

Understanding The “theory of mind” mechanism and the autism triad

Alan M. Leslie
Rutgers University



Help Group SUMMIT, Los Angeles, Sept 2008

Summary

20 years since Theory of Mind *Mechanism* (ToMM) impairment in autism proposed

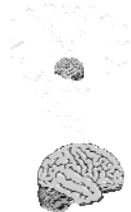
Pattern of impairments plus *sparings* means the hypothesis is still viable today

How the brain thinks about the mind

‘theory of mind’ —

Our everyday ‘commonsense’ ability to understand people’s inner lives...

to interpret and predict people’s behavior in terms of mental states like *wanting, believing, pretending, ...*



“Theory of mind” is:

**An enabler of human sociality.
It allows us to:**

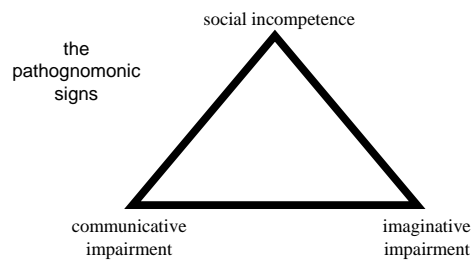
- Share inner thoughts and feelings with others
- Cooperate on complex tasks with others
 - Compete effectively with others

‘Theory of Mind’ Mechanism (ToMM)...

...is a basic system in the human brain

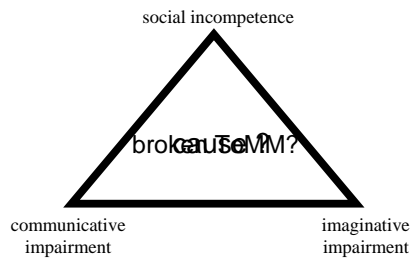
- ...a specialized neuro-cognitive mechanism
- ... epigenesis during first two years of life
- ...unconscious, pre-verbal, intuitive, ‘instinctual’
- ...kick-starts interest in/learning about ‘thoughts and feelings’
- ...is ‘broken’ in Autism

The Autism Triad (Wing & Gould, 1979)



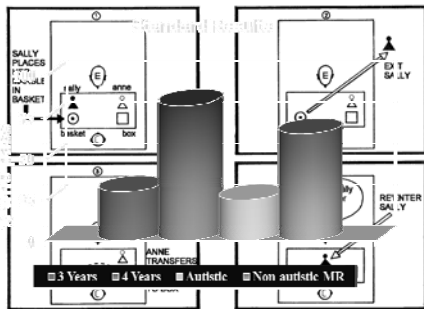
True and False IQ levels, not different IQs controls

The Triad (Wing & Gould, 1979)



The false belief task Test mental perspective-taking

(Baron-Cohen, Leslie, & Frith, 1985)



Challenges to broken ToMM theory

- (1) 'theory of mind' is too *intellectual* (to be a basic impairment)
- (2) truly basic, 'primary' disorders impair 'theory of mind'
e.g., EF, face perception, social orienting,...

(1) Too intellectual?

'theory of mind' much wider than FB:
Not 'intellectual' analysis, sensitive and instinctual
for example, pretend play, ...

Pretend play: emerges 18-24 months of age

Infants recognize pretending-in-others

Behavior:
mother is talking to a banana!

Infer mental state.

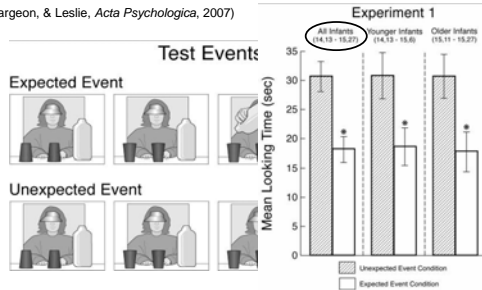


mother PRETENDS
the banana
"it is a telephone"

Leslie, A.M. (1987) *Psychological Review*, 94, 412-426.

Looking time measure of pretense recognition
in 15-month-old infants

(Onishi, Baillargeon, & Leslie, *Acta Psychologica*, 2007)




Looking time measure of pretense recognition in 15-month-old infants

Test Events


Shoe Condition

Expected Event




Exp. 2a No difference

Unexpected Event




Tube Condition

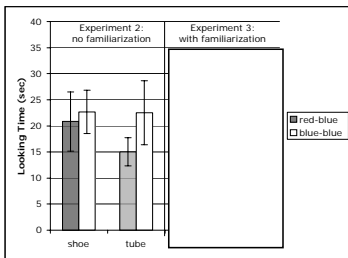
Expected Event



Exp. 2b No difference

Unexpected Event





Violation-of-expectation shows *recognition* of pretense at 15 months

Initial motivation for ToMM

Attend to behavior

Try to infer mental state

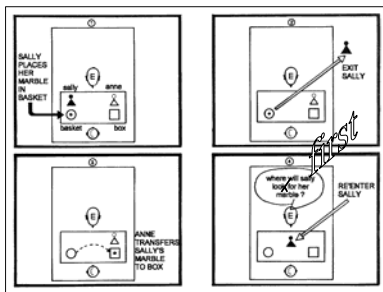


Requires 'Theory of Mind' Mechanism

Challenges to broken ToMM theory

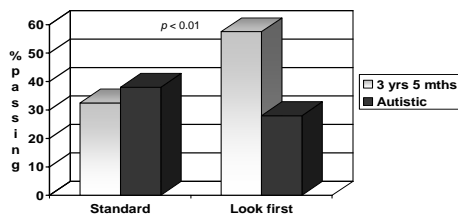
(1) 'theory of mind' is too *intellectual*
(to be a basic impairment)

(1) Too intellectual? doesn't develop till 4?



Standard Q vs Look First Q

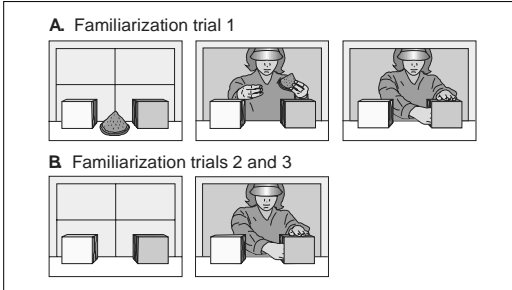
Within-subjects design



(Surian & Leslie, 1999)

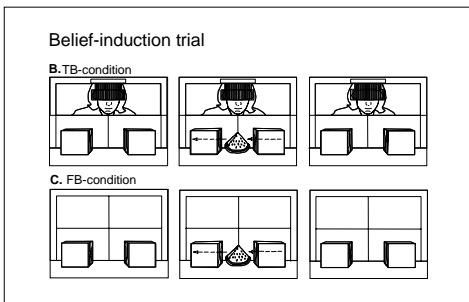
False belief at 15 months old

(Onishi & Baillargeon, 2005)



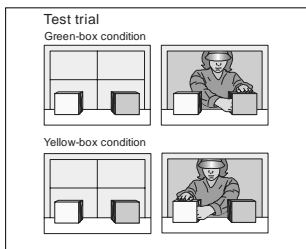
False belief at 15 months?

(Onishi & Baillargeon, 2005)

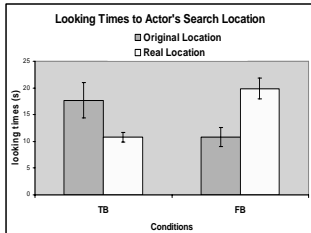


False belief at 15 months?

(Onishi & Baillargeon, 2005)



Infants in the TB and FB conditions show opposite patterns of looking



(2) Truly basic disorders ...

Non-social: Executive Functions

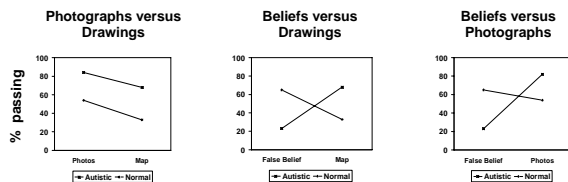
Social: face perception, social orienting, social reward, empathy,...

Can be addressed by looking at what is *spared*

EF control task



Performance on false representations tasks

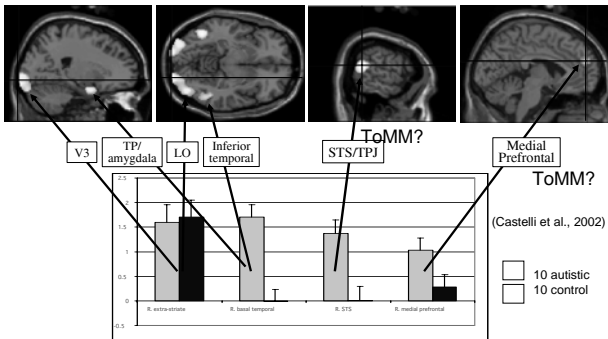


Leslie & Thaiss, 1992

Independence of EF and ToM

- Other ToM-autism studies (Roth & Leslie, 1991, 1998)
- Acquired brain damage – EF and ToM dissociate (Blair & Cipolotti, 2000; Fine, Lumsden & Blair, 2001)
- EF and ToM impairments independent in autism (Joseph & Tager-Flusberg, 2004)

Brain activity associated with ToMM in normal and autistic Ss



Summary

ToMM is a basic, very early developing mechanism

ToMM is NOT identical to passing standard FB task!!!

Social sparring: Basic moral judgment

- good vs bad acts
- reward vs punishment

Good vs Bad stories



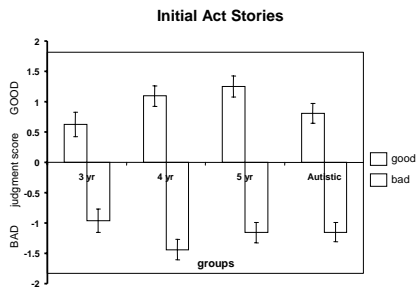
Good or Bad?
Reward or Punish?

Groups

- Normally developing 3 yr olds (n = 13),
4 yr olds (n= 16), and 5 yr olds (n = 16)
- Adolescents with autism
n = 19, mean vMA = 5 yr 11m,

5% passed 2 standard FB tasks

Moral Judgment in Normal and Autistic Subjects



(Leslie, Mallon, & DiCorcia, *Social Neuroscience*, 2006)

Autism and verbal ability

ToM score out of 3, $M = 1.11$

Partial correlation (vMA controlled):

ToM score and moral judgment:
Initial acts, $df = 16$, $r = -.09$, $p = .35$, one-tailed

Zero order:
vMA with ToM, $df = 17$, $r = .501$, $p = .014$, one-tailed

Moral vs Conventional

Requires empathy
(Turiel, Smetana, Killen)

Or just knee-jerk reaction to distress cues?
(Blair)

Moral vs Conventional

- One day Johnny *hits Mary/wears pajamas* to school.
- (1) Was it **okay** for Johnny to *hit Mary/wear pajamas to school*?
- (2) Was it **bad** for Johnny to *hit Mary/wear pajamas to school*?
- What if the Teacher, said, "In this school, anybody can *hit people/wear pajamas*, if they want to."
- (3) Would it be **okay now** for Johnny to *hit Mary/wear pajamas*, if teacher says Johnny can?

Both classic findings and Blair need a control for victim distress

Moral vs Conventional vs the "Cry Baby"

- Reaction to distress cues:
does victim distress *always* produce
a 'moral' judgment?

The "Cry Baby" story

- James and Tammy were eating cookies. But James did not just want *his* cookie, he wanted Tammy's cookie as well.

Teacher says:
"In this school, anybody can eat their own cookie if they want to."

This makes Tammy very happy and she eats her cookie. But this makes James very unhappy, and he begins to cry.

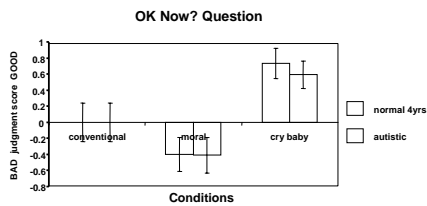
- (1) Was it **okay** for Tammy to eat her own cookie?
- (2) Was it **bad** for Tammy to eat her own cookie?

Action causes distress but no victim

Groups

- Normally developing 4 yr olds, (n = 15)
- Adolescents with autism (n = 17)

Conventional, moral and "cry baby" judgments:



(Leslie, Mallon, & DiCorcia, *Social Neuroscience*, 2006)

Summary

- Simple moral judgments intact in autism
- Reason about victims, not just knee-jerk
- Fairness/'property rights' intact
- Simple moral sentiments independent of ToMM
- Social impairments in autism *circumscribed*

ToMM impairment and the Triad

Still a viable and valuable hypothesis

ToMM = 'instinctual' part of ToM,
develops in infancy

Critical to understanding later development



<http://ruccs.rutgers.edu/~aleslie>
