

Content available at: <https://www.ipinnovative.com/open-access-journals>

IP Indian Journal of Neurosciences

Journal homepage: <https://www.ijnonline.org/>

## Review Article

## Neuro-biological background of social cognitive development in adolescence

Leema Jacob<sup>1,\*</sup>, K. Jayasankara Reddy<sup>2</sup><sup>1</sup>Dept. of Psychology, Christ University, Bengaluru, Karnataka, India<sup>2</sup>Christ University, Bengaluru, Karnataka, India

## ARTICLE INFO

## Article history:

Received 12-05-2023

Accepted 31-07-2023

Available online 14-09-2023

## Keywords:

Social cognition

Neuronal development

Adolescence

Social brain

## ABSTRACT

Social cognitive development has much to do with thoughts and beliefs about the external world where adolescents live in society. Social cognition encompasses beliefs about oneself and others and the beliefs about the specific understanding of people. Social cognition begins to develop in childhood and gradually widens its development into adolescence. In this period, they become more conscious about their own feelings as well as the feelings and emotions of others. The development of social cognition during adolescence is one of the most important milestones of adolescent development. Disruption in the development of social cognition may lead to severe psychopathological conditions characterized by severe social isolation and social discomfort. This review article tries to discuss the neuro-biological background of social cognition and its development in adolescents with the help of a narrative approach. The study's findings indicate that social cognition includes signals from the brain that enable adolescents to learn and understand the social world. Those signals are facial expressions, theory of mind (ToM), emotions, and understanding social norms.

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](#), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: [reprint@ipinnovative.com](mailto:reprint@ipinnovative.com)

## 1. Introduction

Social cognition is defined as a set of psychological processes involved in understanding, interpreting, and responding to social studies from the social world.<sup>1</sup> The process is a very important aspect of adolescence because cognitive and physical development is in a higher mode in this period. Adolescents focus more on making social relationships and repelling from the family due to it. Thus, social cognition allows them to understand social behavior and the responses of others appropriately.<sup>2</sup> Social Cognition also can be explained as a neurocognitive process that helps to understand others' behavior during social interactions. In other words, social cognition is the ability to understand the mental states of others, including their intentions, desires, and beliefs. This is also known as theory of mind (ToM),

mentalizing, or folk psychology.<sup>3</sup>

The study on neuro-biological development during adolescence is critical because it has several implications for adolescents' education and legal treatment for adolescents in their mental illnesses that often have the onset in adolescence.<sup>4</sup>

This paper will discuss the neurobiological bases of social cognition among adolescents with the help of a narrative approach. Both an empirical paper and a review of the literature are included in this paper.

## 2. Research Methodology

This article will try to answer the above research questions by referring to multiple databases, including Google Scholar, JStore, ProQuest, EbscoHost, and Sodhganga. It uses the keywords 'social cognition, social brain, and neuro-biological aspects of human development'

\* Corresponding author.

E-mail address: [leema.jacob@res.christuniversity.in](mailto:leema.jacob@res.christuniversity.in) (L. Jacob).

among adolescents. From these multiple databases, articles exploring the development of social cognition were collected and analyzed for the article. Narrative techniques are used in this research article, which includes the grounds established through existing studies.

This research article is Quantitative and qualitative since it is based on the method applied in the relevant studies, including both quantitative and qualitative studies.<sup>5</sup> The data-related information provided here is from an empirical analysis of existing studies based on the instrumentation applied. Also, it consisted of examinations and observations conducted in the referenced studies.<sup>6</sup>

The method used in the research procedure will be determined by the methods indicated in the necessary research materials. The analysis and interpretation of the collected data will use the techniques performed in the context of the studies tested. At last, the conclusion will be presented based on the detailed information given in the compiled details representing essential knowledge content based on the available references. One significant advantage of archival research is that if there is a rich availability of the research, this type of design encourages researchers to incorporate as wide or narrow and little or as much their focus on what they are trying to prove or determine.<sup>7</sup>

### 2.1. Development of social cognition during Childhood

During infancy, babies begin to engage with items in their environment selectively. This experience helps them to predict the behaviors of others in late development. Gradually they become involved in collaborative or shared activities with objects such as toys in the second half of the year. Jean Piaget explained social cognition as a dominant subject during the 20<sup>th</sup> century.<sup>8</sup> He argued that the thought process of young children is solely characterized by egocentrism as they find difficulty in their own perspective-taking from that of others.<sup>9</sup> That is why preschool children often understand that others feel or think precisely what they do. A basic inability in social-cognitive understanding. After language acquisition, children focus more on the social world and develop communication skills about what is happening in theirs's and others' minds.<sup>10</sup> Research reviews clearly suggest that various verbal tests are used to examine the social cognitive thinking of children in the clinical field. Children with severe social cognitive impairments are characterized by social cognition delays or abnormalities such as autism and other social dysfunctions.<sup>11</sup>

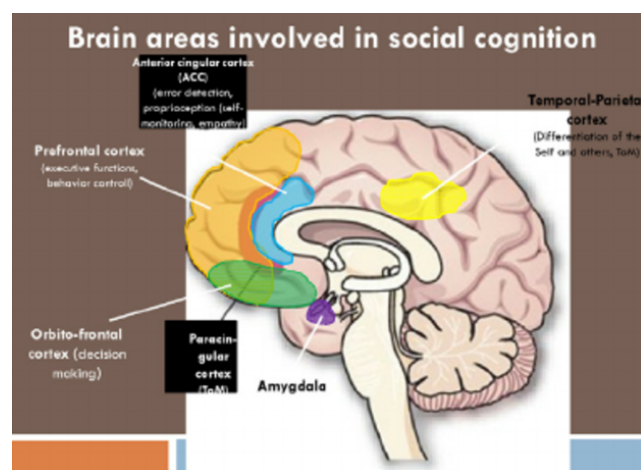
### 2.2. Social Cognition and Adolescence

Adolescence is a crucial period of time when an individual is no longer a child but has not yet become an adult. Acquiring social cognition is an essential developmental task markedly different from childhood.

The social environment during adolescence changes dramatically, and the brain undergoes a restructuring process this time.<sup>12</sup> This is the time when social cognitive abilities such as ToM skills develop and flourish. Adolescents begin to assert enhanced autonomous control over their actions, decisions, and emotions. Earlier research on the development of social cognition has dramatically focused on childhood, and very few empirical studies so far have been found on adolescents' social cognitive development.<sup>13</sup> Recent studies on adolescents' social cognition found that compared with children, adolescents are depositing more socially accepted behavior patterns.

### 2.3. Development of the social brain in Adolescence

Social interaction solely depends upon the brain and neuronal functioning. It allows adolescents to interact with the social world.<sup>3</sup> Adolescents increasingly learn about social relationships in this period, and the brain undergoes neuropsychological changes over this period. Understanding the neuro-physiological basis of social cognition is known as the social brain.<sup>14</sup> Since humans are from social species, it is important to learn about the development of the social brain during adolescence. Several fMRI studies during the past fifteen years indicate a remarkable consistency in finding the brain regions responsible for mentalizing and theory of mind among adolescents. The temporoparietal junction's posterior superior temporal sulcus (pSTS) is responsible for social cognitive tasks during adolescence.<sup>15</sup> Studies using the techniques of brain lesions prove that superior temporal lobes and prefrontal cortex are involved in social cognition, and degenerations in these brain regions may lead to impairments in social cognitive abilities.<sup>16</sup>



**Fig. 1:** Brain areas involved in social cognition.

Figure 1 shows that studies on humans and other primates indicate that the brain regions, the amygdala, the right somatosensory cortex, and the ventromedial frontal

cortex are responsible for social cognitive functioning.<sup>9</sup> These regions appear to mediate between perceptual representations of socially relevant stimuli, such as emotion recognition, knowledge, inter-intra personal understanding of social norms, etc. Recent research focuses on four brain areas for social cognitive functioning.<sup>13</sup>

1. Posterior superior temporal calculus (pSTS) and the adjacent temporoparietal junction (TPJ)
2. Amygdala
3. Temporal poles
4. Adjacent anterior cingulate cortex (ACC)

Posterior superior temporal calculus (pSTS) and the adjacent temporoparietal junction (TPJ) predict movement trajectories. This region of the brain becomes activated when an individual observes the eye movement of the other.<sup>17</sup> The amygdala identifies and regulates adolescent emotions essential for social interactions.<sup>1</sup> Temporal poles help understand social scripts, that is, the knowledge about the social world. Studies prove that damage to this area severely affects the smooth functioning of social actions. The adjacent anterior cingulate cortex is involved in understanding social norms in society.<sup>18</sup>

### 3. Results

The result obtained from the analysis of 10 selected research articles indicates a heightened need for understanding the neuro-biological development of social cognition, which may boost healthy social interactions among adolescents to promote their mental health. An assessment of ten selected articles on the development of social cognition concluded that the neurobiological background of social cognition directly affects adolescents' social interaction.

**Table 1:** Summary of the articles included in the narrative study

No.	Authors	Country	Year of publication	Data accessed from
1	Choudhury et al.	India	2006	PubMed
2	Samson et al.	UK	2004	PubMed
3	Blakemore	UK	2008	PubMed
4	Adolphs	USA	1999	ScienceDirect
5	Pelphrey	USA	2004	PubMed
6	Brizio et al.	Italy	2015	PubMed
7	Bosco et al.	UK	2014	PubMed
8	Schriber & Guyer	USA	2016	ScienceDirect
9	Gabriel et al.	Austria	2019	PubMed
10	Lincoln	USA	2021	ScienceDirect

### 4. Discussions

The study's primary aim is to understand the neurobiological bases of the development of social

cognition among adolescents. Thirty articles were analyzed initially, and ten were selected for advanced analysis as part of the preparation of this article. Information collected from various databases indicates that literature on adolescent social cognition is scattered and scarce. Particularly when compared to the other life stages in human development, very few empirical studies are found on adolescent social cognition.<sup>19</sup>

Yet, a better understanding of social cognition among adolescence would be crucial because most of the world's population falls under this category. The adolescent population is 1.3 billion worldwide.<sup>1</sup> This comprises a quarter of the total world population.

Another critical reason for the adolescent study is that psychopathologies like schizophrenia and substance abuse, mood disorders, and other depressive disorders have their onset during adolescence and early adulthood. This why studies on the development of social cognition is crucial in every aspect. Social cognition, namely ToM, and inter-intrapersonal understanding of social norms are crucially involved in these disorders.<sup>20</sup>

This study proved that two essential social and biological factors drive changes in the development of social cognition during adolescence. Brain matures considerably during adolescence, as evidence is derived from the existing empirical data analysis.

#### 4.1. Implications of the Study

Recent research on social cognition indicates that social cognitive skills are trainable.<sup>21</sup> Those skills are characterized by the cognitive and affective theory of mind and inter-intra personal understanding of social norms. This training is beneficial for an adolescent to develop normal social functioning and social skills in their social life in the world. Social cognition and its development can be considered the part of neurological development that directly connects with the social brain. Developing such kind of a social cognitive skills training program may boost social cognition among adolescents that help them to build a healthy social world in the community.

### 5. Conclusion

Social cognition has been linked to social competency, emotion recognition, ToM skills, and effective adolescent social interactions.<sup>14</sup> It suggests that social cognition can help them involve successfully in a wide range of social interactions.

Neuro-biological development of social cognition beyond childhood is a new area of research but a quickly evolving field in neuropsychology with applications for education and social policy regarding adolescents. Any study on adolescents is crucial because this is when higher-order cognitive development is at a peak level.<sup>17</sup>

The study findings from the available databases proved that the social brain a vital role in developing social cognition, which is essential for adolescents to build up their social world. In this study, the researcher has focused on changes in adolescents' social cognition and related skills required for recognizing the complex interactions between genetics, brain regions, and several biological bases.

## 6. Conflict of interest

Hereby I announce that no conflict of interest is associated with the materials presented in this paper.

## 7. Sources of Funding

The author received no funds to prepare this review study.

## References

- Adolescents Statistics - UNICEF Data. (2023, May 5). UNICEF data. 2023;Available from: <https://data.unicef.org/topic/adolescents/overview/>.
- Bulgarelli D, Molina P. Social cognition in preschoolers: Effects of early experience and individual differences. *Front Psychol*. 2016;7. doi:10.3389/fpsyg.2016.01762.
- Frith CD. The social brain? *Philos Trans R Soc Lond B Biol Sci*. 1480;362(1480):671–8.
- Paus T, Keshavan MS, Giedd JN. Why do many psychiatric disorders emerge during adolescence? *Nat Rev Neurosci*. 2008;9(12):947–57. doi:10.1038/nrn2513.
- Miller S. Social-cognitive development in Early Childhood | Encyclopedia on Early childhood development. USA: University of Florida; 2019. Available from: <https://www.child-encyclopedia.com/social-cognition/according-experts/social-cognitive-development-early-childhood>.
- Lincoln S, Mukerji CE, Dodell-Feder D, Riccio A, Hooker CI. The neural basis of social cognition in typically developing children and its relationship to social functioning. *Front Psychol*. 2021;12. doi:10.3389/fpsyg.2021.714176.
- Msed KC. Social cognition in Psychology; 2023. Available from: <https://www.verywellmind.com/social-cognition-2795912#citation-1>.
- Lefa B. The Piaget Theory of Cognitive Development: An Educational Implications. *Educ Psychol*. 2014;Available from: [https://www.researchgate.net/publication/265916960\\_the\\_piaget\\_theory\\_of\\_cognitive\\_development\\_an\\_educational\\_implications](https://www.researchgate.net/publication/265916960_the_piaget_theory_of_cognitive_development_an_educational_implications).
- Adolphs R. Social cognition and the human brain. *Trends Cogn Sci*. 1999;3(12):469–79. doi:10.1016/s1364-6613(99)01399-6.
- Leekam SR. Social cognitive impairment and autism: what are we trying to explain? *Philos Trans R Soc Lond B Biol Sci*. 1686;371(1686). doi:10.1098/rstb.2015.0082.
- Ruchkin V, Westeinde AV, Cauvet E, Kuja-Halkola R, Lundin K, Neufeld J, et al. Social Cognition in Autism and other Neurodevelopmental Disorders: A Co-twin control study. *J Autism Dev Disord*. 2019;49(7):2838–48. doi:10.1007/s10803-019-04001-4.
- Choudhury S, Blakemore S, Charman T. Social cognitive development during adolescence. *Soc Cogn Affect Neurosci*. 2006;1(3):165–74. doi:10.1093/scan/nsl024.
- Blakemore S. The social brain in adolescence. *Nat Rev Neurosci*. 2008;9(4):267–77. doi:10.1038/nrn2353.
- Burnett SE, Blakemore S. Functional connectivity during a social emotion task in adolescents and in adults. *Eur J Neurosci*. 2009;29(6):1294–301.
- Schriber RA, Guyer AE. Adolescent neurobiological susceptibility to social context. *Dev Cogn Neurosci*. 2016;19:1–18. doi:10.1016/j.dcn.2015.12.009.
- Samson D, Apperly IA, Chiavarino C, Humphreys GW. Left temporoparietal junction is necessary for representing someone else's belief. *Nat Neurosci*. 2004;7(5):499–500.
- Pelphrey KA, Morris J, McCarthy G. Grasping the intentions of others: the perceived intentionality of an action influences activity in the superior temporal sulcus during social perception. *J Cogn Neurosci*. 2004;16(10):1706–16. doi:10.1162/0898929042947900.
- Van Overwalle F. Social cognition and the brain: A meta-analysis. *Human Brain Mapping*. 2009;30(3):829–58. doi:10.1002/hbm.20547.
- Brizio A, Gabbatore I, Tirassa M, Bosco F. No more a child, not yet an adult": studying social cognition in adolescence. *Front Psychol*. 2015;6. doi:10.3389/fpsyg.2015.01011.
- Bosco F, Capozzi F, Colle L, Marostica P, Tirassa M. Theory of Mind Deficit in Subjects with Alcohol Use Disorder: An Analysis of Mindreading Processes. *Alcohol Alcohol*. 2013;49(3):299–307. doi:10.1093/alcalc/agt148.
- Hofmann SG, Doan SN, Sprung M, Wilson A, Ebesutani C, Andrews LA, et al. Training children's theory-of-mind: A meta-analysis of controlled studies. *Cognition*. 2016;150:200–12. doi:10.1016/j.cognition.2016.01.006.

## Author biography

Leema Jacob, Research Scholar

K. Jayasankara Reddy, Assistant Professor

**Cite this article:** Jacob L, Reddy KJ. Neuro-biological background of social cognitive development in adolescence. *IP Indian J Neurosci* 2023;9(3):118–121.