

Lecture 11 - Autism

The Social Brain: Critical Perspectives on Science, Society and Neurodiversity

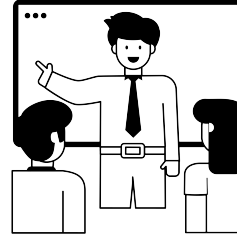
Richard Ramsey



Today

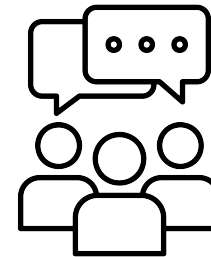
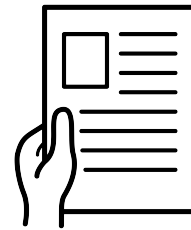
Part 1

- Autism



Part 2

- Read articles and discuss



Overview

- Background
- What factors cause autism?
 - Environmental
 - Genetic
 - Cognitive
 - Neurobiological
- Many autisms?



Background



What is autism?

- Lorna Wing's triad of impairments:
 - difficulties in social interaction
 - difficulties in communication
 - lack of imagination / repetitive interests
- Heterogeneous – no two people are the same.
- There is a spectrum of different diagnoses.



Diagnosis

- DSM criteria (Diagnostic and Statistical Manual of Mental Disorders, APA)
- Clinical observation
- Checklists
 - CHAT (checklist for autism in toddlers)
 - CARS (childhood autism rating scale)
 - DISCO (Diagnostic Interview for Social and Communication Disorders)
- ADOS (Autism Diagnostic Observation Schedule)
- ADI (Autism Diagnostic Interview)



How many children have autism?

- 3–4% of children and adolescents in the US
- 1% of the global population
- 0.7–1.5% in Switzerland
- Male-to-female ratio of approximately 3–4:1.



What factors cause autism?



Possible factors

- environmental
 - vaccines
 - other environment?
- genetic
- cognitive
- neurobiological



Vaccines

- **HELL NO!**
- There is a vast amount of high quality evidence that shows **NO LINK** between vaccines and autism.
- For those who want to read more see [here](#).



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(DeStefano & Shimabukuro 2019; Gahis et al. 2022)

Other environmental factors

- Can a lack of a normal social environment cause autism?
 - “Refrigerator mother” - Bruno Bettelheim (1950’s) blamed “lack of maternal warmth” for autism in a child.
 - Theory is now totally discredited.
- What about sensory deprivation?
 - Blind and deaf children show autistic-like symptoms (Brown et al., 1997; Wolfe et al., 2002).
 - Neither blind nor deaf show all the symptoms of autism.
- Or extreme social deprivation?
 - Romanian orphanage studies (Rutter et al., 2007).
 - 10% had some autism symptoms at age 6, none had full symptoms, and many improved by age 12



Genetic

- Bailey et al, 1995
 - 60% of MZ twin pairs were concordant for autism
 - no DZ twin pairs were concordant
 - shows high heritability (but not 100%)
- Ronald et al, 2005
 - studied over 3000 twin pairs in TEDS
 - find social behaviour is 62-76% heritable

Many genes have been implicated, none conclusively.



Cognitive

Two different cognitive accounts:

- Theory of mind
- Weak central coherence

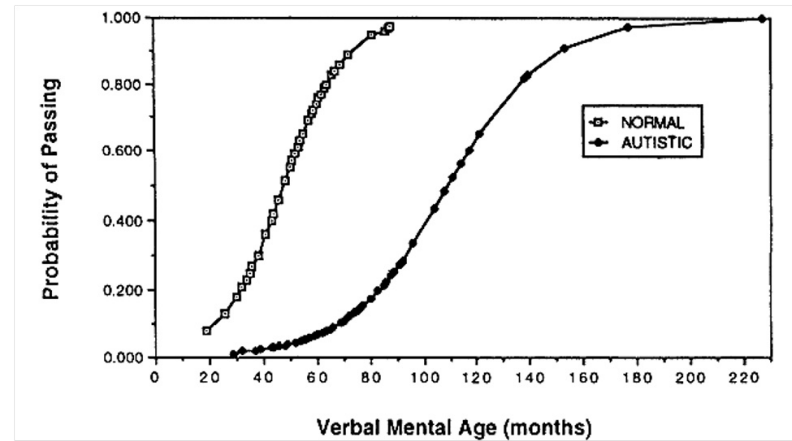
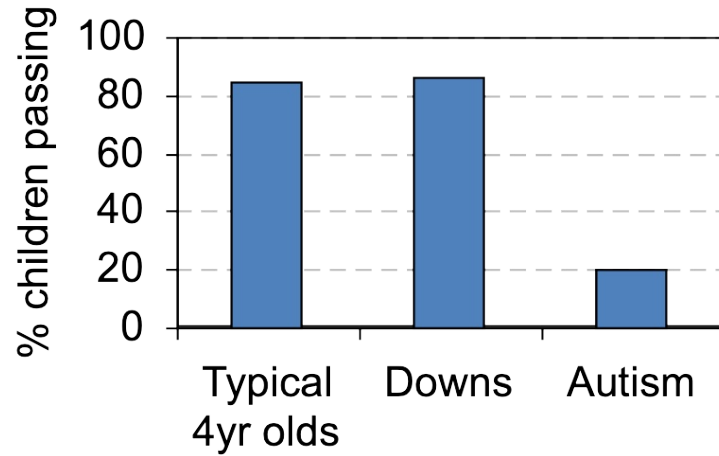


Theory of mind

- The idea that people with autism have difficulty understanding other people's mental states (beliefs, desires etc.).
- Proponents include Frith, Leslie, Happe, Baron-Cohen



False beliefs



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(Baron-Cohen et al. 1985; Happe 1995)



Animated shapes

Kenjirou

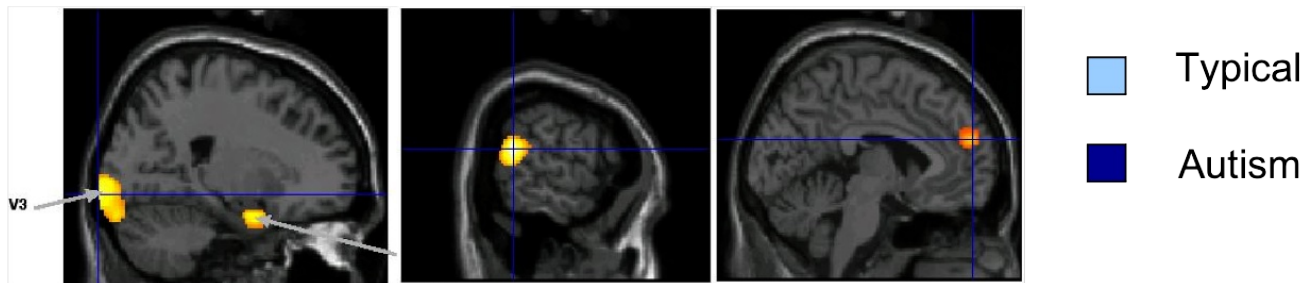
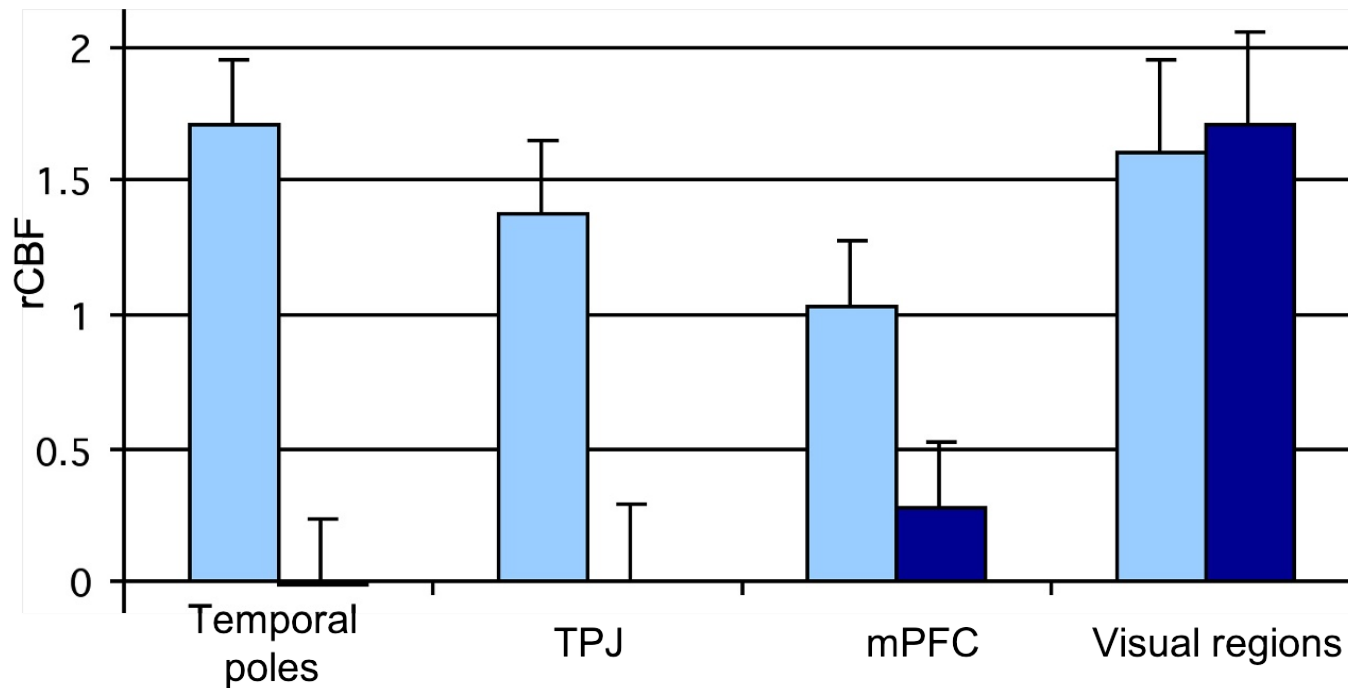
Watch on

(Heider & Simmel 1944)

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Animated shapes, autism and fMRI

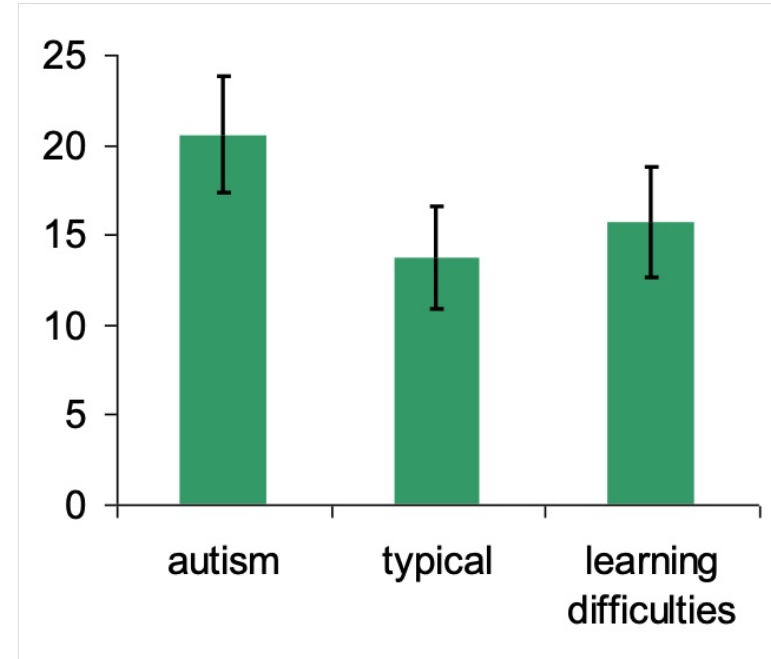
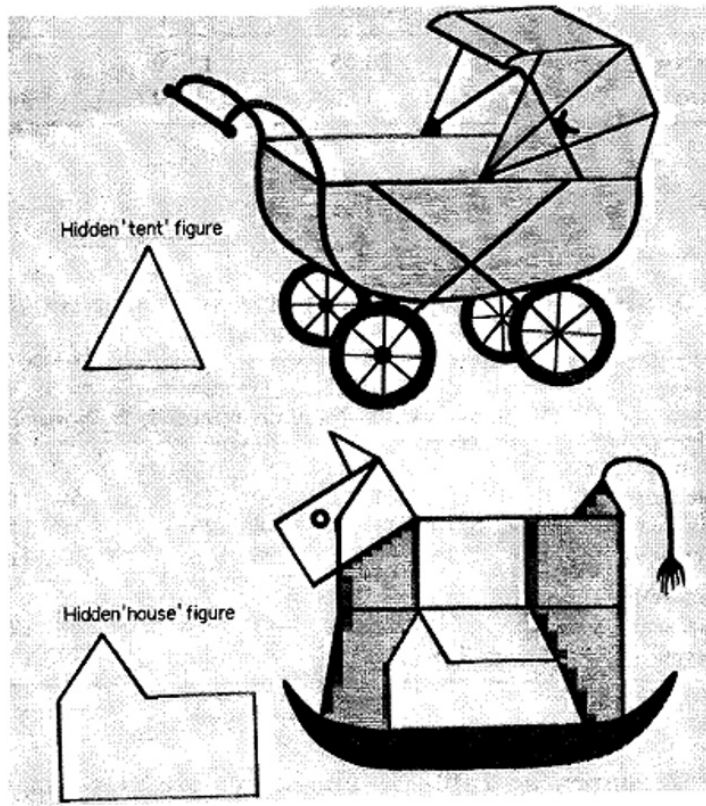


Weak central coherence

- The idea that people with autism have superior processing of detail and less superior processing of whole contexts.
- It can account for many non-social features and strengths.
- Do social tasks require more ‘central coherence’ than non-social tasks?



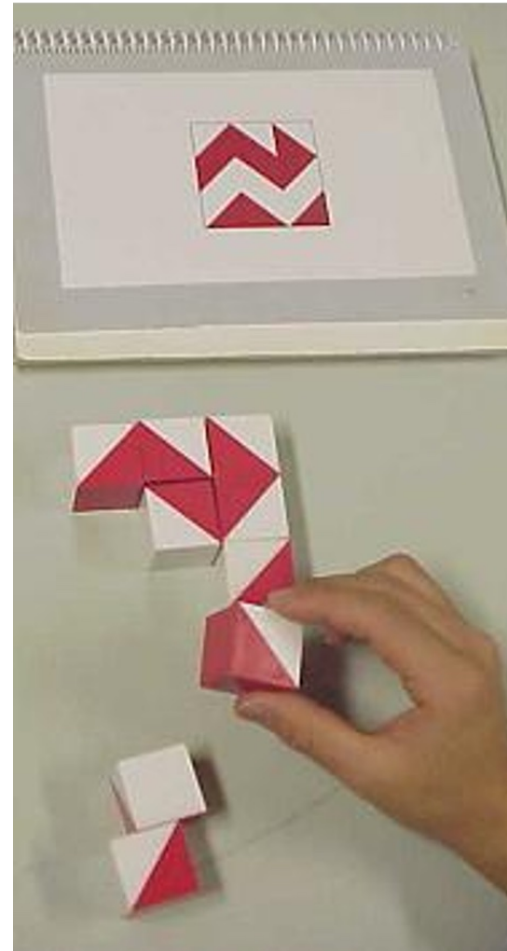
The emebbeded figures task



(Shah & Frith 1982)

The block design task

- Part of WISC IQ test
- Children with autism often perform very well on this task



Cognitive summary

- ToM
 - Lack of ToM in autism could cause breakdown in social interaction and communication
 - But it can't explain savant skills or repetitive behaviours
- Weak central coherence
 - Weak central coherence could maybe account for many non-social features and strengths.
 - But do social tasks require more 'central coherence' than non-social tasks?



Neurobiological

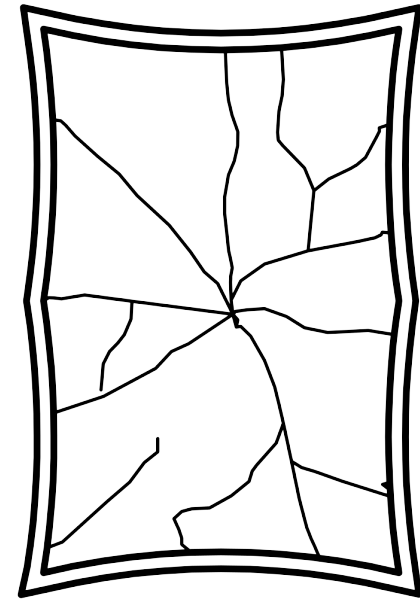
Two different neurobiological accounts:

- Broken mirror theory
- Underconnectivity

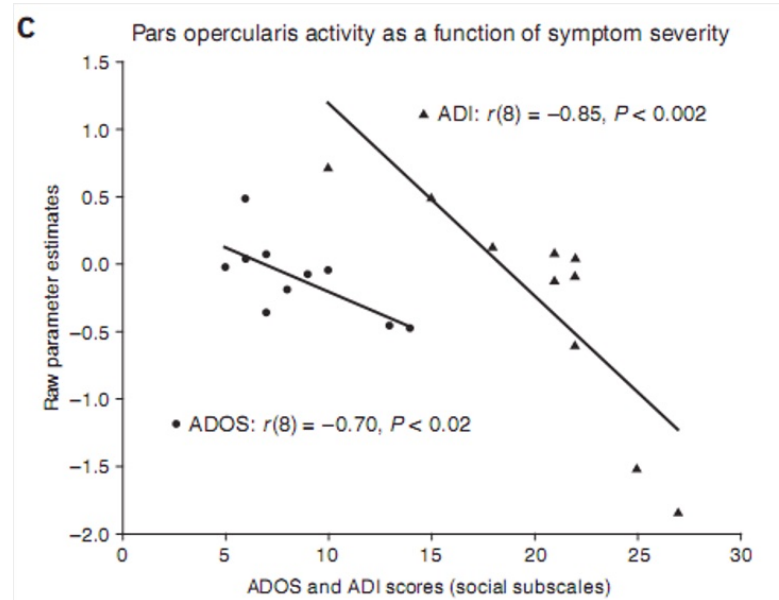


Broken mirrors

- The idea that the ‘mirror neuron system’ is dysfunctional in autism
- Proponents include: Dapretto & Iacoboni, Oberman & Ramachandran, Justin Williams
- Evidence from: imitation behaviour, fMRI, EEG



fMRI evidence



(Dapretto et al. 2006)

Broken mirror criticisms

- Evidence for the theory is weak ([Southgate & Hamilton A. F., 2008](#)).
 - emotion and language tasks used, which are not the like the tasks that activate the mirror neurons in monkeys
 - types of imitation remain intact
- Empirical evidence that EEG and mu rhythmns can serve as an index of mirror neuron system has been heavily questioned ([Hobson & Bishop, 2016, 2017](#)).

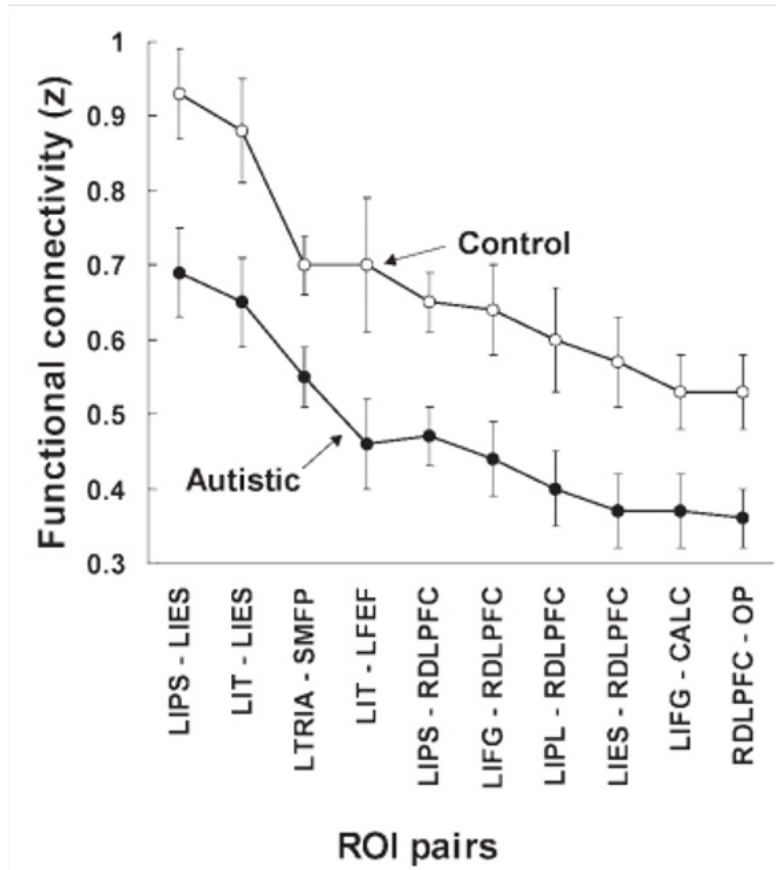


Underconnectivity

- The idea that the cortex is not connected together correctly in autism
 - Underconnectivity could cause lots of information processing problems
- Proponents include Minshew, Just, Courschesne
- Evidence comes from fMRI studies



fMRI evidence



A Autism group



B Control group



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(Just et al. 2004, 2013)



Neurobiological summary

- Broken mirror theory claims to explain many social features of autism, but it does not explain non-social features.
- And ...
 - We still don't know if the MNS contributes to Theory of Mind or language.
 - Mostly indirect measures of MNS function.
 - Tasks are emotional or meaningless actions – not like the tasks that activate the monkey MNS.
- Underconnectivity may explain weak central coherence
- But ...
 - it may not explain social / communication problems (unless social information processing requires more 'connections')



Many autisms?

- No single factor gives a complete explanation
- It is hard to explain both social and non-social symptoms

Time to give up on a single explanation for autism (Happé et al., 2006)

- Should study each part of the triad separately
- No model can yet account for all symptoms
- Different genetic and cognitive causes for each



Take a break



Part 2 - Read and discuss



Discussion material

- break into small groups (~ 5 per group)
- discuss aspects of the lecture
- discuss aspects of the journal article: <https://www.nature.com/articles/nn1770>

And some articles in the popular press:

Vaccines do not cause autism

So, what is going on in the United States?

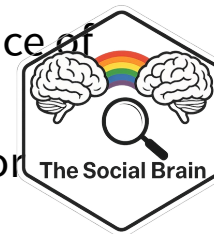


References

- Bailey, A., Couteur, A. L., Gottesman, I., Bolton, P., Simonoff, E., Yuzda, E., & Rutter, M. (1995). Autism as a strongly genetic disorder: Evidence from a British twin study. *Psychological Medicine*, 25(1), 63–77. <https://doi.org/10.1017/S0033291700028099>
- Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition*, 21(1), 37–46. <http://www.ncbi.nlm.nih.gov/htbin-post/Entrez/query?db=m&form=6&dopt=r&uid=2934210>
- Castelli, F., Frith, C., Happe, F., & Frith, U. (2002). Autism, Asperger syndrome and brain mechanisms for the attribution of mental states to animated shapes. *Brain*, 125, 1839–49. <http://www.ncbi.nlm.nih.gov/htbin-post/Entrez/query?db=m&form=6&dopt=r&uid=12135974> <http://brain.oupjournals.org/cgi/content/full/125/8/1839> <http://brain.oupjournals.org/cgi/content/abstract/125/8/1839>
- Dapretto, M., Davies, M. S., Pfeifer, J. H., Scott, A. A., Sigman, M., Bookheimer, S. Y., & Iacoboni, M. (2006). Understanding emotions in others: Mirror neuron dysfunction in children with autism spectrum disorders. *Nat Neurosci*, 9(1), 28–30. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=16327784
- DeStefano, F., & Shimabukuro, T. T. (2019). The MMR Vaccine and Autism. *Annual Review of Virology*, 6, 585–600. <https://doi.org/10.1146/annurev-virology-092818-015515>
- Gabis, L. V., Attia, O. L., Goldman, M., Barak, N., Tefera, P., Shefer, S., Shaham, M., & Lerman, T. (2022). The myth of vaccination and autism spectrum. *European Journal of Paediatric*



- Neurology, 36, 151–158. <https://doi.org/10.1016/j.ejpn.2021.12.011>
- Grosvenor, L. P., Croen, L. A., Lynch, F. L., Marafino, B. J., Maye, M., Penfold, R. B., Simon, G. E., & Ames, J. L. (2024). Autism Diagnosis Among US Children and Adults, 2011-2022. *JAMA Network Open*, 7(10), e2442218. <https://doi.org/10.1001/jamanetworkopen.2024.42218>
- Happe, F. G. (1995). The role of age and verbal ability in the theory of mind task performance of subjects with autism. *Child Dev*, 66(3), 843–855. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=7789204
- Happé, F., Ronald, A., & Plomin, R. (2006). Time to give up on a single explanation for autism. *Nat Neurosci*, 9(10), 1218–1220. <https://doi.org/10.1038/nn1770>
- Heider, F., & Simmel, M. (1944). An Experimental Study of Apparent Behavior. *The American Journal of Psychology*.
- Hirota, T., & King, B. H. (2023). Autism Spectrum Disorder: A Review. *JAMA*, 329(2), 157–168. <https://doi.org/10.1001/jama.2022.23661>
- Hobson, H. M., & Bishop, D. V. M. (2016). Mu suppression – A good measure of the human mirror neuron system? *Cortex*, 82, 290–310. <https://doi.org/10.1016/j.cortex.2016.03.019>
- Hobson, H. M., & Bishop, D. V. M. (2017). The interpretation of mu suppression as an index of mirror neuron activity: Past, present and future. *Royal Society Open Science*, 4(3), 160662. <https://doi.org/10.1098/rsos.160662>
- Just, M. A., Cherkassky, V. L., Keller, T. A., & Minshew, N. J. (2004). Cortical activation and synchronization during sentence comprehension in high-functioning autism: Evidence of underconnectivity. *Brain*, 127(8), 1811–1821. <https://doi.org/10.1093/brain/awh199>
- Just, M. A., Keller, T. A., & Kana, R. K. (2013). A Theory of Autism Based on Frontal-Posterior Underconnectivity. In *Development and Brain Systems in Autism*. Psychology Press.



- Ronald, A., Happé, F., & Plomin, R. (2005). The genetic relationship between individual differences in social and nonsocial behaviours characteristic of autism. *Developmental Science*, 8(5), 444–458. <https://doi.org/10.1111/j.1467-7687.2005.00433.x>
- Shah, A., & Frith, U. (1983). An Islet of Ability in Autistic Children: A Research Note. *Journal of Child Psychology and Psychiatry*, 24(4), 613–620. <https://doi.org/10.1111/j.1469-7610.1983.tb00137.x>
- Shah, A., & Frith, U. (1993). Why do autistic individuals show superior performance on the block design task? *J Child Psychol Psychiatry*, 34(8), 1351–64. <http://www.ncbi.nlm.nih.gov/htbin-post/Entrez/query?db=m&form=6&dopt=r&uid=8294523>
- Southgate, V., & Hamilton A. F. (2008). Unbroken mirrors: Challenging a theory of Autism. *Trends Cogn Sci*, 12(6), 225–229. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18479959



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