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Applying Computation for Social Augmentation of the Neurodivergent

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Abstract

Exploratory survivor produced research on applying computation to help bridge the gap in theory of mind deficits that occur in Autism Spectrum Disorder (ASD). This paper analyses the social challenges adults with a diagnosis of ASD or identifying as Neurodivergent have today and suggests innovative pedagogical approaches have the potential to help optimise social skills as well as increase greater awareness of ASD as a disability. The application of Computational Social Schemas that are accessible on demand could be a more optimal approach of teaching the Hidden Curriculum and could be enhanced by Game Theory modelling. Further reflection on the achievements and legacy of Alan Turing, the father of Computer Science, are made and who historians believe meet the criteria of ASD today.
Keywords: Autism, Aspergers, ASD, Augmentation, Neurodiversity, AI

1. Introduction

Autism Spectrum Disorder (ASD) is a lifelong development disorder first identified by the seminal research of Kanner (1943) and Asperger (1943). Wing and Gould (1979) best described the difficulties of ASD as a "triad of impairments" comprising of social communication, impairment of social interaction and impairment of social imagination. Baron-Cohen, Leslie, and Frith (1985) concluded that those with ASD had a deficit of Theory of Mind (TOM) based on the evidence that autistic children did not have an intellectual disability in their social functioning. TOM originates from Premack and Woodruff (1978) that described it as "the individual who imputes mental states to himself and others". Baron-Cohen (1990, 1997) later coined the term "mind-blindness" as a specific cognitive disorder of ASD where individuals are blind to thoughts, beliefs, knowledge, desires, and intentions of others.

The negative impact of mind-blindness for an individual with ASD can result in not being able to develop and maintain friendships to difficulty in collaborating with colleagues and customers in the workplace. A survey by the National Autistic Society in the UK found that only 16% of Autistic adults in 2016 were in full time work (NAS, 2016). I would argue that Autism is being increasingly diagnosed and recognised as a disability in the early 21st century due to the consequences of this structural unemployment.

Structural unemployment is defined as the mismatch between the skills workers can offer and those demanded by employers. Before the Industrial Revolution in the 18th century the majority of labour worked in agriculture for their own subsistence. The mechanising of agriculture led to workers moving into manufacturing industries where each worker was a specialist at each step of production before delivering a finished good such as a motor vehicle. In the 20th century manufacturing declined in the UK to be superseded with the services industry employing 80% of workers in 2011 (NOS, 2016).

Employment in the services sector represents a hurdle for those with ASD as it could be construed as requiring Affective Labour. Affective Labour is a concept where work is carried out that is intended to produce or modify emotional experiences in people (Dowling, Nunes, & Trott, 2007; Hardt & Negri, 2000; Negri & Hardt, 2004).

Efforts to overcome TOM deficits in ASD have largely been dominated by teaching social skills (Weiss & Harris, 2001). A brief review of the literature suggests most social skill interventions occur during childhood which is consistent with Matson, Matson, and Rivet (2007) in their overview. The approach of Applied Behaviour Analysis (ABA) (Axelrod, McElrath, & Wine, 2012; Matson et al., 2012) is touted as the most successful treatment with its origins from Radical Behaviourism (Skinner, 1974), to its dimensional framework for humans (Baer, Wolf, & Risley, 1968) and application into childhood autism by Lovaas (Özerk, Vea,

Eikeseth, & Özerk, 2016) to modify behaviour. However, in recent years there has been rising criticism of ABA (Devita-Raeburn, 2016) in the emergence of a Neurodiversity Movement (Jaarsma & Welin, 2012) with the advocacy that autistic individuals should not be coercively changed and be viewed as a diverse social norm like that of homosexuality.

Although the proponents of behaviourism and the neurodivergent movement are broad their philosophical difference are opposites on a spectrum on how we view behaviour. A deficit of TOM implies that an individual can only base their understanding of others from their understanding of Philosophy of Mind (POM) (Kim, 2018). Fundamentally we have an age-old debate of our shared understanding of philosophy with both sides at risk of incongruency. We have the experience of the individual "I think, therefore I am" (Descartes, 1637) and the rules of society first modelled in Social Contract theory (Hobbes & Brooke, 1651; Locke, 1689; Rousseau, 1762). Therefore, it can be concluded even where there is a divergence in philosophy there can be a convergence by taking a Pedagogical approach to supporting those with ASD.

We begin learning social skills from childhood, but this learning can usually occur implicitly. Our social rules are taught by convention rather than by an explicit codified curriculum. The "Hidden Curriculum" is a phrase coined by Jackson (1968) to refer to this experience of learned socialisation at school. Myles and Simpson (2001) widened this meaning, in the context of ASD, to include "…the skills, actions, modes of dress, and so on, that most people know and take for granted". Myles and Simpson (2001) argue that a systematic approach is needed to teach the hidden curriculum which conforms with the hyper-systemizing theory of ASD perception (Baron-Cohen, 2002, 2010).

The challenge with the hidden curriculum is there are too many social rules to learn explicitly and the possibility that they may not be delivered culturally appropriately (Hyo Jung, 2010). We are also faced with the issue that society is continuously changing as is the age and life circumstances of the individual with ASD who increasingly prefers to identify as Autistic rather than as with ASD. This may explain why the academic literature on interventions for teaching the hidden curriculum is based at school where social interaction is more predictable (Alsubaie, 2015; Ishaq, 2018; Moyse & Porter, 2015). However, as Byrne (2020) concludes, a lack of understanding ASD and the hidden curriculum at university is causing difficulties for students in higher education as well. Given the structural unemployment those that identify as Autistic face I would argue a lifelong learning approach is needed.

Lifelong learning is a concept that has become more acceptable in the early 21st century due to the exponential technological changes impacting our world. Fischer (2000) was an early advocate for using technology to assist with learning as he argued it had the potential to give learners instant access to the worlds knowledge on demand and when needed. The consequences of lockdowns and social distancing from the COVID-19 pandemic has demonstrated how effective technology can be in communication particularly when enforcing new social rules (such as self-isolating or a local lockdown).

Having defined the social impairments of those with ASD face (which is not true for everyone who identifies as Autistic) I will now move on to discuss how applying algorithmic processes and computational machines from the field of Computer Science may help bridge this gap.

2. Background and Significance

Alan Turing is considered the father of Computer Science and Artificial Intelligence (AI) with his most famous paper that discussed the Imitation Game (Turing, 1950). The Imitation Game, known as the "Turing Test", is a method of inquiry to test if a machine can be indistinguishable from that of a human via interrogation. Alan Turing was depicted in the film titled "The Imitation Game" (Schwarzman et al., 2014) that told the true life story of how he invented the first computer to decrypt the German Enigma code during World War 2. The movie infers that Alan had difficulty with getting on with his colleagues perhaps due to O'Connell and Fitzgerald (2003) conclusion that he met the criteria for a diagnosis of Asperger's (a ASD). The question therefore arises, that if we can teach a machine to pass off as human in social interaction, then can we employ similar systematic methods to assist those with ASD to live more socially independent lives?

Alan Turing died long before his life expectancy like many have with ASD (Hirvikoski et al., 2016; Smith DaWalt, Hong, Greenberg, & Mailick, 2019). Though just as our understanding of ASD and Neurodiversity has improved so has the intelligence of the machines we are creating. In 1997, IBM's Deep Blue chess playing program beat the World Champion Gary Kasparov as it could process 200 million potential moves per second. More recently in 2015, Google's AlphaGo beat the world champion at Go (a game with significantly more permutations than Chess) using artificial neural networks (Haenlein & Kaplan, 2019). Many people todays are using "Weak AI" products such as voice recognition assistants like Amazon's Echo, facial recognition that tags our family in photos on Facebook and online advertising that targets us individually based on data science. However, despite the hype, we are nowhere near the threshold of "Strong AI", where a machine can pass the Turing Test and convince us that it is indistinguishable to human intelligence (Jordan, 2019).

The possibility of Strong AI has been one of deep philosophical debate. Although less concerned with machines being able to do human-like behaviour but whether a machine can have a mind and consciousness. Searle (1980) explained this concept in his widely discussed thought experiment "The Chinese Room". The Chinese room argument explains that you could instruct a human or

a computer to follow a methodological process to have a conversation in Chinese (E.g. they don't know Chinese they just follow an algorithmic process). By following this methodological process, Searle asks does the machine understand Chinese or is it merely simulating Chinese? Searle concludes that without intentionality (the basis for Phenomenology) the machine is not thinking and thus does not have a mind.

The debate of whether a machine is thinking or capable of thinking leads us to what is known as the Computational Theory of Mind (CTM). Just like the proponents of behaviourism and neurodiversity a similar divide exists between the schools of thought on CTM (Rescorla, 2020). Many Cognitive scientists, who study mental processes that diverged from behaviourism, believe the human mind is a biological computational machine. Therefore, to a Cognitive Scientist, an AI that was indistinguishable to speaking Chinese as a human would be considered as thinking. Horst (1999) provides a critic of CTM without intentionality but also an acknowledged opportunity for its development if machines could form their own meaning to their thinking.

People diagnosed with ASD are of course not classical machines as we would describe though they can share deficits in TOM that almost mirror the deficits in CTM. To give an alternative Chinese Room example, there could be a man from Hong Kong with ASD that can speak English and Chinese. However, his ability to understand context and respect societal norms affectively impedes his interaction and thus leads to his social exclusion. We could therefore infer from Searles' Chinese Room and the previous example that if a machine worked co-operatively with the Hong Kong man they could together create an improved social veneer that leads to independence and perhaps inclusion.

The technical development towards a CTM could be thought similar to a hearing aid for the hearing impaired. Some in the Neurodivergent movement may not see the benefit of such a tool given its connotation with a disability aid. There is much discourse over whether ASD is a disorder or a diverse difference. Although I personally agree with the latter for philosophical reasons (No one can know how I experience consciousness), I still see benefits for using tools that improve our life chances. However, I would argue that if such a tool were reverse engineered for neurotypicals understanding ASD then it would be analogous to people with no hearing impairment learning sign language. In any case, if the CTM had a pedagogical approach that individuals with ASD used to improve their social interactions then this could be of benefit to the Neurodivergent Movement in promoting change.

If we can accept that a CTM can be at least be partly created to assist those with ASD then we need to explore how this can be done. A flawed assumption may assume an intelligent AI to instruct the individual with ASD in parrot like fashion on how to interact with their peers. Such a conclusion even if technically feasible would arguably not be one of pedagogy and diminishment of a person's individuality. We can infer from this that Intelligence Amplification (IA) also known as Cognitive Augmentation particularly in Social Intelligence is going to be the aim of such an aid. This also fits into a growing belief that AI Research should be exploited for IA rather than as a replacement of human activity (Hassani, Silva, Unger, TajMazinani, & Mac Feely, 2020). Having defined the potential use of Computation in TOM for ASD I will now refer to such IA as a Social Augmenter.

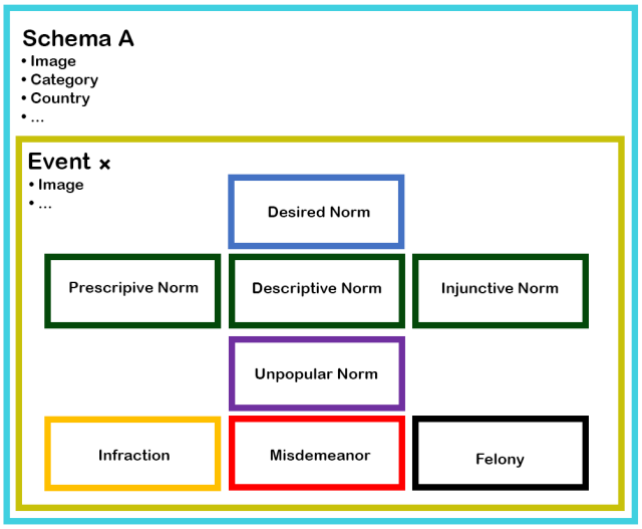
For a Social Augmenter to be most effective it needs to be always with the individual that makes use of it. Though like a hearing aid it needs to be obscure enough that it does not divert from the challenge of social interaction. The smartphone with its prevalence in modern society and the fact it is Turing complete (able to follow instructions as a universal computer) would appear to be the ideal means of augmentation. The augmenter would best be served as a client-side App on a smartphone where a user can interact with it to input and retrieve data whilst having the ability to connect to the internet to retrieve updates and use more powerful computation in the cloud. Now we have described the means of augmentation we need to define how it could be achieved.

If we were to combine the unstated rules of the Hidden Curriculum (Myles, Trautman, & Schelvan, 2004) delivered in the form of a formalised Schema then we may have an effective means of augmentation. Schemas in psychology are a framework to describe patterns of thought, behaviour, and their relationships that Piaget (1926, 1952) and Bartlett (1932) are recognised to have pioneered. A more recent innovation known as Schema therapy developed by Young (2007) has demonstrated effectiveness (particularly for personality disorders) though two systematic reviews highlight the need for more research (Masley, Gillanders, Simpson, & Taylor, 2012; Taylor, Bee, & Haddock, 2017).

The database is one of the greatest innovations in Computer Science since the 1960's (Berg, Seymour, & Goel, 2012) and has allowed for the storage of large amounts of data using a structured schema. SQL known as Structured Query Language has since the 1990's been the most popular method to structure and query data. However, with the rise of storing personal data in the 21st century, NOSQL (Not Only SQL) is beginning to be more widely adopted as the schemas are not strictly formal and can evolve for their use. NOSQL allows for new data and relationships to be more flexibly related without significant redevelopment of the database system (Parker, Poe, & Vrbsky, 2013).

3. Development of NeuroSchemas

This leads us to the development of NeuroSchemas, a smartphone app released on the 23rd June 2021, on the late Alan Turings birthday, that attempts to deliver the first features of a Social Augmenter. The diagram in figure 1



outlines the proposed structure of a computational social schema.

Fig. 1. The structure of a computational social schema used in NeuroSchemas.

Each computational social schema is a particular social topic for example a 'Bus Journey' with several events. These events could be "Boarding a bus", "Payment of Fare' and "Exiting the Bus". Each event has a selection of behaviours like for 'Boarding a Bus' a prescriptive norm such as "Leave the front seats for less able passengers such as the disabled".

In table 1 a simplified framework of behaviours based on generally accepted social norms that Hechter and Opp (2001) infer in their overview of the cultural phenomenon of social norms are applied in NeuroSchemas for each event.

Table 1
Simplified framework of group behaviours

Behaviour	Icon	
Prescriptive Norm	P	Unwritten rules that are understood and followed by society to indicate what we should do.
Descriptive Norm	D	Commonly done in specific situations by most people.
Injunctive Norm	I	What should happen (group approval)
Desired Norm	D	How we desire things done in a situation (group approval)
Unpopular Norm	U	How we do not desire things to be done in a situation (group disproval)
Infraction	I	Minor law breaking. Eg. Speeding
Misdemeanor	M	Serious breaking of law Eg. Stealing from a shop
Felony	F	Severe breaking the law. Eg. Violence

The first version of the NeuroSchemas app will only contain 25 generic schemas for common social situations such as going to a restaurant, travelling by train and respecting people. Each schema has a QR Code linked to its relevant generic schemas so that when it is scanned the schema loads immediately. An example of this is shown in figure 2.

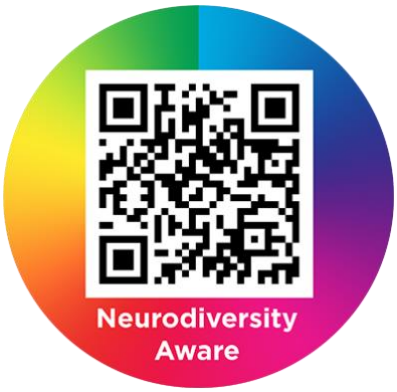


Fig. 2. QR code once scanned loads the associated Schema.

4. Preliminary Suppositions and Implications

Many individuals with ASD suffer from Social Anxiety because of not knowing the rules and expected behaviour in a given situation. This anxiety can originate from difficult past experiences (Bellini, 2006; Kuusikko et al., 2008; Spain, Sin, Linder, McMahon, & Happé, 2018). NeuroSchemas may therefore be useful to other conditions besides ASD such as Social Anxiety. Furthermore, those diagnosed with Schizophrenia are believed to have impaired TOM like those with ASD (Brüne, M., 2005).

If NeuroSchemas proved popular and effective it could lead to additional augmentation features and innovation. Microsoft presently have a live API for Emotional Facial Recognition (Microsoft, 2020) that the social augmenter could plug into through the smartphones camera to probability score others emotional states. Given those with ASD struggle with reading facial expressions this could be an effective learning tool amongst family and friends. In conjunction with innovations like Google Glass, largely based on the HUD (Heads Up Display) used in Fighter Jets there are many possibilities like this that can be incorporated going forward. Though such evasive measures to be used on the public are already of ethical debate.

Later versions of the app could include the ability for users to copy generic schemas and create their own schemas. The ability for users to submit their own bespoke schemas for approval under a user generated schema listing or the ability to import schemas like photos or MP3 music would improve the breadth of its potential usefulness.

If the schemas proved helpful then the undertaking of building a larger database of schemas for different countries, regions and many other demographics could be worthwhile. The decentralising of control of the schema database to one that promotes participation could be a rich and important development. This could be achieved like in the way peer review works with Wikipedia or using more recent technologies like Blockchain (where everyone has a copy on a peer-to-peer basis) with built in digital governance. A global human schema with its beautiful inconsistencies that transcend bodies and borders could bring us closer to a world TOM that the Neurodivergent movement can choose to embrace if they want to.

Furthermore, organisations and employers could engage with Experts by Experience to create certifiable schemas for their venues. These schemas could be linked to NeuroSchema from the organisation's website or by scanning a QR code at the entrance with the smartphone's camera. Like an induction loop installed in a Post Office or a London cab for the hearing impaired such schemas could legally be possible to assist those with autism.

Conflict resolution and social navigation tools could be added by applying game theory models to the schemas. Such strategies can be helpful life skills for challenging social situations that many with ASD are not naturally equipped to handle. Though one must give careful thought to the moral implication of not dehumanising social interaction to that of solely a game of strategy like Chess.

As an individual diagnosed with ASD responsible for NeuroSchemas research and development it may imply an alternative narrative to Alan Turing's legacy. I believe neurodivergent adults like Alan need meaningful participation and opportunity rather than post humorous christened student placement schemes and a £50 bank note that use his image. This makes the quote "Sometimes it is the people no one can imagine anything of who do the things no one can imagine" attributed to Alan so pertinent today. Alan is celebrated for his technical genius of cracking Enigma, but few are aware of the torment he had to endure because he did not fit in socially. Many today with ASD, like myself, know how painful such isolation can be.

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References

Alsubaie, M. A. (2015). Hidden curriculum as one of current issue of curriculum. *Journal of Education and Practice*, *6*(33), 125-128.

Asperger, H. (1943). *Die" autistischen psychopathen" im kindesalter*. Verlag nicht ermittelbar,

Axelrod, S., McElrath, K. K., & Wine, B. (2012). APPLIED BEHAVIOR ANALYSIS: AUTISM AND BEYOND. *Behavioral Interventions*, *27*(1), 1-15. doi:https://doi.org/10.1002/bin.1335

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of applied behavior analysis*, *1*(1), 91-97. doi:10.1901/jaba.1968.1-91

Baker, S. L., Heinrichs, N., Kim, H.-J., & Hofmann, S. G. (2002). The Liebowitz social anxiety scale as a self-report instrument: a preliminary psychometric analysis. *Behaviour Research and Therapy*, *40*(6), 701-715. doi:https://doi.org/10.1016/S0005-7967(01)00060-2

Baron-Cohen, S. (1990). Autism: A specific cognitive disorder of "mind-blindness.". *International Review of Psychiatry*, *2*(1), 81-90. doi:10.3109/09540269009028274

Baron-Cohen, S. (1997). *Mindblindness: An essay on autism and theory of mind*: MIT press.

Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in Cognitive Sciences*, *6*(6), 248-254. doi:https://doi.org/10.1016/S1364-6613(02)01904-6

Baron-Cohen, S. (2010). Chapter 11 - Empathizing, systemizing, and the extreme male brain theory of autism. In I. Savic (Ed.), *Progress in Brain Research* (Vol. 186, pp. 167-175): Elsevier.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind". *Cognition*, *21*(1), 37-46.

Bartlett, F. C. (1932). *Remembering : a study in experimental and social psychology*.

Beck, D. E., & Cowan, C. C. (1996). *Spiral Dynamics: Mastering Values, Leadership and Change*: Wiley-Blackwell; New Ed edition 2005.

Berg, K., Seymour, D. T., & Goel, R. (2012). History Of Databases. *International Journal of Management & Information Systems (IJMIS)*, *17*, 29. doi:10.19030/ijmis.v17i1.7587

Brüne, M., "Theory of Mind" in Schizophrenia: A Review of the Literature, *Schizophrenia Bulletin*, Volume 31, Issue 1, January 2005, Pages 21–42, https://doi.org/10.1093/schbul/sbi002

Byrne, J. P. (2020). Perceiving the social unknown: How the hidden curriculum affects the learning of autistic students in higher education. *Innovations in Education and Teaching International*, 1-8. doi:10.1080/14703297.2020.1850320

Descartes, R. (1637). *A Discourse on method*. London: J.M. Dent & Sons.

Devita-Raeburn, E. (2016). The controversy over autism's most common therapy. Retrieved from https://www.spectrumnews.org/features/deep-dive/controversy-autisms-common-therapy/

Dowling, E., Nunes, R., & Trott, B. (2007). Immaterial and affective labour: Explored. *ephemera: theory and politics in organization*, *7*(1), 1-7.

Fischer, G. (2000). Lifelong learning—more than training. *Journal of Interactive Learning Research*, *11*(3), 265-294.

Haenlein, M., & Kaplan, A. (2019). A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence. *California Management Review*, *61*(4), 5-14. doi:10.1177/0008125619864925

Hardt, M., & Negri, A. (2000). Empire. Retrieved from https://www.degruyter.com/isbn/9780674038325

Hassani, H., Silva, E. S., Unger, S., TajMazinani, M., & Mac Feely, S. (2020). Artificial Intelligence (AI) or Intelligence Augmentation (IA): What Is the Future? *AI*, *1*(2), 143-155. Retrieved from https://www.mdpi.com/2673-2688/1/2/8

Hechter, M., & Opp, K.-D. (2001). *Social norms*: Russell Sage Foundation.

Hirvikoski, T., Mittendorfer-Rutz, E., Boman, M., Larsson, H., Lichtenstein, P., & Bölte, S. (2016). Premature mortality in autism spectrum disorder. *British Journal of Psychiatry*, *208*(3), 232-238. doi:10.1192/bjp.bp.114.160192

Hobbes, T., & Brooke, C. (1651). *Leviathan (Penguin Classics)*. England: Penguin

Horst, S. (1999). Symbols and Computation A Critique of the Computational Theory of Mind. *Minds and Machines, 9*(3), 347-381. doi:10.1023/A:1008351818306

Hyo Jung, L. (2010). Cultural Factors Related to the Hidden Curriculum for Students With Autism and Related Disabilities. *Intervention in school and clinic, 46*(3), 141-149. doi:10.1177/1053451210378162

Ishaq, M. (2018). Teaching Hidden Curriculum to Children with Autism Spectrum Disorder: A Scoping Review. In.

Jaarsma, P., & Welin, S. (2012). Autism as a Natural Human Variation: Reflections on the Claims of the Neurodiversity Movement. *Health Care Analysis, 20*(1), 20-30. doi:10.1007/s10728-011-0169-9

Jackson, P. W. (1968). *Life in classrooms*. New York, N.Y.: Holt, Rinehart and Winston.

Jordan, M. I. (2019). Artificial intelligence—the revolution hasn't happened yet. *Harvard Data Science Review, 1*(1).

Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child, 2*, 217-250.

Kuusikko, S., Pollock-Wurman, R., Jussila, K., Carter, A. S., Mattila, M.-L., Ebeling, H., . . . Moilanen, I. (2008). Social Anxiety in High-functioning Children and Adolescents with Autism and Asperger Syndrome. *Journal of Autism and Developmental Disorders, 38*(9), 1697-1709. doi:10.1007/s10803-008-0555-9

Kim, J. (2018). *Philosophy of mind*: Routledge.

Locke, J. (1689). *The First & Second Treatises of Government*.

Masley, S. A., Gillanders, D. T., Simpson, S. G., & Taylor, M. A. (2012). A Systematic Review of the Evidence Base for Schema Therapy. *Cognitive Behaviour Therapy, 41*(3), 185-202. doi:10.1080/16506073.2011.614274

Matson, J. L., Matson, M. L., & Rivet, T. T. (2007). Social-Skills Treatments for Children With Autism Spectrum Disorders: An Overview. *Behavior Modification, 31*(5), 682-707. doi:10.1177/0145445507301650

Matson, J. L., Turygin, N. C., Beighley, J., Rieske, R., Tureck, K., & Matson, M. L. (2012). Applied behavior analysis in Autism Spectrum Disorders: Recent developments, strengths, and pitfalls. *Research in Autism Spectrum Disorders, 6*(1), 144-150. doi:https://doi.org/10.1016/j.rasd.2011.03.014

Microsoft. (2020). Face AI. Retrieved from https://azure.microsoft.com/en-gb/services/cognitive-services/face/

Moyse, R., & Porter, J. (2015). The experience of the hidden curriculum for autistic girls at mainstream primary schools. *European Journal of Special Needs Education, 30*(2), 187-201.

Myles, B. S., & Simpson, R. L. (2001). Understanding the hidden curriculum: An essential social skill for children and youth with Asperger syndrome. *Intervention in school and clinic, 36*(5), 279-286.

Myles, B. S., Trautman, M. L., & Schelvan, R. L. (2004). *The hidden curriculum: Practical solutions for understanding unstated rules in social situations*: AAPC Publishing.

NAS. (2016). *The autism employment gap: Too Much Information in the workplace*. Retrieved from London, UK: https://www.basw.co.uk/system/files/resources/basw_53224-4_0.pdf

Negri, A., & Hardt, M. (2004). Multitude : war and democracy in the age of empire. Retrieved from http://rbdigital.oneclickdigital.com

NOS. (2016). Five facts about... The UK service sector. Retrieved from https://www.ons.gov.uk/economy/economicoutputandproductivity/output/articles/fivefactsabouttheukservicesector/2016-09-29

O'Connell, H., & Fitzgerald, M. (2003). Did Alan Turing have Asperger's syndrome? *Irish Journal of Psychological Medicine, 20*(1), 28-31. doi:10.1017/S0790966700007503

Özerk, K., Vea, G. D., Eikeseth, S., & Özerk, M. (2016). Ole ivar lovaas-his life, merits and legacy. *International Electronic Journal of Elementary Education, 9*(2), 243-262.

Parker, Z., Poe, S., & Vrbsky, S. V. (2013). *Comparing NoSQL MongoDB to an SQL DB*. Paper presented at the Proceedings of the 51st ACM Southeast Conference, Savannah, Georgia. https://doi.org/10.1145/2498328.2500047

Patton, M. Q. (2015). *Qualitative research & evaluation methods: integrating theory and practice*: SAGE PUBLICATIONS.

Piaget, J. (1926). *The language and thought of the child*. London; New York: Kegan Paul Trench Trubner ; Harcourt Brace.

Piaget, J. (1952). *The origins of intelligence in children*. New York: International Universities Press.

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences, 1*(4), 515-526. doi:10.1017/S0140525X00076512

Rescorla, M. (2020). The Computational Theory of Mind. Retrieved from https://plato.stanford.edu/archives/fall2020/entries/computational-mind

Rousseau, J.-J. (1762). *The Social Contract (French-English Text) (Rossetta Series) (French)* (G. D. H. Cole's, Trans. T. J. Richardson Ed.): JiaHu Books.

Schwarzman, T., Grossman, N., Ostrowsky, I., Tyldum, M., Cumberbatch, B., Knightley, K., . . . Anchor Bay Entertainment, I. (Writers). (2014). The Imitation Game. In I. Anchor Bay Entertainment (Producer).

Searle, J. R. (1980). Minds, brains, and programs. *& &*, 417-457.

Skinner, B. F. (1974). *About behaviorism*. New York: Knopf.

Smith DaWalt, L., Hong, J., Greenberg, J. S., & Mailick, M. R. (2019). Mortality in individuals with autism spectrum disorder: Predictors over a 20-year period. *Autism, 23*(7), 1732-1739. doi:10.1177/1362361319827412

Spain, D., Sin, J., Linder, K. B., McMahon, J., & Happé, F. (2018). Social anxiety in autism spectrum disorder: A systematic review. *Research in Autism Spectrum Disorders, 52*, 51-68. doi:https://doi.org/10.1016/j.rasd.2018.04.007

Taylor, C. D. J., Bee, P., & Haddock, G. (2017). Does schema therapy change schemas and symptoms? A systematic review across mental health disorders. *Psychology and Psychotherapy: Theory, Research and Practice, 90*(3), 456-479. doi:https://doi.org/10.1111/papt.12112

Turing, A. M. (1950). Computing Machinery and Intelligence. In R. Epstein, G. Roberts, & G. Beber (Eds.), *Parsing the Turing Test: Philosophical and Methodological Issues in the Quest for the Thinking Computer* (pp. 23-65). Dordrecht: Springer Netherlands.

Weiss, M. J., & Harris, S. L. (2001). Teaching Social Skills to People with Autism. *Behavior Modification, 25*(5), 785-802. doi:10.1177/0145445501255007

Wing, L., & Gould, J. (1979). Severe impairments of social interaction and associated abnormalities in children: Epidemiology and classification. *Journal of Autism and Developmental Disorders, 9*(1), 11-29. doi:10.1007/BF01531288

Young, J. E. (2007). *Schema Therapy*. Washington: American Psychological Assoc.

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