Chapter 4
Method of Study
CHAPTER 4
METHOD OF STUDY

4.1 Sample
A group of 450 children with 150 children in the early childhood years (4 to 6 years of age), middle childhood years (9 to 11 years of age) and late childhood years (14 to 16 years of age) from six Govt. schools located in and around North and South campuses of University of Delhi, Delhi, participated in the study. Initially they were administered Raven’s Progressive Matrices. All the children were found to be in the average or above average IQ range as per the norms of RPM. Out of the 450 children, 180 children were randomly selected for inclusion in the study. Twenty children each in the 4, 5 and 6 year olds respectively from the early childhood group with 32 boys and 28 girls, 18, 28 and 14 children in each of the age groups of 9, 10 and 11 years from the middle childhood group with 35 boys and 25 girls and 32, 16 and 12 children in each of the age groups of 14, 15 and 16 years from the late childhood group with 34 boys and 26 girls in the group are finally included in the study. The mean ages and SDs were 4.05 and 0.02 (4-Years), 5.03 and 0.03 (5-Years), 6.07 and 0.03 (6-Years), 9.06 and 0.02 (9- Years), 10.04 and 0.02 (10- Years), 11.04 and 0.03 (11- Years), 14.03 and 0.02 (14- Years), 15.03 and 0.02 (15- Years), 16.04 and 0.03 (16- Years).

All children belonged to middle socio-economic status and the mother tongue of all the participants was Hindi. The education of the parents of the participating children was graduation and above and they lived in Govt. approved residential colonies of Delhi. Either parent of the participating child was a central government employee with comparable pay parity with other employees in the colony.
4.2 Measures

The following tests/tasks were administered for assessing IQ, Laterality Quotient (LQ), Mental State Reasoning (MSR), Social Reasoning (SR), and Emotional Reasoning (ER) of the participants (see Table 1).

Table 1. Summary of Measures for Early, Middle and Late Childhood Groups

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Early Childhood (4-6 Years)</th>
<th>Middle Childhood (9-11 Years)</th>
<th>Late Childhood (14-16 Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Side-Bias Measures (Limb Development)</td>
<td>Side-Bias Measures (Limb and Sensory Development)</td>
<td>Side-Bias Measures (Limb and Sensory Development)</td>
</tr>
<tr>
<td>3.</td>
<td>False-Belief Task (First-order)</td>
<td>False-Belief Task (First-, Second-, and Third-order)</td>
<td>False-Belief Task (First-, Second-, and Third-order)</td>
</tr>
<tr>
<td>4.</td>
<td>Social Reasoning (Deception)</td>
<td>Social Reasoning (Lie, White Lie, Misunderstanding, Sarcasm, Persuasion, Contrary Emotion, Joke, Figure of Speech, Double-Bluff and Appearance-Reality)</td>
<td>Social Reasoning (Lie, White Lie, Misunderstanding, Sarcasm, Persuasion, Contrary Emotion, Joke, Figure of Speech, Double-Bluff and Appearance-Reality)</td>
</tr>
</tbody>
</table>

Raven’s Progressive Matrices - Raven’s Progressive Matrices (RPM), first introduced in 1938 is a nonverbal test of inductive reasoning based on figural stimuli (Raven, Court, & Raven, 1986). To correctly answer items on the RPM, examinees must identify a recurring pattern of relationship between figural stimuli organized in a matrix. The items are arranged in progressive order of difficulty. RPM has three forms: Colored Progressive Matrices (CPM), Standard Progressive Matrices (SPM) and Advanced Progressive Matrices (APM). The CPM and SPM were used in the present study; the CPM was used for 4-6 year old children and SPM was used for 9-
11 year and 14-16 year old children. The CPM is a 36-item test grouped under three sets and designed for children aged 5 to 11 years. Raven incorporated colors into this version of the test with an intent to hold the attention of young children. For the CPM, split-half reliabilities vary from .65 to .94 (Raven et al., 1986). For the SPM, a typical split-half reliability is .86, although lower values are found with younger subjects (Raven, Court & Raven, 1983). The SPM is a 60-item test grouped into 5 sets of 12 progressively difficult items, each arranged in the form of a matrix. The APM is similar to the standard version, but has a higher ceiling and is for persons of superior intellect.

**Side Bias Measures** - Side Bias Measures (Mandal, Pandey, Singh & Asthana, 1992 a; Mandal, Asthana, Madan & Pandey, 1992 b) is a 45-item questionnaire that contains questions related to the preferential use or side dominance of long limbs and sense organs. There are 35 questions related to the preferential use of hand (writing, eating, throwing a ball, using scissors, threading a needle, sorting cards etc.), and foot (kicking a ball, stepping on a bug, foot extended to get into bus/train etc) and 5 questions each related to the preferential use of eyes (looking through a telescope, snapping a photograph etc.), and ears (listening to whisper, listening a musical tone etc.) respectively in various activities. For each item, there is a choice of five possible alternatives e.g., “Always Left (1)”, “Usually Left (2)”, “Equally Both (3)”, “Usually Right (4)”, and “Always Right (5)”. For the early childhood group, only 35 items of the questionnaire (Limb Development Measure) meant for measuring side dominance of hand and foot were used, while the entire questionnaire (Limb Development and Sensory) was used for middle and late childhood group. Following the scoring, lateralization quotient (LQ) is calculated. The formula to find out the LQ is R-L/R+L, where R and L refer to right sidedness and left sidedness, respectively. This produces a ratio that varies from +1.00 to -1.00 through 0. The higher the score, the more the person is biased towards right and the lower the score the more the person is biased towards the left. Depending on the criteria set for analyzing the data,
The total group may be categorized into a right-bias or a non-right bias group. Here, LQ primarily reflects a strategy or biasness of individuals for various activities, rather than a strict measure of left-brain or right brain superiority. In the present study, two types of analyses are carried out on LQ: first, by taking LQ as a covariate and second, by categorizing the bias into extreme right bias and extreme non-right bias groups to study the effect of lateralization on mental state reasoning, social reasoning and emotional reasoning in early, middle and late childhood groups of children.

**False Belief Tasks - A (First-Order)** - False belief task which measures mental state reasoning is used to assess children's awareness of other people's belief states (i.e., "he knows" or "he thinks"). The task used for early childhood group assessed first-order false belief among children with a focus on children's understanding of other person's false beliefs, i.e., $x$ believes that $p$. The task used in the present study is designed as per the task design developed by Wimmer and Perner (1983). Two False belief tasks were used in the present study- one dealing with location and another with content. This task is presented in the form of a story using dolls. The child is first shown two dolls - a mother doll and a baby doll. The investigator names the two dolls to which the child agrees. The tasks are given in the Appendix.

Three types of questions are asked in the story. One is the knowledge questions based on memory to check whether the child has comprehended the story and second is the false-belief question that aims at understanding of false belief by the child. The third one is the explanation question that asks the child to justify her/his answer.

**Scoring** - The knowledge questions are scored but not included in the analysis because they are used as the markers of comprehension to qualify for the false belief questions. Only the answers to the false belief questions related to location and content and the corresponding justifications are scored following a scoring criterion describe in the following paragraph.
Method of Study

False belief answers are scored as either ‘0’ or ‘1’. If the answer to the false belief question is wrong, the child gets a score of ‘0’ and if the answer to the false belief question is correct, the child gets a score of ‘1’. The scoring criteria for the justifications are divided into two categories e.g., reality-based criteria or non mental state reasoning based criteria and mental-state reasoning based criteria. The sample answers for each category are discussed later in the Result chapter. The child gets a score of ‘1’ for a correct, non-elaborate and non-mental state reasoning justification, a score of ‘2’ for a correct elaborate and non-mental state reasoning, a score of ‘3’ for a correct non-elaborate mental-state reasoning and a score of ‘4’ for a correct elaborate mental state reasoning justification. The score of a particular child ranges from ‘0’ to ‘5’ for each task. The scores for both location and content tasks are added to get a false belief total score. The false belief total score of a particular child then varies from ‘0’ to ‘10’.

False Belief Tasks - B (First-, Second- and Third- Order) - This task is an extension of the earlier task with higher-order false belief understanding. False belief tasks used for middle and late childhood groups are different from the False Belief tasks used for early childhood group of children with respect to the stories used and the questions asked. However, the underlying logic remains the same. These tasks are considered to be the diagnostic test of theory of mind (Doherty, 2009). The tasks used for 9-11 year olds and 14-16 year olds assess children’s understanding of first-order, second-order and third-order false beliefs. First-order false belief understanding involves representing and reasoning about people’s beliefs: \( x \text{ believes that } p \). Second-order false-belief understanding involves an embedded representation of beliefs about beliefs: \( x \text{ believes that } y \text{ believes that } p \) (Perner & Wimmer, 1985). Third-order false belief understanding is a higher order meta-representation: \( x \text{ believes that } y \text{ believes that } z \text{ believes that } p \).

The ability to manage higher-order representations i.e., third-order representation or more may underlie children’s epistemological development and their understanding of the epistemic concepts of evidence, inference and
Theory of Mind and Cerebral Lateralization

truth (Pattnaik, 2002). Two stories adapted from Perner and Wimmer (1985) were used to measure false belief understanding in children: *The Chocolate Box Story* and *The Ice Cream Story*.

Each story has three sections. Each section deals with the first-order, the second-order and the third-order false belief understanding respectively. The story narration moves from one level to the next level only if the child successfully answers the questions in the previous level. Each section has three types of questions e.g., the knowledge questions, the false belief questions and the justification questions. The knowledge questions are memory based to check whether the child has comprehended the story. The false-belief questions aim at understanding of false beliefs by the child and the explanation questions ask the child to justify her/his answer. The stories in English and Hindi are given in Appendix.

**Scoring** - The knowledge questions are scored but not included in the analysis because they were used as the markers of comprehension to qualify for the false belief questions. Each of the first-, the second- and the third-order false belief answers and the corresponding justifications are scored following a scoring criterion. False belief answers are scored as either ‘0’ or ‘1’. If the answer to the false belief question is wrong, the child gets a score of ‘0’ and if the answer to the false belief question is correct, the child gets a score of ‘1’. The scoring criteria for the justifications are divided into two categories e.g., reality-based criteria and mental-state reasoning based criteria. The child gets a score of ‘1’ for a correct, non-elaborate and non-mental state reasoning justification, a score of ‘2’ for a correct elaborate and non-mental state reasoning, a score of ‘3’ for a correct non-elaborate mental state reasoning and a score of ‘4’ for a correct elaborate mental state reasoning justification. No justification yields a score of ‘0’. For any of the orders, the score of a particular child ranges from ‘0’ to ‘5’. The score of a particular child for each of the story varies from 0 to 15. In the present study, the scores are combined from two stories for ease of analysis and interpretation.
Social Reasoning Task - A (Deception) - This particular task aims at seeing the understanding of a social scenario by preschool children where two animated films from “The Panchatantra” are shown to the child. They are “Bandar ka Bantawara” (The Monkey's Judgment) and “Chalak Lomdi” (The Clever Fox). In each story, one of the protagonists has engaged in an act of deliberate deception. After viewing each film, the child is asked two memory based questions to check if s/he understood the story (see Appendix).

Scoring - The scoring scheme of this task follows a ‘0’ and ‘1’ format. The memory questions are used as qualifiers for the test questions and are indicative of understanding of the story by the child. Hence, those questions are not scored. For the test questions, a correct response yields a score of ‘1’ and an incorrect response yields a score of ‘0’. The score ranges for each of the stories vary from 0 to 5. The total scores for Social Reasoning Task-A (Deception) for each individual child then varies from 0 to 10.

Social Reasoning Task-B (Social Scenarios) - Social Reasoning Task - B consisted of simple naturalistic stories relating to everyday events but capturing different motivations of the story characters that might lie behind their everyday utterances that are not literally true. This particular task is adapted from Happe’s Strange Stories task (Happe, 1994b). The protagonist’s utterances in the story represent a lie, white lie, misunderstanding, sarcasm, persuasion, contrary emotions, joke, figure of speech, double bluff and appearance-reality. Each story is accompanied by two questions e.g., one comprehension and one test/justification questions except for double bluff where there are two test questions. The comprehension questions usually take the form, “Is it true, what X say?” and the justification question, “Why do X say that?”

This task is given only to the middle and late childhood groups because earlier studies using the same task has revealed that between the ages 5 and 6 years most children were only managing to achieve a third of their potential total with this assessment (O’ Hare, Bremmer, Nash, Happe & Pettigrew,
2009). Such studies show that some of the inferred mental states were consistently too difficult for this age group and only a very small number of children succeeded in understanding the concept of sarcasm and no child of this age was able to understand the story about persuasion. Hence, in the present study, the middle and late childhood groups are given this task.

Scoring - The linguistic comprehension is scored correct if the participant decodes them correctly. The correct answer is scored ‘1’ and the incorrect answer is scored ‘0’. The justifications are scored as either involving mental states or physical states. Mental state justifications include all those that referred to thoughts, feelings, desires, traits and dispositions. They include terms such as want, like, happy, cross, afraid, know, think, joke, pretend, expect, lie, hurt and to fool someone etc. Physical state justifications are those that referred to non-mental events, physical appearances, physical events, actions of objects and outcomes. They include terms such as big, looks like, is shaped like, get rid of, to sell, because of the X (object), to not get X (physical outcome), put in jail, told off, have a filling etc.

With little modification in the original scoring procedure used in Happe et al. (1998) study, participant’s answers to the justification questions are scored as ‘2’ for a correct mental state, coherent and contextually relevant justification, ‘1’ for correct physical state, coherent and contextually relevant justification and ‘0’ for an incorrect justification. A justification can be rated as incorrect because it involves errors about the facts given in the story, or because of an inference that is contextually inappropriate as a reason for the story character’s utterance. The participants are scored according to their correct justification. That is, if a person provides one correct answer and an inappropriate answer, the correct answer is considered. Similarly, if a participant’s answers appeal both to a physical state and mental state, the justification is scored as a mental state. The score ranges for each story varies from ‘0’ to ‘4’. Hence, the score ranges for all the ten stories combined would be from ‘0’ to ‘40’. The entire task is administered in Hindi. The stories used in the present study are given in the Appendix.
Emotional Reasoning Task - Emotions are easy to understand but difficult to define. One may easily explain the emotional tone involved in an individual's behavioral expression but, may find difficulty in defining that emotion. This notion also holds true for children. Among many of the developmental milestones during childhood, the development of understanding of emotion in inanimate and animate objects is regarded as a major achievement. One form of the task has been used to assess children's development of an understanding of expression of emotion in emoticons, antecedents of experience of emotion in self and parents. The task is used for the early and middle childhood groups on their understanding of 5 basic emotions i.e., happiness, anger, sadness, surprise and fear in emoticons. The other form of the task measures conceptual role taking, empathetic sensitivity and recognizing emotional expressions in the eyes. This has been used for the late childhood group. The response to each question is recorded and later transcribed for analysis. The complete tasks are given in the Appendix.

(a) Emotion Recognition in Emoticons - The child is shown 5 emoticons one by one, each depicting a distinct emotion (happiness, anger, sadness, surprise, and fear). Following the presentation of each character, the child is asked, “What the character is doing in the picture?” A correct recognition of the emotion in each character earns a score of ‘1’ and an incorrect recognition earns a score of ‘0’. The total score in this section ranges from 0 to 5.

(b) Antecedents of Experience of Emotion in Self - This task is about child’s recognition of his/her own emotions. The child was asked one question corresponding to each of the five emotions (happiness, anger, sadness, surprise, and fear). The form of the question was, “When do you become happy/ angry/ sad/ surprised / fearful?” A correct response (i.e., a description compatible with the emotion in question) for each kind of emotion earned a score of ‘1’ and incorrect response or a ‘No’ response, earned a score of ‘0’. The total score in this section ranges from 0 to 5.
(c) **Antecedents of Experience of Emotion in Parents** - This task is about child’s recognition/ understanding of antecedents of experience of emotion in both parents. The child is asked two questions (one for the father and another for the mother) corresponding to each of the five emotions (happiness, anger, sadness, surprise, and fear). The form of the question was, “When/why does your mother/father becomes happy/angry/sad/surprised/fearful?” A correct response (i.e., a description compatible with the emotion in question) for each kind of emotion pertaining to each parent earns a score of ‘1’ and incorrect response or a ‘No’ response, earns a score of ‘0’. The total score in this section ranges from 0 to 10.

(d) **Conceptual Role Taking and Empathetic Sensitivity** - This task is adapted from Bosacki and Astington (1999). There are two brief vignettes of social situations. The stories are socially ambiguous because past research has found interpretations of ambiguous social situations to be an effective method of eliciting children’s representational understanding of mind (Dodge & Frame, 1982; Levinson, 1995). This task is an attempt to strike a balance between the projective and the open-ended narrative tasks (e.g., Baron-Cohen et al., 1997). One story referred to as “School mein Naya Ladka” (New Boy in the School), involving three boys, and the other, referred to as “School mein Nayi Ladki” (New Girl in the School) involving three girls. With some modifications in the questions as used in the original study, each story is followed by questions to measure the specific concepts of conceptual role-taking and empathetic sensitivity. Two comprehension questions are asked before the main questions to control for memory and comprehension effects. If the comprehension questions are answered incorrectly, the researcher re-read the story only one more time to the child. The tasks are given in the Appendix.

**Scoring** - A coding scheme is developed to obtain a score for understanding of mental states and feelings in others following Bosacki’s (1998) coding system with necessary modifications. Each story has nine questions and are grouped into four categories representing comprehension (Q1 & Q2), conceptual role-taking (Q3 & Q4), control question (Q5) and empathetic
sensitivity (Q6, Q7, Q8 & Q9). The coding framework is based on various schemes in the social-cognitive and ToM literature (Happe, 1994; Hatcher, Hatcher, Berlin, Okla, & Richards, 1990; Homer & Astington, 1995; Yuill, 1992). It represents levels of interpersonal understanding based on increasing cognitive complexity of the responses. That is, the coding of the responses reflects the child’s ability to understand the psychological world of the other, moving from simple, obvious (‘surface’) characteristics to the interaction of several different abstract psychological concepts and the integration of multiple and paradoxical perspectives. The coding scheme for scoring is as follows:

**Comprehension** (Q1 and Q2) - Score 0 or 1. For Q1, if the answer is no, then score 0 and if the answer is yes, then score 1. For Q2, score 0 if the name of the protagonist and/or verbatim does not correspond to the story and score 1 if the name of the protagonist and/or verbatim exactly corresponds to the story.

**Conceptual Role Taking** (Q3 and Q4) - Score 0, 1, 2 and 3. A score of 0 is given for no answer or I don’t know answers. For behavioral/ situational descriptions (to play on the swings), a score of 1 is given. Score 2 for responses that include a mental state, or acts or communication or perception (e.g., they want to make friendship with her). Score 3 for responses that include an integration of two or more mental states and relate them to each other in a coherent manner such as moral judgments or recursive psychological statements (e.g., ‘Because I’ve seen kids on the playground who look lonely and you don’t want them to feel bad, so you try to be their friend, because you know it’s the right thing to do.’)

**Control Question** (Q5) - This is a memory question. A correct answer attracts a score of 1 and an incorrect answer attracts a score of 0.

**Empathetic Sensitivity** (Q6, Q7, Q8 and Q9) - The scoring scheme is the same as that of Conceptual Role Taking (i.e., 0, 1, 2, and 3).
In the present study, only the conceptual role taking and empathetic sensitivity scores are included for final analysis. The score ranges for conceptual role taking for each of the stories vary from ‘0’ to ‘6’ and the score ranges for empathetic sensitivity varies from ‘0’ to ‘12’. Hence, the total score ranges for each of the stories vary from ‘0’ to ‘18’. The total score then ranges from ‘0’ to ‘36’.

(e) Recognizing Emotional Expressions in the Eyes - This task is developed by the researcher after Chapman et al., (2006) with necessary modifications in the nature and presentation of the task. This task consists of a set of 24 pairs of pictures of the eye portion depicting basic emotions like happy, angry, sad, surprise, disgust and fear (See Appendix). The eye portions have been taken from the posed photographs of faces of Indian males and females. There are two pictures from each of the six emotions put in a random order on the page. Each picture has a code number. The code number can be decoded later for scoring purposes. The participant is asked to write down the name of the emotion each eye portion is showing in the blank spaces provided below each picture. There is no time limit; however, participants are encouraged to complete the set as soon as possible. Correct response would attract a score of 1 whereas an incorrect response would attract a score of 0. Hence the score ranges vary from 0 to 24. Following the completion of the responses scoring of the sets is done using the coding keys.

4.3 Procedure
As the study involved school going children, a prior written permission from the principals of respective schools were sought. After getting the permission, the requirements for the data collection process was discussed with the teacher nominated by the principals to help in the process. Accordingly, a quiet room with one or two attendants was arranged for individual testing sessions. Before children were called for individual testing sessions, the Raven’s Progressive Matrices was administered to them in a group setting in order to ascertain that they fall in the average IQ range. The socio-economic
status (SES) of all the children sitting for the group testing session was matched based on their parent’s education, income and place of residence. There are nine age groups of children in the present study from 4, 5, 6, 9, 10, 11, and 14, 15, 16 year olds.

Prior to the beginning of individual testing sessions along with the consultation of the teacher-in-charge, the time table of the participating child in the school was analyzed so as not to hinder with their regular classroom activities. Accordingly, a time chart was prepared for all the participating children in the study. The children were then informed about the dates and timings for their individual testing sessions one week before the actual sessions begin for any particular child. Depending upon the readiness of the child to cooperate in the process and the allotted time slot for the sessions, the tasks were randomized for every child. On average, each child was called for three individual testing sessions. During the individual testing sessions, an effort was made to establish a good rapport with each child so as to make him/her more willing to participate and cooperate in the process. Each individual session was audio-taped for ease of task administration and was transcribed later for analysis.

The tasks used in the present study were administered in Hindi. Most of the tasks except some were an adaptation of the tasks used by other researchers in English or other Indian languages. Prior to finalization of the tasks for the study, all tasks were translated in Hindi and then back translated into English by independent dual language experts. Further, a pilot testing was conducted to ascertain the suitability of the tasks for the context. Following pilot testing, experts in the field were contacted to analyze the data and to make any suggestions for possible changes to maintain the reliability and validity of the tasks. In the present study, an expert consensual approach was followed for the finalization of the tasks. Both English and Hindi formats of the tasks that are used in the present study has been given in the Appendix.