, but not to make a comparison between well- and poor-informedness, the question might not have gained particular responses between sources of a belief.

On the other hand, it could be that explicit source reporting about others' beliefs might be difficult for young children, even though they might discriminate different levels of certainty of the speakers or understand how they obtained information. As noted above, the preschool children in Whitcombe and Robinson showed difficulties in responding to how they knew about objects although they performed at ceiling for identifying. They also replicated similar patterns of findings in a second experiment which involved the means of information being either seeing or feeling. The children proficiently responded to colour or weight of objects according to the informative access. In contrast, children aged 3-4 showed a tendency to guess a source of information. The findings seemed to indicate that children' ability to infer beliefs explicitly might not be well developed during the age of preschool, although they can show an understanding of their own or others' false beliefs, as shown in theory-of-mind literature at the age of 3-5-years. Hence, the incompetence in explaining sources of knowledge in young children could be in line with random responses of the source reporting question in this study.

6.4.4. The role of executive function in selective trust

The findings showed that there were different associations between executive function and selective trust questions. Furthermore, the linguistic markers also influenced the relationships between the two cognitive measures. According to the correlations presented in Table 6.16, selective trust with the evidential markers was not significantly correlated with the composite scores of executive function measures, whereas the role of executive function was found in selective trust with the mental verb terms. As it seems that evidential markers might have particular functions, evidentiality will be discussed in relation to executive function. I will then discuss the role of executive function according to the types of the selective trust questions based on the different associations as shown in Table 6.16.

6.4.4.1. Evidentiality and executive function

Evidentiality which is grammatically embedded in a language includes information about whether a speaker has direct or indirect access (Willett, 1988). It seems plausible that the nature of evidentiality might have reduced the demands of recalling visual experience in the selective trust measure of the current study. In other words, it seems conceivable that listeners of evidential markers do not have to infer how speakers obtained information and their cognitive load was reduced as a result. This feature of evidentiality might have led the children to processing the speakers’ accuracy based upon their verbal information. As noted above, the correlations showed that performance on executive function did not predict children’s selective trust with the evidential markers, considering the composite scores of both tasks. However, regression which explored contributions of individual components of executive function showed that verbal working memory predicted children's judgment on reliability (see Table 6.17). In the Introduction section of this chapter, I reviewed the role of visual and verbal working memory on judgment. However, it appears that the strength of visual memory might be mediated by verbal information as shown in data.

The empirical research by Duncan, Whitney, and Kunen (1982) shows evidence of influences of verbal information on visual memories. They conducted two studies in order to explore whether visual and verbal information were integrated in children's memory. Six-, 8-, 10-year-old children and college-aged adults were shown slides which depicted stories involving cartoon characters. They were then given questions and a recognition test for memory composed of the original and new distractor slides (Experiment 2). Verbal information describing the characters and events of the stories were given to the participants in order to determine whether the verbal information facilitated the recognition of the target slides. Duncan et al. (1982) found that children used verbal information to recognize the target slides correctly as much as adults. They also found that the presentation of verbal information (no- or misinformation) about a distractor increased the likelihood that the participants incorrectly recognized the distractor slide as a study slide. In other words, the incorrect verbal information hindered performance on correct rejections of distracters. The findings seem to suggest that visual sources were simultaneously processed with verbal information in memory (Ceci, Ross, & Toglia, 1987; Loftus, Miller, & Burns, 1978). Taken together, both visual and phonological memory systems appear to be important in the incorporation of the flow of information. There might be less demands of working memory for visual information when sources of information are conveyed in conversations. Therefore, these explicitly presented sources of information might have resulted in a greater need for auditory working memory to process the speakers' verbal information. The findings seem to indicate that working memory might be related to language processing along with cognitive skills.

In the next section, I will discuss how judgment and selective learning in selective trust were related to executive function.

6.4.4.2. The role of working memory on Judgment in selective trust

We hypothesised that working memory would have a predictive role on children's ability to judge reliability between two speakers. First, the findings support the hypothesis that working memory was associated with the children's judgment on a reliable source of information. It seems that this experiment might have predicted the first evidence of a link between executive function and selective trust. The correlations between judgement and working memory might have been found because both processing-information and memory capacity are limited (Hogarth, 1987). Therefore, the ability to incorporate information efficiently might be necessary to select a reliable speaker in the selective trust paradigm. Empirical evidence supports the correlations between memory and judgment. For example, Hastie and Park (1986) conducted a series of experiments in order to research whether judgment influenced memory (on-line) or vice versa (memory-based) using a task in which participants were asked to judge a man's suitability for a job either before hearing a conversation (on-line condition) or afterwards (memory-based condition) (in Experiment 1). For the job suitability assessment, recall of items either in favour of or opposing the person was analysed. They found that there was a positive and significant correlation in the memory-based condition but not in the on-line condition, suggesting that availability of memory to recall information selectively was a crucial factor for judgment. That is, the findings seem to be in line with the view of Hogarth (1987) suggesting the role of memory capacity in judgment. A distinctive finding of the current study was a measure of visual working memory predicted children's judgment when mental-verb terms were a means of information. Thus, I will discuss possible explanations for the association between visual working memory and judgment.

One possible explanation for this finding might be that vivid information of stimuli such as those presented in Figure 6.1 might be relatively easier to recall than verbal information (Hogarth, 1987). There is empirical research supporting this suggestion. Baddeley and Andrade (2000) conducted studies in order to explore whether the visuospatial sketchpad functions in maintaining visual images and the phonological loop retained auditory-verbal information, and to determine which information remained more clearly after being disrupted, either visually or auditorily. They assumed that vividness of visual imagery or auditory information would be reduced by concurrent tasks which selectively interfered with the use of the visuospatial sketchpad and the phonological loop of working memory. Adult participants were told to maintain each of five novel patterns and five novel sequences of tones in mind. In concurrent tasks, the participants were asked to tap a keypad or count aloud while each stimulus was presented on a screen. They then were asked to rate vividness of a stimulus and to decide whether a second stimulus was the same or different from the sample for the memory test (in Experiment 1). Baddeley and Andrade found effects of interference on working memory. Spatial tapping reduced performance on visual imagery more than on auditory images, whereas counting diminished the levels of vividness of auditory information more than of visual patterns, supporting their assumptions of the roles of relative subsystems in working memory. They also found significant differences in recalling the stimuli. That is, visual information was recalled significantly more than the auditory stimuli. In particular, despite the fact that rated vividness was relatively higher in verbal sources than visual patterns in the control condition, it was observed that memory of visual patterns was better than that of verbal sources. Accordingly, the findings seem to imply that the strength of information maintained in memory might differ based on the sources of stimuli and visual perception might be more straightforward to remember than the auditory-verbal form (Paivio & Csapo, 1973).

Another possible explanation might come from the relations between visual working memory and selective attention. For instance, Downing (2000) conducted research in order to probe whether visual working memory influenced the ability to attend selectively to relevant information in college-aged participants. For memory stimuli, two pictures of faces were given to them. One of the faces was held in their mind, while the other was novel. In order to examine their selective attention, bracket features (i.e., ∪ or ∩) were used. Either bracket appeared after the two faces were on a screen. The participants then were asked about the orientation of the bracket or the direction of movement in the judgment task. In the final trial, a test face or an object, which was matched to the sample or was novel, appeared for a memory probe (Experiment 2). Downing found that, when the locations of the stimuli and the bracket were matched, responses on the movement or orientation of the bracket were faster than in a non-matched condition. The findings suggest that storage of the stimuli in memory facilitated the ability to filter incoming information (Desimone, 1996). Thus, it seems plausible to find the correlation between visual working memory and judgment in the present study as it might be required for the children to receive input selectively from a speaker who provided correct information.

So far, this section stressed the importance of visual over verbal information. The task used in this study, where children watched one speaker directly looking at inside a box while the other did not, might have induced vividness of visual information. Thus, it seems possible that this procedure may explain a correlation between selective judgment and visual working memory. Along with the association of working memory and judgment, inhibitory control was significantly associated with children’s selective learning. Thus, I will discuss possible explanations for the role of inhibitory on selective word learning.

6.4.4.3. The role of inhibitory control on word learning in selective trust

It was hypothesised that the relative subcomponents of executive function would explain the children's ability to learn selectively between conflicting information. However, the findings showed that only the inhibition control measure predicted their selective learning. Thus, this section will consider possible explanations for the association between inhibitory control and word learning.

The findings support the hypothesis that the effort to inhibit a prepotent response or irrelevant information was associated with selective learning ability. A distinguishing finding was that not all inhibitory control tasks showed the relationships. Performance by Simon Says, but not by Day/Night, appeared to be facilitative in learning novel words. It seems that the nature of the Simon Says task which involves high working memory demands, rather than the task with relatively lower demands such as Day/Night (Carlson, 2005), might have attributed the correlation, considering the procedure of selective learning used in the present study in which children had to hold the speakers' previous accuracy about labelling and concurrently to suppress an inappropriate response. Thus, this procedure might require higher working memory activation which facilitates the ability of inhibition for incorrect actions (Roberts & Pennington, 1996). It is apparent that Simon Says was significantly correlated with all three working memory tasks given that the Pearson correlations (r = .71 and r = .72, p < .001 showed strong links with BDS and BWS, respectively, r = .46, p = .002 for VCR). The higher correlations between Simon Says and working memory above those between Day/Night and working memory might show differences between the inhibitory tasks. This seems to indicate that the ability to perform conflict inhibitory control tasks which involve substantial working memory demands might support children's selective trust as children had to recall speakers' past reliability.

Another possible reason for the discrepancy between inhibitory control measures might be distributions of performance of the tasks. The high levels of success in the Day/Night task might have reduced the validity of the association with the question of selective learning. In the analyses of regression (as shown in Table 6.19) Day/Night was not included for its near ceiling performance. However, when regression was carried out with inclusion of Day/Night (by a number of correct trials), Simon Says was still significant, *ß* = .32, $t(69) = 2.26$, $p = .03$, while Day/Night did not predict the scores of Endorse questions with the mental verb terms, *ß* = -.07, $t(69) = -.06$, $p = .58$. Sixty eight out of 78 children (accounting for 81%) passed the Day/Night task. The distribution showed a highly skewed pattern with outliers of nine children, who performed less well. Thus, it seems possible that the children's performance with the near ceiling effects might not have presented us a valid means to examine the predictive role of the Day/Night task on selective learning. The findings seemed to indicate that the measure of inhibitory control along with higher demands of working memory and a wide range of the distribution of performance might be appropriate to examine the relationship with selective learning.

6.4.4.4. No role of working memory and set-shifting on selective learning?

Working memory and selective learning

We hypothesised that phonological short-term memory would predict children's ability to learn novel words selectively. However, the finding did not support this hypothesis. One possible reason for the non-significant correlations might stem from performance showing floor effects of the 3-year-olds in BDS and BWS. In fact, none of the 3-year-olds was able to proceed with practice trials for both tasks. In total, 39% and 32% from BDS and BWS, respectively, including the 4- and 5-year-olds received the lowest score (i.e., 1).

Accordingly, it seems conceivable that the distributions with narrow ranges of performance might have deteriorated the sensitivity of the correlations. An alternative assumption to explain the findings is that these particular tasks used to examine the short-term memory might cause the results. As mentioned in the Introduction to this chapter, the research has shown the role of working memory in relation to learning abilities (e.g., Baddeley et al., 1998; Gathercole, 2006; Montgomery, 2002). However, it appears that there are variations in the strength of associations between short-term memory tasks and word learning.

According to Baddeley et al. (1998), a non-word repetition task which requires participants to repeat unfamiliar names may be a more sensitive measure than the digit span task to examine children's language learning. This is because the non-word repetition task measures children's accuracy to repeat unfamiliar words, while the digit span measure is more likely to examine a capacity of phonological loop. There are empirical studies showing that non-word repetition but not digit span is significantly associated with children's vocabulary knowledge. For example, Gathercole and Adams (1993, 1994) conducted a cross-sectional and a longitudinal studies with children aged between two and five in order to examine whether phonological working memory was related to other cognitive skills such as vocabulary knowledge, articulation rate, numerical and nonverbal tests. For short-term memory, digit span and non-word repetition tasks were examined in both studies. They showed consistent findings in both studies; that is, non-word repetition but not digit span was linked with the children's vocabulary knowledge. Thus, according to these findings, it seems possible that non-word repetition might be used to assess the memory capacity more accurately than digit span for learning of novel phonological sounds. Although Gathercole and Adams (1993, 1994) used forward digit span (FDS) task, but not BDS, functions of the two measures may be comparable in terms of storing information. According to Davis and Pratt (1995), BDS requires a higher cognitive skill with the demand of the central executive than FDS because BDS manipulates information. However, demands on the central executive in FDS will also be increased as digit load increases in FDS (Baddeley, 1996). Taken together, the research seems to suggest that performance on the memory-span tasks would be dependent on both the phonological store to hold acoustic information and the central executive. Thus, if it were the case, it seems possible that significant associations between memory-span tasks and novel word learning might not be observed in the present study, as the span tasks used familiar words and numbers while selective learning required to process novel sounds.

The assumption mentioned above regarding the poor relations between span tasks and learning sought an explanation based on the capacity to maintain unfamiliar sounds. Alternatively, it seems also possible to consider the role of the span memory on sentence comprehension. The selective trust paradigm used in the present study may require the ability not only to select novel words but also to process sentences for meaningful representation. The present study hypothesised that children’s ability to understand utterances would differ according to the uses of specific expressions for epistemic states. This is the reason for the use of two different types of linguistic markers. Accordingly, it seems possible that sentence comprehension, along with the capacity to rehearse novel sounds, might be necessary for selective learning. Thus, I will explore whether the conventional memory span tasks play a crucial role in language comprehension.

There is a vast body of research indicating that memory tasks such as reading or listening span are more strongly related to reading comprehension than the traditional span tasks such as digit or word span (e.g., Daneman & Carpenter, 1980, 1983; Just & Carpenter, 1992; Turner & Engle, 1989; Wells, Christiansen, Race, Acheson, & MacDonald, 2009). An influential study was conducted by Daneman and Carpenter (1980) into the role of working memory on language comprehension abilities. They assumed that reading or listening span tasks which involve both the process and storage components would reflect more closely individuals' reading comprehension ability than a relatively simple word-span task which does not tax the processing component of working memory. In the reading or listening span tasks, college-aged participants read or heard a set of sentences and were asked to recall the final words of sentences. For comparison, a simple word span task was also examined. For reading comprehension tests, the participants read a series of passages and were given questions regarding its contents, concerning pronoun, fact and theme. Daneman and Carpenter found that there were significant differences caused by the use of different types of the span tasks. That is, the reading or listening span tasks were significantly correlated with fact and pronoun questions, whereas the word-span task showed non-significant associations. Thus, the findings seem to suggest that sentence comprehension might require more complex cognitive skills than recalling or rehearsing simple words because comprehension of sentences may require an understanding of pragmatic, semantic and syntactic information simultaneously. Their clam was also supported by a subsequent meta-analysis investigating the association between working memory capacity and language comprehension ability by Daneman and Merikle (1996) from 77 studies with a wide range of participants from primary students to elderly participants. For their analyses they adopted studies involving reading and listening along with the traditional span tasks such as digit, letter and word tests. Again, they found influences between different tasks used in the analysis. First, the measures of working-memory capacity which combine processing and storage of information (e.g., reading or listening span) were better (indeed excellent) predictors of comprehension that those of storage capacity (e.g., digit or word span). Secondly, verbal storage predicted better than math span.

The findings seem to indicate that individual differences in processing and storage (rather than storage alone) may account more sensitively for the language comprehension capacity (Just & Carpenter, 1992). Of note is that the meta-analysis includes a wide range of participants from primary school children to elderly participants. If these findings were also applicable to young children, it seems possible to speculate that memory-span tasks which examine the skills to process sentences, rather than to recall words or numbers, might be more appropriate to explore contributions of working memory to children's discrimination of the speakers' utterances in selective learning. In the current study, performance on selective trust showed that there were differences in understanding the speakers' utterances (i.e., an earlier understanding by mental-verb terms than evidentiality). The selective trust measures required children to learn novel lexicons and process the speakers' certainty expressed in statements at the same time. In other words, the selective trust measures might have required children to have the ability to comprehend sentences. Thus, it seems possible that the non-word repetition or sentence comprehension tasks might provide valid measures to explore the relationship with selective learning. This possibility would lead to further research.

Cognitive flexibility and selective learning

It would be necessary to consider the relationships between cognitive flexibility and selective learning. As mentioned in the Introduction to this chapter, there is evidence that cognitive flexibility predicts academic skills such as reading comprehension (e.g., Cartwright, 2012; Cartwright, Marshall, Dandy, & Isaac, 2010; Mazuka, Jincho, & Oishi, 2009). Language processing requires the ability to select and encode information flexibly from multiple sources, a skill which is defined as cognitive flexibility (Deak, 2003). Thus, cognitive flexibility and language learning are codependent (Jacques & Zelazo, 2005). Unlike the findings from the inhibitory control task, performance on both standard and advanced DCCS tasks did not support the view. It seems difficult to come up with theoretical explanations for the poor associations in the present study. One possible reason for poor performance might be the lack of variation in the advanced DCCS (i.e., floor effects) across all age groups. More than two-thirds of children (68%) passed the standard task. It appears that narrow ranges of performance on both tasks might not produce sufficient variability to allow us to examine the relationships with word learning.

The possible explanations for the non-significant associations between working memory/set shifting and selective learning were discussed throughout this section. As mentioned above, it seems plausible that inclusion of measures which may assess wide variations in relation to language acquisition might be required to probe the role of executive function in selective trust for further research. In the next section, I will discuss performance on individual measures of executive function.

6.4.5. Korean children's executive skills

The Korean children's executive skills were examined through three components: inhibitory control, working memory and cognitive flexibility. The findings showed uneven patterns not only among the different components but also within the same one.

Inhibition Control

Inhibitory control was measured by two tasks: Day/Night and Simon Says. The levels of performance on the Day/Night task were in line with those of Chapters Two and Three. It appeared that the Korean children's inhibition in the Day/Night task was relatively proficient compared to others. In this experiment, the percentages of correct trials were 69.2%, 87.5%, 85% and 100% from the 3-, 4-, 5-, and 6-year-olds, respectively. On the other hand, 48% and 58% of 3- and 4-year-olds, respectively, performed 12 and more out of 16 trials in Carlson's (2005) study (the figures are approximate numbers as the data were shown only in a graph in their study). In Gerstadt et al.'s (1994) study, although 3.5- year-olds performed fairly well (i.e., 71.5%), 4-, 5-, and 6-year-olds' performance (i.e., 66%, 77% and 87%, respectively) was poorer than those of Korean children (the age groups were more subdivided in Gerstadt et al.'s study; thus, again the approximated percentages were compared). Performance on the correct trials in the current study did not reveal age-effects in spite of a wide range of age groups. It is difficult to state that the Korean children's performance on Day/Night was remarkably better than their Western counterparts. However, it is apparent that the Korean children's performance tended to be one-year ahead of their counterparts in other cultures (see Oh & Lewis, 2008).

In contrast to this tendency of Day/Night, the Korean children's inhibition by Simon Says was not as skilled. In Carlson and Meltzoff's (2008) study, the 6-year-olds' average score in the control group was 10.35 for anti-imitation trials and the scores of 4- and 5-year-olds in Carlson and Wang's (2007) study were 18.79 and 23.84, respectively, for anti- and imitation (total) scores. It seems that, although the 6-year-olds' anti-imitation performance between the Korean- and English-speaking children might be comparable, the younger Korean children's scores were poor. It is not clear what made such differences between what appear to be somewhat similar inhibitory control tasks. However, one possible account might be the levels of demands of working memory in the task. In other words, it seems conceivable that higher demands of verbal working memory in Simon Says might have caused difficulty. The children's working memory levels will be discussed below.

Working Memory

The capacity of working memory was examined by both phonological and visual tasks. It was apparent from the findings of backward span tasks the Korean children's phonological capacity was relatively limited, compared to those in USA (e.g., Carlson et al., 2002). In particular, the 3-year-olds' performance was considerably poorer. Despite the fact that all 3-year-olds received five practice trials of 2-digit span, none of them correctly recalled the spans. However, the Korean children's performance of the current study is not unique. Davis and Pratt (1995) also reported poor levels of BDS compared to FDS in children aged between three and five. It seems possible that the difficulty of 3-year-olds and those who failed the 2-digit or word span might have stemmed from a lack of their linguistic skills. In other words, it seems that difficulty in understanding 'in reverse order' might have limited their ability to recall digit or word, considering their performance which remembered up to five items in the visually cued recall (VCR) task. Indeed, there were differences in the relationships between working memory measures and verbal skills in the current study. Partial correlations, controlling for age, showed that backward span tasks, but not VCR, showed significant correlations with aggregated verbal scores of the vocabulary tasks (r = 34, p = .002, r = .38, p < .001, r = .19, p = .08 for BDS, BWS and VCR, respectively). Apart from the effect of language, there may be other factors which may influence the children's understanding of the tasks such as procedure (e.g., practice trials or feedback). However, the procedure of the tasks in the current study was in line with the standard one as used in other studies (e.g., Carlson et al., 2002; Davis & Pratt, 1995). Accordingly, it appears that the ability to understand 'in reverse order' might be responsible for the poor levels in BDS and BWS.

Owing to the floor effects of the 3-year-olds in BDS and BWS, age differences were examined with their exclusion from the two tasks (see Table 6.15). The findings in Table 6.15 showed that there was a significant effect of age in all three working memory measures. Overall, the findings from the tasks equate with the view that there is a developmental growth of short-term working memory with increasing age in childhood (Case, Kurland, & Goldberg, 1982; Gathercole, Pickering, Ambridge, & Wearing, 2004).

Cognitive Flexibility

The children's flexible switching ability was explored by the standard and advanced DCCS task. The findings of the standard task were consistent with those presented in Chapters Two and Three apart from the 3-year-olds who showed poorer performance in the current study. In the previous chapters, the average scores out of six trials were 2.77, 4.86 and 4.75 for the 3-, 4- and 5-year-olds, respectively. That is, the score of 1.17 for the 3-year-olds in the current study appeared to be remarkably lower. One possible reason for this discrepancy in the 3-year-olds might be variations in participants between experiments. Indeed, there was a significant difference in the 3-year-olds, but not in the 4- and 5-year-olds, between the studies. The 3-year-olds in the current study were significantly younger (M = 41.1 months) than those in Chapter Two (M = 43.3 months), $t(120) = 2.62$, $p = .01$. In contrast, mean ages of the 4- and 5-year-olds (M = 53.9 and M = 66.3 months, respectively) in the current study were comparable to those in Chapter Three (M = 55.1 and M = 65.4 months, respectively), $t(39.4) = 1.38$, $p = .18$ for the 4-year-olds and $t(43) = -0.81$, $p = .42$ for the 5-year-olds. Furthermore, the vocabulary skills of the 3-year-olds (M = 3.83) in the current study were significantly poorer than those in Chapter Two (M = 6.26), $t(120) = 2.34$, $p = .02$. The children in the two older groups were comparable between studies. There is evidence showing an association between verbal skills and cognitive flexibility (e.g., Oh & Lewis, 2008; Pellicano, 2007; Perner et al., 2002). A significant relationship between aggregated verbal skills and DCCS was found in the current study (Kendall's tau_b correlation, $\tau_b = .48$, $p < .001$). The partial correlation remained significant after controlling for ages ($\tau_b = .39$, $p < .001$). Thus, it may well be the case that the levels of linguistic skills in the 3-year-olds might have resulted in poor performance on the DCCS task in the current study.

In contrast to a gradual development with an increase of age in the standard DCCS task, such trend was not observed in the advanced task (the one with a border). The levels of performance on the advanced task showed floor effects. However, performance with low correct trials might not be surprising, considering that the advanced version is also demanding for 5-6-year-olds (Carlson, 2005). A possible explanation for a loss of sensitivity in developmental changes of the advanced task might be that the procedure used in the current study might not be valid to discover age-related effects. For example, the standard procedure suggested by Zelazo (2006) requires participants to pass the post-switch trials of the standard task and the advanced one. If they do so, this may be a sensitive measure for cognitive flexibility, but it would normally apply to older children such as 7-year-olds. Therefore, it is highly plausible that the procedure which involved all children irrespective of their performance on the standard task might have undermined general levels of the advanced version, indicating no developmental pattern across the age groups.

6.5. Conclusion

The present study was designed to determine the effects of executive skills in selective trust and the effects of linguistic markers on the relationships between them. First, the findings were consistent with the previous chapter in terms of developmental patterns of selective trust according to linguistic references. That is, children's exercise of selective trust was observed at four years of age when information was conveyed by mental-state verb terms (i.e., *know* and *think*). On the other hand, children between 5- and 6-years old were able to access others' mental states when speakers communicated using the specific evidential markers (i.e., -*te* and –*napo*). The second major finding was that the components of executive function were differently related to different aspects of selective trust. That is, judging one's reliability required working memory, whereas selective learning of novel words from conflicting information involved an ability to inhibit prepotent responses. Furthermore, the relationships between executive function and selective trust questions were dependent on the use of particular linguistic terms. When evidential markers presented the speakers' epistemic states, the aspects of executive skills which were required were different from those in the use of verb terms. Taken together, the current work confirms previous findings and contributes to existing knowledge of selective trust by providing empirical evidence of the role of language in revealing children's ability to judge reliability and to learn selectively. Another important contribution is that this work demonstrated the association between selective trust and executive function. In Chapter Seven we return to these issues.

Chapter Seven: **General Discussion**

This work set out to explore whether young children's access to particular aspects of social-cognitive understanding is associated with different linguistic references within a language. The thesis investigated whether specific features of Korean markers, which are grammaticalized to mark one's epistemic state, have facilitative effects on children's social understanding measured by false beliefs and selective trust tasks and their executive functioning. First, linguistic markers embedded in Korean grammar were given to young children in respect of social understanding (false beliefs in Chapters Two and Three and selective trust in Chapter Four) and executive function (Chapters Two and Three). Secondly, by giving different linguistic properties which are either grammatically embedded (i.e., evidential markers) or not (i.e., explicit mental-state verbs) young children's understanding of mental states was assessed using the selective trust paradigm (Chapters Five and Six). This general discussion will focus on four questions regarding the influences of language and children's social-cognitive development. In particular, I will discuss influences of specific linguistic markers on social understanding and Korean children's epistemic understanding of mental states (the first three questions I address [in bold] below). Next, I will consider the relation between the grammaticalized evidentials and executive function. Then, I will move on to limitations of this work and directions for future research.

7.1. Does an understanding of the grammaticalized certainty/evidentiality provide an opportunity for an early access to social understanding?

The findings of the current study suggest some facilitative effects of the grammaticalized markers of certainty/evidentiality on the measures of social understanding. Linguistic manipulation was included in test questions/speaker's statement or instructions.

Thus, it seems difficult to tease apart children's understanding of linguistic references or false beliefs/selective trust. However, a series of experiments compared tasks between with/out the grammatical markers or between grammatical markers and mental verb terms in this thesis. Thus, the findings from different tasks may allow us to discuss the effects of linguistic differences on children's social understanding. A grasp of certainty/evidentiality made by Korean suffixes shows a developmental shift in the data. An understanding of grammaticalized forms (i.e., evidence of certainty identified in suffixes) is easier in some contexts, but in others harder to grasp than verbs identifying specific mental states, such as *know* or *think*. Although I mentioned differences between suffixes and verbs in Chapter One, a brief explanation might be helpful to clarify linguistic terms used here. As grammatical certainty/evidential markers are attached to a verb, such markers are expressed by suffixes. In contrast, mental terms identified by verbs are not grammatically obligatory. The grammatical markers or mental verb terms vary in forms but convey one's epistemic state. Consider Table 7.1. This shows a trend concerning an understanding of Korean suffixes which are used in speakers' statements within the measures of social understanding throughout the five experiments. –*Ci* (sure for certainty) and –*keyss* (may for uncertainty) were used in a false-belief task in Chapters Two and Three. In the two experiments, approximately half the children were administered the certainty marker and the uncertainty expression was given to the rest of the participants. The ticks and crosses are given separately for Chapters Two and Three in Table 7.1.

On the other hand, differential certainty (i.e., a mix of certainty vs. uncertainty) was assessed in Chapters Four, Five and Six using evidential markers of -*te* (I saw for certainty) and –*napo* (I think for uncertainty). As a result only one tick or cross corresponds to the summaries of each condition for Chapters Four, Five and Six in Table 7.1, and it is important to identify why this is the case here. The selective trust paradigm is designed to measure children's ability to judge others' reliability (see also the Introduction of this thesis for a description and analysis of the selective trust procedure). It was necessary to use linguistic markers which include access to evidence in order to highlight a speaker's reliability, rather than expressing only certainty for selective trust in the current work. Thus, the suffixes as linguistic markers in Chapters Four, Five and Six are different from those of Chapters Two and Three.

Table 7.1

Tendencies of a grasp of certainty/evidentiality as a function of age throughout 5 experiments

<table>
<tr><th></th><th colspan="2">3-years</th><th colspan="2">4-years</th><th colspan="2">5-years</th><th colspan="2">6-years</th></tr>
<tr><th>Chapters</th><th>Un.</th><th>Cer.</th><th>Un.</th><th>Cer.</th><th>Un.</th><th>Cer.</th><th>Un.</th><th>Cer.</th></tr>
<tr><td>Ch. 2 with</td><td>×</td><td>✓</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>w/o</td><td>✓</td><td>×</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Ch. 3 with</td><td></td><td></td><td>×</td><td>✓</td><td>✓</td><td>×</td><td></td><td></td></tr>
<tr><td>w/o</td><td></td><td></td><td>✓</td><td>×</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Ch. 4 with EM</td><td colspan="2">×</td><td colspan="2">✓</td><td colspan="2">✓</td><td colspan="2">✓</td></tr>
<tr><td>Ch. 5 with EM</td><td colspan="2">×</td><td colspan="2">×</td><td colspan="2">×</td><td colspan="2">✓</td></tr>
<tr><td>with VT</td><td colspan="2">×</td><td colspan="2">✓</td><td colspan="2">✓</td><td colspan="2">×</td></tr>
<tr><td>Ch. 6 with EM</td><td colspan="2">×</td><td colspan="2">×</td><td colspan="2">✓</td><td colspan="2">✓</td></tr>
<tr><td>with VT</td><td colspan="2">×</td><td colspan="2">✓</td><td colspan="2">×</td><td colspan="2">×</td></tr>
</table>

Note. Ch.: Chapter. Un.: Uncertainty. Cer.: Certainty. EM: Evidential markers. VT: Verb terms.

Turning back to Table 7.1, we need to consider performance on un/certainty of Chapters Two and Three in terms of responses made at chance. In particular, children's performance was at chance on the false-belief measure with the uncertainty expression at 3-4-years of age, while they performed at above-chance levels without the marker. Their performance with the certainty expression showed the opposite pattern. The results suggest that children take into account un/certainty suffixes of epistemic states as young as the age of three, and the exposure to such expressions facilitates their grasp of the fact that another person may hold different beliefs. On the other hand, children's performance on a task discriminating differential certainty, using *–te* and *–napo* in Chapters Four, Five, and Six, shows variations by the age for successful selective trust (i.e., above-chance performance). Overall, the results indicate that children exercise epistemic trust around the age of 5-6 when speakers convey information using evidential markers. In contrast, children show a relatively early understanding of selective trust at the age of four when information is delivered using clearly specified mental verb terms such as *know* and *think*, as shown in Table 7.1. In this case, evidential markers do not promote young children's social understanding. Taken together, the findings suggest that children develop a gradual understanding of grammatical ,markers for mental states and the development of social understanding is constrained by particular forms of language used which are specific to each context.

In favour of the hypothesis that children's acquisition of certainty/evidentiality by suffixes shows a developmental pattern, it would be necessary to tease apart other possibilities which might influence such differences among the experiments. There are two main differences among the experiments of the current study apart from different linguistic uses. First, we need to consider differences between the false belief and selective trust tasks. Secondly, we will explore differences in evaluating the use of linguistic markers in the current work that need to be considered: at the individual lexicon levels and in terms of differential certainty. That is, it is possible that different stages of the emergence of an understanding might stem from specific uses of words in specific contexts.

For the former possibility, it would seem necessary to explore whether there is a difference in difficulty of tasks between the two types of social understanding. With regard to social understanding, there is a wealth of research showing a timetable for understanding beliefs in young children based on theory-of-mind tasks (e.g., Wellman et al., 2001). In contrast, selective trust is a recently growing research field in social understanding. Thus, it seems that not much research has been conducted putting them together to explore young children's social understanding apart from Lucas et al. (2013) and Jaswal et al. (2014) Accordingly, it is beneficial to consider task difficulties in individual performance in terms of when children begin to show a grasp of each type of social understanding. First, Lucas et al. provided evidence of an association between the false-belief and selective trust tasks. As noted in Chapter One, they found that preschoolers of 3-4-years who are precocious in false-belief understanding are also sensitive in judging others' reliability. Again, as mentioned in the section 1.4 of Chapter One in this thesis, children exercise selective trust around 3-4-years of age, with a slight variation according to how speakers' epistemic or knowledge states are expressed (e.g., Birch et al., 2008; Clément, Koenig, & Harris, 2004; Koenig & Harris, 2005b; Sabbagh & Baldwin, 2001). Taken together, the research seems to indicate that the two types of the social understanding measures display similar developmental trajectories. Accordingly, it is conceivable that there might be no significant differences in task difficulty between two epistemic understanding paradigms used in the current work. This would provide evidence for the idea that linguistic access to mental state terms is specific to particular means by which the child is provided with information about another's mental state.

Secondly, we need to consider whether a grasp of differential certainty is more difficult than an understanding of words in particular contexts. This is less likely to be the case. In the current work, children's knowledge about mental terms such as *know* and *think* at lexicon levels was not examined. However, the previously published data regarding such words in English-speaking children and results of Chapters Five and Six of the current study would provide a clue to Korean children's access to mental terms. In the Introduction of this work (Chapter One), I dedicated a section in order to demonstrate the importance of understanding mental terms listed above in relation to the development of beliefs. To recapitulate briefly, children begin to appreciate belief verbs such as *know* and *think* at the age of four (Bartsch & Wellman, 1995), and comprehension of relative certainty between them is also obtained at a similar age (Moore et al., 1989; Moore & Furrow, 1991). Furthermore, it has been observed that Korean children at the age of four discriminated between the different degrees of certainty of *know* and *think* from the last two experiments in the current work. Thus, it seems also possible to speculate that Korean children would understand mental terms by verbs around 4 years of age. In other words, Korean children may develop not only concepts of un/certainty at word levels but also differentials between such verbs at a similar stage. Accordingly, it is less likely that a task in which children had to distinguish between two statements with different levels of certainty (Chapters Four, Five and Six) would have caused more difficulty compared to one which used a single word in a commitment (Chapters Two and Three). Thus, different types of social understanding measures and different access to linguistic terms (i.e., lexicon levels vs. differential certainty) can be ruled out for the developmental shift of the acquisition of the suffixes as shown in Table 7.1. Next, the influences of the suffixes used in the current study will be explored as a source for the different patterns of exercising two types of social understanding.

Regarding the epistemic meanings of Korean suffixes, research has shown that young children acquire the markers gradually (Choi, 1991, 1995). That is, a grasp of a speaker's certainty is obtained earlier than suffixes denoting sources of information which are typically called evidentials. Furthermore, there are also remarkable differences in frequency of the use of suffixes in Korean adults. For example, H. Lee (1993) analysed the use of sentence-ending suffixes from five discourses including face-to-face and telephone conversations, letters and informal spoken narratives among Korean adult speakers in terms of implications of the markers on cognitive perception. He found *–ci* (sure) was the second-most frequent suffix, accounting for 15.8%, and *– te* (I saw) was rarely used in adults' conversations with the occurrence of 0.1%. The former marker was used in the first two experiments and the latter was used in the other three experiments of the current study. It seems conceivable that the notable discrepancy of the suffixes in adults as demonstrated in H. Lee's (1993) study may influence young children's acquisition of them. This is because young children's acquisition of epistemic meanings and concepts interacts with caregivers' input frequency of language for mental state terms (Choi, 2006; Meins et al., 2002; Taumoepeau & Ruffman, 2006, 2008).

Hence, Korean children might have not fully mastered the implications of *–te* or other evidential markers such as *–napo* as early as the preschool period as shown in the current work. It is necessary to note the use of the evidential markers in the present study. If children's acquisition of the epistemic suffixes of Korean were strongly constrained by adults' input, this would call into question the use of suffixes of *–te* and *–napo* in the current study because it is possible that children under the age of six might not understand the implications of the markers owing to insufficient access to them. It seems that there is not much research investigating the acquisition of Korean suffixes in young children. However, an available study by Choi (1991) suggested that an indirect evidential marker (i.e., *-tay* (I heard)) was acquired before the age of three and in her study young children's acquisition of suffixes did not solely depend on caregivers' input frequency (see also the Introduction to this thesis for findings of her study). Furthermore, as mentioned above, evidentials would stress the means of how information was obtained. Thus, this is why we speculated that the use of the two evidential markers would be appropriate to the selective trust paradigm in the current study. However, the findings from the three selective trust experiments reported here suggest that an understanding of evidentiality is more difficult to acquire than certainty by suffixes or verb terms. Within this context this shows that the developmental pattern might, to some extent, have been related to the frequency of young children's exposure to each marker and have reflected their understanding of it.

This section discussed children's grasp of the grammaticalized suffixes within Korean and considered factors which might possibly cause differences in their acquisition of social understanding. In summary, advantages of having the grammatically embedded markers for one's epistemic states over the acquisition of social understanding depend upon children's grasp of respective expressions. In other words, an early access to social understanding in Korean children parallels the trajectory of the acquisition of specific suffixes.

7.2. Do Korean children take account of others' epistemic states?

The various verbal sources noted above have been employed in the current work in order to probe whether children demonstrate epistemic understanding. In order to consider the question, I will focus on the findings from the selective trust experiments, as children's adaptation to a person's epistemic state was clearly shown in false beliefs. In the selective trust paradigm, two cues were provided varying in correctness and the degrees of certainty. Differential correctness was displayed with reference to novel labels for objects. Certainty differed according to the forms of mental terms (i.e., evidentiality vs. verbs) used. In the selective learning stage, children were asked to label names of novel objects in which conflicting information was given to the items. In order to respond correctly, the children were required to track speakers' in/accuracy from the familiarization trials. Fundamentally, this selective trust experiment asks the children to distinguish the speakers' correctness. This is compounded with certainty in the current study design. The findings from Chapters Five and Six showed that the children's performance differed according the use of certainty expressions. If children only considered the speakers' accuracy, the age when they begin to show selective trust would be the same. However, the findings showed differences in terms of age of understanding, as mentioned earlier (i.e., 4-years by verbs such as *know* and *think* and 5-6-years by evidential suffixes of *–te* and *–napo*). That is, the findings suggest that children do not rely solely on speakers' differential accuracy but also consider their cues about mental states, indicating within some contexts the children's epistemic understanding about the speakers' knowledge status.

7.3. What is the role of language on social understanding?

One possibility for these findings showing different ages of social understanding is that semantic development may be responsible for their epistemic understanding. In other words, the different trajectories of the development of linguistic markers for mental state terms (i.e., age differences in understanding epistemic expressions), as noted above, may influence children's epistemic learning. Then what is the mechanism for this? How are certainty markers emphasised over word-object links with differential correctness in selective learning? It is conceivable that the SOV (subject-object-verb) structure of Korean might explain the children's performance. Korean is a pro-drop language in which a subject or object is not obligatory (Kim et al., 2000). It is possible that a speaker expresses his/her epistemic state by a verb with the obligatory use in Korean. However, nouns were explicitly mentioned in test statements for the measures of social understanding in order to make speakers' utterances clear in this thesis. For example, differential accuracy was a key factor to assess others' tesimony in selective trust and this accuracy was expressed by nouns (e.g., ball vs. book). Thus, nouns were uttered clearly. SOV is the verb-final structure, and salient information is placed in the sentence-final position (Herring & Paolillo, 1995). An important meaning in Korean is more likely to be posed by a final verb (Lee & Kim, 2009). This structure placing emphasis on the final verb might lead children to considering implications of it.

There is also research showing effects of structures of languages on children's cognitive development (see Chapter One for the relationships between language and social understanding). In their longitudinal studies, Gopnik and her colleagues (Gopnik & Choi, 1990; Gopnik & Meltzoff, 1987) investigated whether children from cultures, in which their languages place emphasis on nouns and verbs differently, would show different patterns of cognitive development. In order to probe this hypothesis, they employed 10 cognitive tasks (see Gopnik & Meltzoff, 1986 for the descriptions of these tasks). The cultures were chosen according to the previous research, showing that English-speaking children tended to acquire nouns before verbs (English – SVO structure) (Gentner, 1982; Goldfield, 1993), while earlier acquisition of verbs was observed in Korean learners compared to English counterparts (Choi & Gopnik, 1995; Kim et al., 2000). They found relationships between the development of semantic awareness and cognitive skills in both English and Korean speakers. For example, there were close relationships between object-concept tasks for finding objects and words for disappearance, and between means-ends tasks for obtaining objects and words for success/failure. However, a clear contrast was found in the studies in terms of linguistic forms that the children produced in order to perform the cognitive tasks. Korean children tended to solve mean-ends problems using verbs, whereas English learners used lexical types such as *no* and *there*. Furthermore, Korean children's categorization/naming performance developed later than English learners. Regarding these findings of different patterns in cognitive tasks, Gopnik and Choi (1990) suggested that Korean children's use of verbs in developing concepts is related to a way in which adults use such language. Accordingly, it is conceivable that children learning a language which pays more attention to verbs might lead them to considering the implications of verb forms prominently. This particular feature of the grammar of Korean might have led to young children's epistemic understanding of selectivity although this possibility should be taken with caution as the current study did not make a comparison with children from a different language structure. That is, it seems that Korean children's early understanding of epistemic meanings as shown in Chapter Two of the current study and the previous research (e.g, Choi, 1991) might stem from the syntactic structure of Korean in which the use of sentence-ending suffixes is obligatory. Meanwhile, a grasp of these suffixes is also crucial for more general conceptual understanding and particular forms of epistemic markers emerge at different times. Taken together, the findings in selective trust and false beliefs suggest and support the view that the development of syntax and semantics renders children's mentalistic understanding (Astington & Baird, 2005; Milligan et al., 2007).

7.4. Is there a relation between language structure and executive function?

One of the intriguing findings of the current study is that predictive effects of executive function have been shown to differ according to linguistic markers used in the selective trust paradigm. It appears that executive functioning was required less when speakers' utterances were conveyed by the grammaticalized form (i.e., evidentiality) compared with expressions which are not related to the grammar (i.e., belief verbs) in Chapter Six. Different properties of executive skills were also observed in relation to the ability to make judgments. The findings seem to indicate that the process of evidentiality, which involves identifying sources of knowledge, might require less effortful work of executive function than mental-verb terms. One possible explanation for this might consist in the nature of evidentiality which involves the specification of the origin of sources. It seems plausible that evidentials might help in reducing errors in memory and are supportive for longer-term memory of the sources (Aksu-Koç et al., 2009; Aydin & Ceci, 2009). Aksu-Koç et al. (2009) reported findings from Ögel's (2007) study which showed a significant association between the linguistic ability to use a reportative evidential marker and the ability to recall source memory a week later (i.e., to identify a person from whom children acquired information) in Turkish children aged three to six. They concluded that the use of evidential markers had promoting effects on correct retrieval supporting memory for mental representations. The research on children's suggestibility by Aydin and Ceci (2009) seems relevant to this point of view (see also the section 1.4 in the Introduction of this thesis for detail). They found that children who were exposed to a direct evidential marker were more sensitive to misinformation or misleading questions.

The research on evidentiality listed above seems to suggest that children whose language involves evidentiality may hold a more accurate memory about events. The findings of the current study are consistent with the point of the view suggested above. In Chapter Six, when evidential markers were used working memory was also required for children to judge speakers' reliability. However, the subcomponents (i.e., phonological or visual short-term memory) activated for judgment were different from the use of linguistic markers. Working memory, which integrates visual and spatial information, was not strongly activated when evidentiality was the means of communication, possibly as the evidential markers involve such sense. Taken together, it seems conceivable that when children process evidential languages, the origins of information are taken as given; therefore, evidentiality may reduce the executive demands. Hence, it seems possible to contend that there are effects of the language structure on executive function.

7.5. Limitations of this work

This thesis set out to investigate whether language-specificity plays a role in the social-cognitive development of Korean children. The findings revealed effects of the language structure. However, it was only possible to draw a conclusion regarding the effects with certain limitations. The first limitation is that an early grasp of grammaticalized certainty/uncertainty markers, as in Chapters Two and Three, and its relationship to social understanding are not compared with other linguistic references within and across languages. With regard to young children's social understanding, predominantly based on false beliefs, the language terms under investigation have focused on words for mental states such as *know* and *think* (Astington & Baird, 2005; Carpendale & Lewis, 2004). The role of such expressions has been claimed to be intertwined with children's theory of mind, as the emergence of both abilities is closely linked (Milligan et al., 2007; Wellman et al., 2001). Based upon such tendencies and 3-year-olds' adoption of Korean un/certainty expressions in the current study, Chapters Two and Three suggested a facilitative effect on an understanding of beliefs. However, the marker for certainty *–ci* used in this thesis does not translate into *know*, as described in the Introduction to Chapter Two. Furthermore, there seems to be no research on social understanding using other un/certainty expressions apart from the words mentioned above from English speaking children, in particular. Therefore, it is unclear whether young Korean children's social understanding was improved as a result of the use of suffixes or by the familiarity of belief verbs such as *know* and *think*. This limitation leads to a need for future research to conduct comparative studies on various linguistic expressions within and across language.

The next point that needs to be considered is how well the assumption about demands of executive function in language processing could be explained. This thesis suggested that the specific features of Korean might require fewer demands in executive functioning, as listeners could hold information in mind from the evidentiality that they hear, based on the relation between selective trust with different linguistic markers and executive function. However, it is not clear as to whether there are different mechanisms for processing the linguistic markers by evidentials or verbs. Therefore, future research would require more systematic explanations to interpret the load of executive function in processing of languages.

Another limitation of this thesis is that, from the findings in executive function, it might be impetuous to support the view that Korean children develop a precocious skill in inhibitory control, because only one inhibitory task, Day/Night, was used in Chapters Two and Three. Two tasks, Day/Night and Simon Says, were used in Chapter Six and levels of performance between the two tasks showed inconsistency. Furthermore, it has commonly been described that the Day/Night task is a measure for inhibiting responses to perceptual information, while Simon Says involves behavioural inhibition (Montgomery & Koeltzow, 2010). Thus, it is not clear whether different levels of inhibition, which were relatively advanced in Day/Night and comparable in Simon Says to Western children, stemmed from the different nature of such tasks. Thus, more research with tasks including perceptual responses and behavioural inhibition would help in evaluating Korean children's inhibitory skills.

7.6. Directions for future research

As mentioned in the brief limitations of the work, comparison with linguistic expressions for mental states which are not grammatically embedded may enrich the previously published research regarding the association between language and the development of social understanding (Astington & Baird, 2005). Such comparative studies may also allow us to capture whether the specific from which is determined by the grammar in a particular language is responsible for the developmental pattern in the grasp of mental state terms found in the current work.

Researchers have hypothesised a developmental link between social understanding and executive function, as both cognitive skills require activation of the same brain structure within the prefrontal cortex (Ozonoff, Pennington, & Rogers, 1991; Perner & Lang, 1999). Recently, the use of the common brain region in processing language such as sentence comprehension, word production and executive function has been suggested (e.g., Ye & Zhou, 2009). Thus, it is possible that investigations into brain activation in processing differential linguistic markers would provide evidence whether they require different executive skills or certainty/evidentiality by suffixes reduces executive demands (Matsui et al., 2009; Robinson, 2009).

Lastly, a wide range of executive tasks would be required to understand young children's performance on the skills and regarding the link with social understanding. It would be helpful to include not only inhibitory control tasks as mentioned earlier, but also more working memory and set sifting tasks. For example, the backward span tasks in Chapter Six did not reveal, or enable me to assess, 3-year-olds' memory capacity. As discussed in Chapter Six, it seems that there might be a methodological issue in assessing children's set shifting ability from an advanced DCCS task. Thus, the use of the veracious tasks would help clarifying not only the link between social understanding and executive function but also Korean children's individual differences in such abilities.

7.7. Summary and Contributions

Korean preschoolers aged 3-6-years old (N = 462) were examined in order to investigate whether their adoption of speakers' epistemic states was supported by linguistic references. The findings suggest that facilitative effects of the grammaticalized form of certainty/evidentiality are not always observed regarding mental state awareness in the children. The trajectories of their understanding of particular social-cognitive skills are more closely related to their acquisition of linguistic references. This work encompassed the previous findings which stimulated debates about an early grasp of mental states being facilitated by the grammatically embedded form of certainty/evidentiality. In particular, it seems that research with Korean children has not provided sufficient data, as one accessible source was based on spontaneous speech of young children (e.g., Choi, 1991), while the other employed a more complex mechanism to suppose the effects of the language-specific structure (e.g., Papafragou et al., 2007). However, this work focused on the use of Korean suffixes in the frame of the contexts of social understanding. Consequently, an insight into the developmental trends of linguistic references could be investigated in Korean children. The findings from the five experiments suggest that children's ability to understand evidentiality emerges in a piecemeal way around 5-6 years of age (see Table 7.1). However, children also learn about certainty from the suffixes that have been examined in this thesis as young as the age of three and their initial understanding of the linguistic markings leads to their acquisition of beliefs in some contexts. Taken as a whole the studies presented here show that children's acquisition of epistemic markers shows a developmental shift from certainty to evidentiality within the two types of social understanding measures studied here. Preschoolers' grasp of another's epistemic states depends on their access to linguistic references. The language expressions in Korean which refer to mental states and are used in test questions in the measures may mediate children's acquisition of social-cognitive understanding. In summary, the mastery of the language structure and semantics is crucial for children's social-cognitive understanding.

Appendix [Figure of Data Distribution]

Experiment 1

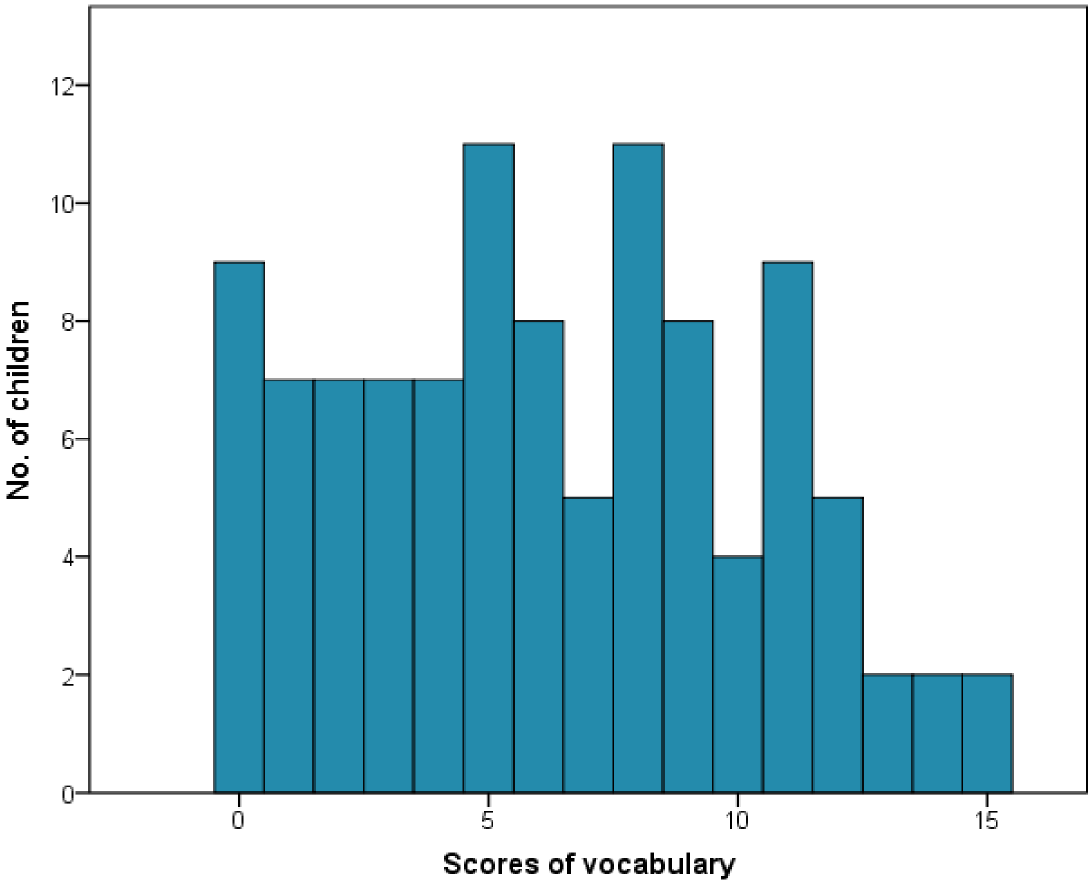

Figure A.1. The distribution of the scores of Vocabulary.

The two scores (i.e., 5 and 8) were the most frequently obtained by each 11 children. The scores accounted for 21.2%.

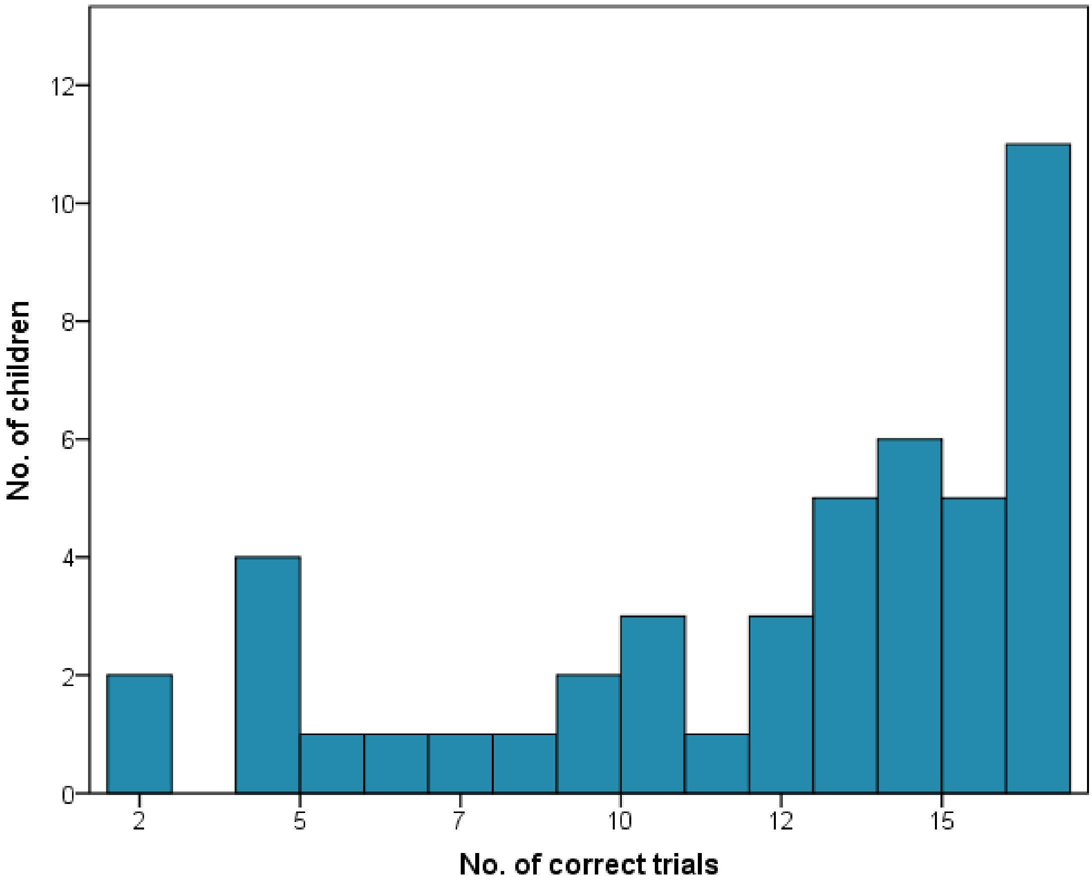

Figure A.2. The distribution of correct responses on the test trials of the Day/Night task.

In the Day/Night task, 30 children correctly responded more than 12 out 16 trials which accounted for 65.2%.

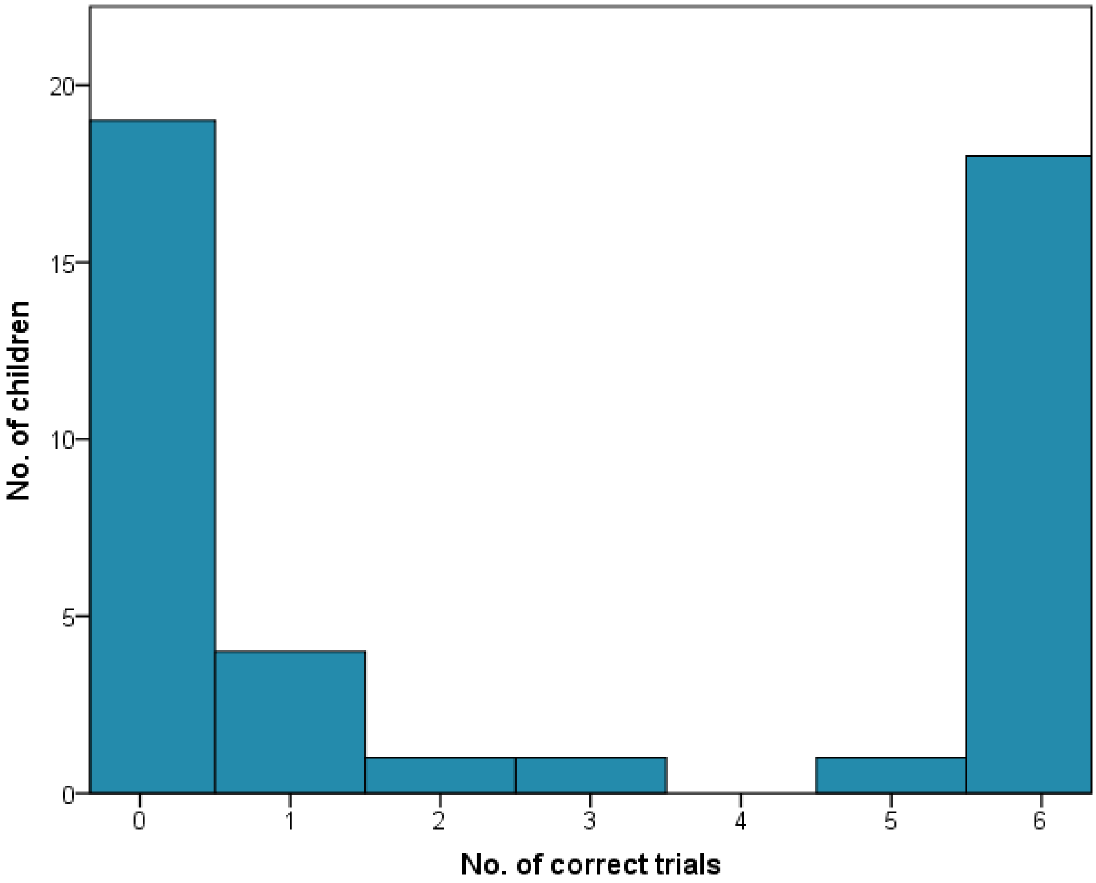

Figure A.3. The distribution of numbers of cards sorted correctly on the Dimensional Change Card Sort (DCCS) task.

In the task, 19 out of 25 three-year-olds passed the post-switch trials accounting for 43.2%.

Experiment 2

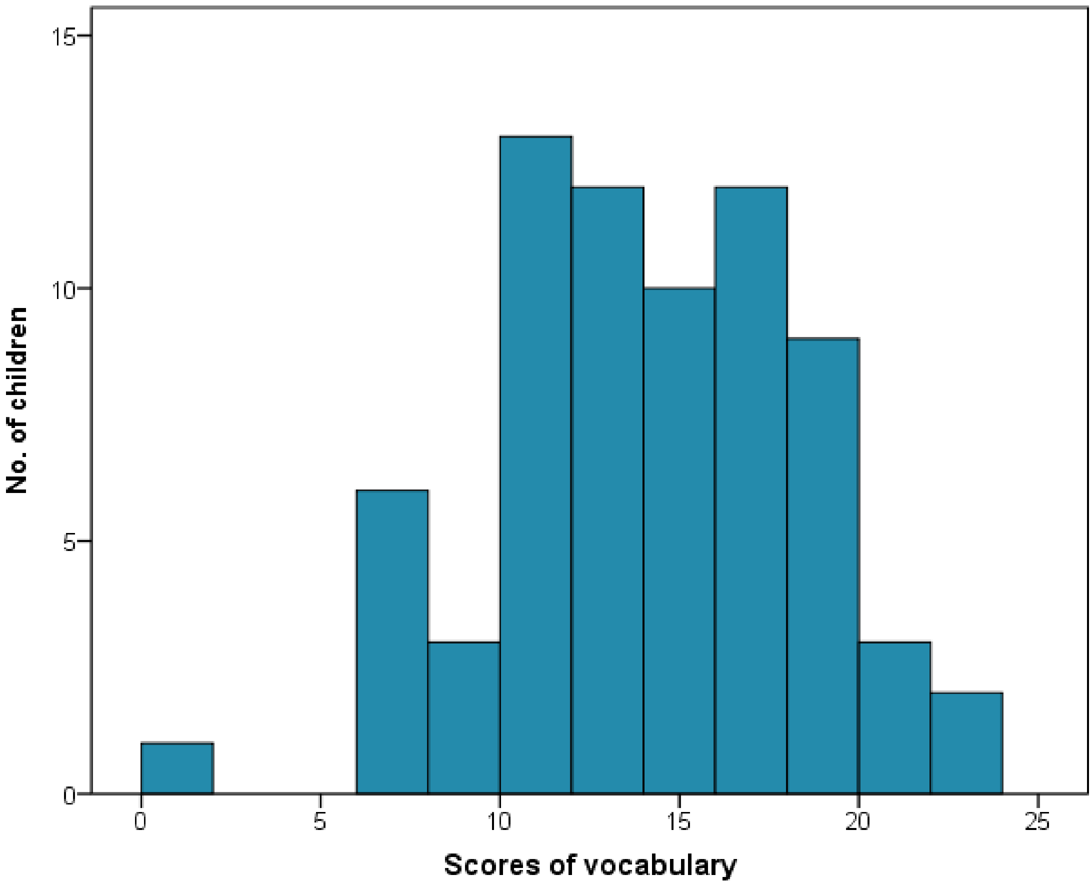

Figure A.4. The distribution of the scores of Vocabulary.

One 4-year-old showed the lowest score (i.e., 1 point) on the vocabulary task. Two children obtained the highest score 23 out of 27 scores. Eleven and 12 were most frequently obtained scores by even-teen children (24%).

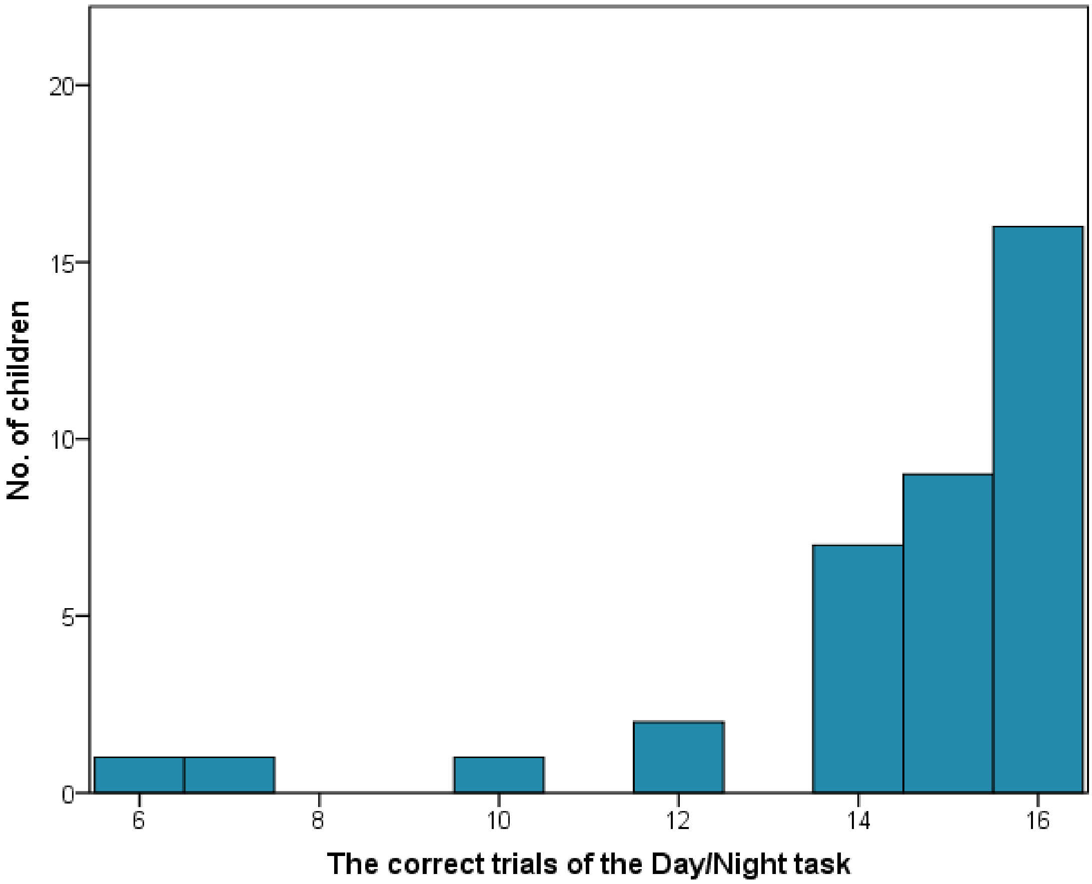

Figure A.5. The distribution of correct responses on the Day/Night task.

Sixteen out of 37 children (43.2%) responded correctly 16 out 16 trials. In total, 91.9% (34 out of 37 children) passed the task. Children who did not pass the task were 4-year-olds.

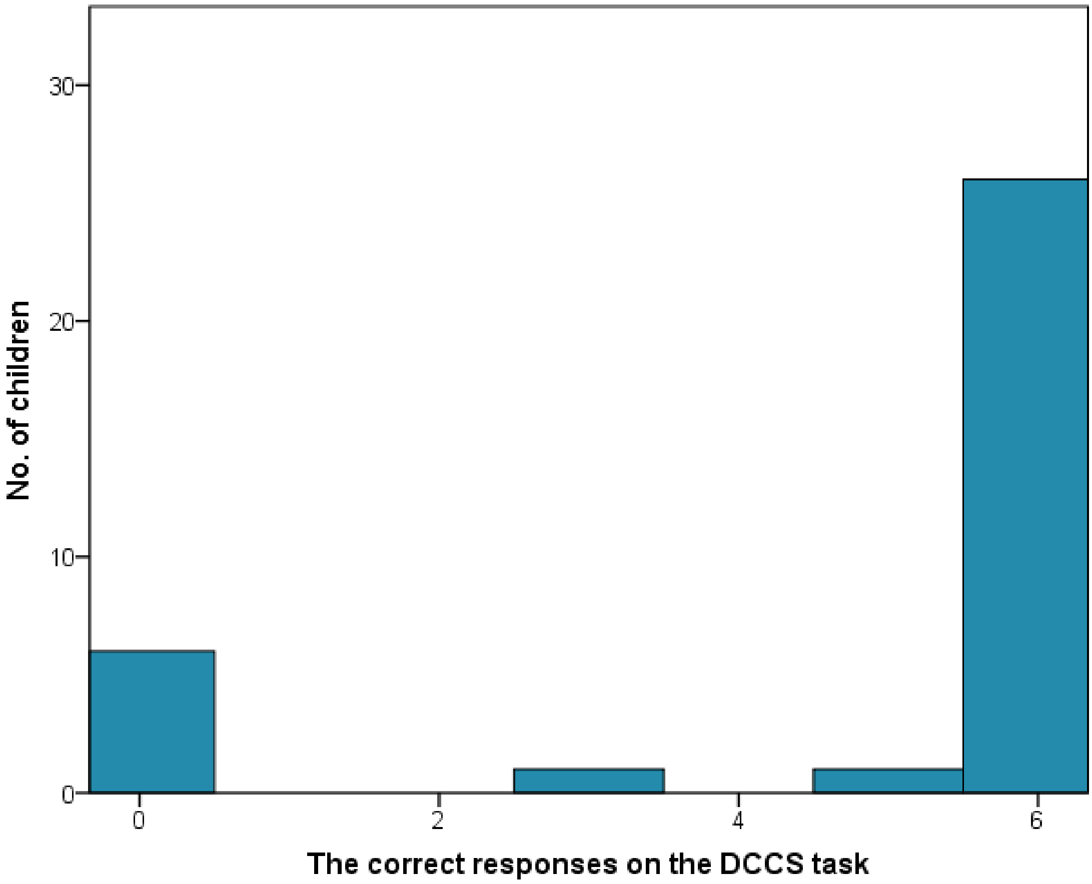

Figure A.6. The distribution of the cards sorted correctly on the Dimensional Change Card Sort (DCCS) task.

Twenty-six out of 34 children (76.5%) sorted cards correctly on the post-switch trials in the DCCS task. In total, 79.4% of children passed the task, sorting cards more than 5 out of 6 trials. Six out of 34 children accounting for 8.5% did not respond correctly at least 1 trial.

Experiment 3

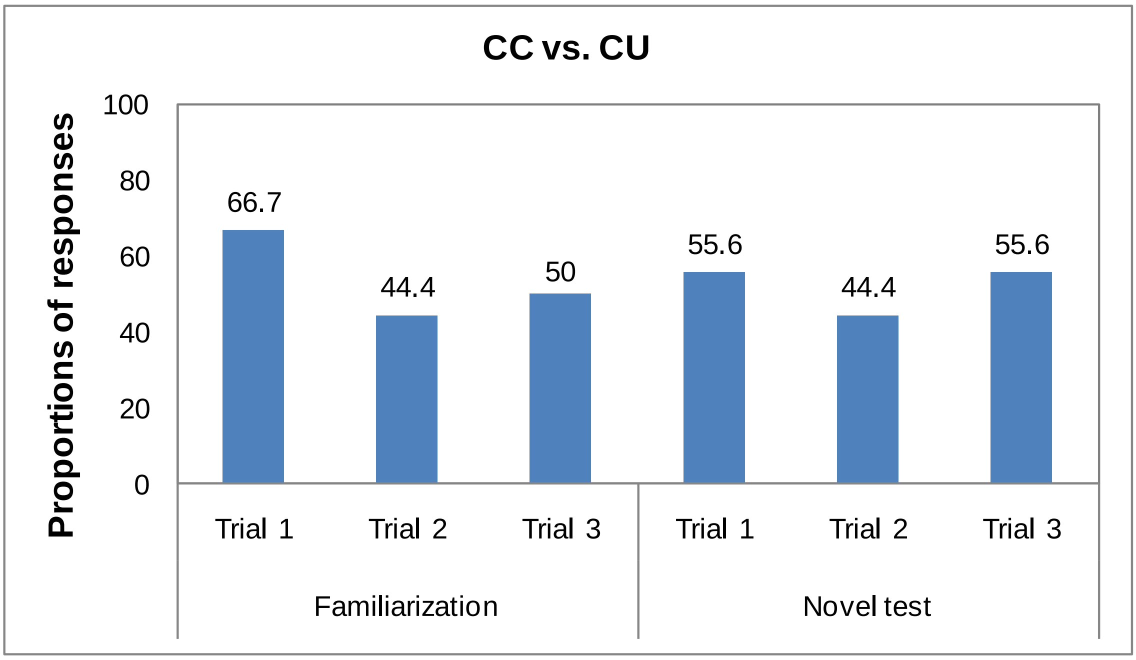

Figure A.7. Responses on the Correct Certain vs. Correct Uncertain (CC vs. CU) type.

Proportions of children who preferred to ask the certain informant for novel objects were shown. The children showed a trend to regard that the certainty expression was relatively reliable on the first question of familiarization (p = .065). However, the rest of the trials indicate that they seemed to guess between the two expressions.

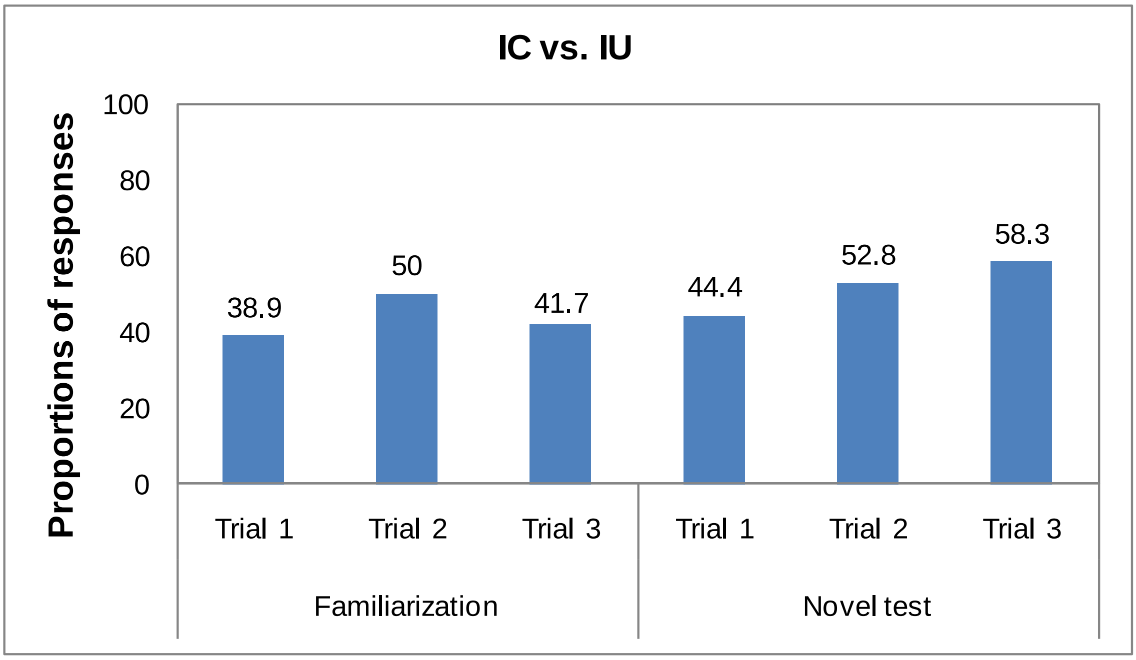

Figure A.8. Responses on the Incorrect Certain vs. Incorrect Uncertain (IC vs. IU) type.

Proportions of children who chose the incorrect uncertain speaker for information about novel objects were shown. Performance on each trial was all at-chance levels. Although the children responded randomly on all trials, it seems that the increased performance over the novel test trials might imply that they tended to consider the meaning of the uncertainty marker over tests.

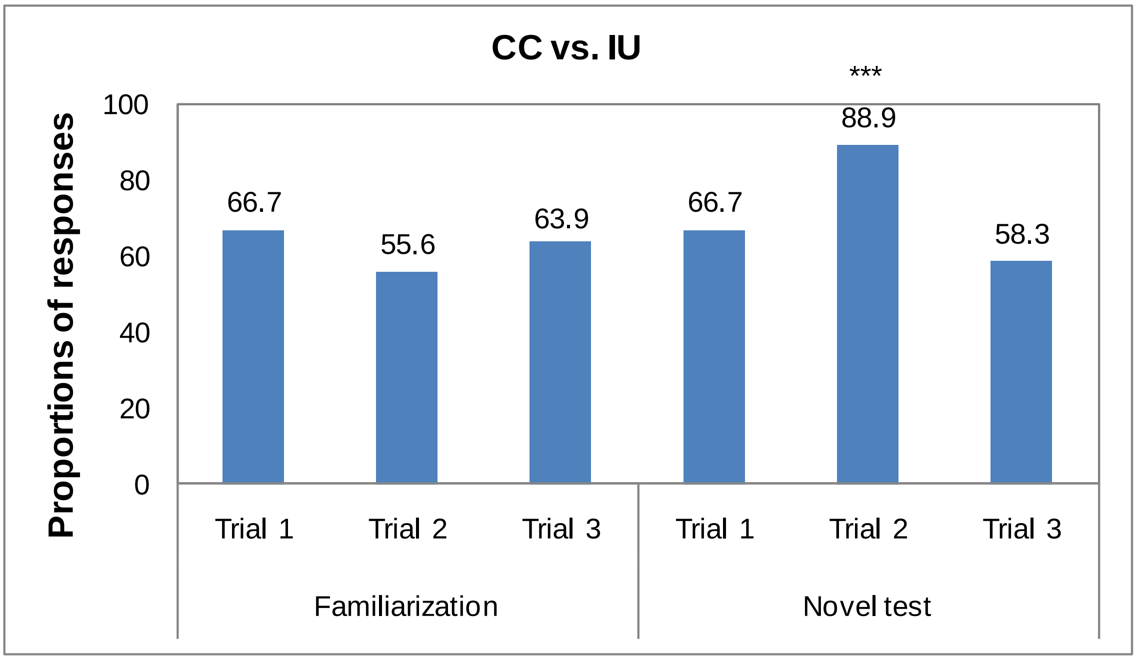

Figure A.9. Responses on the Correct Certain vs. Incorrect Uncertain type (CC vs. IU).

$^{***}p < .001$.

Children showed a tendency to consider the correct certain informant reliable in the correct certain vs. incorrect uncertain type. In particular, performance on the trial 2 of the novel test was above chance, $p < .001$. On other trials, performance remained at chance.

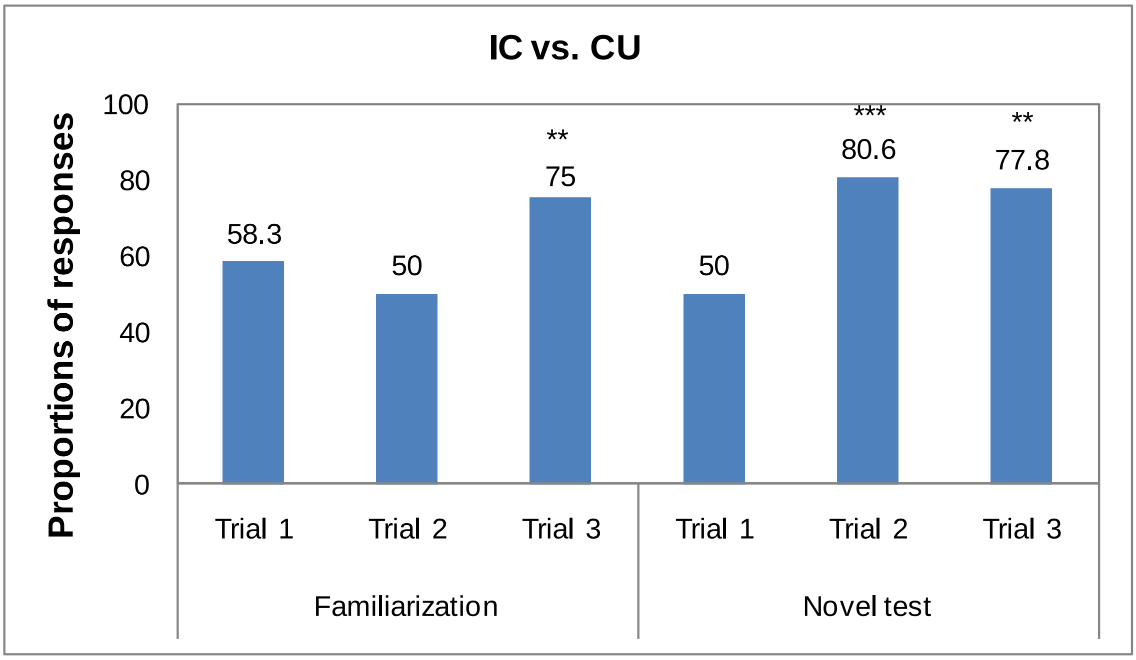

Figure A.10. Responses on the Incorrect Certain vs. Correct Uncertain (IC vs. CU) type. $^{**}p < .01$. $^{***}p < .001$.

Performance on the incorrect certain vs. correct uncertain task showed that the children endorsed the names of the novel objects provided by a previously correct informant although she was uncertain. On the familiarization trials, the children performed on the third trial at above-chance levels, $p = .004$. On the novel test trials, their performance on the second and third trials were above chance, $p < .001$ and $p = .001$, respectively. They showed at-chance performance on the other two and another trial of familiarization and novel test trials, respectively.

Experiment 4

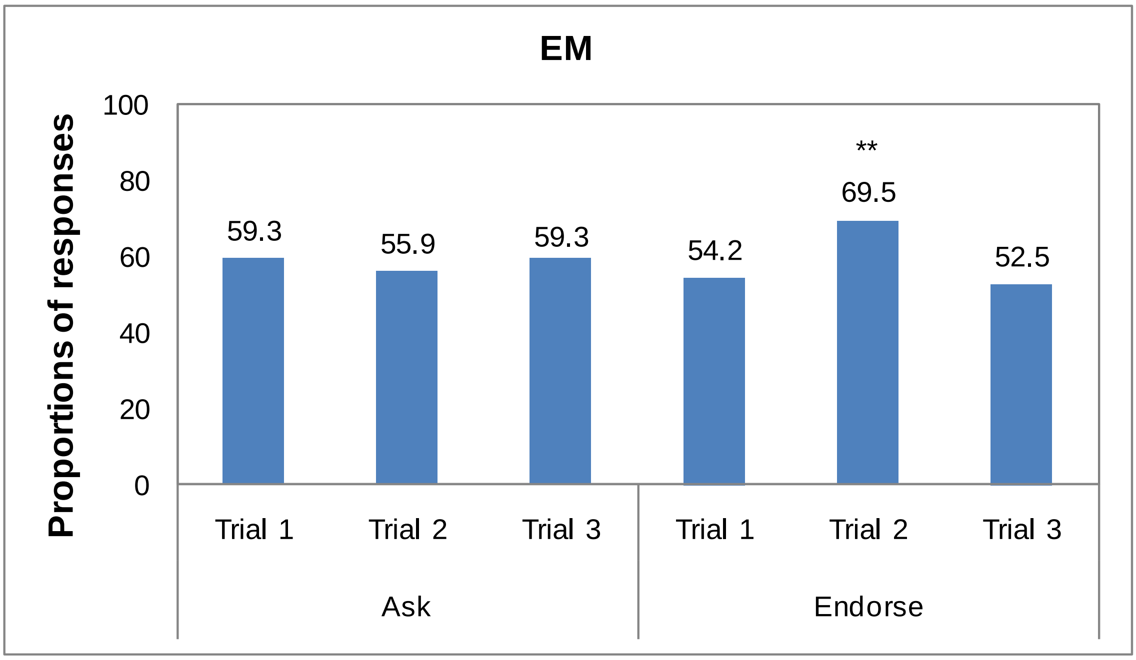

Figure A.11. Responses on the Ask and Endorse questions in the Evidential Markers (EM) task.

**p < .01.

Binomial tests on each trial on both Ask and Endorse questions in the EM (evidential markers) task showed that children tended to respond randomly on either seeking information or learning new words apart from the second trial of the Endorse question which was above chance, $p = .004$.

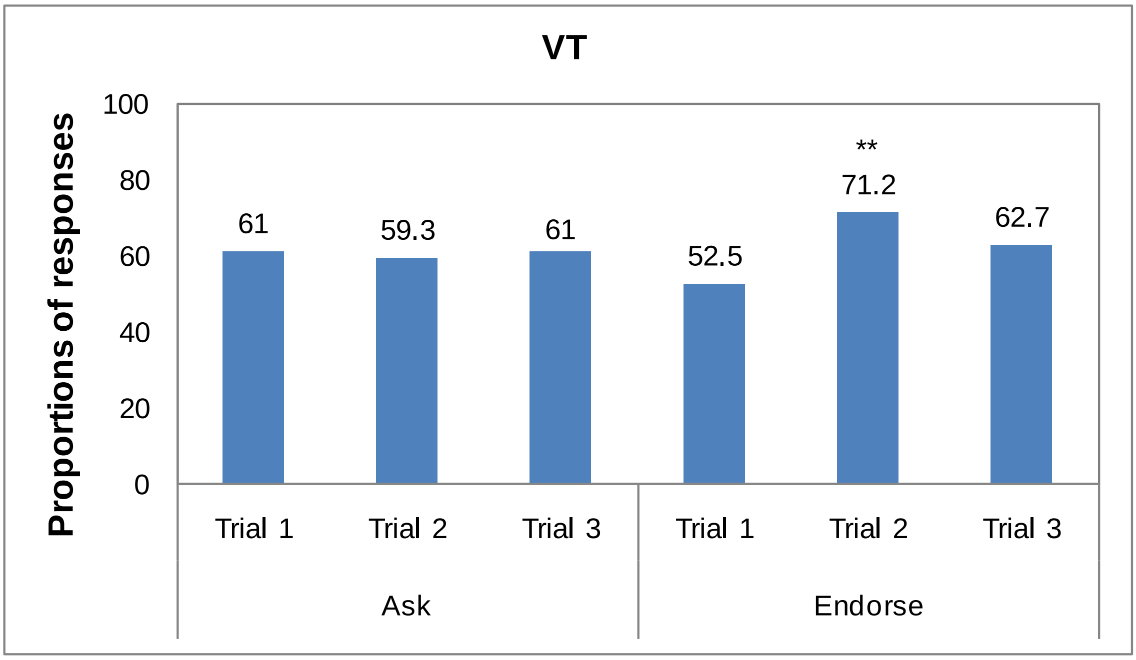

Figure A.12. Responses on the Ask and Endorse questions in the Verb Terms (VT) task.

$^{**}p < .01$.

Performance by binomial tests on each trial on the Ask and Endorse questions in the VT (verb terms) task indicate that children were less likely to be sensitive to speakers' accuracy and certainty by mental-state verbs as shown in the EM task. Only the second trial of the Endorse questions as above chance, $p = .002$, and 42 out of 59 children put forward the novel name after a correct and certain speaker.

Experiment 5

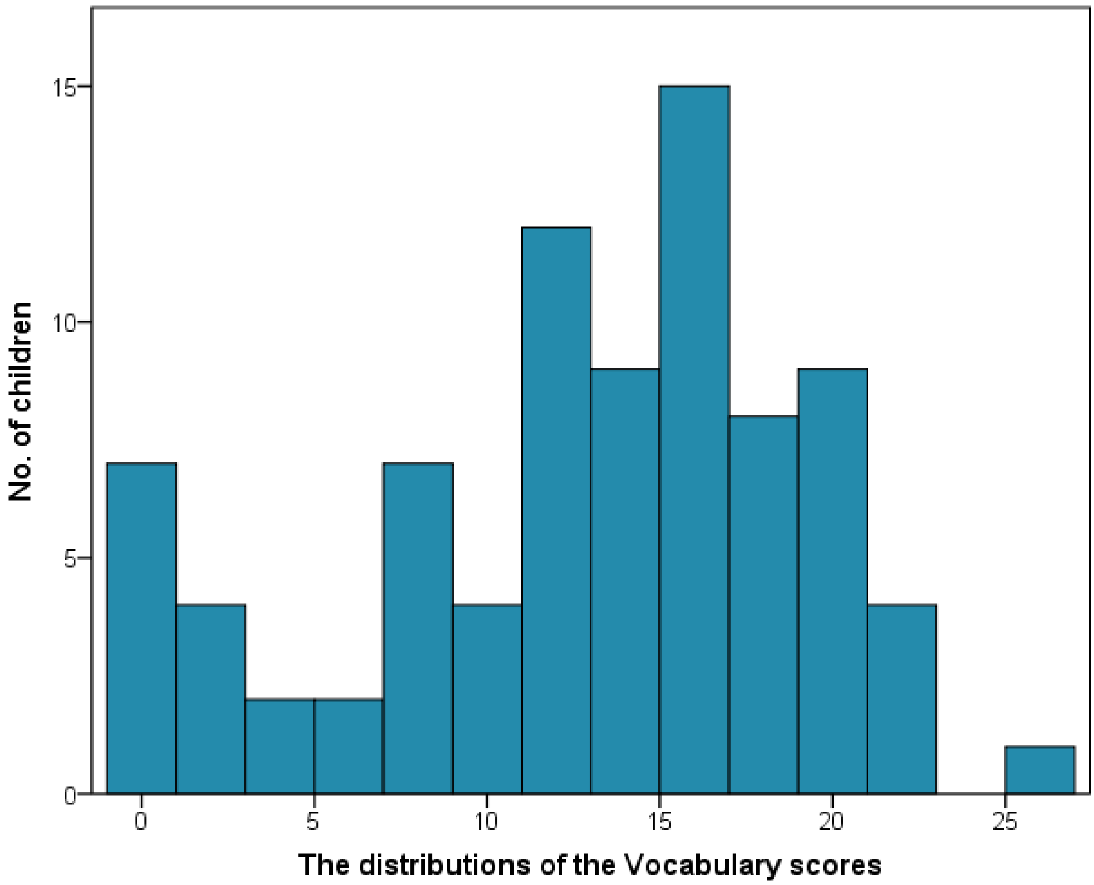

Figure A.13. The distribution of scores of the Vocabulary task.

The most frequently obtained score was 15 accounting for 10.7% of children. Only one child obtained the highest score 26 and seven children received the lowest score 0.

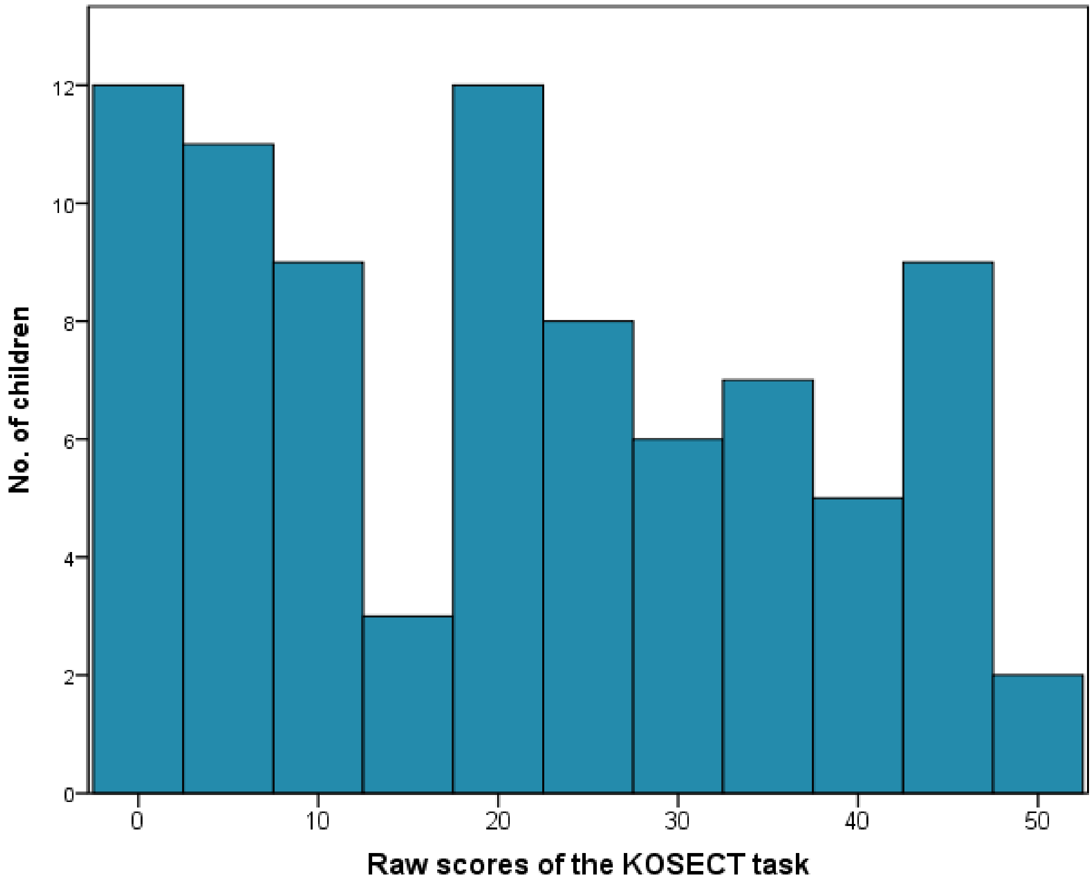

Figure A.14. The distribution of scores on Korean Oral Syntax Expression Comprehension Test (KOSECT) task.

There were 12 children who had scores from 0 to 2 (14.3%). Two children (2.4%) received the highest score of 48.

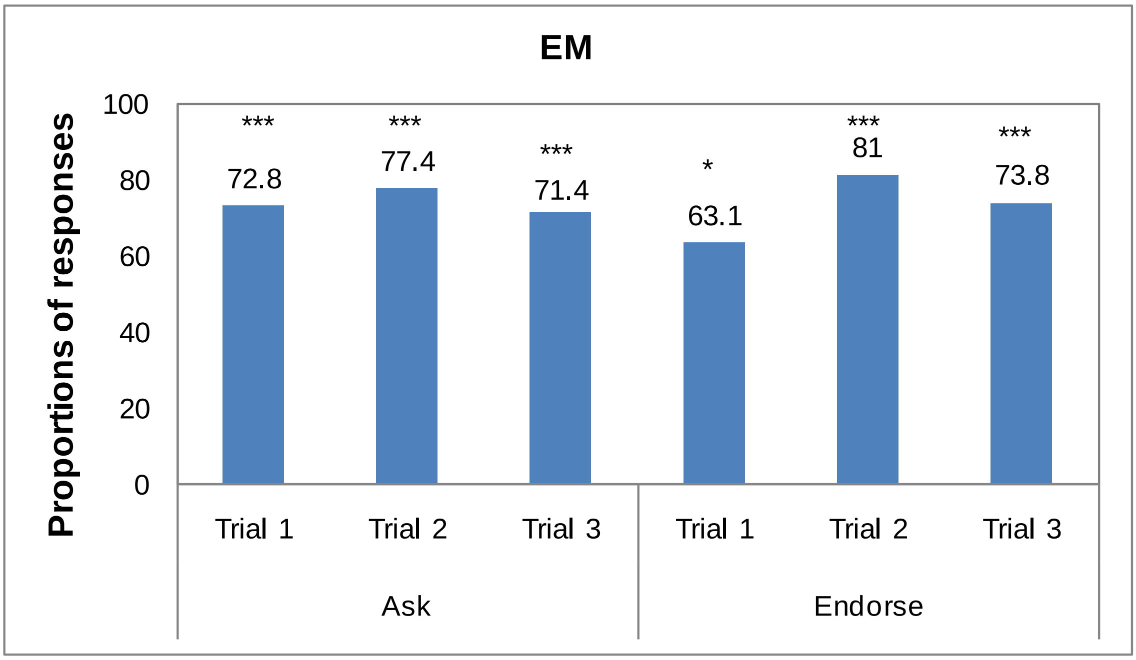

Figure A.15. Responses on the Ask and Endorse questions in the Evidential markers (EM) task.

$^{*}p < .05$. $^{**}p < .001$.

Performance on each Ask and Endorse question in the EM showed that children preferentially requested information and endorsed labels of novel objects at a rate above chance following a previously accurate informant.

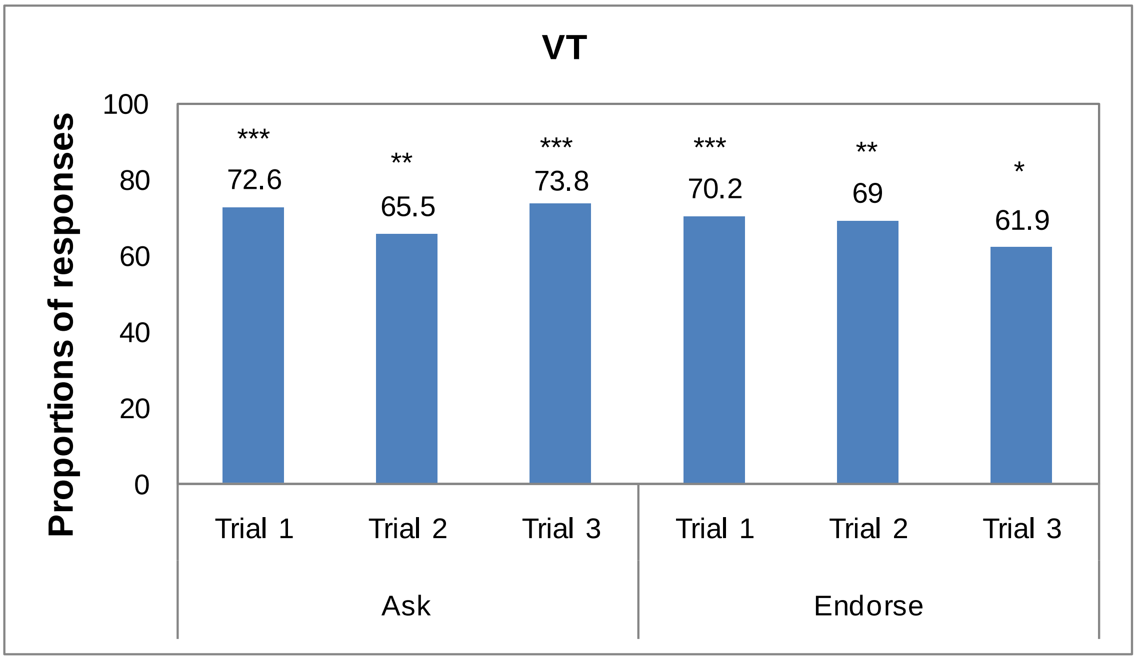

Figure A.16. Responses on the Ask and Endorse questions in the Verb Terms (VT) task.

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Performance on each Ask and Endorse question showed that children across all ages differed from chance levels by binomial tests. That is, when speakers expressed their knowledge state using mental-state verbs, children did not show difficulties in discriminating their reliability.

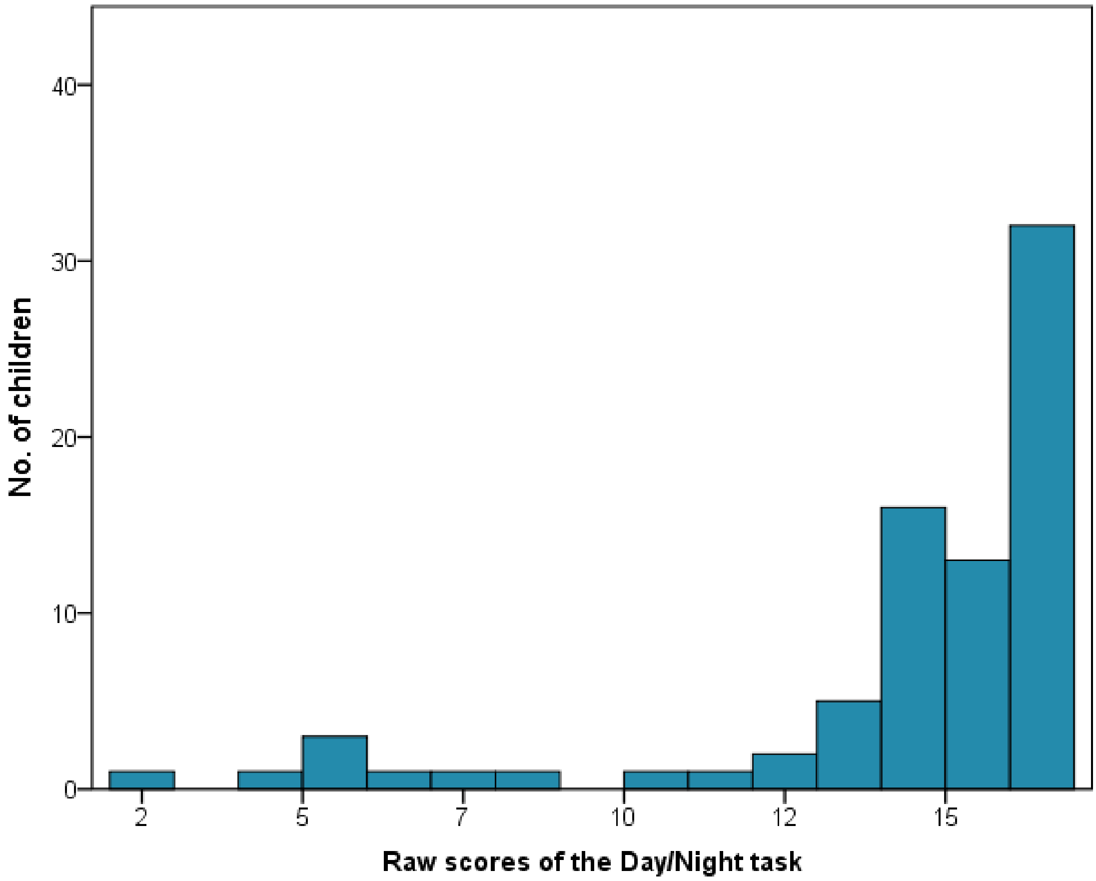

Figure A.17. The distribution of the scores on the Day/Night task.

Thirty-two children (38.1%) responded correctly on 16 trials. Thirteen (15.5%) and 16 children (19%) performed successfully in 15 and 14 out 16 trials. One child (1.2%) showed the worst performance.

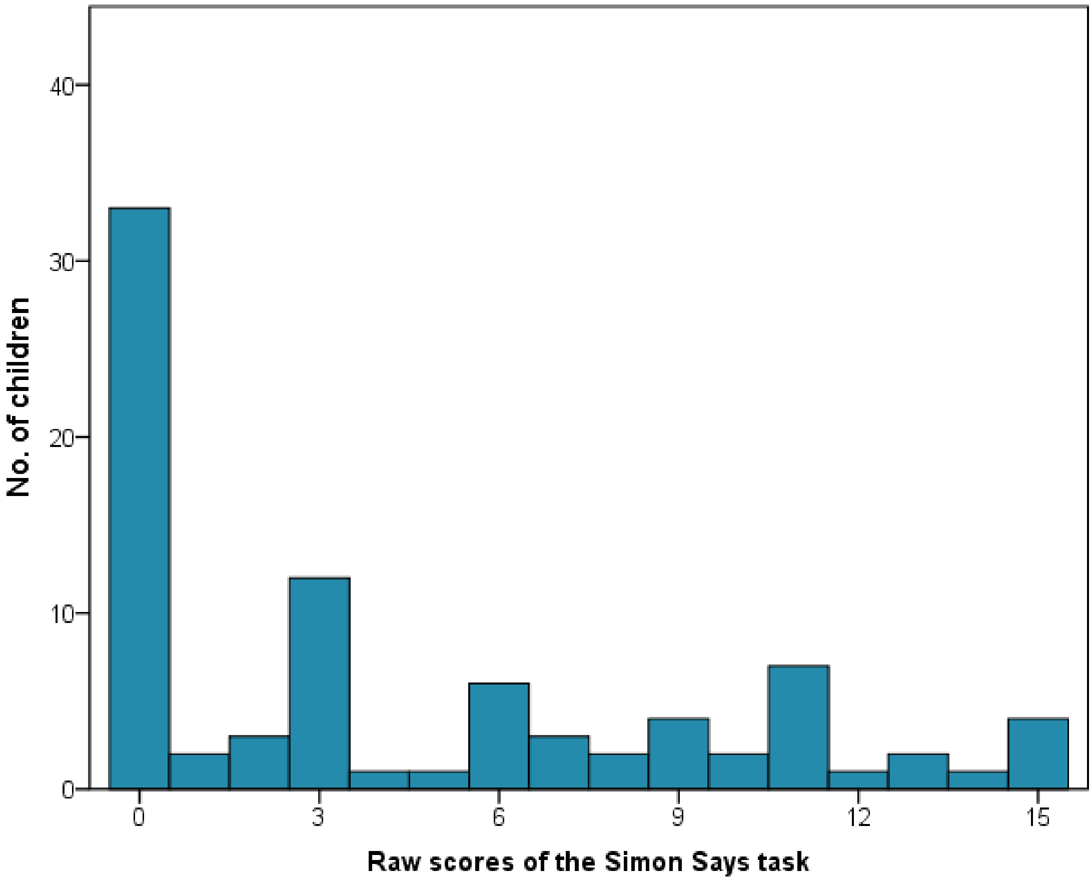

Figure A.18. The distribution of the scores on the anti-imitation trials of the Simon Says task.

More than one third of children (39.3%) did not respond correctly on the five anti-imitation trials. Four children accounting for 4.8% performed successfully on the five trials.

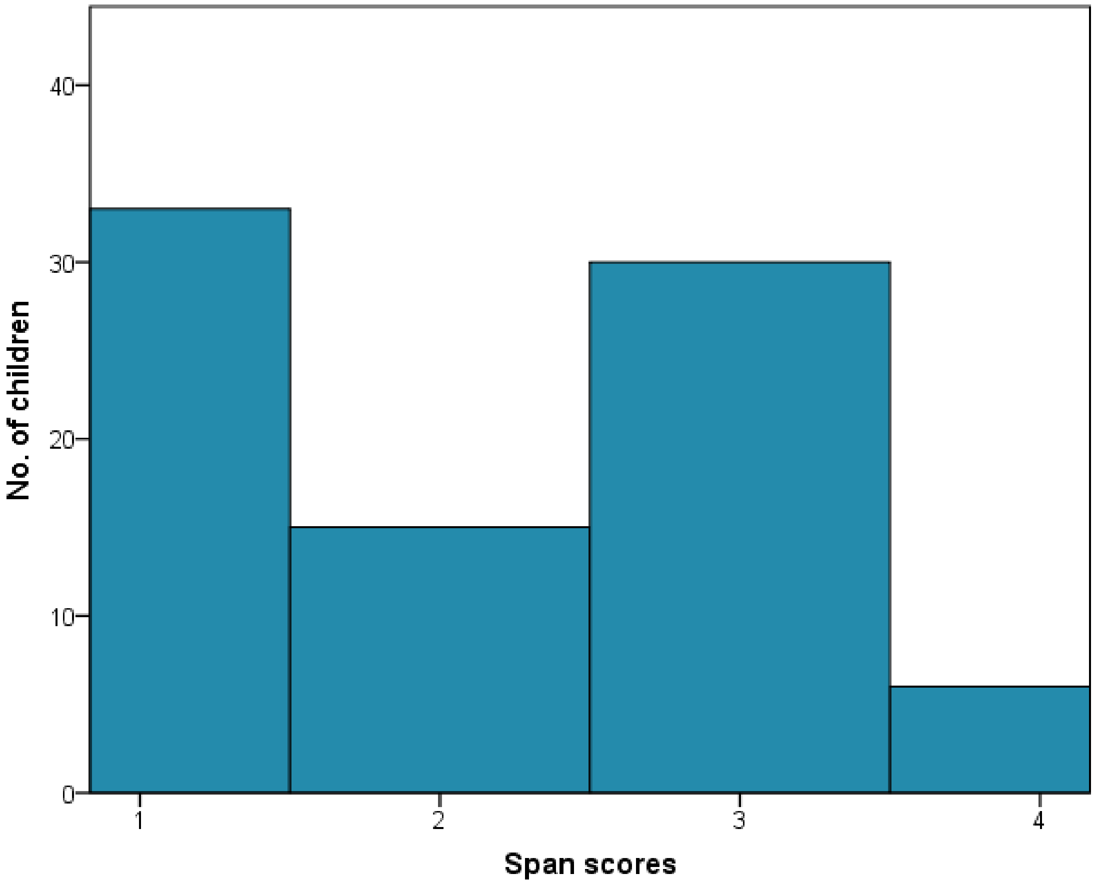

Figure A.19. The distribution of the scores on the Backward Digit Span (BDS) task.

Thirty-three children (39.3%) failed to retrieve 2-digit span, 15 children (17.9%) succeeded 2-digit in reverse order. Thirty (35.7%) and six children (7.1%) recalled the 3- and 4-digit spans, respectively.

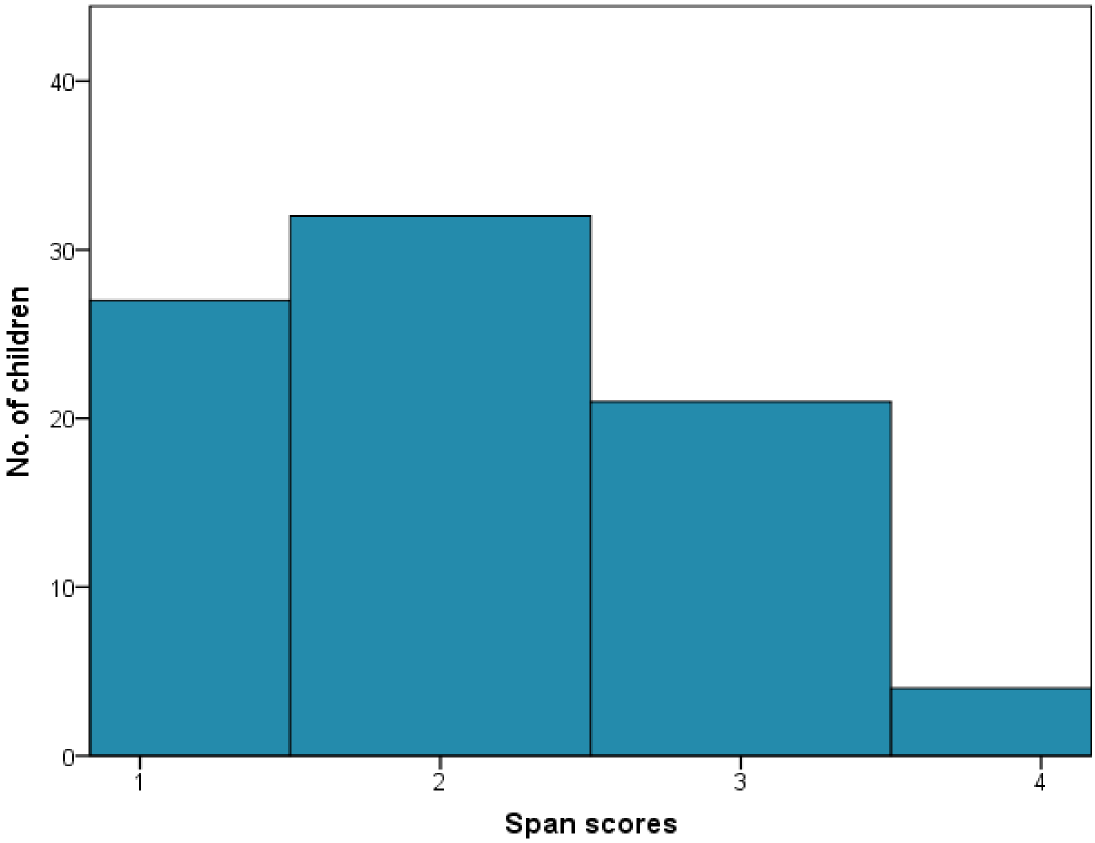

Figure A.20. The distribution of the scores on the Backward Word Span (BWS) task.

Twenty-seven (27 out of 84) children did not perform successfully on the 2 words list. Thirty-two (38.1%), 21 (25%), and 4 (4.8%) children successfully retrieved the 2, 3, and 4 words in reverse order, respectively.

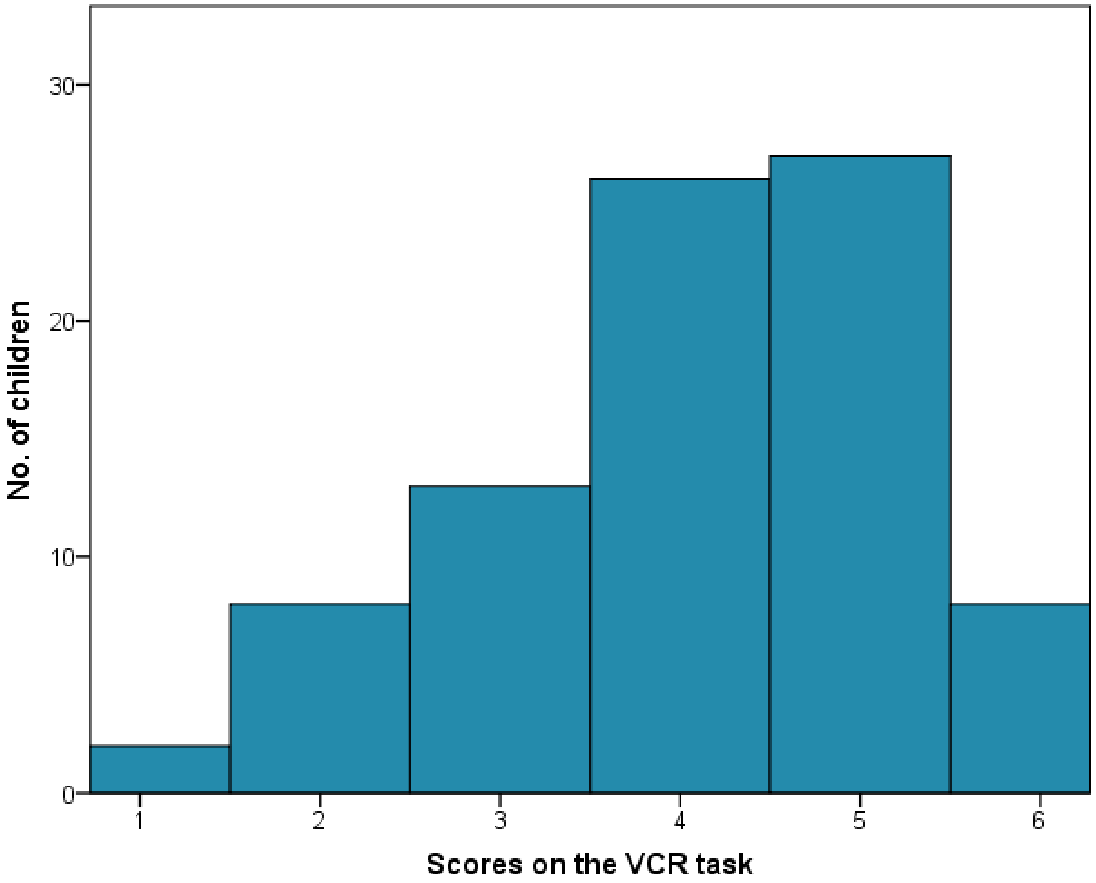

Figure A.21. The distribution of the scores on the Visually Cued Recall (VCR) task.

In the VCR task, two children (2.4%) did not recall the first two items. Five items were most frequently remembered by 27 (out of 84) children (32.1%), and 26 (31%) remembered four items. Eight children (1 4-, 2 5-, and 5 6-year-olds) remembered six items.

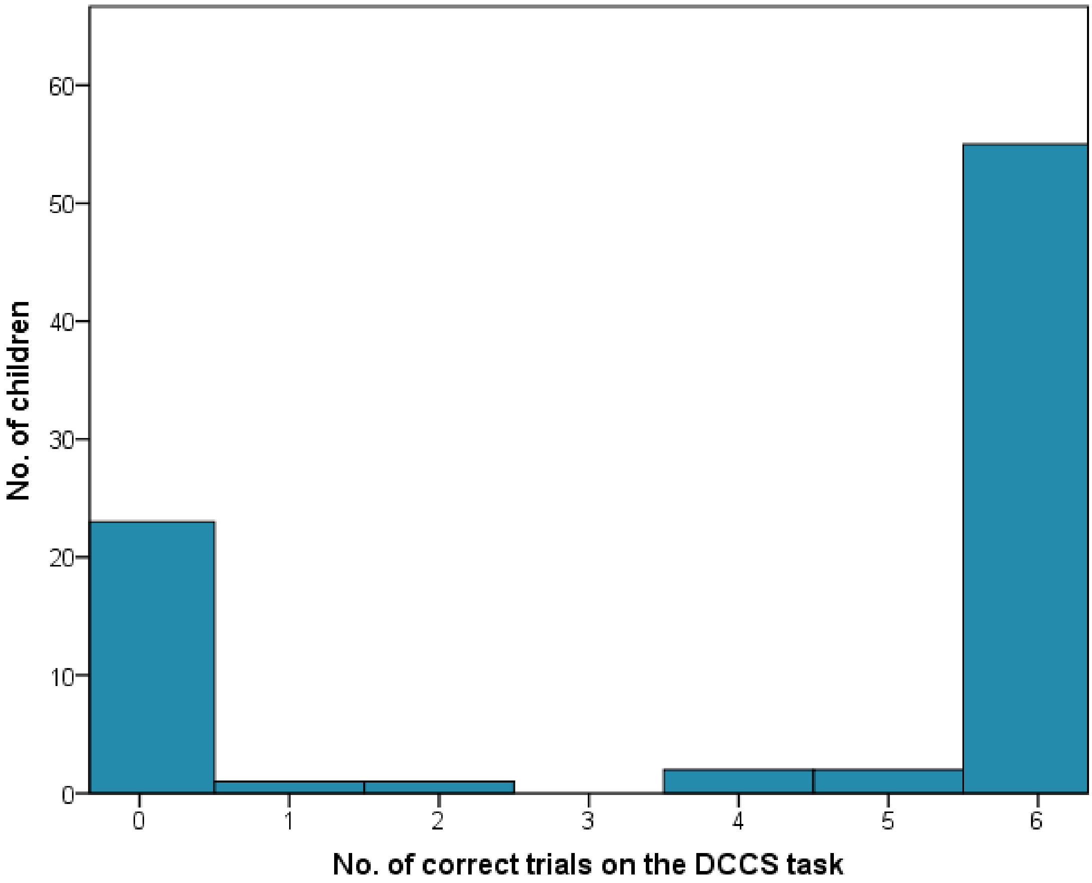

Figure A.22. The distribution of the correct trials on the Dimensional Change Card Sort (DCCS) task.

In the DCCS task, 57 out of 84 children (67.9%) sorted more than five out of six cards correctly on the post-switch trials. Twenty-three (27.4%; 14 3-, 4 4-, and 5 5-year-olds) children made errors sorting correctly none of six trials. Each one child sorted cards in one and two trials correctly, and two children did four trials.

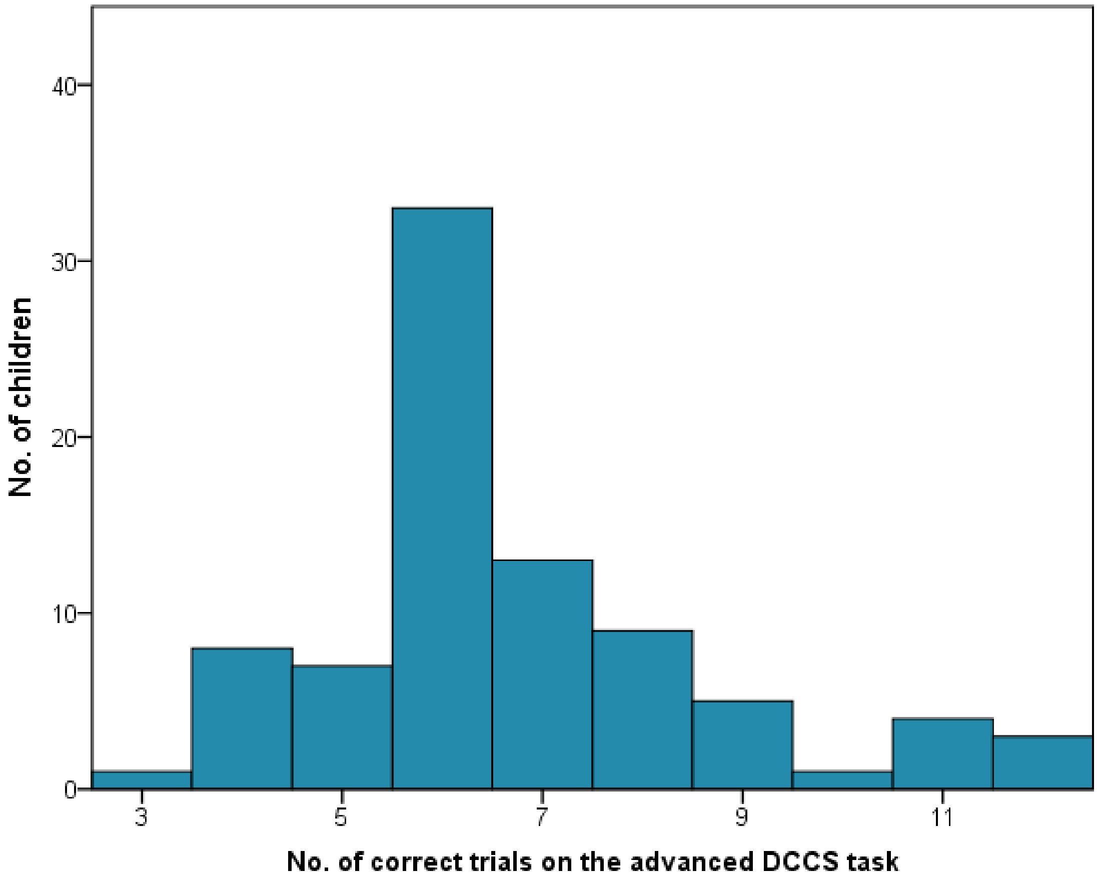

Figure A.23. The distribution of the correct trials on the advanced Dimensional Change Card Sort (DCCS) task.

Thirteen out of 84 children (15.5%) sorted cards correctly on the advanced DCCS task. Six out of 12 trials (69.3%) were the most frequently correctly sorted. Three children (3.6%) performed successfully on the 12 trials.

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