Theory of Mind in Schizophrenia

By : Victoria Mak, Cécile Delbouille, Cullen Conerly & Yvan Reynaud

Introduction

In 1992, Frith voiced the hypothesis in which schizophrenia would be linked with a deficit in theory of mind. He explains it with cognitive, neuropsychological, speculative and heuristic hypothesis

- - **Cognitive** : anomaly of a part of information processing : the attribution of mental states to others like beliefs, thoughts, intentions.
- - **Neuropsychological :** this cognitive anomaly is due to morbid signs and cerebral functional anomalies.
- - **Speculative** : it could be tested experimentally
- - **Heuristic :** permit to reinterpret the troubles of schizophrenia in a clinical way, to explain a part of those troubles, and to open to new ideas of research.

What is Schizophrenia?

Schizophrenia is a mental disorder with clinical signs including:

- - **Positive symptoms:** delusion, hallucinations,…
- - **Negative symptoms:** social retreat, alogia (loss of speaking capacity), apragmatism (loss of capacity to begin actions),…
- - **Desorganization:** language, behavior,…
- - **Cognitive troubles:** memory, attention,…

Biological basis of ToM performance in Schizophrenia

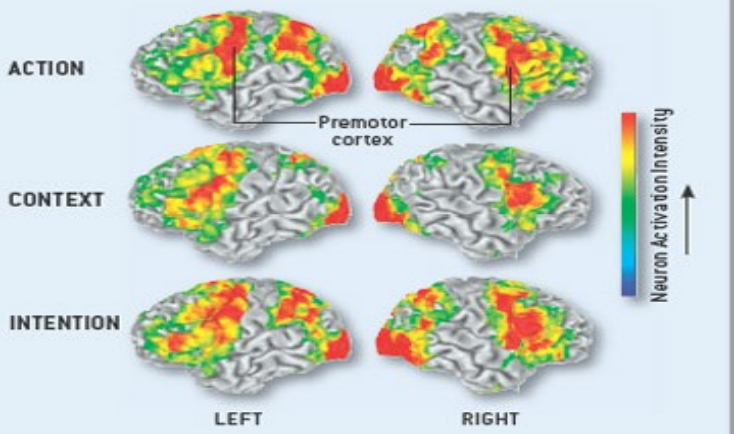
By : Victoria Mak

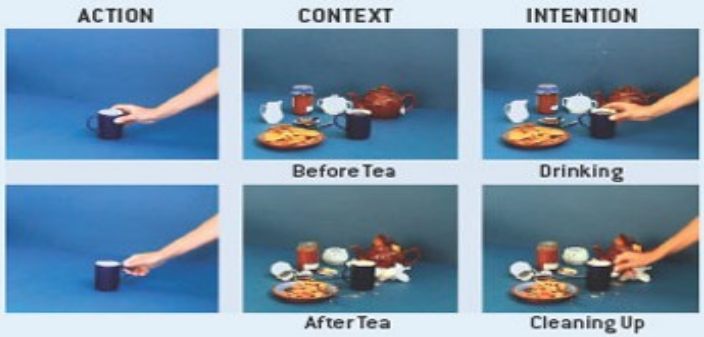
STRUCTURAL

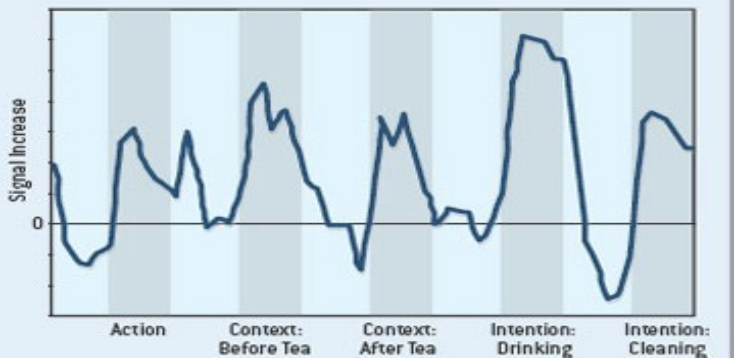
Mirror Neurons ✔

GRASPING INTENTION

Understanding the intentions of others is fundamental to human social behavior, and human mirror neurons appeared to confer that ability in an experiment designed to test their intention recognition. Volunteers were shown film clips (*below left*) depicting two similar cup-grasping actions without context, two contexts without action, and combinations of acts and context that signaled the action's intention: settings for afternoon tea that suggested the cup was being grasped for the purpose of drinking from it or that tea was over and the cup was being cleaned up. Activation of mirror neuron populations in premotor cortex areas in both hemispheres of subjects' brains (*right*) increased most strongly in response to scenes of action with a clear intention. Mirror neurons also distinguished between possible intentions, responding more intensely to the basic biological function of drinking than to the culturally acquired act of cleaning (*below right*).

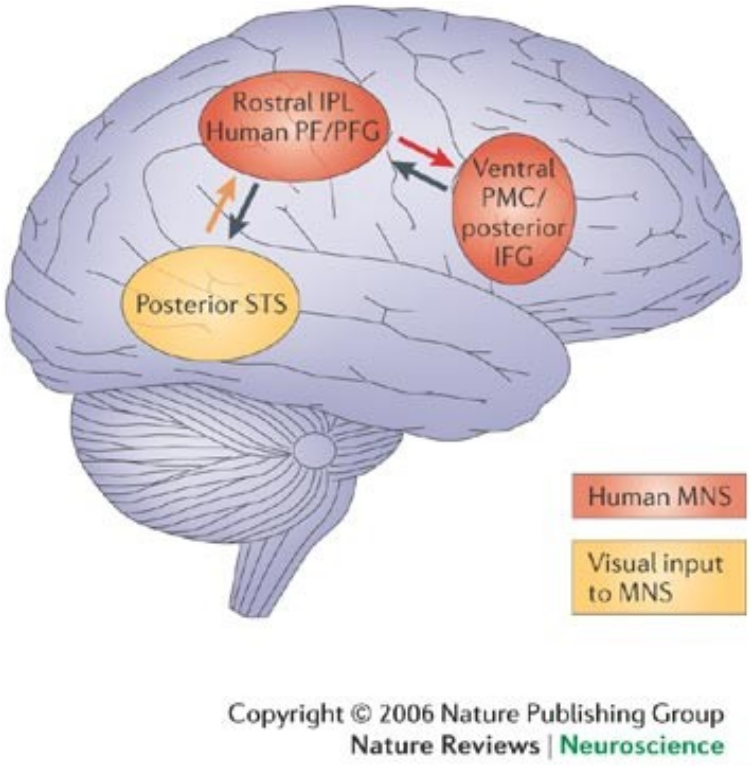






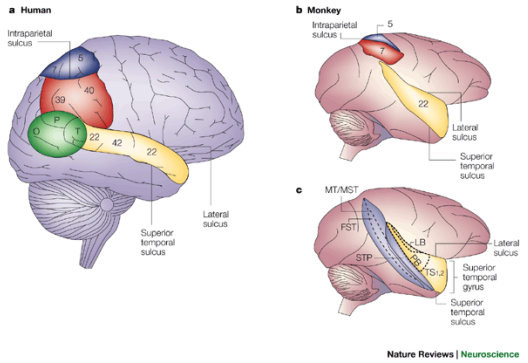
Mirror Neurons ✔

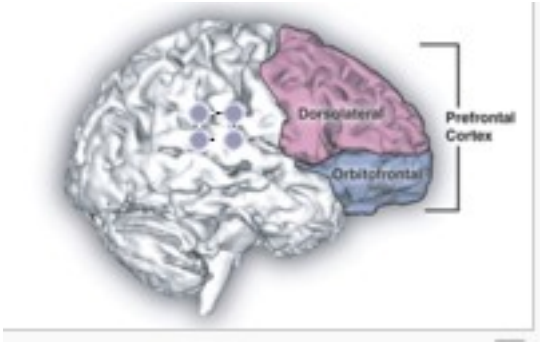
- **Superior Temporal Sulcus (STS)**- biological motion
- **Inferior Parietal Lobe**-perception of emotions
- **Inferior Frontal Gyrus**- mirroring emotion/motion



Frontal Cortex

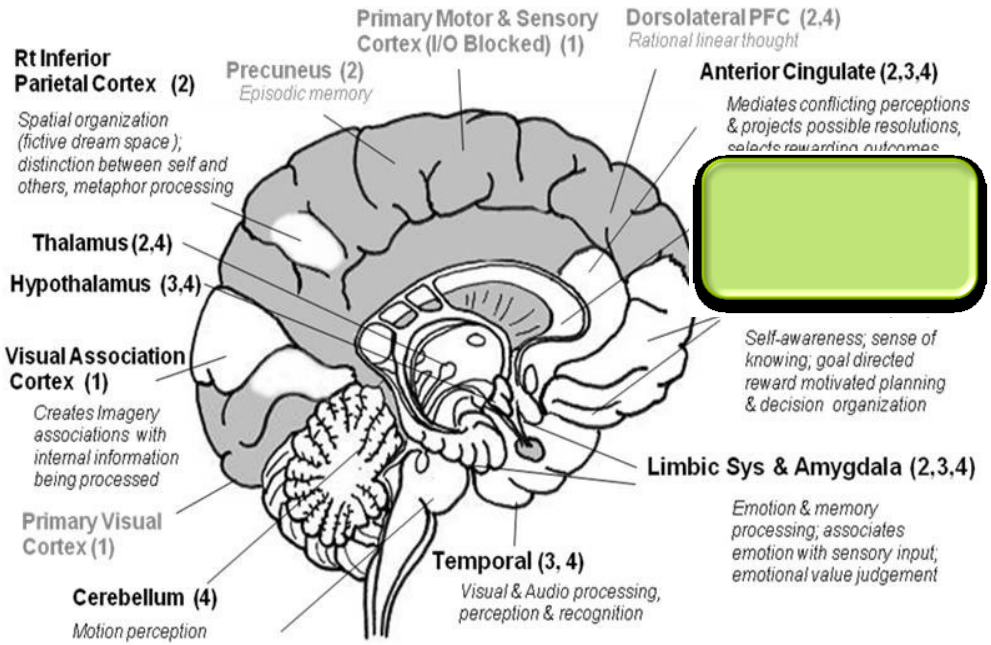
- **Posterior Superior Temporal Sulcus (STS)**initial sensing motion cues of animate objects ✔
- **Medial Prefrontal Cortex** ✔ mentalizing, intentional stance
- **Right prefrontal cortex** ✗ metacognition





Basal Ganglia ✔

- Distinguishing self from others
- Monitoring intention/consequences
- False-belief (self)

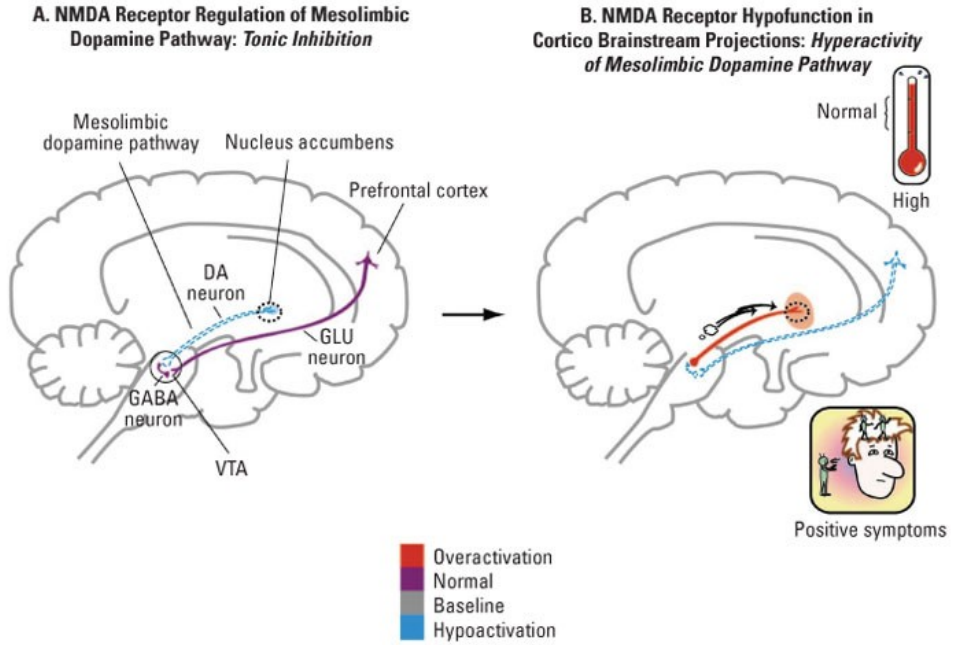


1) Hobson, J. A., et.al. (2003). Dreaming and the brain, *Sleep and Dreaming* (pp 18,19, 31-36). New York, USA, Cambridge University Press. 2) Marquette et.al. (1996); 3) Nofzinger et al (1996); 4) Braun et al (1997) in 1

Chemical (Genetic)

Dopamine

FIGURE 3.
NMDA receptor hypofunction hypothesis and positive symptoms of schizophrenia[2]



Stahl SM. *Essential Psychopharmacology.* 3rd ed. New York, NY: Cambridge University Press. In press. Reproduced with permission. Copyright Neuroscience Education Institute.

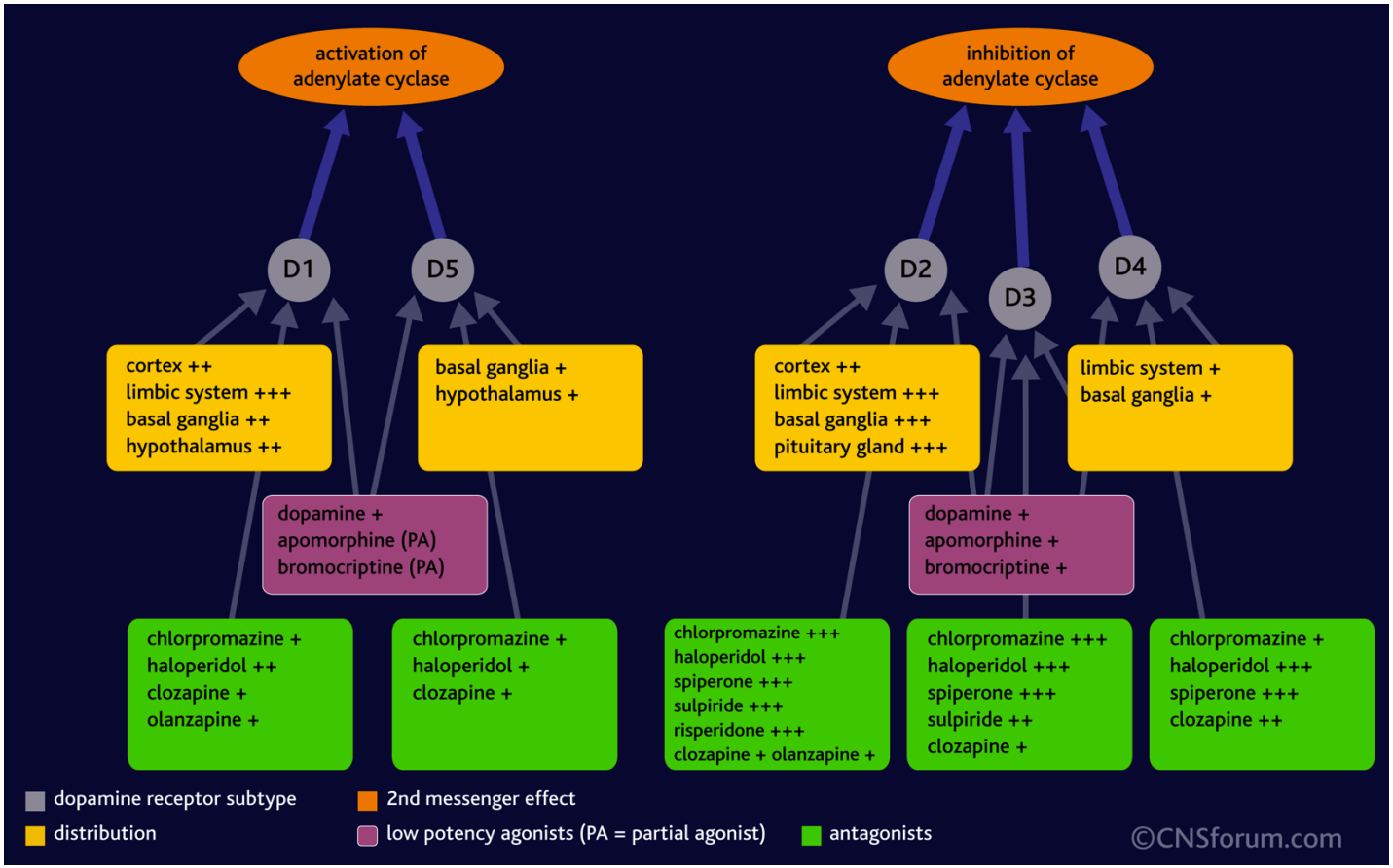
NMDA=*N*-methyl-D-aspartate; DA=dopamine; GLU=glutamate; GABA=γ-aminobuytric acid; VTA=ventral tegmental area.

Stahl SM. *CNS Spectr.* Vol 12, No 4. 2007.

Dopaminergic System

- D4 receptor gene (DRD4) in ToM
- D2 Schizophrenia

Dopamine


activation of adenylate cyclase
inhibition of adenylate cyclase
D1
D5
D2
D3
D4
cortex ++
limbic system +++
basal ganglia ++
hypothalamus ++
basal ganglia +
hypothalamus +
cortex ++
limbic system +++
basal ganglia +++
pituitary gland +++
limbic system +
basal ganglia +
dopamine +
apomorphine (PA)
bromocriptine (PA)
dopamine +
apomorphine +
bromocriptine +
chlorpromazine +
haloperidol ++
clozapine +
olanzapine +
chlorpromazine +
haloperidol +
clozapine +
chlorpromazine +++
haloperidol +++
spiperone +++
sulpiride +++
risperidone +++
clozapine + olanzapine +
chlorpromazine +++
haloperidol +++
spiperone +++
sulpiride ++
clozapine +
chlorpromazine +
haloperidol +++
spiperone +++
clozapine ++
dopamine receptor subtype
distribution
2nd messenger effect
low potency agonists (PA = partial agonist)
antagonists
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Tests about ToM in Schizophrenia

By Cécile Delbouille

Aim of research:

Understand…

- How deficient ToM in schizophrenia is associated with other aspects of cognition
- How the impairment fluctuates with acuity or chronicity of the schizophrenic disorder
- How it affects the patients' use of language and social behavior

1) Tasks involving the detection of irony (Mitchley 1998)

- 9 brief written scenarios including irony
- 18 schizophrenics

Results:

- Schizophrenia didn't understand irony in scenarios
- More likely to interpret the stories literally
- Lower IQ and negative (only negative) symptoms in schizophrenia.

2) Metaphor, or ‘‘real intentions’’ behind indirect speech (Corcoran 1995)

- 55 schizophrenics, 14 depressed and 30 controls
- 10 short stories about a social interaction between 2 characters, read aloud to subjects (‘‘hinting task’’)

Results:

- Schizophrenics with negative symptoms performed worst on ToM tasks
- Schizophrenics with passivity symptoms performed equally to controls
- Patients with incoherence and paranoid symptoms were in between

➡ This study suggests that performance on ToM tasks is a state rather than a trait variable

3) Short text passages illustrated by cartoons (Frith and Corcoran 1996; Pickup and Frith 2001)

- 55 schizophrenics and 22 controls
- 6 stories including a first or second order false belief with cartoon drawings

Results:

- Patients with behavioral and paranoid symptoms performed more poorly on tasks than others

- Easier tasks were successful!!

4) Visual jokes as depicted in cartoon drawings (Corcoran1997)

- 44 schizophrenics, 7 depressed and 40 controls
- 10 jokes could be understood in physical or behavioral terms
- 10 jokes required mental state attribution

  → 7 involving false belief.

Results:

- impaired in schizophrenic patients
- Patients with behavioral symptoms performed worst, particularly if mental state attribution was involved.
- Patients with passivity and paranoid symptoms also performed worse than controls

Main conclusion of the tests:

It is their lack of understanding of the mental states of the story characters that makes them fail in such tests. (Langdon, Pickup, Frith, Brunet)

Dispute:

- Clinical findings of Trognon, Sperber and Wilson

★ impairment in social interaction

★ reduced capacity to effectively engage in communication

- Frith's think

★ ToM in schizophrenia is compromised

★ failure to monitor their own and other's mental states and behavior

Common findings:

Many schizophrenics experience a significant loss of metacognitive capacity or previously held capacities :

- Firstly, to create complex representations of the self and others
- Secondly, to use that knowledge to respond to psychological challenges

Important notice:

During experience, researchers noticed that patients are quite aware of their loss.

Actually, They can describe it and so they fight to live with that conscious diminishment

II/ Cognitive deficits in Schizophrenia

By : Yvan Reynaud

What is cognition?

Cognition is the capacity to treat the information, acquire new knowledge and use it.

Mental processes :

- perception
- attention
- motors functions
- memory
- planning
- language
- learning …

The most severe cognitive functions touched are:

- Verbal memory and learning
- Semantic memory
- Attention
- Executive functions
- Motor speed

Patients with Schizophrenia

Evidence has shown that patients with Schizophrenia show impaired Systematize ToM and cognitive abilities

The cognitive troubles in schizophrenia:

- appear early
- correspond to a general deficit but also specific
- are frequent and often severe
- have important functional consequences
- are not simply the result of prescribed treatment or other clinical symptoms
- require an assessment and specific management
- can't be stopped by a treatment

A central position in Schizophrenia

- Cognitive difficulties are approved since a long time
- For some scientists, Schizophrenia is a pathology of cognition.
- But cognitive troubles are not a part of the diagnostic criteria of this trouble.

Zakzanis and Heinrichs (1998)

In a meta - analysis of 204 studies, they showed that:

- - 61 to 78% of patients had scores below the median of control subjects on all cognitive tests
- - 75% of patients had an IQ score below the median of control subjects
- - A number of patients, however, retain performance "normal"

➔ This study shows the frequency and severity of cognitive impairments.

Research

ToM impairments have been found in schizophrenia in :

- natural communication situations
- tasks assessing first and second order false beliefs
- irony comprehension
- hinting comprehension
- picture-sequencing tasks

An affected way of living

- 10-20% of patients have a job, and only 30% of them work a significant number of hours.
- They are often unable to live independently
- Their have low self-esteem and quality of life

Functional field	**Cognitive deficit correspondent**
Social functioning	Declarative memory Vigilance
Professional functioning	Declarative memory Vigilance Executive functions Work memory
Independent life	Declarative memory Executive functions Work memory

The procedure to show the deficit in theory of mind for schizophrenic people is based on the one used for autistics. They have for common frame, the cognitive neuropsychology.

Affective ToM in Schizophrenia

By: Cullen Conerly

Affective ToM

Affective ToM (or Affective empathy) is the sub-facet of ToM that involves implicit understanding of emotions in others (Shamay-Tsoory, Shur, Harari, & Levkovitz, 2007)

Patients with Schizophrenia

Evidence has shown that patients with Schizophrenia show impaired Affective ToM and empathizing abilities

Thus, they struggle with basic social engagement and functioning.

Patients with Schizophrenia (continued)

Ziv et al. (2011) describes the two main functions of executive functions associated with ToM that would be deficient in patients with Schizophrenia as the ability to **inhibit** salient information so that less salient information can be considered and the ability to **think hypothetically** using mental representations for appropriate reactions to stimuli.

Empathy: Reading the Mind in the Eyes Task

Empathy was assessed through the Reading the Mind in the Eyes Task by Shimansky, David, Rössler, and Haker (2010)

Those with schizophrenia performed poorly on the mentalizing task.

Emotional Recognition

A study by Sparks, McDonald, Lino, O'Donnell, and Green (2010), using the Facial Expressions of Emotions: Stimuli and Tests' (FEEST), found that patients with schizophrenia did significantly worse on emotional recognition than did the healthy control group. The study also found, using self-reports on empathy, that there were higher levels of **personal distress** in participants with schizophrenia. Also, lower levels of perspective taking and empathic concern in those with schizophrenia.

Social Inference and Sarcasm

A study by Sparks et al.(2010) used The Awareness of Social Inference Test which assessed sarcasm recognition using a series of both sincere and sarcastic interactions

It was found that participants diagnosed with schizophrenia scored significantly lower in recognizing both simple sarcasm and paradoxical sarcasm

Links to Symptoms

SANS (Sparks et al. 2010):

Avolition/Apathy

Alogia (language connection)

Attention

Affective Blunting

SAPS (Sparks et al. 2010):

Delusions and Empathic Concern (positive relationship)

Conclusion

Schizophrenia is associated with a number of deficits in ToM and social cognitive functions that adversely affect the individual in his or her daily life.

Work in understanding both the biological factors and social outcomes of these outcomes is necessary for both the caring for and helping manage the lives of those with schizophrenia.

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