

Understanding Actions & Intentions: An Insight into Theory of Mind

Sudhin Karuppali and Jayashree S. Bhat

¹ Dept of Audiology & Speech Language Pathology, Kasturba Medical College (A Unit of Manipal University), Mangalore

Abstract. The ability to understand another person's action and, if needed, imitate that action, is a core component of human social behaviour which can be observed even in young children. Action understanding studies focus on the aspect of interpreting a person's intention thereby giving insights into their theory of mind (ToM) abilities. This principle is the motivation behind this study. Typically developing children between the ages of 4 and 15 years were taken up for the study. The experiment consisted of two tasks. Task 1 consisted of 12 target stimuli which consisted of a picture with a concealed action. High resolution photographs were taken of hand gestures that were appropriate for the target picture with other unrelated gesture. In task 2, four stories were selected to check the ToM abilities of the children. Both the stimuli were shown to children and the results were tabulated and analyzed using SPSS (11.5). The results revealed a linear progression in the mean standard scores of children in the action-intention scores and also a significant progression in the ToM skills. A positive correlation also existed between action-intention recognition and ToM skills. Our study, thus suggests that understanding actions and intentions are the basis of theory of mind research. This study also throws light on the non-linguistic communicative patterns of children. Future studies are to be done in clinical populations on this aspect, which may pave the way to new therapeutic approaches/strategies for children with communicative disabilities.

Keywords: action, intention, ToM, gestures

1. Introduction

The ability to understand another person's action and, if needed, imitate that action, is a core component of human social behaviour which can be observed even in young children. Two schools of thought interlock in contemporary cognitive-development theory: the emergence in infancy of basic understandings that may be continuous with later understanding [1], and the possible domain-specificity of core areas of thought, such as language or theory of mind (ToM) [2].

Action understanding studies assess not only perception and memory, but also infant knowledge within domains of understanding, such as physical or social cognition. [3] provided evidence of infant habituation to human intentional action significantly predicting ToM at 4 years. [4] have taken the view that this involves a process referred to as mentalization. The other view has emphasized the importance of the 'mirror neuron system', which has been suggested to play a general role in understanding other people's intentions and goals by providing an automatic simulation of their actions ([5], [6]), which is in line with simulation theory developed in philosophy in the context of ToM research ([7], [8], [9]).

This association between the emergence of ToM, and action-intention understanding seems to develop parallelly in children or is self dependent on each other, and is fully matured with the development of cognition and daily life exposure of events and situations. Language acquisition itself appears to rely on ToM skills. Research demonstrates that the capacity to engage in joint attention is critical in early word learning and referential communication ([10], [11]). Hence, a link between action-intention recognition and ToM is essential to understand the non-linguistic comprehension of language as a whole new perspective. Such an understanding in typically developing children helps us to have an insight into the social behaviour of the

communicatively challenged. Therefore the aim of the present study was to investigate the development and the relationship between ToM abilities and action-intention recognition abilities in typically developing school going children.

2. Method

2.1. Participants

The current study was conducted on a total of 96 school going normal children (39 males and 57 females) between 4-15 years of age from the Upper Kindergarten to the tenth grade. None of the children had significant deficits in hearing, speech, language, or any cognitive issues, ascertained by screening measures. The consent was obtained from the school authority prior to the conduction.

2.2. Stimuli

The study comprised of 2 tasks. The first task focussed upon the development of action-intention recognition and the second task centered upon the development of ToM skills. The following were the stimuli chosen for both the tasks.

2.2.1. Stimuli for Task 1

The stimuli for the first task were adapted from an early language training kit “With a Little Bit of Help”, developed by [12]. Twelve action pictures were selected on the basis of degree of familiarity across all the targeted age groups and were scanned using a Canon scanner. The hand gestures in each picture were erased till the wrist portion thus concealing the action performed by the individual in the picture. High resolution photographs were taken of the hand gestures modelled by the experimenter, which were appropriate to fill in for the missing hand portion. Photos of other intricate hand gestures (foils) were also taken for the experiment. The reliability of the photographed hand gestures (original and foils), were determined by five judges using a rating system. The highly rated picture was selected as the appropriate hand gesture for the target action. Hence, the target stimuli comprised of an action picture along with three optional hand gestures (2 foils and 1 correct gesture). A total of 12 stimuli were developed for this task. The following is an example of a target stimuli used in the study.

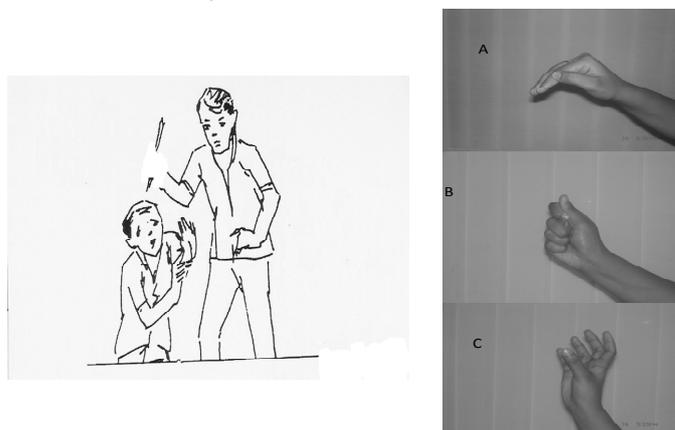


Figure 1: An example of a target stimuli used in the experiment: in the left is the target action picture with the concealed action; and in the right are the 3 optional hand gestures (one original and 2 foils) out of which one is an appropriate hand gesture for the action being performed.

2.2.2. Stimuli for Task 2

False belief understanding provides the most often used, standard assessment for preschool ToM [13]. A set of four stories were used to test for ToM abilities. The first two stories were the classic Sally-Ann Task and Smarties Task and the other two were adapted from a study by [14]. First two stories had one forced choice question each and the next two stories had two associated questions.

2.3. Procedure

Eight children were randomly selected from each class and were seated in front of the examiner. The tasks that were carried out for the experiment are described as follows.

2.3.1 Task 1:

This task was carried out in children between 4-15 years of age. The children were tested individually with each participant being shown 12 stimuli in a sequence and were asked to point to the correct hand gesture. Children were made familiar to the procedure initially by a trial stimulus. Subsequently for the actual test procedure, ten stimuli were shown to the child and each correct response was scored as one and incorrect or no response was marked as zero.

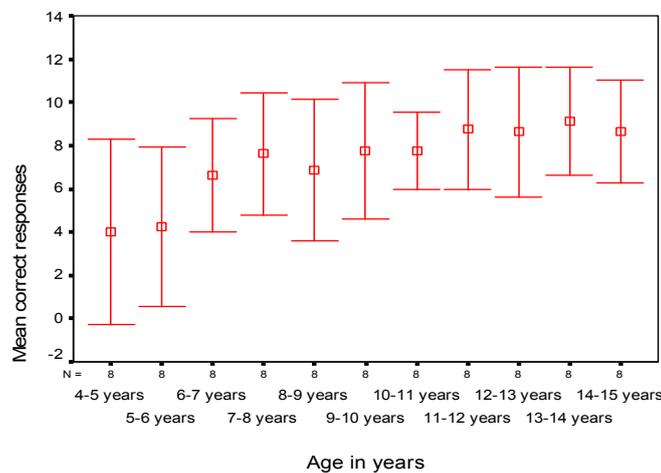
2.3.2 Task 2:

This task was carried out on children only between 4-10 years of age as higher order ToM upto level 3 is almost attained by the age 10. The four stories were narrated to the children and after each story, the participants were asked the forced-choice questions from which they had to select the true one. Each correct response was scored one and an incorrect response as zero.

The scores of both the tasks were analysed using SPSS (11.5). One way ANOVA was done followed by Post Hoc analysis. Pearson's Correlation was also employed to study the extent of correlation between the action-intention recognition and ToM abilities.

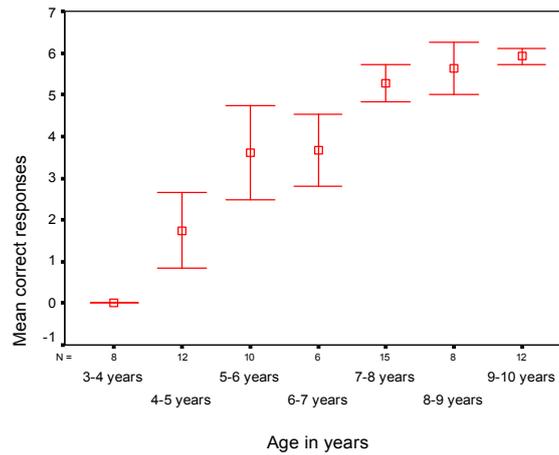
3. Results

The present study was conducted to study the action-intention recognition in typically developing children and also their ToM abilities. The following are the results of the tasks for both action-intention and ToM abilities. For task 1, the findings revealed a progression in the mean correct responses (4-15 years of age) of the action-intention recognition scores. However, the progression was not significant from the age group of 6-7 years to 14-15 years. Graph 1 shows the distribution of the responses across the age groups for the action-intention recognition task.



Graph 1: The mean and standard deviation of the scores obtained by the children between 4–15 years in the action-intention recognition tasks.

For the task 2, the findings revealed a progression in the mean correct responses in the ToM abilities (4-5 years to 9-10 years). Graph 2 depicts the distribution of correct responses across age groups for the ToM tasks.



Graph 2: The mean and standard deviation of the scores obtained by the children between 4-10 years in the theory of mind tasks.

Post Hoc analysis showed a significant difference ($p < 0.05$) in the mean correct responses between the age groups for both the tasks. Pearson's correlation analysis also revealed a positive correlation ($r = 0.87$) between the action-intention recognition and ToM skills.

4. Discussion

The ability to understand and interpret actions and intentions has always been a difficult task for very young children, the skills which are mastered when they become older. This developmental increase in the skill to adapt to much more complex situations and scenarios has recently become a crucial aspect of non-linguistic research. The research in this area has targeted communicatively challenged individuals who find it difficult to infer what happens in their environment. Our whole life involves people around us and we as excellent interpreters are able to unknowingly and almost automatically able to infer what they think and feel by merely looking at their facial emotions and getting contextual cues. This aspect of communication has triggered the concept of ToM which has always had an implication in the communicatively challenged, especially children with autism. The present study also tried to touch upon similar aspects. Typically developing children were selected from schools and were subjected to two tasks that tapped upon action-intention recognition and ToM abilities. The results of task 1 showed an increase in the accuracy of action-intention recognition across the age groups. This accuracy was observed to get stabilised by 7 years of age. The obtained growth trend was similar to that of the ToM (task 2) progression observed in the age group of 4-10 year old children. The results thus obtained, support the previous findings of [7], [8], [9], who suggested that the understanding of other people's intentions and goals is the basis of ToM research. Further the findings of the current study reveals that the development in both action-recognition and ToM occurs parallel and also share a link in their development influencing each other with a high positive correlation. This finding thus can also be attributed to various clinical population having both language and cognitive difficulties. Autistic Mirror Neuron Dysfunction (AMND) hypothesis predicts that children with Autism Spectrum Disorder should have difficulties understanding the actions of other people. Studies done on patients with apraxia also report their tendency to perform poorly on action understanding tasks ([15], [16]). Hence, tasks developed for the present study can also be utilized for the assessment of children with communicative challenges. However [17] found no relation between imitation of intentional actions at 14- or 18-months and later false-belief or ToM scale scores, thus giving scope to more research work to be done in this area.

5. Conclusion

The current study reveals a developmental trend in the understanding of actions-intentions and ToM abilities. This result explains the importance of nonverbal communication and the influence of theory of mind in the normal communication development of children. However, these findings can be strengthened by

using more number of stimuli varieties. The finding of this experiment gives scope to future studies to be done in clinical populations with pragmatic and imitation deficits.

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7. References

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